NASA CONTRACTOR REPORT

NASA CR-1486

NASA CR-148

A STUDY OF NACA AND NASA PUBLISHED INFORMATION OF PERTINENCE IN THE DESIGN OF LIGHT AIRCRAFT

Volume III - Propulsion Subsystems, Performance, Stability and Control, Propellers, and Flight Safety

by Clifford J. Moore and Dennis M. Phillips

Prepared by
NORTH CAROLINA STATE UNIVERSITY
Raleigh, N. C.
for Langley Research Center

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION • WASHINGTON, D. C. • FEBRUARY 1970

NASA CR-1486

A STUDY OF NACA AND NASA PUBLISHED INFORMATION OF PERTINENCE IN THE DESIGN OF LIGHT AIRCRAFT

Volume III - Propulsion Subsystems, Performance, Stability and Control, Propellers, and Flight Safety

Part I - Propulsion Subsystems

By Clifford J. Moore

Part II - Performance, Stability and Control, Propellers, and Flight Safety

By Dennis M. Phillips

Prepared under Contract No. 1-7265 by
DEPARTMENT OF MECHANICAL AND AEROSPACE ENGINEERING
North Carolina State University
Raleigh, N.C.

for Langley Research Center

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

For sale by the Clearinghouse for Federal Scientific and Technical Information
Springfield, Virginia 22151 – Price $3.00

Table of Contents

Table of Contents (continued)

GENERAL INTRODUCTION

Individuals in the National Aeronautics and Space Administration have long felt that much of the agency's research, although originally performed in support of military and commercial transport programs, has not been applied as completely as it might have been to general aviation activity, particularly as the flight speed of these aircraft reached regions in which military and commercial transport aircraft have operated during the past twenty-nine years. NASA has also recognized that general aviation manufacturing concerns are quite small compared to the usual aerospace manufacturer; they do not have the large engineering staffs to adapt new technology rapidly, but operate more nearly like the majority of American manufacturing concerns where evolutionary changes rather than revolutionary changes are the order of the day. As a result, technical information contained in NASA files must be specially processed to make it really useful to such firms. As originally conceived, the vehicle for this transfer would be a modern, step-by-step design manual.

Another difficulty faced by the general aviation industry is the lack of young engineering talent with an appreciation of and interest in the industry's problems. This is a result of the almost exclusive attention to the problems of supersonic and space flight which has been characteristic of American aeronautical education for the past 15 years. Younger faculty, for the most part, are not familiar with the problems of light aircraft design and so fail to motivate students to consider this field.

As a way of aiding the general aviation industry in this area as well as with technical information, NASA contracted with North Carolina State University to have a group of younger faculty and students conduct a survey of all NACA and NASA-generated work since 1940 to identify technical information of potential use in a light aircraft design manual. Five faculty members of the Department of Mechanical and Aerospace Engineering participated in the program. Each was assisted by two Aerospace Engineering seniors who also were given special sections of the regular senior work in Aerospace Engineering of direct pertinence to light aircraft.

Dr. James C. Williams and Delbert C. Summey were responsible for reviewing the work in aerodynamics and were assisted by Mr. Edwin Seiglar.

Dr. John N. Perkins was responsible for reviewing the work in air loads and was assisted by Mr. Donald Knepper and Mr. William Rickard.

Dr. Clifford J. Moore reviewed the work on propulsion systems analysis and was assisted by Mr. Donald Gray and Mr. Johnny Logan.

Mr. Dennis M. Phillips reviewed the work in performance, stability and control, and flight safety and was assisted by Mr. Robert Pitts and Mr. Paul Ho.

Dr. Frederick O. Smetana was responsible for reviewing the work in construction analysis, materials, and techniques and was assisted by Mr. Hudson Guthrie and Mr. Frank Davis. Dr. Smetana also acted as Principal Investigator on the project.

The majority of the work began 1 June 1968. The students devoted approximately 30 hours a week each for the 13 weeks of the summer and 8 hours per week during the fall semester to the project. Faculty commitment was approximately 1/4 time during the summer and 2/5 time during the fall semester.

The students performed the majority of the actual document reviews after being instructed as to the type of information desired. The faculty also provided guidance when pertinence of a particular report was questioned or the treatment was too advanced. Beginning in late fall, the faculty members carried out an analysis of the reviews in their areas of cognizance to (1) identify those of most probable interest in the development of a design manual, (2) define the state of the art in each area, and (3) identify those areas particularly well-treated or requiring additional research. The body of this report contains the results of the analysis relating to structural design. The individual reviews are reproduced in the appendix. Volume II treats aerodynamics and aerodynamic loads while Volume III is concerned with propulsion systems, propellers, performance calculation, stability and control, and flight safety.

It will be recognized that the assignment of a "not applicable" label to a particular report is a judgment decision; the standards for making such assignments inevitably vary somewhat from day to day and from individual to individual. There is also the tendency on the part of any reviewer to become more critical of the value of a report to a particular project as his experience and the number of reports he has reviewed increases. Since the present review began with the earliest documents, this discrimination is applied more noticeably in the later documents. Additionally, it seems to be inevitable that in the process of assigning reports to the various groups and individuals for review some are reviewed twice and others not at all. Although an effort was made to correct such deficiencies, some undoubtedly remain. For these and others, the reader's indulgence is requested.

No attempt has been made to have the analyses prepared by the faculty conform to a single style. This would have been difficult because all were prepared simultaneously; but more importantly, the various topics were found to have been given different emphasis with time and to vary widely in depth. Consequently, each faculty member was asked to adopt that style which seemed most appropriate to the material being covered.

The number of documents to be examined was on the order of 10,000. A simple calculation will show that on the average less than 30 minutes could be allotted to each report. Even if one discounts the 30%-40% which were considered not applicable, the time available for review was still not large. It is a fact, also, that the rate of generation has increased markedly during the last nine years. However, since an in-depth index of all current NASA-generated documents has been available for computer searching since 1962 and since current reports are more likely to be familiar to the working engineer, major emphasis was placed on those reports produced prior to 1962.

GENERAL CONCLUSIONS

Five faculty members, assisted by ten undergraduate students, of the Department of Mechanical and Aerospace Engineering at North Carolina State University have reviewed the NACA/NASA-generated literature published since 1940 for information of possible pertinence to the design of light aircraft. On the basis of these reviews, it is concluded that:

1. There is a wealth of structural design information available which, if incorporated intelligently in light aircraft construction, could result in improved structural efficiency.

2. To apply this information in the most effective fashion possible, computer programs which have modest time requirements and which specify the material gauges, the stiffener configuration and the stiffener spacing when supplied with the body shape desired and the loading expected must be developed.

3. The information available on propulsion subsystems is adequate for design purposes but requires careful and complete assembly and must be accompanied by detailed instructions for it to be used effectively.

4. There are adequate, although, complex, theoretical methods available for calculating aerodynamic wing loads.

5. More sophisticated theoretical methods making use of high-speed computers need to be developed for the calculation of aerodynamic loads on tail surfaces.

6. There is insufficient accurate information available on hinge moments to construct reliable design charts.

7. Information on gust load experiences and spectral distribution is in need of updating to permit structural designs suited to the varied utilization of light aircraft.

8. Information on landing gear loads appears to be adequate.

9. Flutter information, while limited, appears to be suitable for development of adequate design criteria.

10. There is a lack of data on body aerodynamics and wing-body and tail-body interference effects; otherwise, there appears to be sufficient information in the NACA/NASA literature to compile and prepare a design manual suitable for use in the aerodynamic design of personal-type aircraft.

11. Refined performance calculation procedures which permit the attainment of instantaneously optimum flight paths and which are suitable for

use with light aircraft are available. Their utilization could be increased through machine evaluation.

12. Generally-accepted, yet detailed criteria for the stability and control characteristics of light aircraft do not now exist, although there is a wealth of data from which such criteria can probably be constructed.

13. Recent high horsepower propellers have been designed using copious data obtained during the late 1940's. This permits performance improvements over the pre-1943 data used to design current light aircraft propellers.

14. Insufficient attention has been given to fixing quantitatively the combination of aerodynamic, propulsion, and structural parameters which are required for a really safe-to-fly light airplane, although much of the basic data from which such determinations can be made already exists.

PART I

A STUDY OF THE NACA AND NASA LITERATURE APPLICABLE TO THE DESIGN AND EVALUATION OF PROPULSION SUBSYSTEMS FOR LIGHT AIRCRAFT

By Clifford J. Moore, Jr.

Goals of Study

The primary goal of this study was to examine the NACA and NASA literature published since 1940 to determine how much of the research results contained therein would be of use to the designers of present-day light aircraft. Specifically, in this portion of the project, information relating to the design and analysis of propulsion subsystems was sought. The designation "propulsion subsystems" was chosen to indicate the aircraft propulsion system accessories and related internal systems which would normally be designed by a light aircraft manufacturer. This covers such items as air supply systems and various cooling and heating systems. A more complete description is given in the next section.

Obviously, the above definition excludes engine design since engines are usually purchased from engine manufacturers. Engine performance is also excluded here since this area is covered under another part of this report dealing with performance analysis and flight safety.

Another goal of the study was to evaluate the information found and determine if sufficient data existed to allow the compilation of a design manual, or handbook, for designers of light aircraft.

Definition of Areas

For the purposes of this study, propulsion subsystems include the following: (1) engine air supply systems (primary and cooling-air), consisting of inlets and associated ducting, (2) accessory cooling air systems (oil coolers and intercoolers), including heat exchangers and associated inlets and ducting, and (3) cabin and other heating systems, including heat exchangers and associated inlets and ducting.

It was sometimes difficult to distinguish the boundaries of the separate areas within the overall project classification scheme, and in some cases even more difficult to determine to which of the sub-areas certain information rightfully belonged. The first problem is illustrated by considering the subject of engine selection criteria. Obviously, in the main, this comes under the area of performance, but certainly some consideration should be given to the subsystem requirements. In this particular case, however, it turned out to be a mute question since no information of this type was found. Another example of this problem is the subject of air intakes for which there are both internal and external effects. In this instance only internal effects were considered, leaving the external effects to the "aerodynamics" area of the project.

An attempt was made to minimize the occurrence of the second type of problem mentioned above by the choice of sub-areas, which are defined in the "results" section below. Cases in which there was still some question in this regard are commented on separately in that same section of the report.

It should be noted that the selection of sub-categories and the assigning of individual documents to them are judgment decisions which must, as a matter of course, reflect the background of the reviewers. While this may be undesirable, it is also unavoidable.

Investigation Procedure

Cards were prepared for each document to be reviewed and assigned to the appropriate faculty member by title review. Each document assigned to the propulsion subsystem group was reviewed by the writer initially by title only. Those documents for which there was obviously no need for further review were marked and filed as "not applicable." The remainder of the documents were either given to the students for a more complete review or passed on to one of the other project groups whenever the title so indicated. The result of the further review by the students was a brief critique on each document thus handled. Some of these were determined to be not applicable by the students. The remainder were reviewed by the writer and, again, some were found to be not applicable. Documents were determined to be not applicable, at any of the levels of the review, when they contained: (1) only information on details of design of components normally not designed by light aircraft manufacturers (e.g., engines), (2) obviously outdated material, or (3) information pertinent only to large and/or supersonic aircraft. The applicable documents were examined more closely and divided into subareas. The results and conclusions of the investigation are presented in the following section.

Results

By far the largest portion of the documents reviewed which come under the general heading of propulsion were classified as not applicable for the purposes of this project. If the relatively few which were considered to be outdated material are excluded, these not applicable documents can be divided into two time-based categories: (1) those up to around the end of World War II were on piston engine design details, and (2) those from the late 1940's and on were concerned with turbine type propulsion systems and/or high speed flight.

The information contained in the applicable documents has been divided according to the following subarea designations:

1. Internal Flow Systems Design and Analysis

   a. Pipes, ducts (bends and diffusers)
   b. Cowls, inlets and outlets
   c. Exhaust shrouds and ejectors

2. Heat Exchangers Selection and Analysis

   a. Oil coolers (radiator) and intercoolers
   b. Cabin-air, anti-icing and other gas-to-gas type

3. Design Input and Background Information

   a. Altitude cooling correlations
   b. Engine cooling requirements
   c. Properties

Each of the subareas is discussed below with regard to the information available and the possibility of assembling a design manual. Only the general content of the documents will be indicated below. A more complete critique of the individual documents can be found in the Appendix.

Internal Flow Systems Design and Analysis

The most complete single document in this area is WR-L-208, "Design of Power-Plant Installations: Pressure-Loss Characteristics of Duct Components" by J. R. Henry. This report contains the most reliable data available at the time of publication (June 1944) on duct components. The information is given in a convenient form for designing duct systems and estimating their performance. Examples are given to illustrate methods of applying these data to the analysis of duct systems. This is an excellent document and could probably serve as a sort of core around which a design manual for internal flows system could be built. Its main weaknesses are a need for more data in some areas (particularly cooling air inlets and outlets) and a lack of emphasis on a detailed method of procedure. Of course, later data in some areas is also needed. How most of these needs could be met is illustrated by discussions of other available documents in this area.

TR-713 "Internal Flow Systems for Aircraft" by R. M. Rogallo presents a more complete set of simplified procedures for making step-by-step analyses of duct systems. It also contains a lot of data on various inlet and outlet openings (some of which is in WR-L-208). WR-W-21 (see Appendix for title) gives a more precise and rigorous graphical analysis procedure.

Additional data on the performance of inlet and exit configurations is given in TN-813, TR-743, WR-A-1, WR-L-321, WR-L-341, WR-L-407, and WR-L-775. Other information, not data in the usual sense, but rather background information and experience with such problems as boundary layer distortions and noise, which would be helpful in inlet design, can be found in TN-813, WR-A-70, and WR-L-321.

The basic document referred to above, WR-L-208, contains most of the published data at the time of its writing on the pressure loss and flow characteristics of ducts, elbows, and other internal flow system components. This includes most of the data found in such documents as WR-L-328, WR-L-329, WR-L-408, and WR-W-39. A slightly younger document, WR-A-26, contains a comparison of analytically and experimentally determined pressure loss characteristics for straight ducts, elbows, and diffusers, some of this information may be additional to that in WR-L-208.

Later data on frictional pressure losses in straight ducts can be found in TN-1785 and TR-1020. Additional data on bends and elbows is presented in TN-2668 and TN-3995. These documents include data on cascade-diffusing bends (including inlet boundary layer effects) and annular diffusion and expanding bends with transition. Further data and some excellent background information on velocity and pressure distortions in bends is given in TN-1471. Further data on some later developments are to be found in WR-L-84, "Low Pressure Boundary Layer Control in Diffuser and Bends," and in TN-1610 "Effects of Screen in Wide Angle Diffusers."

One of the weaker categories in the internal flow systems area from the standpoint of design information is in charge-air inlet design. Almost all the data available is for NACA cowling designs (with and without flaps) for high performance pursuit planes or large multiengine planes. A representative sampling illustrates this point:

TR-720	"Pressure Available for Cooling with Cowling Flaps"
TR-771	"Review of Flight Tests of NACA C and D Cowlings on the XP-42 Airplane"
TR-950	"Investigation of a Systematic Group of NACA 1-Series Cowlings With and Without Spinners"
WR-L-207	"Cooling Characteristics of a Pratt and Whitney R-2800 Engine Installed in an NACA Short-Nose High-Inlet-Velocity Cowling"
WR-L-579	"A Comparison of Three Spinner-Diffuser Designs in a NACA D_S Cowling for the Pratt and Whitney R-2800 Engine"
TN-813	"Cooling Tests of an Airplane Equipped with a NACA Cowling and a Wing-Duct Cooling System"

It is noted that the latter report does contain data on a wing duct inlet. There is also some good general information and background on the design of cowling and wing inlets in WR-L-341. Some of the data on the cowls could be of value. However, it would be a considerable task to extract it, and it is believed that this is an area where more information is needed.

Another area where information is scarce is the area of exhaust and exhaust related systems. TN-1495 is a substantial document containing equations and procedure for the design and analysis of exhaust pipe shrouds, but it would require some updating. TR-818 gives experimental results of exhaust gas ejection for engine cooling applications, and TR-1192 is a fairly modern document on the design of mufflers. It is questionable as to whether there is sufficient applicable information in this area.

In view of the considerations listed above, it is believed that there may be sufficient information available which could be assembled to form design and analysis manual for internal flow systems (or that section of a manual). It would be a task of considerable proportions, requiring the unification of procedure and methods outlined in the reports mentioned and the assembling of a large amount of data on pressure-loss coefficients, etc. As indicated above, there is sufficient information in some areas, but some others would probably require data from other sources.

Heat Exchanger Selection and Analysis

The selection and performance analysis of heat exchangers is a major part of the propulsion subsystem design area, and, obviously, it is not a consideration which is completely separable from the internal flow systems design discussed above. However, it was felt that, since it is a major sub-area with certain peculiarities of criteria, separate consideration of the information in this area was warranted. Because of the developments in the industry in recent years it was felt that designers of light aircraft would purchase (select) rather than design their own heat exchangers. Thus, only information which was felt to be useful in the selection and performance analysis of heat exchangers was included in this study. Of course, a great deal of this information is contained in reports on the design of heat exchangers.

There are several excellent documents in this area, however, two of them appear to be suitable for a sort of core around which a design manual could possibly be built. The others contain information which represents supplemental and additional material or background information, or more recent developments in the field, which could be incorporated in a format similar to that in the two basic documents.

The first of the two reports referred to is WR-L-341, "Design, Selection and Installation of Aircraft Heat Exchangers," by G. P. Wood, and M. J. Brevoort. This document is divided into three main parts. Part I is entitled "Design" and presents the fundamental relations for calculating heat-transfer rate and pressure loss in heat exchangers, and contains a resume of experimental data on the heat transfer and pressure loss characteristics of many existing designs. It also presents a discussion of the application of the above material to the design of heat exchangers, including methods of calculating power cost of heat exchangers. Part II, entitled "Selection," discusses the selection of external dimensions of coolant radiators, air intercoolers, oil coolers, and engine fins. Part III is entitled "Installation" and considers the problems of installing heat exchangers in aircraft, which includes some information on the design of engine cowlings, wing entrances, scoops, exits, and ducts. The applicability of this document in some of these latter categories has been mentioned in the previous section on internal flow systems. This document is basically quite good with its emphasis on intercoolers and oil coolers. Since the second basic document (to be discussed below) is primarily aimed at cabin-air, wing anti-icing and other, similar gas-to-gas type heat exchangers, a logical division for discussion purposes is automatically provided.

Other information pertinent to intercoolers which may be supplemental or additional to WR-L-341 is presented in TN-781, WR-E-82, WR-E-102, WR-E-104, WR-E-106, WR-E-141, and WR-L-287. At least part of the information in most of these documents is contained in WR-L-341. The first two, TN-781 and WR-E-82, are mathematical analyses of intercooler designs. Design charts, comparisons, and selection charts are the subjects of the last seven in the nine listed above. A somewhat later document, TR-784 (WR-E-130), provides an analysis for intercooling cooling-air flow and pressure drop for minimum power loss. It is noted that whether intercooler design would be the responsibility of the aircraft manufacturer or engine designer would depend on circumstances. At any rate the data is still pertinent to the area of heat exchanger selection and analysis.

Design charts and comparisons of various radiator configurations are the subjects of WR-L-233 and WR-L-492. Although radiators are a rare sight in light aircraft the information is still of general validity for liquid-to-gas heat exchangers. WR-L-744, "Selection of Oil Coolers to Avoid Congealing," by O. J. Martin provides an analytical treatment of the problem of oil cooler selection along with simplified charts. TN-1567 provides experimental data on oil heat dissipation and oil and air pressure drop data at altitude, and provides an analytical basis for correlating and predicting air pressure drop at altitude. TN-3713, "Selection of Optimum Configurations for Heat Exchangers With One Dominating Film Resistance," by E. R. G. Eckert and T. F. Irvine, Jr., is fairly recent document which could add appreciably to the information of WR-L-341 in the area of oil coolers. This document presents a simplified method of optimizing any of several parameters for heat exchangers of this type.

The other major document referred to previously in the area of heat exchanger selection and performance analysis is WR-W-95. Entitled "An Investigation of Aircraft Heaters XVIII - A Design Manual for Exhaust Gas and Air Heat Exchangers," this four-part report on the elements of design of cabin-air heaters, wing anti-icing heat exchangers, and other gas-to-gas heat exchangers is a summary of the NACA reports with the same prefix-title numbers I to XXIII. The first part of WR-W-95 gives the basic relations for the thermal resistances in heat exchanger design. Part II presents examples of application of these basic equations for the prediction of performance for a number of heater designs. In Part III non-isothermal pressure losses and the heating requirements of aircraft are discussed, and the equations used to correct heater performance to any altitude are presented. The third part also summarizes equations required to predict the performance of a ram-operated heater-and-duct system (WR-W-21). The fourth part is an appendix on the properties of air. Additional experimental data on the performance of several types of exhaust-gas-to-air exchangers is presented in WR-A-29 and WR-E-97. A great deal of later data on heat transfer and friction coefficients for heat exchangers and heat exchanger components could be added from such documents as TN-2186, TN-2237, TN-2257, TR-1020, and WR-W-108. Some heat transfer data useful in the design of windshield defogging equipment is presented in TN-1070.

A later document which presents an analytical method for comparing weights and sizes of exhaust gas-to-air exchangers is TN-1312. Another later document, TN-1455, provides a comparison of the experimentally determined performance of a large number of exhaust gas-to-air exchangers, and is a useful contribution.

Two significant advances in the procedure of selection of gas-to-gas heat exchangers came in 1956. TN-3655, "Method of Calculating Core Dimensions of Crossflow Heat Exchangers With Prescribed Gas Flows and Inlet and Exit States," provides a calculation procedure based on a number of charts which can be prepared for each surface. A generalization of their procedure is given in TN 3891, "Rapid Determination of Core Dimensions of Crossflow Gas-to-Gas Heat Exchangers," which omits the necessity of constructing new sets of charts for different flow configurations. This procedure considerably simplifies the effort necessary to select optimum configurations.

It is believed that the basic documents referred to previously plus the others which provide updated data and improved selection and optimization procedures could be combined to form a design manual for aircraft heat exchangers selection and analysis. Again, the assembly procedure would not be easy for such an extensive document. There are several existing books on heat exchanger design, but, in the writer's opinion, they would not serve the present purpose very well. Most of them are textbooks, which contain a lot of non-applicable subjects and are too brief. One book,* on the other hand, might be useful in undertaking a light aircraft design manual (section) on heat exchangers, although it is far too extensive itself for this.

Design Input and Background Information

Although the necessary input data for the air flow and cooling requirements would normally be supplied to the aircraft designer by the engine manufacturer, it was felt that some background information in this area would be an important part of the necessary knowledge of a propulsion subsystem designer.

Some experimental data on the cooling characteristics of radial air-cooled engines is presented in TN-816, TN-1092, TN-1109, and TR-873 (TN-1089). Altitude cooling correlations are given and discussed in TN-1092, WR-E-127, WR-E-201, and WR-L-685. A comparison of several methods of predicting pressure loss across baffled cylinders is presented in TR-858 (TN-1067). A series of five reports on high altitude cooling, WR-L-771 through 775, provides a good resume of the problems and some background information on the cooling and airflow requirements for engines, and propulsion subsystem components.

Some additional, more updated, information would probably be required to provide a good background on engine requirements. One of the basic input requirements is, of course, the physical properties of fluids and materials.

*"The Design and Performance Analysis of Compact Heat Exchangers," Northern Research and Engineering Corp., Cambridge, Massachusetts, 1965.

TN-1026, TN-1912, WR-L-341, and WR-W-95 are just a few examples of NACA documents with this type of data. It is believed that there is certainly sufficient data of this nature available.

Summary and Conclusions

The information found in this study of NACA and NASA documents which is pertinent to the design of light aircraft propulsion subsystems has been discussed with regard to content. Findings in the various subareas have been presented separately, and the strong and weak points in each subarea with regard to a possible design manual have been indicated. In conclusion, it is the writer's opinion that there is probably enough existing information to form the basis of a good design manual or handbook. In certain areas, as indicated in the discussions, some information from other sources will probably be required. It is reemphasized that the assembling of such an extensive amount of data would be a task of considerable magnitude.

The table below gives the initial and final number of the reports in each group by series.

	Applicable	Not Applicable
First NACA Technical Note	781	756
Last NACA Technical Note	3995	4386
First NASA Memorandum (Memo)	None	10-19-58L
Last NASA Memorandum (Memo)	None	5-28-59L
First NASA Technical Note	None	D-2
Last NASA Technical Note	None	D-2639
First NACA Technical Report	713	682
Last NACA Technical Report	1192	1388
First NASA Technical Report	None	R-33
Last NASA Technical Report	None	R-140
First NACA Wartime Report	A-1 L-84 E-82 W-21	A-46 L-3 E-1 W-7
Last NACA Wartime Report	A-70 L-775 E-201 W-108	A-85 L-782 E-285 W-88
First NACA Research Memorandum	None	A7C04
Last NACA Research Memorandum	None	L58G25
First NACA Technical Memorandum	None	923
Last NACA Technical Memorandum	None	1298

	Applicable	Not Applicable
First NASA Technical Translation	None	F-1
Last NASA Technical Translation	None	F-79
First NASA Technical Memorandum	None	X-9
Last NASA Technical Memorandum	None	X-479

APPENDIX

NACA Technical Notes Dealing with Propulsion Subsystems and Judged Applicable to Light Aircraft

TN 781 MATHEMATICAL ANALYSIS OF AIRCRAFT INTERCOOLER DESIGN, Upshur T. Joyner, October 1940

A mathematical analysis was performed to obtain the dimensions of an intercooler that will use the least total power for a given set of design conditions. A new intercooler arrangement can be found using this analysis. The crossflow of air was used for the analysis along with a turbulent air flow and smooth passageways.

TN 813 COOLING TESTS OF AN AIRPLANE EQUIPPED WITH AN NACA COWLING AND A WING-DUCT COOLING SYSTEM, L. I. Turner, Jr., David Biermann, and W. B. Boothby, June 1941

Cooling tests were made on a Northrop A-17A attack airplane equipped with conventional NACA cowling and with wing-duct cooling system. Wing ducts may offer possibilities for improved engine cooling, increased cooling of accessories, and better fairing of the power plant installation. Results showed that: (1) ground cooling for the wing duct system without cowl flap was better than for NACA cowling with the flap, and (2) satisfactory temperatures were maintained in both climb and high speed flight but with the use of conventional baffles, a greater quantity of cooling air appeared to be required for the wing duct system.

TN 816 COOLING AND PERFORMANCE TESTS OF A CONTINENTAL A-75 ENGINE, Herman H. Ellerbrock, Jr., and Robert O. Bullock, July 1941

This report presents the steps taken in developing a set of baffles for a Continental A-75 engine and the cooling and performance characteristics of the engine at sea level and at altitude with these baffles. A description of the system used to cool the oil and tests with this system is given. A new manifold system designed and tested for use with the engine in a low drag configuration is described.

TN 1026 CHARTS OF THERMODYNAMIC PROPERTIES OF FLUIDS ENCOUNTERED IN CALCULATIONS OF INTERNAL COMBUSTION ENGINE CYCLES, H. C. Hottel and G. C. Williams, May 1946

Included in this report is a chart which allows the calculation of the properties of air-octene mixtures before and after combustion. The chart is based on one pound mole of mixture and is applicable below the temperature at which dissociation occurs. Example calculations illustrating how to use the chart and included air tables are given in detail.

TN 1070 AN EMPIRICAL EQUATION FOR THE COEFFICIENT OF HEAT TRANSFER TO A FLAT SURFACE FROM A PLANE HEATED-AIR JET DIRECTED TANGENTIALLY TO THE SURFACE, John Zerbe and James Selna, June 1946

Correlation equation and results for heat transfer coefficients for hot air windshield fog prevention were given. Several outlet area aspect ratios were tested.

TN 1092 FLIGHT INVESTIGATION OF THE COOLING CHARACTERISTICS OF A TWO-ROW RADIAL ENGINE INSTALLATION. I - COOLING CORRELATION, E. Barton Bell, James E. Morgan, John H. Disher, and Jack R. Mercer, July 1946

Flight tests were conducted to determine the cooling characteristics of a two-row radial engine at altitude in a twin-engine airplane and to investigate the accuracy with which low altitude cooling correlation equations can be used for making cooling predictions at higher altitudes. Slightly more accurate results were obtained when the equations were based on the density of cooling air at the rear of the engine than when they were based on average or front densities; however, the difference was small for the range of altitudes encountered. Cooling-correlation equations are established by the method in TR 612 and the accuracy of using the low-altitude correlation for higher altitude predictions was investigated.

TN 1109 FLIGHT INVESTIGATION OF THE COOLING CHARACTERISTICS OF A TWO-ROW RADIAL ENGINE INSTALLATION. II - COOLING-AIR PRESSURE RECOVERY AND PRESSURE DISTRIBUTION, E. John Hill, Calvin C. Blackman, and James E. Morgan, July 1946

Flight tests were conducted to investigate the cooling-air pressure recovery and distribution for a two-row radial engine enclosed in a low-inlet-velocity cowling of a twin-engined airplane. The effect of flight variables on average recovery and circumferential, radial, and longitudinal distribution were presented for level flight; also included is a comparison of pressure-drop measurements across the engine. Variables effecting pressure recovery and distribution the most are cowl-flap angle, angle of attack of the thrust axis, and the propeller thrust diskloading coefficient. An important consideration in the design of cowlings and cowl flaps should be the obtaining of good distribution of cooling air, as well as minimum drag for installation.

TN 1312 A COMPARATIVE STUDY OF WEIGHTS AND SIZES OF FLAT-PLATE EXHAUST-GAS-TO-AIR HEAT EXCHANGERS WITH AND WITHOUT FINS, Thorval Tendeland and Charles P. Steinmetz, July 1947

Analytical comparisons of weights and volumes are made for flat-plate heat exchangers having the same calculated thermal output and friction pressure drop for configurations of (1) no fins,

(2) fins in both the air and exhaust gas passages and (3) fins in the air passages only. Configurations (1) and (2) were compared with predicted weights and volumes.

TN 1455 AN INVESTIGATION OF AIRCRAFT HEATERS. XXXI - SUMMARY OF LABORATORY TESTING OF SEVERAL EXHAUST-GAS AND AIR HEAT EXCHANGERS, L. M. K. Boelter, A. G. Guibert, F. E. Romie, F. D. Sanders, and J. M. Rademacher, June 1948

A comparison of the thermal performance and pressure-drop characteristics of heat exchangers is presented. These exchangers included both parallel and cross-flow units as well as extended-surface and all prime surface units. The results are presented in tabular form and in a series of performance charts for each heater. A description of the testing techniques used during these tests and a discussion of the measurement of the variables-temperature, weight rate, and pressure drop are presented.

An extensive bibliography is presented for the different heat exchangers that have been experimented with. This report combines many different experimental results.

TN 1471 EXPERIMENTAL INVESTIGATION OF VELOCITY DISTRIBUTIONS DOWNSTREAM OF SINGLE DUCT BENDS, J. R. Weske, January 1948

This report presents velocity distributions (and discusses flow features) at the outlet of a large number of duct elbows (round elliptical, square and rectangular cross-sections). It includes findings on the decay of velocity patterns produced by curved ducts and of the effect of asymmetrical upstream velocity distributions.

TN 1495 ANALYSIS, VERIFICATION, AND APPLICATION OF EQUATIONS AND PROCEDURES FOR DESIGN OF EXHAUST-PIPE SHROUDS, Herman H. Ellerbroch, Jr., Chester R. Wcislo, and Howard E. Dexter, December 1947

Simplified equations for the design of exhaust pipe shrouds are the result of the analysis in this report. The only data required for use in the design equations are the upstream temperatures and flow rates of the exhaust gases and cooling air and the upstream pressures of the cooling air. A step by step example is presented with the steps tabulated in the appendix.

Detailed procedures and charts for the design of shrouds are presented for both parallel-flow and counter-flow systems. These procedures permit the determination of the proportions of an exhaust pipe shroud that will provide desired cooling or permit the determination of the proportions of the shroud that will provide the maximum cooling and the values of installation temperatures associated with that shroud.

TN 1567 SIMULATED ALTITUDE INVESTIGATIONS OF PERFORMANCE OF TUBULAR AIRCRAFT OIL COOLERS, S. V. Manson, April 1948

This report presents experimental values of oil heat dissipation, oil pressure drop, and air pressure drop at simulated altitudes up to 40,000 feet, and shows the effect of congealing on oil heat dissipation and oil pressure drop. It also presents analytical basis for correlating and predicting air pressure drops at altitude and compares experimental and predicted air pressure-drop values.

TN 1610 EFFECTS OF SCREENS IN SIDE ANGLE DIFFUSERS, G. B. Schubauer and W. G. Spangenberg, July 1948

Low speed experimental data on the effect of screens in a diffuser is presented. Data on pressure loss coefficient and velocity profiles shows "filling effect" of screens, i.e. preventing separation in diffuser and keeping the velocity profiles similar to those at entrance (at the expense of efficiency). Also some effects of diffuser shape are discussed.

TN 1785 FRICTION COEFFICIENTS IN THE INLET LENGTH OF SMOOTH ROUND TUBES, Ascher H. Shapiro and R. Douglas Smith, November 1948

An experimental study was made of friction coefficients near the inlet of smooth, round tubes with bellmouth entrances. The range of Reynolds number was from 39,000 to 590,000; these values corresponded to turbulent flow in the region of a fully developed velocity profile. The object of this investigation was to determine experimentally the values of the friction coefficient in the inlet length of round, straight, smooth tubes and to find the effects on the friction coefficient of Reynolds number, distance from the entrance, and initial turbulence.

TN 1912 AN INVESTIGATION OF AIRCRAFT HEATERS. XXXII - MEASUREMENTS OF THERMAL CONDUCTIVITY OF AIR AND OF EXHAUST GASES BETWEEN 50° AND 900° F, L. M. K. Boelter and W. H. Sharp, July 1949

By means of a hot-wire method, the thermal conductivity of air was measured from air temperatures of 50° to 900° F and the thermal conductivity of gasoline-engine exhaust gases was measured from gas temperatures of 250° to 900° F. The values for exhaust gases from an engine operating on fuel-air ratios between 0.056 and 0.085 are practically the same as those for air at the same temperature, but the richer mixtures show increasingly larger values of thermal conductivity.

TN 2186 METHOD FOR DETERMINING PRESSURE DROP OF AIR-FLOWING THROUGH CONSTANT AREA PASSAGES FOR ARBITRARY HEAT-INPUT DISTRIBUTIONS, Benjamin Pinkel, Robert N. Noyes, and Michael F. Valerino, September 1950

A method is presented that enables convenient determination of the pressure drop sustained by air flowing at high subsonic speeds in a constant area passage under the simultaneous influence of friction and heat addition. The method is applicable for arbitrary heat-flux distribution along the flow passage length. Air pressure drop working charts based on the method developed are presented.

TN 2237 CORRELATIONS OF HEAT-TRANSFER DATA AND OF FRICTION DATA FOR INTERRUPTED PLANE FINS STAGGERED IN SUCCESSIVE ROWS, S. V. Manson, December 1950

The heat-transfer data and the friction data from five referenced reports on interrupted plane fins that are staggered in successive rows in the fluid flow direction were separately correlated. A single heat-transfer correlation equation was obtained that satisfactorily represents the heat transfer data over the entire range of conditions investigated. The friction data required separate correlation equations below and above the transition Reynolds number of 3500.

TN 2257 TEMPERATURE DISTRIBUTION IN INTERNALLY HEATED WALLS OF HEAT EXCHANGERS COMPOSED OF NONCIRCULAR FLOW PASSAGES, E. R. G. Eckert and George M. Low, January 1951

Presented in this report is an analytical means for the prediction of the variation of heat transfer coefficient and temperature in heat exchangers composed of polygonal flow passages. The heat exchanger described is one in which only one working fluid is utilized with heat being transferred to the coolant by heat sources located in the passage walls. The flow within the passages is assumed to be turbulent.

TN 2668 EXPERIMENTAL INVESTIGATION OF A 90° CASCADE DIFFUSING BEND WITH AN AREA RATIO OF 1.45:1 AND WITH SEVERAL INLET BOUNDARY LAYERS, Daniel Friedman and Willard R. Westphal, April 1952

Experimental data on 90° bend (square duct) with airfoil turning cascade is presented. Total pressure loss compares favorably with ordinary (valueless) diffusing bend but allows a shorter bend.

TN 3655 METHOD OF CALCULATING CORE DIMENSIONS OF CROSSFLOW HEAT EXCHANGER WITH PRESCRIBED GAS FLOWS AND INLET AND EXIT STATES, E. R. G. Eckert and Anthony J. Diaguila, April 1956

A calculation procedure is described by which the dimensions of the core of a gas-to-gas crossflow heat exchanger with prescribed heat-transfer surfaces can be readily determined. The procedure is based on a number of charts that may be prepared for each surface with prescribed entrance conditions, pressure drops, and temperature changes. The Reynolds numbers that determine the flow velocities on both sides of the heat exchanger as well as the three basic dimensions of the heat exchanger core are found by reading values from the charts and performing a few simple calculations.

TN 3713 SELECTION OF OPTIMUM CONFIGURATIONS FOR HEAT EXCHANGER WITH ONE DOMINATING FILM RESISTANCE, E. R. G. Eckert and T. F. Irvine, June 1956

This report is for heat exchangers in which one fluid's heat transfer resistance is predominant. A method of optimizing the design is presented which assumes that the heat exchanged per unit time and the mass flow and inlet state of each fluid are prescribed. Any one of the parameters, power expended, weight, volume or frontal area, can be optimized w/t in any one of the three remaining parameters when the heat exchanger is arranged normal to primary flow direction. When the heat exchanger is inclined at an angle, any one of the parameters, power, weight or volume, can be optimized w/t any one of the two remaining parameters.

TN 3891 RAPID DETERMINATION OF CORE DIMENSIONS OF CROSSFLOW GAS-TO-GAS HEAT EXCHANGERS, Anthony J. Diaguila and John N. B. Livingood, December 1956

The report presents a generalization of the procedure of TN 3655 to omit the necessity of constructing new sets of charts (like those in TN 3655) for different core configurations. Present method of use, with illustrations, allows efficient investigation to meet best space, weight, and frontal area requirements.

TN 3995 AN INVESTIGATION OF FLOW IN CIRCULAR AND ANNULAR 90° BENDS WITH A TRANSITION IN CROSS SECTION, Stafford W. Wilbur, August 1957

Experimental data on 90° circular and annular bends of simple shapes for cross-sectional areas that are constant, contracting, and expanding is presented. It includes two transition bends from circular to annular and vice-versa. Tests were run with flow transition occurring upstream, in, and downstream of bend. Exit velocity profiles, total pressure coefficient and an index of total pressure spatial distortion at exit are given.

NACA Technical Notes Dealing with Propulsion But Not Judged Applicable to Light Aircraft

TN 756 THE EFFECT OF PISTON-HEAD SHAPE, CYLINDER-HEAD SHAPE, AND EXHAUST RESTRICTION, ON THE PERFORMANCE OF A PISTON-PORTED TWO STROKE CYLINDER, A. R. Rogowski, C. L. Bouchard, and C. Fayette Taylor, March 1940

TN 766 A STUDY OF AIR MOVEMENTS IN TWO AIRCRAFT-ENGINE CYLINDERS, Dana W. Lee, July 1940

TN 767 THE EFFECTS OF ENGINE SPEED AND MIXTURE TEMPERATURE ON THE KNOCKING CHARACTERISTICS OF SEVERAL FUELS, Dana W. Lee, July 1940

TN 768 CORRELATION OF KNOCKING CHARACTERISTICS OF FUELS IN AN ENGINE HAVING A HEMISPHERICAL COMBUSTION CHAMBER, A. M. Rothrock and Arnold E. Biermann, July 1940

TN 772 ANALYSIS OF CYLINDER-PRESSURE INDICATOR DIAGRAMS SHOWING EFFECTS OF MIXTURE STRENGTH AND SPARK TIMING, Harold C. Gerrish and Fred Voss, August 1940

TN 774 IONIZATION IN THE KNOCK ZONE OF AN INTERNAL-COMBUSTION ENGINE, Charles E. Hastings, September 1940

TN 787 FACTORS AFFECTING HEAT TRANSFER IN THE INTERNAL-COMBUSTION ENGINE, P. M. Ku, December 1940

TN 794 TWO-STAGE SUPERCHARGING, Richard S. Buck, February 1941

TN 795 EFFECT OF SEVERAL SUPERCHARGER CONTROL METHODS ON ENGINE PERFORMANCE, Eugene W. Wasielewski and J. Austin King, February 1941

TN 831 A METHOD OF DETERMINING THE EQUILIBRIUM PERFORMANCE AND THE STABILITY OF AN ENGINE EQUIPPED WITH AN EXHAUST SUPERCHARGER, James Buchanan Rea, November 1941

TN 839 RISE IN TEMPERATURE OF THE CHARGE IN ITS PASSAGE THROUGH THE INLET VALVE AND PORT OF AN AIR-COOLED AIRCRAFT ENGINE CYLINDER, J. E. Forbes and E. S. Taylor, January 1942

TN 861 THE EFFECT OF VALVE COOLING UPON MAXIMUM PERMISSIBLE ENGINE OUTPUT AS LIMITED BY KNOCK, Maurice Munger, H. D. Wilsted, and B. A. Mulcany, September 1942

TN 915 THE EFFECT OF INLET-VALVE DESIGN, SIZE, AND LIFT ON THE AIR CAPACITY AND OUTPUT OF A FOUR-STROKE ENGINE, James C. Livengood and John D. Stanitz, November 1943

TN 919 PART-THROTTLE OPERATION AND CONTROL OF A PISTON-PORTED TWO STROKE CYLINDER, A. R. Rogowski and C. Fayette Taylor, November 1943

TN 935 DYNAMICS OF THE INLET SYSTEM OF A FOUR STROKE ENGINE, R. H. Boden and Harry Schecter, May 1944

TN 956 BIBLIOGRAPHY ON PISTON RING LUBRICATION, Mayo D. Hersey, October 1944

TN 977 DEVELOPMENT OF A DETONATION DETECTOR SUITABLE FOR USE IN FLIGHT, C. S. Draper, E. S. Taylor, J. H. Lancor, and R. T. Coffey, December 1944

TN 996 NET HEAT OF COMBUSTION OF AN-F-28 AVIATION GASOLINES, R. S. Jessup and C. S. Crabtree, June 1945

TN 1023 THE SYNTHESIS OF METHYLENECYCLOBUTANE, SPIROPENTANE, AND 2-METHYL-1-BUTANE FROM PENTAERYTHRITYL TETRABROMIDE, Vernon A. Slabey, February 1946

TN 1035 STEADY AND INTERMITTENT-FLOW COEFFICIENTS OF POPPET INTAKE VALVES, John D. Stanitz, Robert E. Lucia, and Francis L. Masselle, March 1946

TN 1037 A STUDY OF COMBUSTION IN A FLOWING GAS, Mitchell Gilbert, Gordon Haddock, and Allen Metzler, April 1946

TN 1053 USE OF DUCTED HEAD BAFFLES TO REDUCE REAR-ROW CYLINDER TEMPERATURES OF AN AIR-COOLED AIRCRAFT ENGINE, Michael A. Sipko, Charles B. Cotton, and James B. Lusk, August 1946

TN 1068 EFFECTS OF AXIAL-PLANE CURVATURE AND PASSAGE-AREA VARIATION OF FLOW CAPACITY OF RADIAL-DISCHARGE IMPELLER WITH CONVENTIONAL INLET BUCKETS, William K. Ritter, Ambrose Ginsburg, and Alfred G. Redlitz, May 1946

TN 1069 EFFECT OF THE NACA INJECTION IMPELLER ON THE MIXTURE DISTRIBUTION OF A DOUBLE-ROW RADIAL AIRCRAFT ENGINE, Frank E. Marble, William K. Ritter, and Mahlon A. Miller, May 1946

TN 1078 AN ANALYSIS OF THE FACTORS AFFECTING THE STATE OF FUEL AND AIR MIXTURES, Mitchell Gilbert, John N. Howard, and Bruce L. Hicks, May 1946

TN 1082 COMPARATIVE EFFECTIVENESS OF A CONVECTION-TYPE AND A RADIATION-TYPE COOLING CAP ON A TURBOSUPERCHARGER, Frederick J. Hartwig, Jr., June 1946

TN 1086 THERMODYNAMIC CHARTS FOR THE COMPUTATION OF COMBUSTION AND MIXTURE TEMPERATURES AT CONSTANT PRESSURE, Richard L. Turner and Albert M. Lord, June 1946

TN 1106 PERFORMANCE PARAMETERS FOR JET PROPULSION ENGINES, Newell D. Sanders, July 1946

TN 1108 LOAD CAPACITY OF ALUMINUM-ALLOY CRANKPIN BEARINGS AS DETERMINED IN A CENTRIFUGAL BEARING TEST MACHINE, E. Fred Macks and Milton C. Shaw, August 1946

TN 1116 STRAIN-GAUGE STUDY OF INTERNALLY COOLED EXHAUST VALVES HAVING VARIOUS THROAT DESIGNS, Arthur G. Holms and Richard D. Faldetta, August 1946

TN 1117 COMPARISON OF RELATIVE SENSITIVITIES OF THE KNOCK LIMITS OF TWO FUELS TO SIX ENGINE VARIABLES, Harvey A. Cook, Louis F. Held, and Ernest I. Pritchard, August 1946

TN 1131 THE EFFECT OF ENGINE VARIABLES ON THE PRE-IGNITION-LIMITED PERFORMANCE OF THREE FUELS, Donald W. Male, November 1946

TN 1138 STANDARD PROCEDURES FOR RATING AND TESTING MULTISTAGE AXIAL-FLOW COMPRESSORS, NACA Subcommittee on Compressors, November 1946

TN 1147 FLIGHT INVESTIGATION OF THE COOLING CHARACTERISTICS OF A TWO-ROW RADIAL ENGINE INSTALLATION. III - ENGINE TEMPERATURE DISTRIBUTION, Robert M. Rennak, Wesley E. Messing, and James E. Morgan, November 1946

TN 1148 FLOW TESTS OF AN NACA - DESIGNED SUPERCHARGER INLET ELBOW AND THE EFFECTS OF VARIOUS COMPONENTS OF THE FLOW CHARACTERISTICS AT THE ELBOW OUTLET, D. C. Guentert, D. J. Todd, and W. P. Simmons, Jr., November 1946

TN 1149 PERFORMANCE OF HOODS FOR AIRCRAFT EXHAUST-GAS TURBINES, R. L. Turner, W. H. Lowdermilk, and A. M. Lord, February 1947

TN 1155 A PRELIMINARY STUDY OF A PROPELLER POWERED BY GAS JETS ISSUING FROM THE BLADE TIPS, J. C. Sanders and N. B. Sanders, February 1947

TN 1159 TURBOSUPERCHARGER-ROTOR TEMPERATURES IN FLIGHT, Edward R. Bartoo, February 1947

TN 1163 THE SYNTHESIS AND PURIFICATION OF AROMATIC HYDROCARBONS, J. M. Lamberti, T. W. Reynolds, and H. H. Chanan, February 1947

TN 1164 THE SYNTHESIS AND PURIFICATION OF AROMATIC HYDROCARBONS V-1-TEHYL-3-METHYLBENZENE, Earl R. Ebersole, February 1947

TN 1174 THE APPLICATION OF HIGH-TEMPERATURE STRAIN GAGES TO THE MEASUREMENT OF VIBRATORY STRESSES IN GAS-TURBINE BUCKETS, R. H. Kemp, W. C. Morgan, and S. S. Manson, April 1947

TN 1180 ANALYSIS OF JET-PROPULSION ENGINE COMBUSTION CHAMBER PRESSURE LOSSES, Irving I. Pinkel and Harold Shames, February 1947

TN 1189 PRESSURE-DISTRIBUTION MEASUREMENTS ON THE ROTATING BLADES OF A SINGLE-STAGE AXIAL-FLOW COMPRESSOR, Jack F. Runckel and Richard S. Davey, February 1947

TN 1199 CHARTS OF PRESSURE RISE OBTAINABLE WITH AIRFOIL-TYPE AXIAL FLOW COOLING FANS, A. Kahane, March 1947

TN 1201 PERFORMANCE OF AXIAL-FLOW FAN AND COMPRESSOR BLADES DESIGNED FOR HIGH LOADINGS, Seymor M. Bogdonoff and L. Joseph Horrig, February 1947

TN 1206 IN-LINE AIRCRAFT-ENGINE BEARING LOADS. III - MAIN-BEARING LOADS, Milton C. Shaw and E. Fred Macks, March 1947

TN 1209 EXHAUST-VALVE TEMPERATURES IN A LIQUID-COOLED AIRCRAFT-ENGINE CYLINDER AS AFFECTED BY ENGINE OPERATING VARIABLES, Alois T. Sutor and Carl Dudugjian, March 1947

TN 1213 EXPERIMENTAL AND THEORETICAL STUDIES OF SURGING IN CONTINUOUS-FLOW COMPRESSORS, Robert O. Bullock, Ward W. Wilcox, and Jason J. Moses, March 1947

TN 1214 PERFORMANCE OF A RADIAL-INLET IMPELLER DESIGNED ON THE BASIS OF TWO-DIMENSIONAL-FLOW THEORY FOR AN INFINITE NUMBER OF BLADES, I. A. Johnsen, W. K. Ritter and R. J. Anderson, March 1947

TN 1216 EFFECTS ON PERFORMANCE OF CHANGING THE DIVISION OF WORK BETWEEN INCREASE OF ANGULAR VELOCITY AND INCREASE OF RADIUS OF ROTATION IN AN IMPELLER, Ambrose Ginsburg, William K. Ritter, and John Palasics, February 1947

TN 1217 SPARK-TIMING CONTROL BASED ON CORRELATION OF MAXIMUM-ECONOMY SPARK TIMING, FLAME FRONT TRAVEL, AND CYLINDER PRESSURE RISE, Harvey A. Cook, Orville H. Heinicke, and William H. Haynie, March 1947

TN 1220 EFFECT OF EXHAUST PRESSURE ON THE PERFORMANCE OF AN 18-CYLINDER AIR-COOLED RADIAL ENGINE WITH A VALVE OVERLAP OF 40°, David S. Boman, Tobor F. Nagey, and Roland B. Doyle, March 1947

TN 1221 EFFECT OF EXHAUST PRESSURE ON THE COOLING CHARACTERISTICS OF AN AIR-COOLED ENGINE, Michael F. Valerino, Samuel J. Kaufman, and Richard Hughes, March 1947

TN 1232 EFFECT OF EXHAUST PRESSURE ON THE PERFORMANCE OF AN 18-CYLINDER AIR-COOLED RADIAL ENGINE WITH A VALVE OVERLAP OF 62°, Leroy V. Humble, Tibor F. Nagey, and David S. Boman, April 1947

TN 1238 THE NACA MIXTURE ANALYZER AND ITS APPLICATION TO MIXTURE-DISTRIBUTION MEASUREMENT IN FLIGHT, Aarold C. Gerrish, J. Lawrence Meem, Jr., Marvin D. Scadron, and Anthony Colnar, March 1947

TN 1242 AN ANALYSIS OF THE FACTORS THAT AFFECT THE EXHAUST PROCESS OF A FOUR-STROKE-CYCLE RECIPROCATING ENGINE, John D. Stanitz, April 1947

TN 1243 A SPECTROPHOTOMETRIC METHOD FOR IDENTIFICATION AND ESTIMATION OF ALKYLNAPHTHALENTIC TYPE HYDROCARBONS IN KEROSENE, Alden P. Cleaves and Mildred S. Carver, April 1947

TN 1247 THE PREPARATION AND PHYSICAL PROPERTIES OF SEVERAL ALIPHATIC HYDROCARBONS AND INTERMEDIATES, Frank L. Howard, Thomas W. Mears, A. Fookson, Philip Pomerantz, and Donald B. Brooks, June 1947

TN 1249 A STUDY OF PISTON-RING FRICTION, James C. Livengood and Chapin Wallour, September 1947

TN 1254 ITERATIVE INTERFERENCE METHODS IN THE DESIGN OF THIN CASCADE BLADES, Leo Diesendruck, May 1947

TN 1271 AXIAL-FLOW FAN AND COMPRESSOR BLADE DESIGN DATA AT 52.5° STAGGER AND FURTHER VERIFICATION OF CASCADE DATA BY ROTOR TESTS, Seymour M. Bogdonoff and Eugene E. Hess, April 1947

TN 1280 DISTRIBUTION OF BEARING REACTIONS ON A ROTATING SHAFT SUPPORTED ON MULTIPLE JOURNAL BEARINGS, S. S. Manson and W. C. Morgan, May 1947

TN 1313 AN INVESTIGATION OF THE EFFECT OF BLADE CURVATURE ON CENTRIFUGAL-IMPELLER PERFORMANCE, Robert J. Anderson, William K. Ritter, and Dean M. Dildine, June 1947

TN 1332 A RAPID COMPRESSION MACHINE SUITABLE FOR STUDYING SHORT IGNITION DELAYS, W. A. Leary, E. S. Taylor, C. F. Taylor, and J. V. Jovellanos, March 1948

TN 1334 EFFECTS OF TEMPERATURE DISTRIBUTION AND ELASTIC PROPERTIES OF MATERIALS ON GAS-TURBINE-DISK STRESSES, Arthur G. Holms and Richard Faldetta, June 1947

TN 1349 PERFORMANCE AND RANGES OF APPLICATION OF VARIOUS TYPES OF AIRCRAFT PROPULSION SYSTEMS, Cleveland Laboratory Staff, August 1947

TN 1362 TESTS TO DETERMINE THE EFFECT OF HEAT ON THE PRESSURE DROP THROUGH RADIATOR TUBES, Louis W. Habel and James J. Gallagher, July 1947

TN 1365 THE EFFECT OF CHANGING THE RATIO OF EXHAUST-VALVE FLOW CAPACITY TO INLET-VALVE FLOW CAPACITY ON VOLUMETRIC EFFICIENCY AND OUTPUT OF A SINGLE-CYLINDER ENGINE, Eppes, Livengood, and Taylor, October 1947

TN 1366 EFFECT OF CHANGING MANIFOLD PRESSURE, EXHAUST PRESSURE AND VALVE TIMING ON THE AIR CAPACITY AND OUTPUT OF A FOUR-STROKE ENGINE OPERATED WITH INLET VALVES OF VARIOUS DIAMETERS AND LIFTS, James C. Livengood and James V. D. Eppes, December 1947

TN 1367 EFFECT OF EXHAUST PRESSURE ON THE PERFORMANCE OF A 12-CYLINDER LIQUID-COOLED ENGINE, Loland G. Desmon and Ronald B. Doyle, July 1947

TN 1374 EXPERIMENTAL STUDIES OF THE KNOCK-LIMITED BLENDING CHARACTERISTICS OF AVIATION FUELS. II - INVESTIGATION OF LEADED PARAFFINIC FUELS IN AN AIR-COOLED CYLINDER, Jerrold D. Wear and Newell D. Sanders, July 1947

TN 1388 PERFORMANCE OF AN AXIAL-FLOW COMPRESSOR ROTOR DESIGNED FOR A PITCH-SECTION LIFT COEFFICIENT OF 1.20, L. Joseph Herrig and Seymour H. Bogdonoff, July 1947

TN 1399 PRELIMINARY INVESTIGATION OF A GAS TURBINE WITH SILLIMANITE CERAMIC ROTOR BLADES, Frederick J. Hartwig, Bob W. Sheflin, and Robert J. Jones, August 1947

TN 1408 INSTANTANEOUS ULTRAVIOLET KNOCK SPECTRA CORRELATED WITH HIGH-SPEED PHOTOGRAPHS, M. A. Hirshfeld and Cearcy D. Miller, August 1947

TN 1413 PERFORMANCE OF A DOUBLE-ROW RADIAL AIRCRAFT ENGINE WITH THREE METHODS OF SAFETY FUEL INJECTION, Donald J. Michel, Robert O. Hickel, and Charles H. Voit, August 1947

TN 1416 EXPERIMENTAL STUDIES OF THE KNOCK-LIMITED BLENDING CHARACTERISTICS OF AVIATION FUELS. III - AROMATICS AND CYCLOPARAFFINS, I. L. Drell and J. D. Wear, August 1947

TN 1418 INVESTIGATION OF THE PRESSURE-LOSS CHARACTERISTICS OF A TURBOJET INLET SCREEN, John L. Lankford, September 1947

TN 1426 METHOD OF DESIGNING VANELESS DIFFUSERS AND EXPERIMENTAL INVESTIGATION OF CERTAIN UNDETERMINED PARAMETERS, W. Byron Brown and Guy R. Bradshaw, September 1947

TN 1446 THEORY OF THE INLET AND EXHAUST PROCESSES OF INTERNAL-COMBUSTION ENGINES, Tsung-Chi Tsu, January 1949

TN 1447 THE PERFORMANCE OF A COMPOSITE ENGINE CONSISTING OF A RECIPROCATING SPARK-IGNITION ENGINE, A BLOWDOWN TURBINE, AND A STEADY-FLOW TURBINE, Richard L. Turner and Robert N. Noyes, October 1947

TN 1459 ANALYSIS OF THE PERFORMANCE OF A JET ENGINE FROM CHARACTERISTICS OF THE COMPONENTS. I - AERODYNAMIC AND MATCHING CHARACTERISTICS OF THE TURBINE COMPONENT DETERMINED WITH COLD AIR, Arthur W. Goldstein, October 1947

TN 1470 THE EFFECT OF FUEL COMPOSITION, COMPRESSION PRESSURE, AND FUEL-AIR RATIO ON THE COMPRESSION-IGNITION CHARACTERISTICS OF SEVERAL FUELS, W. A. Leary, E. S. Taylor, and J. U. Jovellanos, March 1948

TN 1475 AN INVESTIGATION OF VALVE-OVERLAP SCAVENGING OVER A WIDE RANGE OF INLET AND EXHAUST PRESSURES, John W. R. Creagh, Melvin J. Hartmann, and W. L. Arthur, Jr., November 1947

TN 1490 COMPARATIVE PERFORMANCE OF TWO VANELESS DIFFUSERS DESIGNED WITH DIFFERENT RATES OF PASSAGE CURVATURE FOR MIXED-FLOW IMPELLERS, Frank J. Barina, November 1947

TN 1497 A METHOD OF CYCLE ANALYSIS FOR AIRCRAFT GAS-TURBINE POWER PLANES DRIVING PROPELLERS, Robert E. English and Cavour H. Hauser, January 1948

TN 1498 EFFECT OF LOCAL BOILING AND AIR ENTRAINMENT ON TEMPERATURES OF LIQUID-COOLED CYLINDERS, A. P. Colburn, Carl Gazley, Jr., E. M. Schoenborn, and C. S. Sutton, March 1948

TN 1500 COMPARISON OF COMPUTED PERFORMANCE OF COMPOSITE POWER PLANTS USING 18-CYLINDER AIRCRAFT ENGINES WITH 62° AND 40° VALVE OVERLAP, Samuel J. Kaufmann and David S. Boman, January 1948

TN 1507 SYMBOLS FOR COMBUSTION RESEARCH, NACA Subcommittee on Combustion, June 1948

TN 1508 PROVISIONAL SYMBOLS AND DEFINITIONS FOR AIRCRAFT TURBINES, NACA Subcommittee on Turbines, March 1949

TN 1509 CYLINDER-TEMPERATURE AND COOLING-AIR-PRESSURE INSTRUMENTATION FOR AIR-COOLED-ENGINE COOLING INVESTIGATIONS, Michael F. Valerino and Samuel J. Kaufman, January 1948

TN 1537 APPARENT EFFECT OF INLET TEMPERATURE ON ADIABATIC EFFICIENCY OF CENTRIFUGAL COMPRESSORS, Robert J. Anderson, William K. Ritter, and Shirley R. Parsons, March 1948

TN 1568 DESIGN AND PERFORMANCE OF FAMILY OF DIFFUSING SCROLLS WITH MIXED-FLOW IMPELLER AND VANELESS DIFFUSER, W. Byron Brown and Guy R. Bradshaw, May 1948

TN 1602 CALCULATED PERFORMANCE OF 12-CYLINDER LIQUID-COOLED ENGINE WITH EXHAUST-GAS TURBINE GEARED TO CRANKSHART, Leland G. Desmon and Ronald B. Doyle, June 1948

TN 1603 APPLICATION OF STATISTICAL METHODS TO STUDY OF GAS-TURBINE BLADE FAILURES, Charles A. Hoffman and G. Mervin Ault, June 1948

TN 1606 CYLINDER-HEAD TEMPERATURES AND COOLANT HEAT REJECTIONS OF A MULTICYLINDER, LIQUID-COOLED ENGINE OF 1710-CUBIC-INCH DISPLACEMENT, John H. Povolny and Louis J. Chelko, June 1948

TN 1607 EFFECT OF SIZE AND NUMBER OF OUTLET PIPES ON DESIGN OF COLLECTORS FOR RATING AND TESTING AXIAL-FLOW COMPRESSORS, Jason J. Moses and Thomas I. Kazberovich, June 1948

TN 1608 QUANTITATIVE ANALYSIS OF TERNARY MIXTURES OF NAPHTHALENE 1-METHYLNAPHTHALENE, AND 2-METHYNAPHTHALENE BY ULTRAVIOLET SPECTROPHOTOMETRY, Alden P. Cleaves, Mildred S. Carver, and Robert R. Hibbard, June 1948

TN 1609 EFFECT OF HYDROCARBON TYPE AND CHAIN LENGTH ON UNIFORM FLAME MOVEMENT IN QUIESCENT FUEL-AIR MIXTURES, Thaine W. Reynolds and Earl R. Ebersole, June 1948

TN 1610 EFFECT OF SCREENS IN WIDE ANGLE DIFFUSERS, G. B. Schubauer and W. G. Spangenberg, July 1948

TN 1612 EFFECT OF REDUCING VALVE OVERLAP ON ENGINE AND COMPOUND-POWER-PLANT-PERFORMANCE, David S. Boman and Samuel J. Kaufman, June 1948

TN 1614 KNOCKING COMBUSTION OBSERVED IN A SPARK-IGNITION ENGINE WITH SIMULTANEOUS DIRECT AND SCHLIEREN HIGH-SPEED MOTION PICTURES AND PRESSURE RECORDS, Gordon E. Osterstrom, July 1948

TN 1616 KNOCK-LIMITED PERFORMANCE OF SEVERAL BRANCHED PARAFFINS AND OLEFINS, R. S. Genco and I. L. Drell, June 1948

TN 1617 EFFECT OF EXHAUST PRESSURE ON KNOCK-LIMITED PERFORMANCE OF AN AIR-COOLED AIRCRAFT-ENGINE CYLINDER, Albert M. Lord, Orville H. Heinicke, and Edward G. Stricker, June 1948

TN 1618 EFFECTS OF FUEL-NOZZLE CARBON DEPOSITION ON COMBUSTION EFFICIENCY OF SINGLE TUBULAR-TYPE, REVERSE-FLOW TURBOJET COMBUSTION AT SIMULATED ALTITUDE CONDITIONS, Ralph T. Dittrich, June 1948

TN 1619 AN EVALUATION OF PROPOSED REFERENCE FUEL SCALES FOR KNOCK RATING, Henry C. Barnett and Thomas C. Clarke, July 1948

TN 1637 EFFECT OF PRE-IGNITION ON CYLINDER TEMPERATURES PRESSURES, POWER OUTPUT, AND PISTON FAILURES, Lester C. Corrington and William F. Fisher, June 1948

TN 1641 A METHOD FOR DETERMINATION OF AROMATICS IN 150° TO 300° C FRACTIONS OF CRUDE PETROLEUM BY MEASUREMENT OF ANILINE-POINT RISE, Arthur M. Busch, Alden P. Cleaves, and Robert R. Hibbard, June 1948

TN 1652 INVESTIGATION OF AXIAL-FLOW FAN AND COMPRESSOR ROTORS DESIGNED FOR THREE-DIMENSIONAL FLOW, A. Kahane, July 1948

TN 1653 CHARTS FOR THE COMPUTATION OF EQUILIBRIUM COMPOSITION OF CHEMICAL REACTIONS IN THE CARBON-HYDROGEN-OXYGEN-NITROGEN SYSTEM AT TEMPERATURES FROM 2000° TO 5000° K, Verl N. Huff and Clyde S. Calvert, July 1948

TN 1655 THERMODYNAMIC CHARTS FOR THE COMPUTATION OF FUEL QUANTITY REQUIRED FOR CONSTANT-PRESSURE COMBUSTION WITH DILUENTS, Donald Bogart, David Okrent, and L. Richard Turner, July 1948

TN 1687 JET DIFFUSER FOR SIMULATING RAM-PRESSURE CONDITIONS ON A TURBOJET-ENGINE STATIC TEST STAND, Robert H. Essig, H. R. Bohanon, and David S. Gabriel, August 1948

TN 1688 DYNAMOMETER-STAND INVESTIGATION OF THE MUFFLER USED IN THE DEMONSTRATION OF LIGHT AIRPLANE NOISE REDUCTION, K. R. Czarnecki and Don Davis, Jr., October 1949

TN 1695 EFFECT OF PRESSURE RECOVERY ON THE PERFORMANCE OF A JET-PROPELLED AIRPLANE, Fredrick H. Hanson, Jr., and Emmet A. Mossman, September 1948

TN 1701 ANALYSIS OF THE PERFORMANCE OF A JET ENGINE FROM CHARACTERISTICS OF THE COMPONENTS. II - INTERACTION OF THE COMPONENTS AS DETERMINED FROM ENGINE OPERATION, Arthur W. Goldstein, Sumner Alpert, William Bede, and Karl Kovach, September 1948

TN 1702 ANALYTICAL AND EXPERIMENTAL PERFORMANCE OF AN EXPLOSION-CYCLE COMBUSTION CHAMBER FOR A JET-PROPULSION ENGINE, Morris A. Zipkin and George W. Lewis, Jr., September 1948

TN 1713 EXPERIMENTAL STUDY OF EFFECT OF VANELESS-DIFFUSER DIAMETER ON DIFFUSER PERFORMANCE, Guy R. Bradshaw and Eugene B. Laskin, September 1948

TN 1730 EFFECTS OF TEMPORAL TANGENTIAL BEARING ACCELERATION ON PERFORMANCE CHARACTERISTICS OF SLIDER AND JOURNAL BEARINGS, Dezo J. Ladanyl, October 1948

TN 1735 PERFORMANCE OF EXHAUST-GAS BLOWDOWN TURBINE AND VARIOUS ENGINE SYSTEMS USING A 12-CYLINDER LIQUID COOLED ENGINE, Leland G. Desmon and Eldon W. Sams, October 1948

TN 1744 TWO-DIMENSIONAL COMPRESSIBLE FLOW IN CONICAL MIXED-FLOW COMPRESSORS, John D. Stanitz, November 1948

TN 1745 THEORETICAL EVALUATION OF THE DUCTED-FAN TURBOJET ENGINE, Richard B. Parisen, John C. Armstrong, and Sidney C. Huntley, November 1948

TN 1757 PERFORMANCE OF CONICAL JET NOZZLES IN TERMS OF FLOW AND VELOCITY COEFFICIENTS, R. E. Grey and H. D. Wilsted, December 1948

TN 1762 CONTROL CONSIDERATIONS FOR OPTIMUM-POWER PROPORTIONMENT IN TURBINE PROPELLER ENGINES, Marcus F. Heidmann and David Novik, December 1948

TN 1774 CALCULATED PERFORMANCE OF A COMPRESSION-IGNITION ENGINE-COMPRESSOR-TURBINE COMBINATION BASED ON EXPERIMENTAL DATA, Alexander Mendelson, December 1948

TN 1795 APPLICATION OF RADIAL-EQUILIBRIUM CONDITION TO AXIAL-FLOW COMPRESSOR AND TURBINE DESIGN, Chung-Hua Wu and Lincoln Wolfenstein, January 1949

TN 1807 EFFECTS OF PARTIAL ADMISSION ON PERFORMANCE OF A GAS TURBINE, Robert C. Kohl, Howard Z. Herzig, and Warren J. Whitney, January 1949

TN 1810 COMPARISON BETWEEN PREDICTED AND OBSERVED PERFORMANCE OF GAS-TURBINE STATOR BLADE DESIGNED FOR FREE-VORTEX FLOW, M. C. Huppert and Charles MacGregor, April 1949

TN 1814 EFFECTS OF SEVERAL DESIGN VARIABLES ON TURBINE-WHEEL WEIGHT, Vincent L. LaValle and Merle C. Huppert, February 1949

TN 1838 DYNAMOMETER INVESTIGATION OF A GROUP OF MUFFLERS, Don D. Davis, Jr., and K. R. Czarnecki, April 1949

TN 1841 QUANTITATIVE STUDY OF VARIATIONS IN CONCENTRATION OF GLYCEROL AND AEROSOL OT ON FOAMING VOLUME OF OIL AT ROOM TEMPERATURE, J. W. McBain and Sydney Ross, April 1949

TN 1842 CONTROL OF FOAMING BY ADDING KNOWN MIXTURES OF PURE CHEMICALS, J. W. McBain, Sydney Ross, A. P. Brady, and R. B. Dean, April 1949

TN 1843 EFFECT OF VARIOUS COMPOUNDS IN USE WITH AIRPLANE ENGINES UPON FOAMING OF AIRCRAFT LUBRICATING OIL, J. W. McBain and W. W. Woods, April 1949

TN 1844 SURFACE PROPERTIES OF OILS, J. W. McBain and James V. Robinson, March 1949

TN 1845 ATTEMPTS TO DEFOAM EXISTING OILS BY PROCESSING, J. W. McBain, J. V. Robinson, W. W. Woods, and I. M. Abrams, April 1949

TN 1846 AERATION OF AIRCRAFT LUBRICATING OILS OVER A RANGE OF TEMPERATURE, W. W. Woods and J. V. Robinson, April 1949

TN 1847 REVIEW OF EMULSIFIED ANTIFOAMS FOR AIRCRAFT LUBRICATING OILS, W. W. Woods and J. V. Robinson, March 1949

TN 1874 ANALYSIS OF ALTITUDE COMPENSATION SYSTEMS FOR AIRCRAFT CARBURETORS, Edward W. Otto, May 1949

TN 1880 DETERMINATION OF CENTRIFUGAL-COMPRESSOR PERFORMANCE ON BASIS OF STATIC-PRESSURE MEASUREMENTS IN VANELESS DIFFUSER, Ambrose Ginsburg, Irving A. Johnsen, and Alfred C. Redlitz, June 1949

TN 1882 OXIDATION CHARACTERISTICS OF MOLYBDENUM DISULFIDE AND EFFECT OF SUCH OXIDATION ON ITS ROLE AS A SOLID-FILM LUBRICANT, Douglas Godfrey and Erva C. Nelson, June 1949

TN 1883 THERMODYNAMIC CHARTS FOR INTERNAL-COMBUSTION-ENGINE FLUIDS, W. J. McCann, July 1949

TN 1908 GENERAL ALGEBRAIC METHOD APPLIED TO CONTROL ANALYSIS OF COMPLEX ENGINE TYPES, Aaron S. Boksenbom and Richard Hood, July 1949

TN 1927 GENERALIZATION OF TURBOJET-ENGINE PERFORMANCE IN TERMS OF PUMPING CHARACTERISTICS, Newell D. Sanders and Michael Behun, August 1949

TN 1949 ANNULAR JET EJECTORS, Elliot G. Reid, November 1949

TN 1951 METHOD OF DETERMINING CONDITIONS OF MAXIMUM EFFICIENCY OF AN INDEPENDENT TURBINE-PROPELLER COMBINATION, Marcus F. Heidmann, September 1949

TN 1954 EXPERIMENTAL AND THEORETICAL DISTRIBUTION OF FLOW PRODUCED BY INLET GUIDE VANES OF AN AXIAL-FLOW COMPRESSOR, Harold B. Finger, Harold J. Schum, and Howard A. Buckner, Jr., October 1949

TN 1956 EQUILIBRIUM OPERATING PERFORMANCE OF AXIAL-FLOW TURBOJET ENGINES BY MEANS OF IDEALIZED ANALYSIS, John C. Sanders and Edward C. Chapin, October 1949

TN 1958 ANALYSIS OF EJECTOR THRUST BY INTEGRATION OF CALCULATED SURFACE PRESSURES, John C. Sanders and Virginia L. Brightwell, October 1949

TN 1994 KNOCK-LIMITED PERFORMANCE OF FUEL BLENDS CONTAINING AROMATICS. VI-10. ALKYBENZENES, I. L. Drell and H. E. Alquist, December 1949

TN 2025 EFFECT OF VALVE OVERLAP AND COMPRESSION RATIO ON VARIATION OF MEASURED PERFORMANCE WITH EXHAUST PRESSURE OF AIRCRAFT CYLINDER AND ON COMPUTED PERFORMANCE OF COMPOUND POWER PLANT, Carroll S. Eian, February 1950

TN 2027 FRICTION AND WEAR OF HOT-PRESSED BEARING MATERIALS CONTAINING MOLYBDENUM DISULFIDE, R. L. Johnson, Max A. Swikert, and Edmond E. Bisson, February 1950

TN 2030 VARIATION WITH TEMPERATURE OF SURFACE TENSION OF LUBRICATING OILS, Sydney Ross, February 1950

TN 2031 COMPARATIVE FOAMING CHARACTERISTICS OF AERONAUTICAL LUBRICATING OILS, W. W. Woods and J. V. Robinson, February 1950

TN 2032 FOAMING MIXTURES OF PURE HYDROCARBONS, W. W. Woods and J. V. Robinson, February 1950

TN 2033 RISE OF AIR BUBBLES IN AIRCRAFT LUBRICATING OILS, J. V. Robinson, February 1950

TN 2049 ANALYSIS OF FACTORS INFLUENCING THE STABILITY CHARACTERISTICS OF SYMMETRICAL TWIN-INTAKE AIR-INDUCTION SYSTEMS, Norman J. Martin and Curt A. Holzhauser, March 1950

TN 2053 EFFECT OF HEAT AND POWER EXTRACTION OF TURBOJET - ENGINE PERFORMANCE. I - ANALYTICAL METHOD OF PERFORMANCE EVALUATION WITH COMPRESSOR-OUTLET AIR BLEED, Reece V. Hensley, Frank E. Rom, and Stanley L. Koutz, March 1950

TN 2059 METHOD OF EXPERIMENTALLY DETERMINING RADIAL DISTRIBUTIONS OF VELOCITY THROUGH AXIAL-FLOW COMPRESSOR, Harold B. Finger, April 1950

TN 2066 CORRELATION OF EFFECTS OF FUEL-AIR RATIO, COMPRESSION RATIO, AND INLET-AIR TEMPERATURE ON KNOCK LIMITS OF AVIATION FUELS, Leonard K. Tower and Henry E. Alquist, April 1950

TN 2067 CHART FOR SIMPLIFYING CALCULATIONS OF PRESSURE DROP OF A HIGH-SPEED COMPRESSIBLE FLUID UNDER SIMULTANEOUS ACTION OF FRICTION AND HEAT TRANSFER-APPLICATION TO COMBUSTION CHAMBER COOLING PASSAGES, Merwin Sibulkin and William K. Koffel, April 1950

TN 2068 THEORETICAL EFFECT OF INLET HUB-TIP-RADIUS RATIO AND DESIGN SPECIFIC MASS FLOW ON DESIGN PERFORMANCE OF AXIAL-FLOW COMPRESSORS, Chung-Hua Wu, John T. Sinnette, Jr., and Robert E. Forrette, April 1950

TN 2069 CYLINDER-HEAD TEMPERATURES AND COOLANT HEAT REJECTION OF A MULTI-CYLINDER LIQUID-COOLED ENGINE OF 1650-CUBIC-INCH DISPLACEMENT, John H. Povolny, Louis J. Bogdan, and Louis J. Chelko, April 1950

TN 2070 KNOCK-LIMITED PERFORMANCE OF FUEL BLENDS CONTAINING ETHERS, I. L. Drell and J. R. Branstetter, May 1950

TN 2071 CHARTS OF THERMODYNAMIC PROPERTIES OF AIR AND COMBUSTION PRODUCTS FROM 300° TO 3500° R, Robert E. English and William W. Wachtl, April 1950

TN 2072 AN INVESTIGATION OF AIRCRAFT HEATERS. XXXIII - EXPERIMENTAL DETERMINATION OF THERMAL AND HYDRODYNAMICAL BEHAVIOR OF AIR FLOWING ALONG FINNED PLATES, L. M. K. Boelter, R. Leasure, F. E. Romie, V. D. Sanders, W. R. Elswick, and G. Young, March 1950

TN 2081 CORRELATION OF PHYSICAL PROPERTIES WITH MOLECULAR STRUCTURE FOR DICYCLIC HYDROCARBONS I-2-n-ALKYBIPHENYL, 1, 1-DIPHENYLALKANE, α, ω-DIPHERYLALKANE, 1, 1-DICYCLOHEXYLALKANE, AND α, ω-DICYCLOHEXYLALKANE SERIES, P. H. Wise, K. T. Serijan, and I. A. Goodman, May 1950

TN 2083 THEORETICAL ANALYSIS OF VARIOUS THRUST-AUGMENTATION CYCLES FOR TURBOJET ENGINES, Bruce T. Lundin, May 1950

TN 2088 PERFORMANCE AND LOAD-RANGE CHARACTERISTICS OF TURBOJET ENGINE IN TRANSONIC SPEED RANGE, Bernard Lubarsky, May 1950

TN 2091 DYNAMICS OF A TURBOJET ENGINE CONSIDERED AS A QUASI-STATIC SYSTEM, Edward W. Otto and Burt L. Taylor, III, May 1950

TN 2104 THEORETICAL TURBOJET THRUST AUGMENTATION BY EVAPORATION OF WATER DURING COMPRESSION AS DETERMINED BY USE OF A MOLLIER DIAGRAM, Arthur M. Trout, June 1950

TN 2105 TURBOJET THRUST AUGMENTATION BY EVAPORATION OF WATER PRIOR TO MECHANICAL COMPRESSION AS DETERMINED BY USE OF PSYCHROMETRIC CHART, E. Clinton Wilcox, June 1950

TN 2107 INVESTIGATION OF FIRST STAGE OF TWO-STAGE TURBINE DESIGNED FOR FREE-VORTEX FLOW, G. W. Englert and A. O. Ross, June 1950

TN 2119 EFFECT OF HUMIDITY ON PERFORMANCE OF TURBOJET ENGINES, John C. Samuels and B. M. Gale, June 1950

TN 2127 AN INVESTIGATION OF THE EFFECT OF TETRAETHYL LEAD AND ETHYL NITRITE ON THE AUTO-IGNITION CHARACTERISTICS OF ISOCTANE AND TRIPTANE, J. U. Jovellanos, E. S. Taylor, C. F. Taylor, and W. A. Leary, June 1950

TN 2144 EFFECT OF CHEMICAL REACTIVITY OF LUBRICANT ADDITIVES ON FRICTION AND SURFACE WELDING AT HIGH SLIDING VELOCITIES, Edmond E. Bisson, Max A. Swikert, and Robert L. Johnson, August 1950

TN 2155 CALCULATED ENGINE PERFORMANCE AND AIRPLANE RANGE FOR VARIETY OF TURBINE-PROPELLER ENGINES, Tibor F. Nagey and Cecil G. Martin, August 1950

TN 2161 TABLES OF THERMODYNAMIC FUNCTIONS FOR ANALYSIS OF AIRCRAFT-PROPULSION SYSTEMS, Vearl N. Huff and Sanford Gordon, August 1950

TN 2165 METHOD OF ANALYSIS FOR COMPRESSIBLE FLOW THROUGH MIXED-FLOW CENTRIFUGAL IMPELLERS OF ARBITRARY DESIGN, Joseph T. Hamrick, Ambrose Ginsburg, and Walter M. Osborn, August 1950

TN 2166 EFFECT OF HEAT AND POWER EXTRACTION ON TURBOJET ENGINE PERFORMANCE. II - EFFECT OF COMPRESSOR OUTLET AIR BLEED FOR SPECIFIC MODES OF ENGINE OPERATION, Frank E. Rom and Stanley L. Koutz, August 1950

TN 2170 EFFECT OF INITIAL MIXTURE TEMPERATURES ON FLAME SPEEDS AND BLOW-OFF LIMITS OF PROPANE-AIR FLAMES, Gordon L. Dugger, August 1950

TN 2178 METHOD FOR DETERMINING OPTIMUM DIVISION OF POWER BETWEEN JET AND PROPELLER FOR MAXIMUM THRUST POWER OF A TURBINE-PROPELLER ENGINE, Arthur M. Trout and Eldon W. Hall, September 1950

TN 2179 TURNING ANGLE DESIGN RULES FOR CONSTANT THICKNESS CIRCULAR ARC INLET GUIDE VANES IN AXIAL ANNULAR FLOW, Seymour Lieblein, September 1950

TN 2182 ANALYSIS OF EFFECT OF VARIATION IN PRIMARY VARIABLES ON TIME CONSTANT AND TURBINE-INLET-TEMPERATURE OVERSHOOT OF TURBOJET ENGINE, Marcus F. Heidmann, September 1950

TN 2183 ANALYSIS FOR CONTROL APPLICATION OF DYNAMIC CHARACTERISTICS OF TURBOJET ENGINE WITH TAIL-PIPE BURNING, Melvin S. Feder and Richard Hood, September 1950

TN 2184 INVESTIGATION OF FREQUENCY-RESPONSE CHARACTERISTICS OF ENGINE SPEED FOR A TYPICAL TURBINE-PROPELLER ENGINE, Burt L. Taylor, III, and Frank L. Oppenheimer, September 1950

TN 2193 EFFECT OF HEAT-CAPACITY LAG ON A VARIETY OF TURBINE-NOZZLE FLOW PROCESSES, Robert B. Spooner, October 1950

TN 2202 EFFECT OF HEAT AND POWER EXTRACTION ON TURBOJET-ENGINE PERFORMANCE. III - ANALYTICAL DETERMINATION OF EFFECTS OF SHAFT-POWER EXTRACTION, Stanley L. Koutz, Reece V. Hensley, and Frank E. Rom, October 1950

TN 2207 ANALYSIS OF TURBULENT FREE-CONVECTION BOUNDARY LAYER ON FLAT PLATE, E. R. G. Eckert and Thomas W. Jackson, November 1950

TN 2227 RELATION BETWEEN INFLAMMABLES AND IGNITION SOURCES IN AIRCRAFT ENVIRONMENTS, Wilfred E. Scull, December 1950

TN 2230 SYNTHESIS AND PURIFICATION OF ALKYLDIPHENYLMETHANE HYDROCARBONS. I - 2-METHYLDIPHENYLMETHANE, 3-METHYLDIPHENYLMETHANE 2-ETHYLDIPHENYLMETHANE, 4-ETHYLDIPHENYLMETHANE AND 4-SIOPROPYLDIPHENYLMETHANE, John H. Lamneck, Jr., and Paul H. Wise, December 1950

TN 2248 ANALYSIS OF THE EFFECTS OF DESIGN PRESSURE RATIO PER STAGE AND OFF-DESIGN EFFICIENCY ON THE OPERATING RANGE OF MULTISTAGE AXIAL-FLOW COMPRESSORS, Melvyn Savage and Willard R. Westphal, December 1950

TN 2254 REGENERATOR-DESIGN STUDY AND ITS APPLICATION TO TURBINE-PROPELLER ENGINES, S. V. Manson, January 1951

TN 2255 TWO-DIMENSIONAL COMPRESSIBLE FLOW IN CENTRIFUGAL COMPRESSORS WITH LOGARITHMIC-SPIRAL BLADES, Gaylord O. Ellis and John D. Stanitz, January 1951

TN 2258 SYNTHESIS OF CYCLOPROPANE HYDROCARBONS FROM METHYCYCLOPROPYL KETONE. I - 2-CYCLOPROPYLPROPENE AND 2-CYCLOPROPYLPROPANE, Vernon A. Slabey and P. H. Wise, January 1951

TN 2259 SYNTHESIS OF CYCLOPROPANE HYDROCARBONS FROM METHYLCYCLOPROPHYL KETONE. I - 2-CYCLOPROPYL-1-PENTENT, cis AND trans 2-CYCLOPROPYL-2-PENTENT AND 2-CYCLOPROPYLPENTANE, Vernon A. Slabey and P. H. Wise, January 1951

TN 2260 SYNTHESIS AND PURIFICATION OF SOME ALKYLBIPHENYLS AND ALKYLBICYCLOHEXYLS, Irving A. Goodman and Paul H. Wise, February 1951

TN 2291 INFLUENCE OF WALL BOUNDARY LAYER UPON THE PERFORMANCE OF AN AXIAL FLOW FAN ROTOR, Emanuel Boxer, February 1951

TN 2302 A GENERAL THROUGH-FLOW THEORY OF FLUID FLOW WITH SUBSONIC OR SUPERSONIC VELOCITY IN TURBOMACHINES OF ARBITRARY HUB AND CASING SHAPES, Chung-Hua Wu, March 1951

TN 2304 EFFECT OF HEAT AND POWER EXTRACTION ON TURBOJET-ENGINE PERFORMANCE. IV - ANALYTICAL DETERMINATION OF EFFECTS OF HOT-GAS BLEED, Stanley L. Koutz, March 1951

TN 2321 ANALYSIS OF TEMPERATURE DISTRIBUTION IN LIQUID-COOLED TURBINE BLADES, John N. B. Livingood and W. Byron Brown, April 1951

TN 2323 THEORETICAL INVESTIGATION OF SUBMERGED INLETS AT LOW SPEEDS, Alvin H. Sacks and John R. Spreiter, August 1951

TN 2357 METHOD FOR CALCULATION OF RAM-JET PERFORMANCE, John R. Henry and J. Buel Bennett, June 1951

TN 2365 ANALYTICAL EVALUATION OF AERODYNAMIC CHARACTERISTICS OF TURBINES WITH NONTWISTED ROTOR BLADES, William R. Slivka and David H. Silvern, May 1951

TN 2371 POSSIBLE APPLICATION OF BLADE BOUNDARY-LAYER CONTROL TO IMPROVEMENT OF DESIGN AND OFF-DESIGN PERFORMANCE OF AXIAL-FLOW TURBO-MACHINES, John T. Sinnette, Jr., and George R. Costello, May 1951

TN 2374 EFFECT OF INITIAL MIXTURE TEMPERATURE ON FLAME SPEED OF METHANE-AIR, PROPANE-AIR, AND ETHYLENE-AIR MIXTURES, Gordon L. Dugger, May 1951

TN 2398 SYNTHESIS OF CYCLOPROPANE HYDROCARBONS FROM METHYLCYCLOPROPYL DETONE. III - 2-CYCLOPROPYL-1-BUTENE, CIS AND TEANS 2-CYCLOPROPYL-2-BUTENE, AND 2-CYCLOPROPYLBUTANE, Vernon A. Slabey and Paul H. Wise, June 1951

TN 2402 CONSTRUCTION AND USE OF CHARTS IN DESIGN STUDIES OF GAS TURBINES, Sumner Alpert and Rose M. Litrenta, July 1951

TN 2407 METHOD OF ANALYSIS FOR COMPRESSIBLE FLOW PAST ARBITRARY TURBO-MACHINE BLADES ON GENERAL SURFACE OF REVOLUTION, Chung-Hua Wu and Curtis A. Brown, July 1951

TN 2408 APPROXIMATE DESIGN METHOD FOR HIGH-SOLIDITY BLADE ELEMENTS IN COMPRESSORS AND TURBINES, John D. Stanitz, July 1951

TN 2419 CORRELATION OF PHYSICAL PROPERTIES WITH MOLECULAR STRUCTURE FOR DICYCLIC HYDROCARBONS. II - 2-ALKYLBIPHENYL AND THE TWO ISOMERIC 2-ALKYLBICYCLOHEXYL SERIES, Irving A. Goodman and Paul H. Wise, July 1951

TN 2421 A RAPID APPROXIMATE METHOD FOR DETERMINING VELOCITY DISTRIBUTION ON IMPELLER BLADES OF CENTRIFUGAL COMPRESSORS, John D. Stanitz and Vasily D. Prian, July 1951

TN 2430 SYNTHESIS, PURIFICATION, AND PHYSICAL PROPERTIES OF HYDROCARBONS OF THE NAPHTHALENE SERIES. I - 1-METHYLNAPTHALENE, 1-ETHYLNAPHTHALENE, 1-BUTYLNAPHTHALENE, AND 1-ISOBUTYLNAPHTHALENE, Harold F. Hipsher and Paul H. Wise, August 1951

TN 2450 METHOD OF MATCHING COMPONENTS AND PREDICTING PERFORMANCE OF A TURBINE-PROPELLER ENGINE, Alois T. Sutor and Morris A. Zipkin, September 1951

TN 2455 A METHOD OF DESIGNING TURBOMACHINE BLADES WITH A DESIRABLE THICKNESS DISTRIBUTION FOR COMPRESSIBLE FLOW ALONG AN ARBITRARY STREAM FILAMENT OF REVOLUTION, Chung-Hua Wu and Curtis A. Brown, September 1951

TN 2456 ANALYTICAL METHOD FOR DETERMINING PERFORMANCE OF TURBOJET-ENGINE TAIL-PIPE HEAT EXCHANGERS, Michael Behun and Harrison C. Chandler, Jr., September 1951

TN 2464 TWO AXIAL-SYMMETRY SOLUTIONS FOR INCOMPRESSIBLE FLOW THROUGH A CENTRIFUGAL COMPRESSOR WITH AND WITHOUT INDUCER VANES, Gaylord O. Ellis, John D. Stanitz, and Leonard J. Sheldrake, September 1951

TN 2493 ANALYSIS OF AN AXIAL COMPRESSOR STAGE WITH INFINITESIMAL AND FINITE BLADE SPACING, H. J. Reissner and L. Myerhoff, October 1951

TN 2526 DETERMINATION OF RAM-JET COMBUSTION-CHAMBER TEMPERATURES BY MEANS OF TOTAL-PRESSURE SURVEYS, I. Irving Pinkel, December 1951

TN 2549 INVESTIGATION OF HYDROCARBON IGNITION, Charles E. Frank and Angus U. Blackham, January 1952

TN 2557 INFRARED SPECTRA OF 59 DICYCLIC HYDROCARBONS, K. T. Serijan, I. A. Goodman, and W. J. Yankauskas, November 1951

TN 2584 AN ANALYSIS OF FLOW IN ROTATING PASSAGE OF LARGE RADIAL INLET CENTRIFUGAL COMPRESSOR AT TIP SPEED OF 700 FEET PER SECOND, Vasily D. Prian and Donald J. Michel, December 1951

TN 2589 AN ANALYTICAL INVESTIGATION USING AERODYNAMIC LIMITATIONS OF SEVERAL DESIGNS OF HIGH STAGE PRESSURE RATIO MULTISTAGE COMPRESSORS, Curtis H. Voit and Arthur R. Thomson, December 1951

TN 2598 A TECHNIQUE APPLICABLE TO THE AERODYNAMIC DESIGN OF INDUCER TYPE MULTISTAGE AXIAL FLOW COMPRESSORS, Melvyn Savage and Loren A. Beatty, March 1952

TN 2604 A GENERAL THEORY OF THREE DIMENSIONAL FLOW IN SUBSONIC AND SUPERSONIC TURBOMACHINES OF AXIAL, RADIAL, AND MIXED FLOW TYPES, Chung-Hua Wu, January 1952

TN 2610 ONE DIMENSIONAL COMPRESSIBLE FLOW IN VANELESS DIFFUSERS OF RADIAL AND MIXED FLOW CENTRIFUGAL COMPRESSORS, INCLUDING EFFECTS OF FRICTION, HEAT TRANSFER AND AREA CHANGE, John D. Stanitz, January 1952

TN 2614 ANALYTICAL INVESTIGATION OF SOME THREE DIMENSIONAL FLOW PROBLEMS IN TURBOMACHINES, Frank E. Marble and Irving Michelson, March 1952

TN 2624 FLAME SPEEDS OF METHANE-AIR, PROPANE-AIR, AND ETHYLENE-AIR MIXTURES AT LOW INITIAL TEMPERATURES, Gordon L. Dugger and Sheldon Heimel, February 1952

TN 2634 EVALUATION OF THREE METHODS FOR DETERMINING DYNAMIC CHARACTERISTICS OF A TURBOJET ENGINE, Gene J. Delio, February 1952

TN 2642 APPLICATION OF LINEAR ANALYSIS TO AN EXPERIMENTAL INVESTIGATION OF A TURBOJET ENGINE WITH PROPORTIONAL SPEED CONTROL, Marcel Dandois and David Novik, February 1952

TN 2649 EFFECT OF MACH NUMBER ON THE FLOW AND APPLICATION OF COMPRESSIBILITY CORRECTIONS IN A TWO DIMENSIONAL SUBSONIC TRANSONIC COMPRESSOR CASCADE HAVING VARIED POROUS WALL SUCTION AT THE BALED TIPS, William B. Briggs, March 1952

TN 2652 APPLICATION OF A CHANNEL DESIGN METHOD TO HIGH SOLIDITY CASCADES AND TESTS OF AN IMPULSE CASCADE WITH 90° OF TURNING, John D. Stanitz and Leonard J. Sheldrake, March 1952

TN 2653 A THERMODYNAMIC STUDY OF THE TURBINE PROPELLER ENGINE, Benjamine Pinkel and Irving M. Karp, March 1952

TN 2654 TWO DIMENSIONAL FLOW ON GENERAL SURFACES OF REVOLUTION IN TURBOMACHINES, John D. Stanitz and Gaylord O. Ellis, March 1952

TN 2672 THEORETICAL AUGMENTATION OF TURBINE-PROPELLER ENGINE BY COMPRESSOR INLET WATER INJECTION, TAIL-PIPE BURNING, AND THEIR COMBINATION, Reece V. Hensley, March 1952

TN 2673 THEORETICAL PERFORMANCE OF AN AXIAL FLOW COMPRESSOR IN A GAS TURBINE ENGINE OPERATING WITH INLET WATER INJECTION, Reece V. Hensley, March 1952

TN 2680 FLAME SPEEDS OF 2,2,4-TRIMETHYLPENTANE-OXYGEN-NITROGEN MIXTURES, Gordon L. Dugger and Dorothy D. Graab, April 1952

TN 2681 A COMPRESSIBLE FLOW PLOTTING DEVICE AND ITS APPLICATION TO CASCADE FLOWS, Willard R. Westphal and James C. Dunavant, April 1952

TN 2691 THEORETICAL AND EXPERIMENTAL ANALYSIS OF ONE DIMENSIONAL COMPRESSIBLE FLOW IN A ROTATING RADIAL INLET IMPELLER CHANNEL, Seymour Lieblien, April 1952

TN 2702 AN APPROXIMATE METHOD OF DETERMINING THE SUBSONIC FLOW IN AN ARBITRARY STREAM FILAMENT OF REVOLUTION CUT BY ARBITRARY TURBOMACHINE BLADES, Chung-Hua Wu, Curtis Brown, and Vasily D. Prian, June 1952

TN 2705 THEORY OF SUPERSONIC POTENTIAL FLOW IN TURBOMACHINES, Robert H. Wasserman, June 1952

TN 2706 EFFECT OF CHANGING PASSAGE CONFIGURATION ON INTERNAL FLOW CHARACTERISTICS OF A 48-INCH CENTRIFUGAL COMPRESSOR. I - CHANGE IN BLADE SHAPE, Donald J. Michel, John Mizisin, and Vasily D. Prian, May 1952

TN 2711 THE AERODYNAMIC DESIGN OF HIGH MACH NUMBER NOZZLES UTILIZING AXISYMMETRIC FLOW WITH APPLICATION TO A NOZZLE OF SQUARE TEST SECTION, Ivan E. Beckwith, Herbert W. Ridyard, and Nancy Cromer, June 1952.

TN 2713 EFFECT OF COMPRESSOR OUTLET AIR BLEED ON PERFORMANCE OF A CENTRIFUGAL FLOW TURBOJET ENGINE WITH A CONSTANT AREA JET NOZZLE, Sidney C. Huntley, June 1952

TN 2718 A TWO DIMENSIONAL STEADY NONVISCOUS AND VISCOUS COMPRESSIBLE FLOW THROUGH A SYSTEM OF EQUIDISTANT BLADES, Hans J. Reissner, Leonard Meyerhoff, and Martin Bloom, June 1952

TN 2730 CHOKING OF A SUBSONIC INDUCTION TUNNEL BY THE FLOW FROM AN INDUCTION NOZZLE, W. F. Lindsey, July 1952

TN 2732 THEORETICAL INVESTIGATION OF VELOCITY DIAGRAMS OF A SINGLE STAGE TURBINE FOR A TURBOJET ENGINE AT MAXIMUM THRUST PER SQUARE FOOT TURBINE FRONTAL AREA, Leo Cohen, June 1952

TN 2736 TWO-DIMENSIONAL SHEAR FLOW IN A 90° ELBOW, James J. Kramer and John D. Stanitz, July 1952

TN 2749 ANALYSIS OF FLOW IN A SUBSONIC MIXED FORM IMPELLER, Chung-Hua Wu, Curtis A. Brown, and Eleanor L. Costilow, August 1952

TN 2750 MATRIX AND RELAXATION SOLUTIONS THAT DETERMINE SUBSONIC THROUGH FLOW IN AN AXIAL FLOW GAS TURBINE, Chung-Hua Wu, July 1952

TN 2756 NOISE FROM INTERMITTENT JET ENGINES AND STEADY FLOW JET ENGINES WITH ROUGH BURNING, Leslie W. Lassiter, August 1952

TN 2806 COMPARISON OF TWO AND THREE DIMENSIONAL POTENTIAL FLOW SOLUTIONS IN A ROTATING IMPELLET PASSAGE, Gaylord O. Ellis and John D. Stanitz, October 1952

TN 2810 ONE DIMENSIONAL ANALYSIS OF CHOKED FLOW TURBINES, Robert E. English and Richard H. Cavicci, October 1952

TN 2826 SIMULATION OF LINEARIZED DYNAMICS OF GAS TURBINE ENGINES, J. R. Ketchum and R. T. Craig, November 1952

TN 2834 SLOW SURFACES IN ROTATING AXIAL FLOW PASSAGES, John D. Stanitz and Gaylord O. Ellis, November 1952

TN 2835 EFFECT OF CHANGING PASSAGE CONFIGURATION ON INTERNAL FLOW CHARACTERISTICS OF A 48-INCH CENTRIFUGAL COMPRESSOR. II - CHANGE IN HUB SHAPE, John Mizisin and Donald J. Michel, November 1952

TN 2848 INVESTIGATION OF SPONTANEOUS IGNITION TEMPERATURES OF ORGANIC COMPOUNDS WITH PARTICULAR EMPHASIS ON LUBRICANTS, Charles E. Frank, Angus U. Blackham, and Donald E. Swarts, December 1952

TN 2905 A RAPID METHOD FOR USE IN DESIGN OF TURBINES WITHIN SPECIFIED AERODYNAMIC LIMITS, Richard H. Cavicci and Robert E. English, April 1953

TN 2909 STUDY OF SECONDARY FLOW PATTERNS IN AN ANNULAR CASCADE OF TURBINE NOZZLE BLADES WITH VORTEX DESIGN, Harold E. Rohlik, Hubert W. Allen, and Howard Z. Herzig, March 1953

TN 2936 COMBUSTION INSTABILITY IN AN ACID HEPTANE ROCKET WITH A PRESSURIZED GAS PROPELLANT BUMPING SYSTEM, Adelbert O. Tischler and Donald R. Bellman, May 1953

TN 2947 A VISUALIZATION STUDY OF SECONDARY FLOWS IN CASCADES, Arthur G. Hansen, Howard Z. Herzig, and George R. Costello, May 1953

TN 2958 REACTION PROCESSES LEADING TO SPONTANEOUS IGNITION OF HYDROCARBONS, Charles E. Frank and Angus U. Blackham, June 1953

TN 2961 SUBSONIC FLOW OF AIR THROUGH A SINGLE STAGE AND A SEVEN STAGE COMPRESSOR, Chung-Hua Wu, June 1953

TN 2969 THE CONDENSATION LINE OF AIR AND THE HEATS OF VAPORIZATION OF OXYGEN AND NITROGEN, George T. Furukawa and Robert E. McCoskey, June 1953

TN 2970 PHYSICAL PROPERTIES OF CONCENTRATED NITRIC ACID, W. L. Sibbitt, C. R. St. Clair, T. R. Bump, P. F. Pagerey, J. P. Kern, and D. W. Fyfe, June 1953

TN 2974 EXPERIMENTS ON MIXED FREE AND FORCED CONVECTIVE HEAT TRANSFER CONNECTED WITH TURBULENT FLOW THROUGH A SHORT TUBE, E. R. G. Eckert, Anthony J. Diaguila, and Arthur N. Curren, July 1953

TN 2999 IMPINGEMENT OF DROPLETS IN 90° ELBOWS WITH POTENTIAL FLOW, Paul T. Hacker, Rinaldo J. Brun, and Bemrose Boyd, September 1953

TN 3004 THEORETICAL PERFORMANCE CHARACTERISTICS OF SHARP-LIP INLETS AT SUBSONIC SPEEDS, Evan A. Fradenburgh and DeMarquis D. Wyatt, September 1953

TN 3010 COMPARISON OF EFFECTIVENESS OF CONVECTION-; TRANSPIRATION-, AND FILM-COOLING METHODS WITH AIR AS COOLANT, E. R. G. Eckert and John N. B. Livingood, October 1953

TN 3012 AN ANALYSIS OF TURBOJET-ENGINE-INLET MATCHING, DeMarquis D. Wyatt, September 1953

TN 3013 A NOTE ON SECONDARY FLOW IN ROTATING RADIAL CHANNELS, James J. Kramer and John D. Stanitz, October 1953

TN 3015 AN EXPERIMENTAL INVESTIGATION OF SECONDARY FLOW IN AN ACCELERATING RECTANGULAR ELBOW WITH 90° OF TURNING, John D. Stanitz, Walter M. Osborn, and John Mizisin, October 1953

TN 3033 APPLICATION OF AN ELECTRO-OPTICAL TWO-COLOR PYROMETER TO MEASUREMENT OF FLAME TEMPERATURE FOR LIQUID OXYGEN-HYDROCARBON PROPELLANT COMBINATION, M. F. Heidmann and R. J. Priem, October 1953

TN 3060 USE OF ELECTRIC ANALOGS FOR CALCULATION OF TEMPERATURE DISTRIBUTION OF COOLED TURBINE BLADES, Herman H. Ellerbrock, Jr., Eugene F. Schum, and Alfred J. Nachtigall, December 1953

TN 3066 EFFECT OF SURFACE ROUGHNESS OVER THE DOWNSTREAM REGION OF A 23° CONICAL DIFFUSER, Jerome Persh and Bruce M. Bailey, January 1954

TN 3078 TRANSIENT TEMPERATURES IN HEAT EXCHANGERS FOR SUPERSONIC BLOWDOWN TUNNELS, Joseph H. Judd, April 1954

TN 3101 STUDY OF THREE-DIMENSIONAL INTERNAL FLOW DISTRIBUTION BASED ON MEASUREMENTS IN A 48-INCH RADIAL-INLET CENTRIFUGAL IMPELLER, Joseph T. Hamrick, John Mizisin, and Donald J. Michel, February 1954

TN 3106 AN EVALUATION OF THE SOAP-BUBBLE METHOD FOR BURNING VELOCITY MEASUREMENTS USING ETHYLENE-OXYGEN-NITROGEN AND METHANE-OXYGEN-NITROGEN MIXTURES, Dorothy M. Simon and Edgar L. Wong, February 1954

TN 3112 ANALOG STUDY OF INTERACTING AND NONINTERACTING MULTIPLE-LOOP CONTROL SYSTEMS FOR TURBOJET ENGINES, George J. Pack and W. E. Philips, Jr., March 1954

TN 3123 EFFECT OF VARIOUS ARRANGEMENTS OF TRIANGULAR LEDGES ON THE PERFORMANCE OF A CONICAL DIFFUSER AT SUBSONIC MACH NUMBERS, Jerome Persh and Bruce M. Bailey, January 1954

TN 3124 A METHOD FOR ESTIMATING THE EFFECT OF TURBULENT VELOCITY FLUCTUATIONS IN THE BOUNDARY LAYER ON DIFFUSER TOTAL-PRESSURE-LOSS MEASUREMENTS, Jerome Persh and Bruce M. Bailey, January 1954

TN 3149 PREDICTION OF LOSSES INDUCED BY ANGLES OF ATTACK IN CASCADES OF SHARP-NOSED BLADES FOR INCOMPRESSIBLE AND SUBSONIC COMPRESSIBLE FLOW, James J. Kramer and John D. Stánitz, January 1954

TN 3152 TRANSVERSE OSCILLATIONS IN A CYLINDRICAL COMBUSTION CHAMBER, Franklyn K. Moore and Stephen H. Maslen, October 1954

TN 3170 AN EXPERIMENTAL INVESTIGATION AT LOW SPEEDS OF THE EFFECTS OF LIP SHAPE ON THE DRAG AND PRESSURE RECOVERY OF A NOSE INLET IN A BODY OF REVOLUTION, James R. Blackaby and Earl C. Watson, April 1954

TN 3179 A THEORETICAL INVESTIGATION OF THE HEATING-UP PERIOD ON INJECTED FUEL DROPLETS VAPORIZING IN AIR, M. M. El Wakil, O. A. Uyehara, and P. S. Myers, May 1954

TN 3180 DETERMINATION OF VISCOSITY OF EXHAUST-GAS MIXTURES AT ELEVATED TEMPERATURES, J. C. Westmoreland, June 1954

TN 3253 SOME EFFECTS OF EXPOSURE TO EXHAUST-GAS STREAMS ON EMITTANCE AND THERMOELECTRIC POWER OF BARE-WIRE PLATINUM RHODIUM - PLATINUM THERMOCOUPLES, George E. Glawe and Charles E. Shepard, August 1954

TN 3254 DETERMINATION OF FLAME TEMPERATURES FROM 2000° TO 3000° K BY MICROWAVE ABSOPRTION, Perry W. Kuhns, August 1954

TN 3260 SMOKE STUDY OF NOZZLE SECONDARY FLOWS IN A LOW-SPEED TURBINE, Milton G. Kofskey and Hubert W. Allen, November 1954

TN 3261 A METHOD FOR EVALUATING THE EFFECTS OF DRAG AND INLET PRESSURE RECOVERY ON PROPULSION-SYSTEM PERFORMANCE, Emil J. Kremzier, August 1954

TN 3263 LIFT AND MOMENT EQUATIONS FOR OSCILLATING AIRFOILS IN AN INFINITE UNSTAGGERED CASCADE, Alexander Mendelson and Robert W. Carroll, October 1954

TN 3266 EXPERIMENTAL EVALUATION OF MOMENTUM TERMS IN TURBULENT PIPE FLOW, Virgil A. Sandborn, January 1965

TN 3270 EFFECT OF DISSOCIATION ON THERMODYNAMIC PROPERTIES OF PURE DIATOMIC GASES, Harold W. Woolley, April 1955

TN 3271 THERMODYNAMIC PROPERTIES OF GASEOUS NITROGEN, Harold W. Woolley, March 1956

TN 3272 GENERALIZED TABLES OF CORRECTIONS TO THERMODYNAMIC PROPERTIES FOR NONPOLAR GASES, Harold W. Woolley and William S. Benedict, March 1956

TN 3273 COMPRESSIBILITY FACTOR, DENSITY, SPECIFIC HEAT, ENTHALPY, ENTROPY, FREE-ENERGY FUNCTION, VISCOSITY, AND THERMAL CONDUCTIVITY OF STEAM, Lilla Fano, John H. Hubbell, and Charles W. Beckett, August 1956

TN 3274 SOME LINEAR DYNAMICS OF TWO-SPOOL TURBOJET ENGINES, David Novik, June 1956

TN 3275 INVESTIGATION OF THE EFFECT OF IMPACT DAMAGE ON FATIGUE STRENGTH OF JET-ENGINE COMPRESSOR ROTOR BLADES, Albert Kaufman and Andre J. Meyer, Jr., June 1956

TN 3276 PROPERTIES OF AIRCRAFT FUELS, Henry C. Barnett and Robert R. Hibbard, August 1956

TN 3277 SPACE HEATING RATES FOR SOME PREMIXED TURBULENT PROPANE-AIR FLAMES, Burton D. Fine and Paul Wagner, June 1956

TN 3327 APPROXIMATE EFFECT OF LEADING-EDGE THICKNESS, INCIDENCE ANGLE, AND INLET MACH NUMBER ON INLET LOSSES FOR HIGH-SOLIDITY CASCADES OF LOW CAMBERED BLADES, Linwood C. Wright, December 1954

TN 3329 SHOCKS IN HELICAL FLOWS THROUGH ANNULAR CASCADES OF STATOR BLADES, Robert Wasserman and Arthur W. Goldstein, December 1954

TN 3330 INGESTION OF FOREIGN OBJECTS INTO TURBINE ENGINES BY VORTICES, Lewis A. Rodert and Floyd B. Garrett, February 1955

TN 3331 ANALYSIS OF LAMINAR FORCED-CONVECTION HEAT TRANSFER IN ENTRANCE REGION OF FLAT RECTANGULAR DUCTS, E. M. Sparrow, January 1955

TN 3332 BURNING TIMES OF MAGNESIUM RIBBONS IN VARIOUS ATMOSPHERES, Kenneth P. Coffin, December 1954

TN 3339 EXPERIMENTS ON TURBULENT FLOW THROUGH CHANNELS HAVING POROUS ROUGH SURFACES WITH OR WITHOUT AIR INJECTION, E. R. G. Eckert, Anthony J. Diaguila, and Patrick L. Donoughe, February 1955

TN 3359 AN INVESTIGATION OF DRAINS DISCHARGING LIQUID INTO SUBSONIC AND TRANSONIC STREAMS, Allen R. Vick and Frank V. Silhan, March 1955

TN 3384 EFFECT OF HYDROCARBON STRUCTURE ON REACTION PROCESSES LEADING TO SPONTANEOUS IGNITION, Donald E. Swarts and Charles E. Frank, July 1955

TN 3385 THEORY OF THE JET SYPHON, B. Szczeniowski, May 1955

TN 3394 LOW-SPEED INVESTIGATION OF THE EFFECTS ON ANGLE OF ATTACK ON THE PRESSURE RECOVERY OF A CIRCULAR NOSE INLET WITH SEVERAL SHAPES, James R. Blackaby, May 1955

TN 3397 AN EVALUATION OF NON-NEWTONIAN FLOW IN PIPE LINES, Ruth N. Weltmann, February 1955

TN 3398 A THERMAL EQUATION FOR FLAME QUENCHING, A. E. Potter, Jr., and A. L. Berlad, February 1955

TN 3400 ANALYSIS OF ERRORS INTRODUCED BY SEVERAL METHODS OF WEIGHTING NONUNIFORM DUCT FLOWS, DeMarquis D. Wyatt, March 1955

TN 3403 ANALYTICAL DETERMINATION OF EFFECT OF WATER INJECTION ON POWER OUTPUT OF TURBINE-PROPELLER ENGINE, Albert O. Ross and Merle C. Huppert, March 1955

TN 3407 INTERACTION OF A FREE FLAME FRONT WITH TURBULENCE FIELD, Maurice Tucker, March 1955

TN 3408 ONE-DIMENSIONAL CALCULATION OF FLOW IN A ROTATING PASSAGE WITH EJECTION THROUGH A POROUS WALL, E. R. G. Eckert, John N. B. Livingood, and Ernst I. Prasse, March 1955

TN 3436 AN INVESTIGATION OF SEVERAL NACA 1-SERIES NOSE INLETS WITH AND WITHOUT PROTRUDING CENTRAL BODIES AT HIGH-SUBSONIC MACH NUMBERS AND AT A MACH NUMBER OF 1.2, Robert E. Pendley and Harold L. Robinson, May 1955

TN 3437 PRELIMINARY INVESTIGATION OF A SUBMERGED AIR SCOOP UTILIZING BOUNDARY-LAYER SUCTION TO OBTAIN INCREASED PRESSURE RECOVERY, Mark P. Nichols and P. Kenneth Pierpont, April 1955

TN 3445 DESIGN AND PERFORMANCE OF THROTTLE-TYPE FUEL CONTROLS FOR ENGINE DYNAMIC STUDIES, Edward W. Otto, Harold Gold, and Kirby W. Hiller, April 1955

TN 3446 EFFECT OF AMMONIA ADDITION ON LIMITS OF FLAME PROPAGATION FOR ISOOCTANE-AIR MIXTURES AT REDUCED PRESSURES AND ELEVATED TEMPERATURES, Cleveland O'Neal, Jr., April 1955

TN 3447 ANALYTIC DETERMINATION OF THE DISCHARGE COEFFICIENTS OF FLOW NOZZLES, Frederick S. Simmons, April 1955

TN 3448 THEORETICAL ANALYSIS OF INCOMPRESSIBLE FLOW THROUGH A RADIAL-INLET CENTRIFUGAL IMPELLER AT VARIOUS WEIGHT FLOWS. I - SOLUTION BY A MATRIX METHOD AND COMPARISON WITH AN APPROXIMATE METHOD, Vasily D. Prian, James J. Kramer and Chung-Hua Wu, June 1955

TN 3449 THEORETICAL ANALYSIS OF INCOMPRESSIBLE FLOW THROUGH A RADIAL-INLET CENTRIFUGAL IMPELLER AT VARIOUS WEIGHT FLOWS. II - SOLUTION IN LEADING-EDGE REGION BY RELAXATION METHODS, James J. Kramer, June 1955

TN 3456 PROPAGATION OF A FREE FLAME IN A TURBULENT GAS STREAM, William R. Mickelsen and Norman E. Ernstein, July 1955

TN 3457 ESTIMATION OF INLET LIP FORCES AT SUBSONIC AND SUPERSONIC SPEEDS, W. E. Moeckel, June 1955

TN 3458 UNSTABLE CONVECTION IN VERTICAL CHANNELS WITH HEATING FROM BELOW, INCLUDING EFFECTS OF HEAT SOURCES AND FRICTIONAL HEATING, Simon Ostrach, July 1955

TN 3488 SOME MEASUREMENTS OF FLOW IN A RECTANGULAR CUTOUT, Anato Roshko, August 1955

TN 3490 EXPERIMENTAL AND CALCULATED TEMPERATURE AND MASS HISTORIES OF VAPORIZING FUEL DROPS, M. M. El Wakil, R. J. Priem, H. J. Brikowski, P. S. Myers, and O. A. Uyehara, January 1956

TN 3491 EXPERIMENTAL INVESTIGATION OF ECCENTRICITY RATIO, FRICTION, AND OIL FLOW OF LONG AND SHORT JOURNAL BEARINGS WITH LOAD-NUMBER CHARTS, George B. DuBois, Fred W. Ocvirk, and R. L. Wehe, September, 1955

TN 3506 CRITERIONS FOR PREDICTION AND CONTROL OF RAM-JET FLOW PULSATIONS, William H. Sterbentz and John C. Evvard, August 1955

TN 3512 EFFECT OF SOME SELECTED HEAT TREATMENTS ON THE OPERATING LIFE OF CAST HS-21 TURBINE BLADES, Francis J. Clauss, Floyd B. Garrett, and John W. Weeton, July 1955

TN 3515 ANALYSIS OF TWO-DIMENSIONAL COMPRESSIBLE-FLOW LOSS CHARACTERISTICS DOWNSTREAM OF TURBOMACHINE BLADE ROWS IN TERMS OF BASIC BOUNDARY-LAYER CHARACTERISTICS, Warner L. Stewart, July 1955

TN 3517 APPROXIMATE METHOD FOR DETERMINING EQUILIBRIUM OPERATION OF COMPRESSOR COMPONENT OF TURBOJET ENGINE, Merle C. Huppert, July 1955

TN 3519 VISUALIZATION STUDY OF SECONDARY FLOWS IN TURBINE ROTOR TIP REGIONS, Hubert W. Allen and Milton G. Kofskey, September 1955

TN 3520 FLAME PROPAGATION LIMITS OF PROPANE AND n-PENTANE IN OXIDES OF NITROGEN, Riley O. Miller, August 1955

TN 3545 INVESTIGATION OF THE EFFECT OF SHORT FIXED DIFFUSERS ON STARTING BLOWDOWN JETS IN THE MACH NUMBER RANGE FROM 2.7 TO 4.5, John A. Moore, January 1966

TN 3558 HEAT CAPACITY LAG OF GASEOUS MIXTURES, Thomas D. Rossing, Robert C. Amme, and Sam Legrold, March 1956

TN 3560 SPONTANEOUS IGNITION STUDIES RELATING TO LUBRICANTS OF REDUCED FLAMMABILITY, Kenneth T. Mecklenborg, January 1956

TN 3565 CHEMICAL ACTION OF HALOGENATED AGENTS IN FIRE EXTINGUISHING, Frank E. Belles, September 1955

TN 3566 A POLAR-COORDINATE SURVEY METHOD FOR DETERMINING JET-ENGINE COMBUSTION-CHAMBER PERFORMANCE, Robert Friedman and Edward R. Carlson, September 1955

TN 3567 STUDY OF SCREECHING COMBUSTION IN A 6-INCH SIMULATED AFTERBURNER, Perry L. Blackshear, Warren D. Rayle, and Leonard K. Tower, October 1955

TN 3572 AMPLITUDE OF SUPERSONIC DIFFUSER FLOW PULSATIONS, Joseph Davids and William H. Sterbentz, October 1955

TN 3573 EFFECT OF EXHAUST-NOZZLE EJECTORS ON TURBOJET NOISE GENERATION, Warren J. North and Willard D. Coles, October 1955

TN 3574 ACOUSTIC ANALYSIS OF RAM-JET BUZZ, Harold Mirels, November 1955

TN 3575 BURNING VELOCITIES OF VARIOUS PREMIXED TURBULENT PROPANE FLAMES ON OPEN BURNERS, Paul Wagner, October 1955

TN 3576 FURTHER MEASUREMENTS OF INTENSITY SCALE, AND SPECTRA OF TURBULENCE IN A SUBSONIC JET, James C. Laurence and Truman M. Stickney, October 1956

TN 3579 VAPOR-PHASE OXIDATION AND SPONTANEOUS IGNITION - CORRELATION AND EFFECT OF VARIABLES, Donald E. Swarts and Milton Orchin, April 1956

TN 3580 STALL PROPAGATION IN AXIAL-FLOW COMPRESSORS, Alan H. Stenning, Anthony R. Kriebel, and Stephen R. Montgomery, June 1956

TN 3581 EXPERIMENTAL INVESTIGATION OF BLADE FLUTTER IN AN ANNULAR CASCADE, J. R. Rowe and A. Mendelson, November 1955

TN 3584 FREE-CONVECTION EFFECTS ON HEAT TRANSFER FOR TURBULENT FLOW THROUGH A VERTICAL TUBE, E. R. G. Eckert, Anthony J. Diaguila, and John N. B. Livingood, December 1955

TN 3585 DETERMINATION OF SURGE AND STALL LIMITS OF AN AXIAL-FLOW TURBOJET ENGINE FOR CONTROL APPLICATIONS, Ross D. Schmidt, George Vasu, and Edward W. McGraw, September 1957

TN 3589 DESIGN CRITERIA FOR AXISYMMETRIC AND TWO-DIMENSIONAL SUPERSONIC INLETS AND EXITS, James F. Connors, Rudolph C. Mayer, January 1966

TN 3590 INVESTIGATION OF FAR NOISE FIELD OF JETS. I - EFFECT OF NOZZLE SHAPE, Edmund E. Callaghan and William D. Coles, January 1956

TN 3591 INVESTIGATION OF FAR NOISE FIELD OF JETS. II - COMPARISON OF AIR JETS AND JET ENGINES, Willard D. Coles and Edmund E. Callaghan, January 1956

TN 3593 CLOUD-DROPLET INGESTION IN ENGINE INLETS WITH INLET VELOCITY RATIOS OF 1.0 AND 0.7, Rinaldo J. Brun, January 1956

TN 3594 EFFECT OF TRANSVERSE BODY FORCE ON CHANNEL FLOW WITH SMALL HEAT ADDITION, Simon Ostrach and Frank K. Moore, February 1956

TN 3620 THE DESIGN OF A MINIATURE SOLID-PROPELLANT ROCKET, Robert H. Heitkotter, March 1956

TN 3625 INVESTIGATION OF THE PROPULSIVE CHARACTERISTICS OF A HELICOPTER-TYPE PULSE-JET ENGINE OVER A RANGE OF MACH NUMBERS AND ANGLE OF YAW, Paul J. Carpenter, James P. Shivers, and Edwin E. Lee, Jr., January 1956

TN 3654 PERFORMANCE ANALYSIS OF FIXED- AND FREE-TURBINE HELICOPTER ENGINES, Richard P. Krebs and William S. Miller, Jr., June 1956

TN 3662 THEORETICAL LOSS RELATIONS FOR LOW-SPEED TWO-DIMENSIONAL-CASCADE FLOW, Seymour Lieblein and William H. Roudebush, March 1956

TN 3663 DISCHARGE COEFFICIENTS FOR COMBUSTOR-LINEAR AIR-ENTRY HOLES. I - CIRCULAR HOLES WITH PARALLEL FLOW, Ralph T. Dittrich and Charles C. Graves, April 1956

TN 3664 SUMMARY OF SCALE-MODEL THRUST-REVERSER INVESTIGATION, John H. Povolny, Fred W. Steffen, and Jack G. McArdle, February 1956

TN 3665 PERFORMANCE AND OPERATIONAL STUDIES OF A FULL-SCALE JET-ENGINE THRUST REVERSER, Robert C. Kohl, April 1956

TN 3668 PRELIMINARY INVESTIGATION OF A FAMILY OF DIFFUSERS DESIGNED FOR NEAR SONIC INLET VELOCITIES, Richard Scherrer and Warren E. Anderson, February 1956

TN 3683 MECHANISM OF GENERATION OF PRESSURE WAVES AT FLAME FRONTS, Boa-Teh Chu, October 1956

TN 3695 AN ANALYSIS OF BUZZING IN SUPERSONIC RAMJETS BY A MODIFIED ONE-DIMENSIONAL NON-STATIONARY WAVE THEORY, Robert L. Trimpi, July 1956

TN 3696 A STUDY OF THE HIGH-SPEED PERFORMANCE CHARACTERISTICS OF 90° BENDS IN CIRCULAR DUCTS, James T. Higginbotham, Charles C. Wood, and E. Floyd Valentine, June 1956

TN 3711 SOME EFFECTS OF GUIDE-VANE TURNING AND STATORS ON THE ROTATING STALL CHARACTERISTICS OF A HIGH HUB-TIP RATIO SINGLE-STAGE COMPRESSOR, Eleanor L. Costilow and Merle C. Huppert, April 1956

TN 3714 SONIC-FLOW ORIFICE PROBE FOR THE IN-FLIGHT MEASUREMENT OF TEMPERATURE PROFILES OF A JET ENGINE EXHAUST WITH AFTERBURNING, C. Dewey Havill and L. Stewart Rolls, May 1956

TN 3715 COMPARISON OF THE EXPERIMENTAL AND THEORETICAL DISTRIBUTIONS OF LIFT ON A SLENDER INCLINED BODY OF REVOLUTION AT M=2, Edward W. Perkins and Donald Ml Kuehn, May 1956

TN 3724 CHARACTERISTICS OF FOUR NOSE INLETS AS MEASURED AT MACH NUMBERS BETWEEN 1.4 AND 2.0, George B. Brajnikoff and Arthur W. Rogers, August 1956

TN 3739 FLIGHT INVESTIGATION OF THE PERFORMANCE OF A TWO-STAGE SOLID-PROPELLANT NIKE-DEACON (DAN) METEOROLOGICAL SOUNDING ROCKET, Robert H. Heitkotter, July 1956

TN 3759 ANALYSIS OF LAMINAR INCOMPRESSIBLE FLOW IN SEMIPOROUS CHANNELS, Patrick L. Donoughe, August 1956

TN 3765 SOME EFFECTS OF SMALL-SCALE FLOW DISTURBANCE ON NOZZLE-BURNER FLAMES, Edgar L. Wong, September 1956

TN 3767 THE USE OF PERFORATED INLETS FOR EFFICIENT SUPERSONIC DIFFUSION, John C. Evvard and John W. Blakey, September 1956

TN 3770 IMPINGEMENT OF DROPLETS IN 60^{o} ELBOWS WITH POTENTIAL FLOW, Paul T. Hacker, Paul G. Saper, and Charles F. Kadow, October 1956

TN 3771 LOW-SPEED WAKE CHARACTERISTICS OF TWO-DIMENSIONAL CASCADE AND ISOLATED AIRFOIL SECTIONS, Seymour Lieblein and William H. Roudebush, October 1956

TN 3793 EXPLORATORY INVESTIGATION OF THE USE OF AREA SUCTION TO ELIMINATE AIR-FLOW SEPARATION IN DIFFUSERS HAVING LARGE EXPANSION ANGLES, Curt A. Holzhauser and Leo P. Hall, October 1956

TN 3802 INVESTIGATION OF A RELATED SERIES OF TURBINE-BLADE PROFILES IN CASCADE, James C. Dunavant and John R. Erwin, October 1956

TN 3806 COMPARISON OF NACA 65-SERIES COMPRESSOR BLADE PRESSURE DISTRIBUTIONS AND PERFORMANCE IN A ROTOR AND IN CASCADE, Willard R. Westphal and William R. Godwin, March 1957

TN 3817 TWO-DIMENSIONAL LOW-SPEED CASCADE INVESTIGATION OF NACA COMPRESSOR BLADE SECTIONS HAVING A SYSTEMATIC VARIATION IN MEAN-LINE LOADING, John R. Erwin, Melvyn Sauage, and James C. Emery, November 1956

TN 3823 INVESTIGATION OF ROTATING STALL IN A SINGLE-STAGE AXIAL COMPRESSOR, S. R. Montgomery and J. J. Braun, January 1957

TN 3827 EXPERIMENTAL INVESTIGATION OF A LIGHT-WEIGHT ROCKET CHAMBER, John E. Dalgleish and Adelbert O. Tischler, October 1956

TN 3829 EFFECT OF PRESSURE ON THE SPONTANEOUS IGNITION TEMPERATURE OF LIQUID FUELS, Cleveland O'Neal, Jr., October 1956

TN 3830 GROWTH OF DISTURBANCES IN A FLAME-GENERATED SHEAR REGION, Perry L. Blackshear, Jr., November 1956

TN 3831 TABULATION OF MASS-FLOW PARAMETERS FOR USE IN DESIGN OF TURBO-MACHINE BLADE ROWS FOR RATIOS OF SPECIFIC HEATS OF 1.3 AND 1.4, Warren J. Whitney, October 1956

TN 3833 STABILITY LIMITS AND BURNING VELOCITIES LAMINAR HYDROGEN-AIR FLAMES AT REDUCED PRESSURE, Burton Fine, November 1956

TN 3834 EFFECT OF AMBIENT-TEMPERATURE VARIATION ON THE MATCHING REQUIRE-MENTS OF INLET-ENGINE COMBINATIONS AT SUPERSONIC SPEEDS, Eugene Perchonok and Donald P. Hearth, January 1957

TN 3838 PERFORMANCE CHARACTERISTICS OF RING-CASCADE-TYPE THRUST REVERSERS, Jack G. McArdle, November 1956

TN 3855 THE EFFECT OF FORWARD-FLIGHT SPEED ON THE PROPULSIVE CHARACTERIS-TICS OF A PULSE-JET ENGINE MOUNTED ON A HELICOPTER ROTOR, Robert D. Powell, January 1957

TN 3882 A RELATION BETWEEN BURNING VELOCITY AND QUENCHING DISTANCE, A. E. Potter, Jr., and A. L. Berlad, November 1956

TN 3884 IGNITION DELAYS AND FLUID PROPERTIES OF SEVERAL FUELS AND NITRIC ACID OXIDANTS IN TEMPERATURE RANGE FROM 70° TO -105° F, Riley O. Miller, December 1956

TN 3887 EFFECT OF CONCENTRATION ON IGNITION DELAYS FOR VARIOUS FUEL-OXYGEN-NITROGEN MIXTURES AT ELEVATED TEMPERATURES, E. Anagnostou, R. S. Brokaw, and J. N. Butler, December 1956

TN 3906 FREE-JET TESTS OF A 1.1-INCH-DIAMETER SUPERSONIC RAM-JET ENGINE, Joseph H. Judd and Otto F. Trout, Jr., February 1957

TN 3913 SUMMARY OF 65-SERIES COMPRESSOR-BLADE LOW-SPEED CASCADE DATA BY USE OF THE CARPET-PLOTTING TECHNIQUE, A. Richard Felix, February 1957

TN 3916 SYSTEMATIC TWO-DIMENSIONAL CASCADE TESTS OF NACA 65-SERIES COM-PRESSOR BLADES AT LOW SPEEDS, L. Joseph Herrig, James C. Emery, and John R. Erwin, February 1957

TN 3922 ANALYTICAL INVESTIGATION OF THE EFFECT OF WATER INJECTION ON SUPERSONIC TURBOJET-ENGINE-INLET MATCHING AND THRUST AUGMENTATION, Andrew Beke, January 1957

TN 3923 EFFECT OF CHORD SIZE ON WEIGHT AND COOLING CHARACTERISTICS OF AIR-COOLED TURBINE BLADES, Jack B. Esgar, Eugene F. Schum, and Arthur N. Curren, January 1957

TN 3924 DISCHARGE COEFFICIENTS FOR COMBUSTOR-LINER AIR-ENTRY HOLES. II - FLUSH RECTANGULAR HOLES, STEP LOUVERS, AND SCOOPS, Ralph T. Dittrich, April 1958

TN 3929 A GENERAL SYSTEM FOR CALCULATING BURNING RATES OF PARTICLES AND DROPS AND COMPARISON OF CALCULATED RATES FOR CARBON, BORON, MAGNESIUM, AND ISOOCTANE, Kenneth P. Coffin and Richard S. Brokaw, February 1957

TN 3937 A COMPARISON OF TYPICAL NATIONAL GAS TURBINE ESTABLISHMENT AND NACA AXIAL-FLOW COMPRESSOR BLADE SECTIONS IN CASCADE AT LOW SPEED, A. Richard Felix and James C. Emery, March 1957

TN 3953 A LIMITED CORRELATION OF ATMOSPHERIC SOUNDING DATA AND TURBULENCE EXPERIENCED BY ROCKET-POWERED MODELS, Homer P. Mason and William N. Gardner, April 1957

TN 3959 CASCADE INVESTIGATION OF A RELATED SERIES OF 6-PERCENT-THICK GUIDE-VANE PROFILES AND DESIGN CHARTS, James C. Dunavant, May 1957

TN 3973 ORIGIN AND PREVENTION OF CRASH FIRES IN TURBOJET AIRCRAFT, I. Irving Pinkel, Solomon Weiss, George M. Preston, Gerard J. Pesman, May 1957

TN 3974 FULL-SCALE INVESTIGATION OF SEVERAL JET-ENGINE NOISE-REDUCTION NOZZLES, Willard D. Coles and Edmund E. Gallagham, April 1957

TN 3975 INVESTIGATION OF A FULL-SCALE, CASCADE-TYPE THRUST REVERSER, Robert C. Kohl and Joseph S. Algranti, April 1957

TN 3980 INVESTIGATION OF SEMIVANELESS TURBINE STATOR DESIGNED TO PRODUCE AXIALLY SYMMETRICAL FREE-VORTEX FLOW, Harold E. Rohlik and William T. Wintucky, April 1957

TN 3983 EFFECT OF STANDING TRANSVERSE ACOUSTIC OSCILLATIONS ON FUEL-OXIDENT MIXING IN CYLINDRICAL COMBUSTION CHAMBERS, William R. Mickelsen, May 1957

TN 3985 PROPELLANT VAPORIZATION AS A CRITERION FOR ROCKET ENGINE DESIGN; CALCULATIONS OF CHAMBER LENGTH TO VAPORIZE A SINGLE n-HEPTANE DROP, Richard J. Priem, July 1957

TN 3996 INVESTIGATION OF A SHORT-ANNULAR-DIFFUSER CONFIGURATION UTILIZING SUCTION AS A MEANS OF BOUNDARY-LAYER CONTROL, Stafford W. Wilbur and James T. Higginbotham, June 1957

TN 4007 AN INVESTIGATION OF DISCHARGE AND THRUST CHARACTERISTICS OF FLAPPED OUTLETS FOR STREAM MACH NUMBERS FROM 0.40 TO 1.30, Allen R. Vick, July 1957

TN 4023 DESIGN AND EXPERIMENTAL EVALUATION OF A LIGHT-WEIGHT TURBINE-WHEEL ASSEMBLY, W. C. Morgan and R. H. Kemp, June 1957

TN 4025 THERMODYNAMIC STUDY OF A ROOTS COMPRESSOR AS A SOURCE OF HIGH-TEMPERATURE AIR, Clarence B. Cohen, Richard R. Woollett, and Kenneth C. Weston, June 1957

TN 4028 PRELIMINARY INVESTIGATION OF PROPANE COMBUSTION IN A 3-INCH-DIAMETER DUCT AT INLET-AIR TEMPERATURES OF 1400° TO 1600° F, Erwin A. Lezberg, July 1957

TN 4031 STABILITY LIMITS AND BURNING VELOCITIES FOR SOME LAMINAR AND TURBULENT PROPS AND HYDROGEN FLAMES AT REDUCED PRESSURE, Burton Fine, August 1957

TN 4034 EFFECT OF FLUID-SYSTEM PARAMETERS ON STARTING FLOW IN A LIQUID ROCKET, Richard P. Krebs, September 1957

TN 4062 EFFECT OF SWEEP ON PERFORMANCE OF COMPRESSOR BLADE SECTIONS AS INDICATED BY SWEPT-BLADE ROTOR, UNSWEPT-BLADE ROTOR, AND CASCADE TESTS, William R. Godwin, July 1957

TN 4095 AN ANALYSIS OF THE EFFECT OF SEVERAL PARAMETERS ON THE STABILITY OF AN AIR-LUBRICATED HYDROSTATIC THRUST BEARING, William H. Roudebush, October 1957

TN 4097 INVESTIGATION OF SOME MECHANICAL PROPERTIES OF THERMENOL COMPRESSOR BLADES, Donald F. Johnson, October 1957

TN 4098 PROPELLANT VAPORIZATION AS A CRITERION FOR ROCKET-ENGINE DESIGN; CALCULATIONS USING VARIOUS LOG-PROBABILITY DISTRIBUTIONS OF HEPTANE DROPS, Richard J. Priem, October 1957

TN 4100 VIBRATION SURVEY OF FOUR REPRESENTATIVE TYPES OF AIR-COOLED TURBINE BLADES, Howard F. Calvert and Gordon T. Smith, July 1958

TN 4118 LOW-TEMPERATURE, VAPOR-PHASE OXIDATION OF FUEL-RICH HYDROCARBON MIXTURES, William T. House and Milton Orchin, January 1958

TN 4126 EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF SOME SHROUD DESIGN VARIABLES ON THE STATIC THRUST CHARACTERISTICS OF A SMALL-SCALE SHROUDED PROPELLER SUBMERGED IN A WING, Robert T. Taylor, January 1958

TN 4134 STALL PROPAGATION IN A CASCADE OF AIRFOILS, Anthony R. Kriebel, Barry S. Seidel, and Richard G. Schwind, June 1958

TN 4136 THEORETICAL INVESTIGATION OF SUBSONIC OSCILLATORY BLADE-ROW AERODYNAMICS, Frank Lane and Manfred Friedman, February 1958

TN 4159 EXPERIMENTAL INVESTIGATION OF TURBOJET-ENGINE MULTIPLE-LOOP CONTROLS FOR NON-AFTERBURNING AND AFTERBURNING MODES OF ENGINE OPERATION, Donald B. Kirsch, Leon M. Wenzel, and Clint E. Hart, January 1958

TN 4162 STUDY OF SOME BURNER CROSS-SECTION CHANGES THAT INCREASE SPACE-HEATING RATES, Donald R. Boldman and Perry L. Blackshear, Jr., November 1957

TN 4164 TWO-DIMENSIONAL DIFFUSION THEORY ANALYSIS OF REACTIVITY EFFECTS OF A FUEL-PLATE-REMOVAL EXPERIMENT, Edward R. Gotsky, James P. Cusick, and Donald Bogart, January 1958

TN 4178 LOW-SPEED CASCADE INVESTIGATION OF COMPRESSOR BLADES HAVING LOADED LEADING EDGES, James C. Emery, January 1958

TN 4210 STABILITY OF PROPANE-AIR FLAMES IN VORTEX FLOW, A. E. Potter, Jr., E. L. Wong, and A. L. Berlad, February 1958

TN 4215 APPLICATION OF A HIGH-TEMPERATURE STATIC STRAIN GAGE TO THE MEASUREMENT OF THERMAL STRESSES IN A TURBINE STATOR VANE, R. H. Kemp, C. R. Morse, and M. H. Hirschberg, March 1958

TN 4219 PROPELLANT VAPORIZATION AS A CRITERION FOR ROCKET ENGINE DESIGN; RELATION BETWEEN PERCENTAGE OF PROPELLANT VAPORIZED AND ENGINE PERFORMANCE, Marcus F. Heidmann and Richard J. Priem, March 1958

TN 4222 DROP-SIZE DISTRIBUTIONS FOR IMPINGING-JET BREAKUP IN AIRSTREAMS SIMULATING THE VELOCITY CONDITIONS IN ROCKET COMBUSTORS, Robert D. Ingebo, March 1958

TN 4252 EXPERIMENTAL INVESTIGATION OF AN IMPULSE-TYPE SUPERSONIC COMPRESSOR ROTOR HAVING A TURNING OF 73° AT THE MEAN RADIUS, James R. Sterrett, June 1958

TN 4253 DESIGN AND TESTS OF A SIX-STAGE AXIAL-FLOW COMPRESSOR HAVING A TIP SPEED OF 550 FEET PER SECOND AND A FLAT OPERATING CHARACTERISTIC AT CONSTANT SPEED, Willard R. Westphal and John W. Maynard, Jr., June 1958

TN 4261 ACOUSTIC, THRUST, AND DRAG CHARACTERISTICS OF SEVERAL FULL-SCALE NOISE SUPPRESSORS FOR TURBOJET ENGINES, Carl C. Ciepluch, Warren J. North, Willard D. Coles, and Robert J. Antl, April 1958

TN 4263 EFFECT OF PRIOR AIR FORCE OVERTEMPERATURE OPERATION ON LIFE OF J47 BUCKETS EVALUATED IN A SEA-LEVEL CYCLIC ENGINE TEST, Robert A. Signorelli, James R. Johnston, and Floyd B. Garrett, April 1958

TN 4264 INTERNAL CHARACTERISTICS AND PERFORMANCE OF SEVERAL JET DEFLECTORS AT PRIMARY-NOZZLE PRESSURE RATIOS UP TO 3.0, Jack G. McArdle, June 1958

TN 4266 STUDIES OF OH, CO, CH, AND C_2 RADIATION FROM LAMINAR AND TURBULENT PROPANE-AIR AND ETHYLENE-AIR FLAMES, Thomas P. Clark, June 1958

TN 4267 PRELIMINARY SURVEY OF PROPULSION USING CHEMICAL ENERGY STORED IN THE UPPER ATMOSPHERE, Lionel V. Baldwin and Perry L. Blackshear, May 1958

TN 4309 USE OF SHORT FLAT VANES FOR PRODUCING EFFICIENT WIDE-ANGLE TWO-DIMENSIONAL SUBSONIC DIFFUSERS, D. L. Cochran and S. J. Kline, September 1958

TN 4317 TURBOJET ENGINE NOISE REDUCTION WITH MIXING NOZZLE-EJECTOR COMBINATIONS, Willard D. Coles, John A. Mihaloew, and Edmund E. Callaghan, August 1958

TN 4318 ANALYTICAL RELATION FOR WAKE MOMENTUM THICKNESS AND DIFFUSION RATIO FOR LOW-SPEED COMPRESSOR CASCADE BLADES, Seymour Lieblein, August 1958

TN 4319 ON FULLY DEVELOPED CHANNEL FLOWS: SOME SOLUTIONS AND LIMITATIONS, AND EFFECTS OF COMPRESSIBILITY, VARIABLE PROPERTIES, AND BODY FORCES, Stephen H. Maslen, September 1958

TN 4324 METHOD FOR DETERMINING THE NEED TO REWORK OR REPLACE COMPRESSOR ROTOR BLADES DAMAGED BY FOREIGN OBJECTS, Albert Kaufman, September 1958

TN 4338 GRAPHS OF REDUCED VARIABLES FOR COMPUTING HISTORIES OF VAPORIZING FUEL DROPS, AND DROP HISTORIES UNDER PRESSURE, G. L. Borman, M. M. El Wakil, O. A. Uyehara, and P. S. Myers, September 1958

TN 4344 PERFORMANCE AT LOW SPEEDS OF COMPRESSOR ROTORS HAVING LOW-CAMBERED NACA 65-SERIES BLADES WITH HIGH INLET ANGLES AND LOW SOLIDITIES, James C. Emery and Paul W. Howard, August 1958

TN 4373 THEORETICAL AND EXPERIMENTAL ANALYSIS OF THE REDUCTION OF ROTOR BLADE VIBRATION OF TURBOMACHINERY THROUGH THE USE OF MODIFIED STATOR VANE SPACING, Richard H. Kemp, Marvin H. Hirschberg, and William C. Morgan, September 1958

TN 4379 TORQUE-SPEED CHARACTERISTICS FOR HIGH-SPECIFIC-WORK TURBINES, Warner L. Stewart, September 1958

TN 4381 EFFECT OF PRESSURE AND DUCT GEOMETRY ON BLUFF-BODY FLAME STABILIZATION, Andrew E. Potter, Jr., and Edgar L. Wong, September 1958

TN 4386 AN ANALYSIS OF RAMJET ENGINES USING SUPERSONIC COMBUSTION, Richard J. Weber and John S. MacKay, September 1958

Applicable NASA Memoranda (Memo)

There were no applicable propulsion subsystem reports in the NASA memorandum, NASA technical note, NASA technical report, NACA research memorandum, NACA technical memorandum, NASA technical translation, and NASA technical memorandum series.

Not Applicable NASA Memoranda (Memo)

MEMO 10-19-58L STATIC INVESTIGATION OF PADDLE VANE OSCILLATING IN JET OF 1,300-POUND-THRUST ROCKET MOTOR, Wade E. Lanford, November 1958

MEMO 11-26-58E COMPARISON OF CALCULATED AND EXPERIMENTAL TOTAL-PRESSURE LOSS AND AIRFLOW DISTRIBUTION IN TUBULAR TURBOJET COMBUSTORS WITH TAPERED LINERS, Jack S. Grobman, January 1959

MEMO 11-27-58E PERFORMANCE OF TYPICAL REAR-STAGE AXIAL-FLOW COMPRESSOR ROTOR BLADE ROW AT THREE DIFFERENT BLADE SETTING ANGLES, Marvin I. Kussoy and Daniel Bachkin, January 1959

MEMO 12-8-58E NASA REACTOR FACILITY HAZARDS SUMMARY. VOLUME I, Lewis Research Center, Edited by T. M. Hallman and B. Lubarsky, January 1959

MEMO 12-10-58E NASA REACTOR FACILITY HAZARDS SUMMARY. VOLUME II, Lewis Research Center, February 1959

MEMO 12-11-58E EVALUATION OF INJECTOR PRINCIPLES IN 2400-POUND-THRUST ROCKET ENGINE USING LIQUID OXYGEN AND LIQUID AMMONIA, Robert C. Hendricks, Robert C. Ehlers, and Robert W. Graham, January 1959

MEMO 12-13-58E THE THERMAL STABILITY OF UNSYMMETRICAL DIMETHYLHYDRAZINE, Adolph E. Spakowski, December 1958

MEMO 12-22-58E PERFORMANCE OF MACH NO. 3.0 DESIGN AXISYMMETRIC DOUBLE-CONE EXTERNAL-COMPRESSION INLET IN MACH NUMBER RANGE 2.07 TO 1.48 (WITH LIST OF REFERENCES), John L. Allen and Glenn A. Mitchell, January 1959

MEMO 12-23-58E A STUDY OF OXIDATION OF HYDROGEN BASED ON FLASHBACK OF HYDROGEN-OXYGEN-NITROGEN BURNER FLAMES, Burton D. Fine, January 1959

MEMO 12-24-58E COMPUTER PROGRAM FOR SOLVING NINE-GROUP DIFFUSION EQUATIONS FOR CYLINDRICAL REACTORS, James W. Miser, Robert E. Hyland, and Daniel Fieno, January 1959

MEMO 12-29-58E PROPELLANT VAPORIZATION AS A CRITERION FOR ROCKET-ENGINE DESIGN; EXPERIMENTAL PERFORMANCE, VAPORIZATION, AND HEAT-TRANSFER RATES WITH VARIOUS PROPELLANT COMBINATIONS, Bruce J. Clark, Martin Hersch, and Richard J. Priem, January 1959

MEMO 12-31-58A EXPLORATORY INVESTIGATION OF THE EFFECTS OF BOUNDARY-LAYER CONTROL ON THE PRESSURE-RECOVERY CHARACTERISTICS OF A CIRCULAR INTERNAL-CONTRACTION INLET WITH TRANSLATING CENTERBODY AT MACH NUMBERS OF 2.00 AND 2.35, Norman J. Martin, February 1959

MEMO 1-5-59E ESTIMATED PERFORMANCE OF RADIAL-FLOW EXIT NOZZLES FOR AIR IN CHEMICAL EQUILIBRIUM, Gerald W. Englert and Fred D. Kochendorfer, February 1959

MEMO 1-6-59E ANALYTICAL INVESTIGATION OF THE SIGNIFICANCE OF TURBINE-INLET TEMPERATURE IN HIGH-ENERGY ROCKET TURBODRIVE APPLICATIONS, Harold E. Rohlik, February 1959

MEMO 1-9-59E EXPERIMENTAL INVESTIGATION OF EXPANDED DUCT SECTIONS AND SCREENS FOR REDUCING FLOW DISTORTIONS AT SUBSONIC FLOWS, Bruce G. Chiccine and Kaleen L. Abdalla, May 1959

MEMO 1-10-59L A HYDROGEN PEROXIDE HOT-JET SIMULATOR FOR WIND-TUNNEL TESTS OF TURBOJET-EXIT MODELS, Jack F. Runckel and John M. Swihart, February 1959

MEMO 1-15-59E COMBUSTION OF VARIOUS HIGHLY REACTIVE FUELS IN A 3.84- BY 10-INCH MACH 2 WIND TUNNEL, Harrison Allen, Jr., and Edward A. Fletcher, April 1959

MEMO 1-26-59E APPLICATION OF GAS ANALYSIS TO COMBUSTOR RESEARCH, R. R. Hibbard and Albert Evans, February 1959

MEMO 1-29-59E EVALUATION OF TRANSPIRATION-COOLED TURBINE BLADES WITH SHELLS OF "POROLOY" WIRE CLOTH, Hadley T. Richards, May 1959

MEMO 2-1-59H RESIDUAL FUEL EXPULSION FROM A SIMULATED 50,000-POUND-THRUST LIQUID-PROPELLANT ROCKET ENGINE HAVING A CONTINUOUS ROCKET-TYPE IGNITER, Wesley E. Messing, February 1959

MEMO 2-3-59E PERFORMANCE OF SEVERAL INLET-BY-PASS SYSTEMS FOR MATCHING 2-DIMENSIONAL VARIABLE-GEOMETRY MACH 1.5 AND 2.0 (WITH LIST OF REFERENCES), Richard A. Yeager and Laurence W. Gertsma, March 1959

MEMO 2-9-59E AIR-COOLED TURBINE BLADES WITH TIP CAP FOR IMPROVED LEADING-EDGE COOLING, Howard F. Calvert, Andre J. Meyer, Jr., and William C. Morgan, February 1959

MEMO 2-11-59E EFFECT OF STATOR AND ROTOR ASPECT RATIO ON TRANSONIC-TURBINE PERFORMANCE, Robert Y. Wong and Daniel E. Monroe, February 1959

MEMO 2-13-59E EXPERIMENTAL EVALUATION OF CERMET TURBINE STATOR BLADES FOR USE AT ELEVATED GAS TEMPERATURES, Patrick T. Chiarito and James R. Johnston, February 1959

MEMO 2-16-59L EFFECT OF ADSORBED NITROGEN ON THE THERMIONIC EMISSION FROM LANTHANUM HEXABORIDE, Arlen F. Carter and George P. Wood, March 1959

MEMO 2-17-59E EFFECTS OF EXTERNAL STREAM ON PERFORMANCE OF ISENTROPIC PLUG-TYPE NOZZLES AT MACH NUMBERS OF 2.0, 1.8, AND 1.5 (WITH LIST OF REFERENCES), Alfred S. Valerino, Robert F. Zappa, and Kaleel L. Abdalla, March 1959

MEMO 2-19-59A EXPERIMENTAL INVESTIGATION OF CIRCULAR INTERNAL-COMPRESSION INLETS WITH TRANSLATING CENTERBODIES EMPLOYING BOUNDARY-LAYER REMOVAL AT MACH NUMBERS FROM 0.85 TO 3.50 (WITH LIST OF REFERENCES), Frank A. Pfyl and Earl C. Watson, March 1959

MEMO 2-19-59L FLIGHT INVESTIGATION OF AN AUTOMATIC THROTTLE CONTROL IN LANDING APPROACHES, Lindsay J. Lina, Robert A. Champine, and Garland J. Morris, March 1959

MEMO 2-23-59E A NUMERICAL METHOD FOR OBTAINING MONO-ENERGETIC NEUTRON FLUX DISTRIBUTIONS AND TRANSMISSIONS IN MULTIPLE-REGION SLABS, Harold Schneider, February 1959

MEMO 3-3-59E PERFORMANCE OF TWO BORON-MODIFIED S-816 ALLOYS IN A TURBOJET ENGINE OPERATED AT 1650°F., William J. Waters, Robert A. Signorelli, and James R. Johnston, March 1959

MEMO 3-6-59E PRELIMINARY STUDY OF A PISTON PUMP FOR CRYOGENIC FLUIDS, Arnold E. Biermann and Robert C. Kohl, March 1959

MEMO 3-6-59L A FIVE-STAGE SOLID-FUEL SOUNDING-ROCKET SYSTEM, Andrew G. Swanson, March 1959

MEMO 3-16-59W EFFECT OF CASCADE PARAMETERS ON ROTATING STALL, A. H. Stenning, B. S. Seidel, and Y. Senoo, April 1959

MEMO 3-18-59E EFFECT ON INLET PERFORMANCE OF COWL VISOR AND INTERNAL CONTRACTION COWL FOR DRAG REDUCTION AT MACH NUMBERS 3.07 AND 1.89(WITH LIST OF REFERENCES), Laurence W. Gertsma, April 1959

MEMO 4-6-59E INVESTIGATION OF A 4.5-INCH-MEAN-DIAMETER TWO-STAGE AXIAL-FLOW TURBINE SUITABLE FOR AUXILIARY POWER DRIVES, Robert Y. Wong and Daniel E. Monroe, March 1959

MEMO 4-7-59E ENGINE OPERATING CONDITIONS THAT CAUSE THERMAL-FATIGUE CRACKS IN TURBOJET-ENGINE BUCKETS, James R. Johnston, John W. Weeton, and Robert A. Signorelli, April 1959

MEMO 4-9-59E EXPLORATORY INVESTIGATION OF AERODYNAMIC FLAMEHOLDERS FOR AFTERBURNER APPLICATION, Helmut F. Butze and Allen J. Metzler, May 1959

MEMO 4-21-59E ANALYSIS OF FLOW-SYSTEM STARTING DYNAMICS OF TURBOPUMP-FED LIQUID-PROPELLANT ROCKET, Richard P. Krebs and Clint E. Hart, April 1959

MEMO 4-26-59A FLIGHT MEASUREMENTS OF THE EFFECT OF A CONTROLLABLE THRUST REVERSER ON THE FLIGHT CHARACTERISTICS OF A SINGLE-ENGINE JET AIRPLANE, Seth B. Anderson, George E. Cooper, and Alan E. Faye, Jr., May 1959

MEMO 5-12-59E ANALYTICAL INVESTIGATION OF THE EFFECT OF TURBOPUMP DESIGN ON GROSS-WEIGHT CHARACTERISTICS OF A HYDROGEN-PROPELLED NUCLEAR ROCKET, Harold E. Rohlik and James E. Crouse, June 1959

MEMO 5-14-59E EXPERIMENTAL ALTITUDE PERFORMANCE OF JP-4 FUEL AND LIQUID-OXYGEN ROCKET ENGINE WITH AN AREA RATIO OF 48, Anthony Fortini, Charles D. Hendrix, and Vearl N. Huff, May 1959

MEMO 5-18-59E PERFORMANCE CHARACTERISTICS OF FLUSH AND SHIELDED AUXILIARY EXITS AT MACH NUMBERS OF 1.5 TO 2.0, Kaleel L. Abdalla, June 1959

MEMO 5-21-59E THEORETICAL PERFORMANCE OF LIQUID HYDROGEN WITH LIQUID OXYGEN AS A ROCKET PROPELLANT, Sanford Gordon and Bonnie J. McBride, June 1959

MEMO 5-26-59E EFFECT OF OZONE ADDITION ON COMBUSTION EFFICIENCY OF HYDROGEN-LIQUID-OXYGEN PROPELLANT IN SMALL ROCKETS, Riley O. Miller and Dwight D. Brown, June 1959

MEMO 5-28-59L INVESTIGATION ON THE USE OF A FREELY ROTATING ROTOR AT THE COWL FACE OF A SUPERSONIC CONICAL INLET TO REDUCE INLET FLOW DISTORTION, Theodore J. Goldberg and Emanuel Boxer, June 1959

Not Applicable NASA Technical Notes

TN D 2 APPROXIMATE COMPOSITION AND THERMODYNAMIC PROPERTIES OF NONIONIZED NITROGEN OXYGEN MIXTURES, Richard A. Hord, August 1959

TN D 4 INFLUENCE OF SHAFT DEFLECTION AND SURFACE ROUGHNESS ON LOAD-CARRYING CAPACITY OF PLAIN JOURNAL BEARINGS, F. H. Raven and R. L. Wehe, August 1959

TN D 21 NEAR-FIELD AND FAR-FIELD NOISE SURVEYS OF SOLID-FUEL ROCKET ENGINES FOR A RANGE OF NOZZLE EXIT PRESSURES, William H. Mayes, Wade E. Lanford, and Harvey H. Hubbard, August 1959

TN D 23 EXPERIMENTAL OPERATING PERFORMANCE OF A SINGLE-STAGE ANNULAR AIR EJECTOR, Robert R. Howell, October 1959

TN D 34 AIRPLANE AND ENGINE RESPONSES TO ABRUPT THROTTLE STEPS AS DETERMINED FROM FLIGHT TESTS OF EIGHT JET-PROPELLED AIRPLANES, Maurice D. White and Bernard A. Schlaff, September 1959

TN D 54 SHOCK-TUBE HEAT-TRANSFER MEASUREMENTS ON INNER SURFACE OF A CYLINDER (SIMULATING A FLAT PLATE) FOR STAGNATION-TEMPERATURE RANGE 4,100° TO 8,300°R, Jim J. Jones, September 1959

TN D 60 JET-ENGINE EXHAUST NOISE FROM SLOT NOZZLES, Willard D. Coles, September 1959

TN D 61 EFFECT OF FORWARD VELOCITY ON SOUND-PRESSURE LEVEL IN THE NEAR NOISE FIELD OF A MOVING JET, John C. Fakan and Harold R. Mull, October 1959

TN D 62 ANALYSIS OF THE TRANSIENT RADIATION HEAT TRANSFER OF AN UNCOOLED ROCKET ENGINE OPERATING OUTSIDE EARTH'S ATMOSPHERE, William H. Robbins, December 1959

TN D 65 PROPELLANT VAPORIZATION AS A CRITERION FOR ROCKET-ENGINE DESIGN; EXPERIMENTAL EFFECT OF CHAMBER DIAMETER ON LIQUID OXYGEN - HEPTANE PERFORMANCE, Marcus F. Heidmann, September 1959

TN D 66 ANALYSIS OF EFFECTS OF ROCKET-ENGINE DESIGN PARAMETERS ON REGENERATIVE-COOLING CAPABILITIES OF SEVERAL PROPELLANTS, Arthur N. Curren, Harold G. Price, Jr., and Howard W. Douglass, September 1959

TN D 67 BLOWOFF OF PROPANE AND HYDROGEN DIFFUSION FLAMES AT HIGH MACH NUMBER, RAMJET CONDITIONS, R. J. Bacigalupi and E. A. Lezberg, December 1959

TN D 72 FULL-SCALE WIND-TUNNEL INVESTIGATION OF THE EFFECTS OF A TARGET-TYPE THRUST REVERSER ON THE LOW-SPEED AERODYNAMIC CHARACTERISTICS OF A SINGLE-ENGINE JET AIRPLANE, William H. Tolhurst, Jr., Mark W. Kelly and R. K. Greif, September 1959

TN D 74 AN OPTIMIZATION STUDY OF EFFECTS ON AIRCRAFT PERFORMANCE OF VARIOUS FORMS OF HEAT ADDITION, Barrett S. Baldwin, Jr., March 1960

TN D 78 ANALYTICAL COMPARISON OF HYDRAZINE WITH PRIMARY PROPELLANTS AS THE TURBINE DRIVE FLUID FOR HYDROGEN-FLUORINE AND HYDROGEN-OXYGEN ALTITUDE STAGE ROCKETS, William T. Wintucky, October 1959

TN D 82 CONTROL OF COMBUSTION-CHAMBER PRESSURE AND OXIDANT-FUEL RATIO FOR A REGENERATIVELY COOLED HYDROGEN-FLUORINE ROCKET ENGINE, Edward W. Otto and Richard A. Flage, November 1959

TN D 84 DISPERSION OF JETTISONED JP-4 JET FUEL BY ATMOSPHERIC TURBULENCE, EVAPORATION, AND VARYING RATES OF FALL OF FUEL DROPLETS, Herman H. Lowell, October 1959

TN D 110 METHOD FOR PREDICTING OFF-DESIGN PERFORMANCE OF AXIAL-FLOW COMPRESSOR BLADE ROWS, George K. Serovy and E. W. Anderson, August 1959

TN D 123 INVESTIGATION OF THE EFFECT OF A GUIDE-VANE-ROTOR COMBINATION ON INLET TOTAL PRESSURE DISTORTIONS IN A COMPRESSIBLE FLUID, George C. Ashby, Jr., December 1959

TN D 125 THERMAL-STRESS FATIGUE CRACKING OF TURBINE BUCKETS OPERATED AT 1700°F IN A TURBOJET ENGINE WITH FREQUENT STARTS AND STOPS, R. A. Signorelli, J. R. Johnston, and J. W. Weeton, October 1959

TN D 126 A HIGH-PERFORMANCE 250-POUND-THRUST ROCKET ENGINE UTILIZING COAXIAL-FLOW INJECTION OF JP-4 FUEL AND LIQUID OXYGEN, Samuel Stein, October 1959

TN D 128 FLAME STABILITY EFFECT OF GASES EJECTED INTO A STREAM FROM A BLUFF-BODY FLAME-HOLDER, Edgar L. Wong, August 1959

TN D 129 COMBINED EFFECT OF CONTRACTION RATIO AND CHAMBER PRESSURE ON THE PERFORMANCE OF A GASEOUS-HYDROGEN - LIQUID-OXYGEN COMBUSTOR FOR A GIVEN PROPELLANT WEIGHT FLOW AND OXIDANT-FUEL RATIO, Martin Hersch, February 1961

TN D 130 USE OF A THEORETICAL FLOW MODEL TO CORRELATE DATA FOR FILM COOLING OR HEATING AN ADIABATIC WALL BY TANGENTIAL INJECTION OF GASES OF DIFFERENT FLUID PROPERTIES, James E. Hatch and S. Stephen Papell, November 1959

TN D 131 COMPARISON OF HYDRAZINE - NITROGEN TETROXIDE AND HYDRAZINE - CHLORINE TRIFLUORIDE IN SMALL-SCALE ROCKET CHAMBERS, R. James Rollbuhler and William A. Tomazic, October 1959

TN D 132 A GENERAL METHOD FOR AUTOMATIC COMPUTATION OF EQUILIBRIUM COMPOSITIONS AND THEORETICAL ROCKET PERFORMANCE OF PROPELLANTS, Sanford Gordon, Frank J. Zeleznik, and Vearl N. Huff, October 1959

TN D 134 SOME THRUST AND TRAJECTORY CONSIDERATIONS FOR LUNAR LANDINGS, Richard J. Weber and Werner M. Pauson, November 1959

TN D 150 APPROXIMATE SOLUTIONS TO OPTIMUM CLIMB TRAJECTORY FOR A ROCKET-POWERED AIRCRAFT, Angelo Miele and James O. Cappellari, Jr., September 1959

TN D 151 COMBINED OPERATIONS WITH AND WITHOUT AFTERBURNING FOR MINIMUM FUEL CONSUMPTION IN LEVEL FLIGHT, Angelo Miele and Carlos R. Cavoti, September 1959

TN D 152 APPROXIMATE SOLUTIONS TO OPTIMUM FLIGHT TRAJECTORIES FOR A TURBOJET-POWERED AIRCRAFT, Angelo Miele and James O. Cappellari, Jr., September 1959

TN D 168 STATIC FORCE TESTS OF SEVERAL ANNULAR JET CONFIGURATIONS IN PROXIMITY TO SMOOTH AND IRREGULAR GROUND, Edwin E. Davenport, Richard E. Kuhn, and Irving R. Sherman, November 1959

TN D 169 SPECTROGRAPHIC TEMPERATURE MEASUREMENTS IN A CARBON-ARC-POWERED AIR JET, David H. Greenshields, December 1959

TN D 185 THE HYDROGEN-PEROXIDE ROCKET REACTION-CONTROL SYSTEM FOR THE X-1B RESEARCH AIRPLANE, James E. Love and Wendell H. Stillwell, December 1959

TN D 197 LUBRICATION OF CORROSION-RESISTANT ALLOYS BY MIXTURES OF HALOGEN-CONTAINING GASES AT TEMPERATUES UP TO 1200°F., Donald H. Buckley and Robert L. Johnson, November 1959

TN D 198 CHEMICAL SAMPLING DOWNSTREAM OF LEAN, FLAT HYDROGEN AND PROPANE FLAMES, Burton D. Fine, December 1959

TN D 199 FREE FALL AND EVAPORATION OF JP-1 JET FUEL DROPLETS IN A QUIET ATMOSPHERE, Herman H. Lowell, March 1960

TN D 200 EXPERIMENTAL INVESTIGATION IN AN ALTITUDE TEST FACILITY OF BURNING OF EXCESS COMBUSTIBLES IN A ROCKET ENGINE EXHAUST, Harry E. Bloomer, Paul E. Renas, and Robert J. Antl, January 1960

TN D 202 EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF HEAT-TRANSFER CHARACTERISTICS OF A RETURN-FLOW AIR-COOLED TURBINE ROTOR BLADE, Francis S. Stepka and Reeves P. Cochran, December 1959

TN D 203 EXPERIMENTAL STUDY OF ZERO-FLOW EJECTORS USING GASEOUS NITROGEN, William L. Jones, Harold G. Price, Jr. and Carl F. Lorenzo, March 1960

TN D 204 EXPERIMENTAL DETERMINATION OF THE TEMPERATURE AND DYNAMIC-STRAIN ENVIRONMENT OF A TURBULAR COMBUSTOR LINER IN A TURBOJET ENGINE, Patrick T. Chiarito, William C. Morgan, and C. Robert Morse, March 1960

TN D 206 HETEROGENEOUS COMBUSTION OF MULTICOMPONENT FUELS, Bernard J. Wood, Henry Wise, and S. Henry Inami, November 1959

TN D 222 AN INVESTIGATION OF THE ROLE OF GASEOUS DIFFUSION IN THE OXIDATION OF A METAL FORMING VOLATILE OXIDE, Jerry L. Modisette and David R. Schryer, March 1960

TN D 231 A STUDY OF EQUILIBRIUM REAL-GAS EFFECTS IN HYPERSONIC AIR NOZZLES, INCLUDING CHARTS OF THERMODYNAMIC PROPERTIES FOR EQUILIBRIUM AIR, Wayne D. Erickson and Helen S. Creekmore, April 1960

TN D 252 INVESTIGATION OF THE NATURAL FREQUENCIES OF FLUID IN SPHERICAL AND CYLINDRICAL TANKS, John Locke McCarty and David G. Stephens, May 1960

TN D 257 PERFORMANCE INVESTIGATION OF A NONPUMPING ROCKET-EJECTOR SYSTEM FOR ALTITUDE SIMULATION, Anthony Fortini, December 1959

TN D 258 PROPELLANT VAPORIZATION AS A CRITERION FOR ROCKET-ENGINE DESIGN: EXPERIMENTAL EFFECT OF COMBUSTOR LENGTH, THROAT DIAMETER, INJECTION VELOCITY, AND PRESSURE ON ROCKET COMBUSTOR EFFICIENCY, Bruce J. Clark, April 1960

TN D 260 CONTINUED STUDY OF ADVANCED-TEMPERATURE NICKEL-BASE ALLOYS TO INVESTIGATE VANADIUM ADDITIVES, John C. Freche, Thomas J. Riley and William J. Waters, February 1960

TN D 261 ONE-DIMENSIONAL ANALYSIS OF ION ROCKETS, Harold R. Kaufman, March 1960

TN D 262 URANIUM DIOXIDE COMPATIBILITY WITH REFRACTORY METALS, CARBIDES, BORIDES, NITRIDES, AND OXIDES BETWEEN 3500° AND 5000°F, James J. Gangler, William A. Sanders, and Isadore L. Drell, February 1960

TN D 263 EFFECTS OF MELTING PRACTICE AND ALUMINUM COATING ON THE LIFE OF GMR 235 BUCKETS OPERATED AT 1650°F IN A TURBOJET ENGINE, C. A. Gyorgak, Jr. R. Johnston, and J. W. Weeton, March 1960

TN D 265 EXPERIMENTAL RESULTS OF A HEAT-TRANSFER STUDY FROM A FULL-SCALE PEBBLE-BED HEATER, Richard B. Lancashire, Erwin A. Lezberg, and James F. Morris, March 1960

TN D 266 ANALYSIS OF ONE-DIMENSIONAL ION ROCKET WITH GRID NEUTRALIZATION, Harold Mirels and Burt M. Rosenbaum, March 1960

TN D 267 HEAT TRANSFER TO CYLINDERS IN CROSSFLOW IN HYPERSONIC RAREFIED GAS STREAMS, Ruth N. Weltman and Perry W. Kuhns, March 1960

TN D 273 NUMERICAL COMPUTATION OF AERODYNAMIC HEATING OF LIQUID PROPELLANTS, John L. Kramer, Herman H. Lowell, and William H. Roudebush, April 1960

TN D 274 CRASH-FIRE PROTECTION SYSTEM FOR A J57 TURBOJET ENGINE USING WATER AS A COOLING AND INERTING AGENT, Dugald O. Black, February 1960

TN D 275 COMPILATION OF THERMODYNAMIC PROPERTIES TRANSPORT PROPERTIES, AND THEORETICAL ROCKET PERFORMANCE OF GASEOUS HYDROGEN, Charles R. King, April 1960

TN D 276 PERFORMANCE STUDY OF A PISTON-TYPE PUMP FOR LIQUID HYDROGEN, Arnold E. Biermann and William G. Shinko, March 1960

TN D 277 APPLICATION OF VARIOUS TECHNIQUES FOR DETERMING LOCAL HEAT-TRANSFR COEFFICIENTS IN A ROCKET ENGINE FROM TRANSIENT EXPERIMENTAL DATA, Curt H. Liebert, James E. Hatch, and Ronald W. Grant, April 1960

TN D 282 INVESTIGATION OF AERODYNAMIC EFFECTS OF EXTERNAL COMBUSTION BELOW FLAT-PLATE MODEL IN 10- BY 10-FOOT WIND TUNNEL AT MACH 2.4, Robert G. Dorsch, Harrison Allen, Jr., and Murray Dryer, April 1960

TN D 285 SATELLITE AND SPACE PROPULSION SYSTEMS, Wolfgang E. Moeckel, Lionel V. Baldwin, Robert E. English, Bernard Lubarsky, and Stephen H. Maslen, June 1960

TN D 286 COMPARISON OF LOCALIZED HEAT-TRANSFER RATES IN A LIQUID-OXYGEN - HEPTANE ROCKET ENGINE EMPLOYING SEVERAL INJECTION METHODS AND OXIDANT-FUEL RATIOS, Richard F. Neu., June 1960

TN D 287 EFFECT OF TRANSVERSE ACOUSTIC OSCILLATIONS ON THE VAPORIZATION OF A LIQUID-FUEL DROPLET, Paul R. Wieber and William R. Mickelson, May 1960

TN D 288 NASA RESEARCH ON THE HYDRODYNAMICS OF THE GASEOUS VORTEX REACTOR, Robert G. Ragsdale, September 1960

TN D 289 IGNITION OF A COMBUSTIBLE ATMOSPHERE BY INCANDESCENT CARBON WEAR PARTICLES, Donald H. Buckley, Max A. Swikert, and Robert L. Johnson, September 1960

TN D 290 PHOTOMICROGRAPHIC TRACKING OF ETHANOL DROPS IN A ROCKET CHAMBER BURNING ETHANOL AND LIQUID OXYGEN, Robert D. Ingeho, June 1960

TN D 293 PERFORMANCE OF SEVERAL METHOD-OF-CHARACTERISTICS EXHAUST NOZZLES, John M. Farley and Carl E. Campbell, October 1960

TN D 294 TURBULENCE STUDIES OF A RECTANGULAR SLOTTED NOISE-SUPPRESSOR NOZZLE, James C. Laurence, September 1960

TN D 296 A STUDY OF THE COMBUSTION OF ALUMINUM BOROHYDRIDE IN A SMALL SUPERSONIC WIND TUNNEL, Harrison Allen, Jr. and Edward A. Fletcher, July 1960

TN D 297 MEASUREMENT OF SCREEN-SIZE EFFECTS ON INTENSITY, SCALE, AND SPECTRUM OF TURBULENCE IN A FREE SUBSONIC JET, Charles D. Howard and James C. Laurence, August 1960

TN D 298 EXPERIMENTAL EVALUATION OF ROCKET EXHAUST DIFFUSERS FOR ALTITUDE SIMULATION, Joseph N. Sivo, Carl L. Meyer, and Daniel J. Peters, July 1960

TN D 299 EFFECT ON GASEOUS FILM COOLING OF COOLANT INJECTION THROUGH ANGLED SLOTS AND NORMAL HOLES, S. Stephen Papell, September 1960

TN D 308 THE EFFECT ON THE DRAG OF A WING-BODY COMBINATION OF MOMENT-OF-AREA-RULE MODIFICATIONS WITH PODS DUCTED TO SIMULATE ENGINE NACELLES, Robert R. Dickey and Lionel L. Levy, Jr., February 1960

TN D 319 A WIND-TUNNEL INVESTIGATION OF THREE PROPELLERS THROUGH AN ANGLE-OF-ATTACK RANGE FROM 0° TO 85°, Paul F. Yaggy and Vernon L. Rogallo, May 1960

TN D 332 AXIAL-FORCE REDUCTION BY INTERFERENCE BETWEEN JET AND NEIGHBORING AFTERBODY, William C. Pitts and Lyle E. Wiggins, September 1960

TN D 336 AN EXPLORATORY STUDY OF THERMOELECTROSTATIC POWER GENERATION FOR SPACE FLIGHT APPLICATIONS, Benjamin H. Beam, October 1960

TN D 380 TEMPERATURE AND COMPOSITION OF A PLASMA OBTAINED BY SEEDING A CYANOGEN-OXYGEN FLAME WITH CESIUM, Richard A. Hord and Byron Pennington, May 1960

TN D 382 EFFECT OF BLADE CUTOUT ON POWER REQUIRED BY HELICOPTERS OPERATING AT HIGH TIP-SPEED RATIOS, Alfred Gessow and F. B. Gustafson, September 1960

TN D 397 DATA FROM A STATIC-THRUST INVESTIGATION OF A LARGE-SCALE GENERAL RESEARCH VTOL-STOL MODEL IN GROUND EFFECT, Robert J. Huston and Matthew M. Winston, August 1960

TN D 418 STATIC THRUST OF AN ANNULAR NOZZLE WITH A CONCAVE CENTRAL BASE, Blake W. Corson, Jr., and Charles E. Mercer, September 1960

TN D 440 INVESTIGATION OF MINIMUM CORONA TYPE CURRENTS FOR IGNITION OF AIRCRAFT FUEL VAPORS, M. M. Newman and J. D. Robb, June 1960

TN D 441 FLIGHT PERFORMANCE OF A SPIN-STABILIZED 20-INCH-DIAMETER SOLID-PROPELLANT SPHERICAL ROCKET MOTOR, Jack Levine, C. William Martz, Robert L. Swain, and Andrew G. Swanson, September 1960

TN D 442 A PRELIMINARY INVESTIGATION ON THE DESTRUCTION OF SOLID-PROPELLANT ROCKET MOTORS BY IMPACT FROM SMALL PARTICLES, David J. Carter, Jr., September 1960

TN D 452 MODULATED ENTRY, Frederick C. Grant, August 1960

TN D 465 THE MAGNETIC FIELD OF A FINITE SOLENOID, Edmund E. Callaghan and Stephen H. Maslen, October 1960

TN D 466 A GRAPHICAL METHOD FOR ESTIMATING ION-ROCKET PERFORMANCE, Thaine W. Reynolds and J. Howard Childs, August 1960

TN D 467 PERFORMANCE OF SEVERAL CONICAL CONVERGENT-DIVERGENT ROCKET-TYPE EXHAUST NOZZLES, C. E. Campbell and J. M. Farley, September 1960

TN D 469 LIQUID-PHASE HEAT-RELEASE RATES OF THE SYSTEMS HYDRAZINE - NITRIC ACID AND UNSYMMETRICAL DIMETHYLHYDRAZINE - NITRIC ACID, Dezso Somogyi and Charles E. Feiler, September 1960

TN D 472 ANALYTICAL INVESTIGATION OF CYCLE CHARACTERISTICS FOR ADVANCED TURBOELECTRIC SPACE POWER SYSTEMS, Thomas P. Moffitt and Frederick W. Klag, October 1960

TN D 473 AN ANALYTICAL INVESTIGATION OF THREE GENERAL METHODS OF CALCULATING CHEMICAL-EQUILIBRIUM COMPOSITIONS, Frank J. Zeleznik and Sanford Gordon, September 1960

TN D 474 DETERMINATION OF NUCLEAR-ROCKET POWER LEVELS FOR UNMANNED MARS VEHICLES STARTING FROM ORBIT ABOUT EARTH, Richard H. Cavicchi and James W. Miser, January 1962

TN D 475 SOME NUCLEAR CALCULATIONS OF U^{235}-D_2O GASEOUS-CORE CAVITY REACTORS, Robert G. Ragsdale and Robert E. Hyland, October 1961

TN D 480 EFFECT OF PROPELLANT AND CATALYST BED TEMPERATURES ON THRUST BUILDUP IN SEVERAL HYDROGEN PEROXIDE REACTION CONTROL ROCKETS, John P. Wanhainen, Phil S. Ross, and Richard L. DeWitt, October 1960

TN D 482 AN ANALYSIS OF NUCLEAR-ROCKET NOZZLE COOLING, William H. Robbins, Daniel Bachkin, and Arthur A. Medeiros, November 1960

TN D 500 THE DIELECTRIC BOLOMETER, A NEW TYPE OF THERMAL RADIATION DETECTOR, R. A. Hanel, November 1960

TN D 513 THRUST CHARACTERISTICS OF MULTIPLE LIFTING JETS IN GROUND PROXIMITY, Edwin E. Davenport and Kenneth P. Spreeman, September 1960

TN D 516 THE EFFECT OF CATALYST-BED ARRANGEMENT ON THRUST BUILDUP AND DECAY TIME FOR A 90 PERCENT HYDROGEN PEROXIDE CONTROL ROCKET, Conrad M. Willis, September 1960

TN D 533 PRANDTL NUMBER, THERMAL CONDUCTIVITY, AND VISCOSITY OF AIR-HELIUM MIXTURES, E. R. G. Eckert, W. E. Ibele, and T. F. Irvine, Jr., September 1960

TN D 539 EFFECT OF BASE BLEED AND TERMINAL FAIRINGS ON THE PERFORMANCE OF EXHAUST-NOZZLE - AFTERBODY COMBINATIONS AT MACH NUMBERS OF 1.93, 2.55 AND 3.05, Harry T. Norton, Jr., and Arvid L. Keith, Jr., November 1960

TN D 544 MEASURED BASE PRESSURES ON SEVERAL TWIN ROCKET-NOZZLE CONFIGURATIONS AT MACH NUMBERS OF 0.6 TO 1.4 WITH EFFECTS DUE TO NOZZLE CANTING AND STABILIZING FINS, James M. Cubbage and Earl H. Andrews, Jr., October 1960

TN D 551 PROPAGATION OF FREE FLAMES IN LAMINAR-AND TURBULENT-FLOW FIELDS, Ray E. Bolz and Henry Burlage, Jr., September 1960

TN D 563 INVESTIGATION OF S-IV ALL SYSTEMS VEHICLE EXPLOSION, J. B. Gayle, September 1964

TN D 574 KINEMATIC ANALYSIS OF THE ENGINE AND PUMP INLET DUCT GIMBAL JOINT SYSTEM IN THE S-IC STAGE OF THE SATURN V VEHICLE, F. F. Garcia, October 1964

TN D 575 ANALYSIS OF MAGNETIC TRIODES FOR DIRECT-ENERGY CONVERSION HAVING FLAT-PLATE CATHODES AND ANODES AT AN ARBITRARY ANGLE, James E. Hatch, November 1960

TN D 577 LIQUID-HYDROGEN-FLOWMETER CALIBRATION FACILITY; PRELIMINARY CALIBRATION ON SOME HEAD-TYPE AND TURBINE-TYPE FLOWMETERS, Herbert L. Minkin and Howard F. Hobart, October 1961

TN D 579 EFFECT OF NOZZLE CONVERGENCE LENGTH ON PERFORMANCE OF A HEPTANE-OXYGEN COMBUSTOR, Marshall C. Burrows, December 1960

TN D 581 A THERMODYNAMIC ANALYSIS OF THRUST AUGMENTATION FOR NUCLEAR ROCKETS, Hugh M. Henneberry, Lester C. Corrington, and Roger D. Becker, March 1961

TN D 582 PERFORMANCE CHARTS FOR MULTISTAGE ROCKET BOOSTERS, John S. MacKay and Richard J. Weber, January 1961

TN D 585 AN ION ROCKET WITH AN ELECTRON-BOMBARDMENT ION SOURCE, Harold R. Kaufman, January 1961

TN D 586 AN ANALYSIS OF THERMAL RADIATION HEAT TRANSFER IN A NUCLEAR-ROCKET NOZZLE, William H. Robbins, January 1961

TN D 587 ANALYSIS OF LIQUID-HYDROGEN STORAGE PROBLEMS FOR UNMANNED NUCLEAR-POWERED MARS VEHICLES. R. J. Brun, J. N. B. Livingood, E. G. Rosenberg, and D. W. Drier, APPENDIX D: CALCULATIONS OF SHIELDING NECESSARY TO PREVENT RADIATION DAMAGE TO REACTOR CONTROL EQUIPMENT, John M. Smith, January 1962

TN D 589 ELECTRIC SPARK IGNITION IN CARBON-VANE FUEL PUMPS, John A. Campbell, Richard J. Parker, and Robert G. Dorsch, February 1961

TN D 591 INVESTIGATION OF THE PERFORMANCE OF AN AXIAL-FLOW-PUMP STAGE DESIGNED BY THE BLADE-ELEMENT THEORY - DESIGN AND OVERALL PERFORMANCE, James F. Crouse, John C. Montgomery, and Richard F. Soltis, February 1961

TN D 675 AN OPTIMIZATION OF POWERPLANT PARAMETERS FOR ORBITAL-LAUNCH NUCLEAR ROCKETS, Paul G. Johnson and Roger L. Smith, February 1961

TN D 678 PERFORMANCE OF A LOW-THRUST STORABLE-BIPROPELLANT ROCKET AT VERY LOW CHAMBER PRESSURE, John P. Wanhainen, Richard L. DeWitt, and Phil S. Ross, March 1961

TN D 682 THEORETICAL PERFORMANCE OF PROPELLANTS SUITABLE FOR ELECTROTHERMAL JET ENGINES, John R. Jack, April 1961

TN D 684 IGNITION OF HYDROGEN-OXYGEN ROCKET COMBUSTOR WITH CHLORINE TRIFLUORIDE AND TRIETHYLALUMINUM, John W. Gregory and David M. Straight, April 1961

TN D 686 LARGE-SCALE WIND-TUNNEL TESTS OF EXHAUST INGESTION DUE TO THRUST REVERSAL ON A FOUR-ENGINE JET TRANSPORT DURING GROUND ROLL, William H. Tolhurst, Jr., David H. Hickey, and Kiyoshi Aoyagi, January 1961

TN D 693 CHARTS FOR AIR-FLOW PROPERTIES IN EQUILIBRIUM AND FROZEN FLOWS IN HYPERVELOCITY NOZZLES, Kenneth K. Yoshikawa and Elliott D. Katzen, April 1961

TN D 706 THE ARCTIC METEOROLOGY PHOTO PROBE, Harold E. Evans, Robert C. Baumann, and Richard J. Andryshak, February 1962

TN D 713 A PRELIMINARY STUDY OF THE USE OF FINITE-THRUST ENGINES FOR ABORT DURING LAUNCH OF SPACE VEHICLES, William A. McGowan and John M. Eggleston, December 1961

TN D 720 EFFECT OF RATIO OF JET AREA TO TOTAL AREA AND OF PRESSURE RATIO ON LIFT AUGMENTATION OF ANNULAR JETS IN GROUND EFFECT UNDER STATIC CONDITIONS, K. W. Goodson and J. H. Otis, Jr., March 1961

TN D 751 INVESTIGATION OF A RETROROCKET EXHAUSTING FROM THE NOSE OF A BLUNT BODY INTO A SUPERSONIC FREE STREAM, Nickolai Charczenko and Katherine W. Hennessey, September 1961

TN D 754 THE EFFECT ON THRUST MINUS BASE DRAG OF EXCHANGING BASE AREA FOR NOZZLE EXPANSION IN SUPERSONIC NOZZLES AT TRANSONIC MACH NUMBERS, Travis H. Slocumb, Jr. and Earl H. Andrews, Jr., April 1961

TN D 762 INTERNAL-PERFORMANCE EVALUATION OF A TWO-POSITION DIVERGENT SHROUD EJECTOR, James R. Mihaloew and Andrew J. Stofan, January 1961

TN D 763 INTERNAL-PERFORMANCE EVALUATION OF TWO FIXED-DIVERGENT-SHROUD EJECTORS, James R. Mihaloew, January 1961

TN D 764 EXAMINATION OF PRESSURE OSCILLATIONS INDUCED BY CHANGES IN THE BURNING RATE OF FLAMES, Rose L. Schalla, April 1961

TN D 765 EXPERIMENTAL HEAT TRANSFER AND PRESSURE DROP OF LIQUID HYDROGEN FLOWING THROUGH A HEATED TUBE, R. C. Hendricks, R. W. Graham, Y. Y. Hsu, and R. Friedman, May 1961

TN D 766 PERFORMANCE EVALUATION OF A TWO-DIMENSIONAL ION ROCKET USING THROUGH-FEED AND POROUS TUNGSTEN IONIZERS, David L. Lockwood and Ronald J. Cybulski, April 1961

TN D 767 SIMULTANEOUS LEAST-SQUARES APPROXIMATION OF A FUNCTION AND ITS FIRST INTEGRALS WITH APPLICATION TO THERMODYNAMIC DATA, F. J. Zeleznik and Sanford Gordon, May 1961

TN D 768 REACTION OF COPPER AND FLUORINE FROM 800° TO 1200°F, Patricia M. O'Donnell and Adolph E. Spakowski, April 1961

TN D 770 EFFECT OF MULTIPLE-NOZZLE GEOMETRY ON JET-NOISE GENERATION, Vern G. Rollin, September 1961

TN D 776 A WIND-TUNNEL INVESTIGATION OF A 4-FOOT-DIAMETER DUCTED FAN MOUNTED ON THE TIP OF A SEMISPAN WING, Paul F. Yaggy and Kenneth W. Mort, March 1961

TN D 784 AN EXPERIMENTAL INVESTIGATION OF THE FLOW IN AN AXISYMMETRIC INTERNAL-COMPRESSION INLET FOR M = 2.75, Earl C. Watson and William P. Peterson, April 1961

TN D 786 INVESTIGATION OF THE LONGITUDINAL CHARACTERISTICS OF A LARGE-SCALE JET TRANSPORT MODEL EQUIPPED WITH CONTROLLABLE THRUST REVERSERS, David H. Hickey, William H. Tolhurst, Jr., and Kiyoshi Aoyagi, March 1961

TN D 789 AERODYNAMICS OF A FAN-IN-FUSELAGE MODEL, Ralph L. Maki and David H. Hickey, May 1961

TN D 843 RESIDUAL-LOAD-PLUS-POWERPLANT WEIGHTS FOR ORBITAL-LAUNCH NUCLEAR ROCKETS, Paul G. Johnson, James W. Miser, and Roger L. Smith, May 1961

TN D 845 COMPARATIVE MEASUREMENTS OF BEAM POWER IN ION-ROCKET RESEARCH, E. A. Richley, V. A. Sandborn, L. V. Baldwin, and E. E. Dangle, May 1961

TN D 846 EXPERIMENTAL STUDY OF EFFECTS OF GEOMETRIC VARIABLES ON PERFORMANCE OF CONICAL ROCKET-ENGINE EXHAUST NOZZLES, Harry E. Bloomer, Robert J. Antl, and Paul E. Renas, June 1961

TN D 847 EXPERIMENTAL PERFORMANCE OF NOZZLES HAVING AREA RATIOS UP TO 300 ON JP-4 FUEL - LIQUID-OXYGEN ROCKET ENGINE, J. Calvin Lovell and Nick E. Samanich, June 1961

TN D 851 RELATIONS OF COMBUSTION DEAD TIME TO ENGINE VARIABLES FOR A 20,000-POUND-THRUST GASEOUS-HYDROGEN - LIQUID-OXYGEN ROCKET ENGINE, Daniel I. Drain, Harold J. Schum, and Charles A. Wasserbauer, June 1961

TN D 854 INVESTIGATION OF AN AXISYMMETRIC INTERNAL COMPRESSION INLET AT A MACH NUMBER OF ABOUT 3.8, John H. Lundell, Richard Scherrer, and Lewis A. Anderson, June 1961

TN D 876 THEORETICAL PERFORMANCE OF REVERSE-FEED CESIUM ION ENGINES, J. Howard Childs. APPENDIX B: SIMULATION OF MOLECULAR FLOW BY LIGHT, Ronald J. Cybulski and David L. Lockwood, August 1961

TN D 878 ANALYSIS, FEASIBILITY, AND WALL-TEMPERATURE DISTRIBUTION OF A RADIATION-COOLED NUCLEAR-ROCKET NOZZLE, William H. Robbins and Carroll A. Todd, January 1962

TN D 887 EFFECTS OF BOATTAILING AND NOZZLE EXTENSION ON THE THRUST-MINUS-DRAG OF A MULTIPLE-JET CONFIGURATION, William R. Scott, June 1961

TN D 914 CALCULATION PROCEDURE FOR THERMODYNAMIC, TRANSPORT, AND FLOW PROPERTIES OF THE COMBUSTION PRODUCTS OF A HYDROCARBON FUEL MIXTURE BURNED IN AIR WITH RESULTS FOR ETHYLENE-AIR AND METHANE-AIR MIXTURES, E. W. Leyhe and R. R. Howell, January 1962

TN D 944 CONFIGURATION FACTORS FOR EXCHANGE OF RADIANT ENERGY BETWEEN AXISYMMETRICAL SECTIONS OF CYLINDERS, CONES, AND HEMISPHERES AND THEIR BASE, Albert J. Buschman, Jr. and Claud M. Pittman, October 1961

TN D 953 ANALYSIS OF A LINEAR SYSTEM FOR VARIABLE-THRUST CONTROL IN THE THERMAL PHASE OF RENDEZVOUS, Richard A. Hord and Barbara J. Durling, September 1961

TN D 963 PAYLOAD VIBRATION DATA MEASURED DURING FIVE FLIGHTS OF A TWO-STAGE SOLID-PROPELLANT LAUNCH VEHICLE, Sherman A. Clevenson, January 1962

TN D 980 ESTIMATES OF MINIMUM ENERGY REQUIREMENTS FOR RANGE-CONTROLLED RETURN OF A NON-LIFTING SATELLITE FROM A CIRCULAR ORBIT, Charlie M. Jackson, Jr., November 1961

TN D 991 PRELIMINARY INVESTIGATION OF AN UNDERWATER RAMJET POWERED BY COMPRESSED AIR, Elmo J. Mottard and Charles J. Shoemaker, December 1961

TN D 1006 EFFECT OF GEOMETRIC PARAMETERS ON THE STATIC PERFORMANCE OF AN ANNULAR NOZZLE WITH A CONCAVE CENTRAL BASE, Charles E. Mercer and Albert J. Simonson, February 1962

TN D 1046 EXPERIMENTAL INVESTIGATION OF AN AIR-COOLED TURBINE OPERATING IN A TURBOJET ENGINE AT TURBINE INLET TEMPERATURES UP TO 2500°F, Reeves P. Cochran and Robert P. Dengler, July 1961

TN D 1048 DETERMINATION OF LOCAL EXPERIMENTAL HEAT-TRANSFER COEFFICIENTS ON COMBUSTION SIDE OF AN AMMONIA-OXYGEN ROCKET, Curt H. Liebert and Robert C. Ehlers, September 1961

TN D 1049 ANNULAR INTERNAL-EXTERNAL-EXPANSION ROCKET NOZZLES FOR LARGE BOOSTER APPLICATIONS, James F. Connors, Robert W. Cubbison, and Glenn A. Mitchell, September 1961

TN D 1052 RECOMBINATION OF HYDROGEN-AIR COMBUSTION PRODUCTS IN AN EXHAUST NOZZLE, Erwin A. Lezberg and Richard B. Lancashire, APPENDIX B: CALIBRATION OF PYROMETER WITH ARC SOURCE, Donald R. Buchele, August 1961

TN D 1053 STABILITY OF TITANIUM NITRIDE AND TITANIUM CARBIDE WHEN EXPOSED TO HYDROGEN ATOMS FROM 298° TO 1950°K, Warren H. Philipp, August 1961

TN D 1104 EXPERIMENTAL STUDY OF COMBINED FORCED AND FREE LAMINAR CONVECTION IN A VERTICAL TUBE, Theodore M. Hallman, December 1961

TN D 1107 THERMODYNAMIC PROPERTIES OF HYDROGEN FROM ROOM TEMPERATURE TO 100,000°K, Burt M. Rosenbaum and Leo Levitt, January 1962

TN D 1108 NONVISCOUS FLOW THROUGH A PUMP IMPELLER ON A BLADE-TO-BLADE SURFACE OF REVOLUTION, James J. Kramer, Norbert O. Stockman, and Ralph J. Bean, February 1962

TN D 1109 INVESTIGATION OF THE PERFORMANCE OF AN AXIAL-FLOW-PUMP STAGE DESIGNED BY THE BLADE-ELEMENT THEORY - BLADE-ELEMENT DATA, James E. Crouse, Richard F. Soltis, and John C. Montgomery, December 1961

TN D 1110 A PARAMETRIC STUDY OF THE THERMIONIC DIODE SYSTEM FOR LARGE NUCLEAR-ELECTRIC POWERPLANTS IN SPACE VEHICLES, Daniel T. Bernatowicz, January 1962

TN D 1117 LUNAR STORAGE OF LIQUID PROPELLANTS, W. E. Dempster, R. L. Evans, and J. R. Olivier, July 1962

TN D 1118 GIMBAL GEOMETRY AND ATTITUDE SENSING OF THE ST-124 STABILIZED PLATFORM, Richard L. Moore and Herman E. Thomason, May 1962

TN D 1143 ORBITAL PAYLOAD REDUCTIONS RESULTING FROM BOOSTER AND TRAJECTORY MODIFICATIONS FOR RECOVERY OF A LARGE ROCKET BOOSTER, Alan D. Levin and Edward J. Hopkins, December 1961

TN D 1162 PERFORMANCE OF SMALL (100-LB THRUST) ROCKET MOTORS USING COAXIAL INJECTION OF HYDRAZINE AND NITROGEN TETROXIDE, Joseph F. Wasserbauer and William Tabata, December 1961

TN D 1163 INVESTIGATION OF A 10-CENTIMETER-DIAMETER ELECTRON-BOMBARDMENT ION ROCKET, Paul D. Reader, January 1962

TN D 1166 A COMPARISON OF REVERSE FEED AND POROUS TUNGSTEN ION ENGINES, Thaine W. Reynolds and J. Howard Childs, February 1962

TN D 1168 ACCELERATOR GRID TESTS ON AN ELECTRON-BOMBARDMENT ION ROCKET, William R. Kerslake, February 1962

TN D 1181 EXPERIMENTAL STUDY OF EFFECTS OF GEOMETRIC VARIABLES ON PERFORMANCE OF CONTOURED ROCKET-ENGINE EXHAUST NOZZLES, Harry E. Bloomer, Robert J. Antl, and Paul E. Renas, January 1962

TN D 1193 PRELIMINARY STUDY OF THE EFFECTS OF IONIZING RADIATIONS ON PROPELLANTS; THE X-IRRADIATION OF AMMONIA AND HYDRAZINE, Harold W. Lucien, February 1962

TN D 1212 SOME STUDIES OF LIQUID ROTATION AND VORTEXING IN ROCKET PROPELLANT TANKS, H. Norman Abramson, Wen-Hwa Chu, Luis R. Garza, and Guido E. Ransleben, Jr., February 1962

TN D 1213 PERFORMANCE EVALUATION OF A MERCURY-PROPELLANT FEED SYSTEM FOR A FLIGHT-MODEL ION ENGINE, Eguene V. Pawlik and Norman C. Wenger, June 1962

TN D 1214 INVESTIGATION OF FORCED-CONVECTION NUCLEATE BOILING OF WATER FOR NOZZLE COOLING AT VERY HIGH HEAT FLUXES, John W. Schaefer and John R. Jack, May 1962

TN D 1215 AN ANALYTICAL AND EXPERIMENTAL EVALUATION OF A TWO-STAGE ANNULAR AIR EJECTOR FOR HIGH-ENERGY WIND TUNNELS, John A. Sheldon and Henry R. Hunczak, June 1962

TN D 1219 COMPARATIVE MEASUREMENTS OF SINGLY AND DOUBLY IONIZED MERCURY PRODUCED BY ELECTRON-BOMBARDMENT ION ENGINE, Nelson L. Milder, July 1962

TN D 1261 STATIC THRUST AUGMENTATION OF A ROCKET-EJECTOR SYSTEM WITH A HEATED SUPERSONIC PRIMARY JET, Albert J. Simonson and James W. Schmeer, May 1962

TN D 1283 ANALYTICAL INVESTIGATION OF RECIRCULATION-PUMP AND RADIATOR-AREA REQUIREMENTS FOR FLASH VAPORIZATION IN A TURBOELECTRIC SPACE POWER SYSTEM, Arthur J. Glassman, July 1962

TN D 1288 ANALYTICAL INVESTIGATION OF PERFORMANCE OF TWO-STAGE TURBINE OVER A RANGE OF RATIOS OF SPECIFIC HEATS FROM 1.2 TO 1-2/3, Warren J. Whitney and Warner L. Stewart, July 1962

TN D 1305 EMISSION SPECTRA FROM HIGH-PRESSURE HYDROGEN-OXYGEN COMBUSTION, Marshall C. Burrows and Louis A. Povinelli, July 1962

TN D 1306 PERFORMANCE EVALUATION OF FIXED- AND VARIABLE-AREA ROCKET EXHAUST DIFFUSERS USING SINGLE AND CLUSTERED NOZZLES WITH AND WITHOUT GIMBALING, Bruce E. Church, William L. Jones, and Richard J. Quentmeyer, July 1962

TN D 1309 IGNITION OF A HYDROGEN-OXYGEN ROCKET ENGINE BY ADDITION OF FLUORINE TO THE OXIDANT, R. James Rolbuhler and David M. Straight, July 1962

TN D 1315 AIR-PERFORMANCE EVALUATION OF A 4.0-INCH-MEAN-DIAMETER SINGLE-STAGE TURBINE AT VARIOUS INLET PRESSURES FROM 0.14 TO 1.88 ATMOSPHERES AND CORRESPONDING REYNOLDS NUMBERS FROM 2500 TO 50,000, Robert Y. Wong and William J. Nusbaum, August 1962

TN D 1317 DESIGN AND PERFORMANCE OF A LIQUID-HYDROGEN, LIQUID-OXYGEN GAS GENERATOR FOR DRIVING A 1000-HORSEPOWER TURBINE, Nick J. Sekas and Loren W. Acker, July 1962

TN D 1318 PERFORMANCE OF SEVERAL CAST NICKEL-BASE ALLOYS AS TURBOJET-ENGINE BUCKET MATERIALS AT 1650°F, James R. Johnston, Charles A. Gyorgak, and John H. Sinclair, September 1962

TN D 1321 EXPERIMENTAL PERFORMANCE OF AN ION ROCKET ENGINE USING A RECTANGULAR-SLAB POROUS-TUNGSTEN EMITTER, Ronald J. Cybulski, Joseph T. Kotnik, and David L. Lockwood, November 1962

TN D 1333 CHARTS FOR EQUILIBRIUM FLOW PROPERTIES OF AIR IN HYPERVELOCITY NOZZLES, Leland H. Jorgensen and Gayle M. Baum, September 1962

TN D 1343 NONADIABATIC THEORY OF ELECTRON-HYDROGEN SCATTERING, A. Temkin, July 1962

TN D 1354 AN EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF THE NATURAL FREQUENCIES AND MODE SHAPES OF A FOUR-STAGE SOLID-PROPELLANT ROCKET VEHICLE, Sumner A. Leadbetter, Vernon L. Alley, Jr., Robert W. Herr, and A. Harper Gerringer, August 1962

TN D 1368 STUDY OF UMBRELLA-TYPE ERECTABLE PARABOLOIDAL SOLAR CONCENTRATORS FOR GENERATION OF SPACECRAFT AUXILIARY POWER, William D. Nowlin and Harold E. Benson, August 1962

TN D 1392 OPERATIONAL EXPERIENCES OF TURBINE-POWERED COMMERCIAL TRANSPORT AIRPLANES, Staff of Langley Airworthiness Branch, October 1962

TN D 1399 EFFECT OF AFTERBODY-EJECTOR CONFIGURATIONS ON THE PERFORMANCE AT TRANSONIC SPEEDS OF A PYLON-SUPPORTED NACELLE MODEL HAVING A HOT-JET EXHAUST, John M. Swihart, Charles E. Mercer, and Harry T. Norton, Jr., October 1962

TN D 1403 THERMODYNAMIC CONSISTENCY OF SOLUBILITY DATA FOR THE HYDROGEN-HELIUM VAPOR-LIQUID SYSTEM, Irving Brazinsky and Byron S. Gottfried, August 1962

TN D 1408 VAPORIZATION RATES OF ETHANOL SPRAYS IN A COMBUSTOR WITH LOW-FREQUENCY FLUCTUATIONS OF COMBUSTION-GAS PRESSURE, Robert D. Ingebo, October 1962

TN D 1409 COMBUSTION INSTABILITY LIMITS DETERMINED BY A NONLINEAR THEORY AND A ONE-DIMENSIONAL MODEL, Richard J. Priem and Donald C. Guentert, October 1962

TN D 1410 STARTING CONDITIONS FOR NONOSCILLATORY LOW-THRUST PLANET-ESCAPE TRAJECTORIES, Wilbur F. Dobson, John S. Mackay, and Vearl N. Huff, August 1962

TN D 1411 ADDITIONAL STUDIES OF SCREEN AND ACCELERATOR GRIDS FOR ELECTRON-BOMBARDMENT ION THRUSTORS, William R. Kerslake and Eugene V. Pawlik, August 1963

TN D 1414 A STELLAR MODEL OF MIXED OPACITY AND ITS VARIATIONS WITH THE MASS, CHEMICAL COMPOSITION, OPACITY COEFFICIENTS, AND ENERGY-GENERATION COEFFICIENT, Su-Shu Huang, July 1962

TN D 1437 OPTICAL TORQUEMETER FOR HIGH ROTATIONAL SPEEDS, Alois Krsek, Jr., and Marvin Tiefermann. APPENDIX: THE OPTICAL SYSTEM, Donald R. Buchele, October 1962

TN D 1461 SPACE-CHARGE-FLOW THEORY AND ELECTRODE DESIGN FOR ELECTROSTATIC ROCKET ENGINES, David L. Lockwood and Vladimir Hamza, December 1962

TN D 1525 INFLUENCE OF WEIGHT PARAMETERS ON THE PROPULSION REQUIREMENTS OF ORBIT-LAUNCHED VEHICLES, Dietrich W. Fellenz and Ronald J. Harris, May 1963

TN D 1528 SAMPLING STUDIES DOWNSTREAM OF HYDROGEN NITROUS OXIDE - DILUENT FLAMES, Burton D. Fine, November 1962

TN D 1529 COLD-AIR INVESTIGATION OF PROTYPE SNAP-8 TURBINE, William J. Nusbaum and Donald E. Holeski, October 1962

TN D 1533 RELATIVE IGNITABILITY OF TYPICAL SOLID PROPELLANTS WITH CHLORINE TRIFLUORIDE, Harrison Allen, Jr. and Murray L. Pinns, January 1963

TN D 1559 EFFECT OF COMPOSITION ON COMBUSTION OF SOLID PROPELLANTS DURING A RAPID PRESSURE DECREASE, Carl C. Ciepluch, December 1962

TN D 1578 FEASIBILITY OF OPTIMIZING NOZZLE PERFORMANCE FOR ORBITAL-LAUNCH NUCLEAR ROCKETS, John R. Jack, April 1963

TN D 1611 PERFORMANCE AND SOME DESIGN ASPECTS OF THE FOUR-STAGE SOLID-PROPELLANT ROCKET VEHICLE USED IN THE RAM A1 FLIGHT TEST, Jack Levine, March 1963

TN D 1688 THE EFFECTIVENESS OF THREE EXIT VANE CASCADE CONFIGURATIONS FOR VECTORING THE THRUST OF A DUCTED FAN, Kenneth W. Mort and Paul F. Yaggy, October 1964

TN D 1710 ANALYTICAL STUDY OF TURBINE-GEOMETRY CHARACTERISTICS FOR ALKALI-METAL TURBOELECTRIC SPACE POWER SYSTEMS, Arthur J. Glassman and S. M. Futral, May 1963

TN D 1723 LUNAR LANDING PROPULSION CONSIDERATIONS, K. R. Stehling, February 1963

TN D 1806 INVESTIGATION OF PROPELLER-POWER-PLANT AUTOPRECESSION BOUNDARIES FOR A DYNAMIC-AEROELASTIC MODEL OF A FOUR-ENGINE TURBOPROP TRANSPORT AIRPLANE, Frank T. Abbott, Jr., H. Neale Kelly, and Kenneth D. Hampton, August 1963

TN D 1831 THE EFFECT OF PROPELLANT SLOSHING ON THE STABILITY OF AN ACCELEROMETER CONTROLLED RIGID SPACE VEHICLE, Helmut F. Bauer, October 1963

TN D 1835 SOME REQUIREMENTS OF ELECTRIC AND CHEMICAL THRUST SYSTEMS FOR SPACE STATION DRAG CANCELLATION, Dennis W. Brown, September 1964

TN D 1843 EXPERIMENTAL STUDIES ON BOWEN'S DECARBONATION SERIES, II. P-T UNIVARIANT EQUILIBRIA OF THE REACTION: FORSTERITE + CALCITE = MONTICELLITE + PERICLASE + CO_2, L. S. Walter, July 1963

TN D 1846 A METHOD TO OPTIMIZE THE SOLAR CELL POWER SUPPLY FOR INTERPLANETARY SPACECRAFT, Grady B. Nichols, September 1963

TN D 1876 STUDY OF THE EFFECT OF A CLOSED-END SIDE BRANCH ON SINUSOIDALLY PERTURBED FLOW OF LIQUID IN A LINE, William Lewis, Robert J. Blade, and Robert G. Dorsch, September 1963

TN D 1988 AN EXPERIMENTAL INVESTIGATION OF GASEOUS-FILM COOLING OF A ROCKET MOTOR, James G. Lucas and Richard L. Golladay, October 1963

TN D 2076 EXPERIMENTAL INVESTIGATION OF A 4.54-INCH-MEAN-DIAMETER THREE-STAGE REVERSE-FLOW REENTRY TURBINE, Donald E. Holeski and William T. Wintucky, November 1963

TN D 2164 ELECTROMAGNETIC ACCELERATION OF A VARIABLE-MASS PLASMA, Donald J. Vargo, October 1964

TN D 2167 SPONTANEOUS REIGNITION OF PREVIOUSLY EXTINGUISHED SOLID PROPELLANTS, Carl C. Ciepluch, March 1964

TN D 2169 EFFECT OF INTERCHANGING PROPELLANTS ON ROCKET COMBUSTOR PERFORMANCE WITH COAXIAL INJECTION, Martin Hersch, February 1964

TN D 2170 DIRECT REACTION CALCULATION, W. R. Gibbs, V. A. Madsen, J. A. Miller, W. Tobocman, E. C. Cox, and L. Mowry, February 1964

TN D 2172 STATUS OF ELECTROSTATIC THRUSTORS FOR SPACE PROPULSION, William R. Mickelsen and Harold R. Kaufman, May 1964

TN D 2173 EVALUATION OF FILAMENT DETERIORATION IN ELECTRON-BOMBARDMENT ION SOURCES, Nelson L. Milder and William R. Kerslake, May 1964

TN D 2187 RADIATION FORM SLOTTED-CYLINDER ANTENNAS IN A REENTRY PLASMA ENVIRONMENT, Calvin T. Swift, February 1964

TN D 2220 LONGITUDINAL SPRING CONSTANT FOR LIQUID-PROPELLANT TANKS WITH ELLIPSOIDAL ENDS, Larry D. Pinson, November 1964

TN D 2263 DYNAMIC PRESSURE AND THRUST CHARACTERISTICS OF COLD JETS DISCHARGING FROM SEVERAL EXHAUST NOZZLES DESIGNED FOR VTOL DOWNWASH SUPPRESSION, C. C. Higgins and T. W. Wainwright, April 1964

TN D 2335 EFFECT OF STAGE SPACING ON PERFORMANCE OF 3.75-INCH-MEAN-DIAMETER TWO-STAGE TURBINE HAVING PARTIAL ADMISSION IN THE FIRST STAGE, William J. Nusbaum and Robert Y. Wong, June 1964

TN D 2391 YLR99-RM-1 ROCKET ENGINE OPERATING EXPERIENCES IN THE X-15 AIRCRAFT, James F. Maher, Jr., C. Wayne Ottinger, and Vincent N. Capasso, Jr., July 1964

TN D 2409 ANALYSIS OF EFFECT OF COMPENSATING-BELLOWS DEVICE IN A PROPELLANT LINE AS A MEANS OF SUPPRESSING ROCKET PUMP INLET PERTURBATIONS, William Lewis and Robert J. Blade, August 1964

TN D 2455 BLAST EFFECTS OF TWIN VARIABLE-CANT ROCKET NOZZLES ON VISIBILITY DURING LANDING ON A PARTICLE-COVERED SURFACE, George J. Hurt, Jr., and Lindsay J. Lina, December 1964

TN D 2500 RENDEZVOUS CAPABILITY OF HORIZONTAL-TAKE-OFF LAUNCH VEHICLE WITH AIR-BREATHING PROPULSION, Charlie M. Jackson, November 1964

TN D 2544 A PARAMETRIC EXPLORATION OF AXIAL-FLOW TURBINES FOR RANKINE CYCLE SPACE POWER-PLANTS IN THE MEGAWATT RANGE, John L. Klann and Paul T. Kerwin, December 1964

TN D 2639 EXPERIMENTAL INVESTIGATION OF A 3.0-INCH-MEAN-DIAMETER FULL-ADMISSION THREE-STAGE TURBINE SUITABLE FOR SMALL AUXILIARY POWER UNITS, Robert Y. Wong and William J. Nusbaum, Lewis Research Center, February 1965

Applicable NACA Technical Reports

TR 713 INTERNAL-FLOW SYSTEMS FOR AIRCRAFT, F. M. Rogallo, 1941 (Same as TN 777)

This report deals with the problem of efficiency in internal flow systems, including some theoretical treatment of the problem and many results from wind tunnel tests of a large number of inlet and outlet opening configurations in a flat plate and in a wing. Graphs are given of flow coefficient versus power-loss coefficient, static to dynamic pressure ratio and drag coefficient, and static pressure coefficient versus power-loss coefficient. Both effects of shape and location were studied.

TR 720 PRESSURE AVAILABLE FOR COOLING WITH COWLING FLAPS, George W. Stickle, Irven Naiman, and John L. Crigler, 1941

These tests were performed to determine the pressure difference available for cooling with cowling flaps. The flaps were applied to an exit slot of smooth contour at flap angles of 0^o, 15^o and 30^o. Two propellers were used; one propeller had conventional round blade shanks and the other had airfoil sections extending closer to the hub. The pressure available for cooling is shown to be a direct function of the thrust disk loading coefficient of the propeller. The total pressure in front of the cowling is critically dependent on the ratio of the front opening to the propeller diameter for the round-shank propeller. The propeller with airfoil sections closer to the hub gave a higher total pressure in front of the cowling. Changing the area of the exit slot of a smooth contour exit design by means of flaps results in: (1) the increase in the cowling exit area increases the conductance of the exit slot and consequently the pressure drop across the engine, and (2) the change in the contour of the cowling in the region of the exit changes the pressure distribution over the cowling and thereby affects the overall available pressure.

TR 743 INVESTIGATION IN THE 7- BY 10-FOOT WIND TUNNEL OF DUCTS FOR COOLING RADIATORS WITHIN AN AIRPLANE WING, Thomas A. Harris and Isidore G. Recant, 1942

Many locations and configurations of wing inlets and exits for cooling air were tested. Results are given for pressure recovery data, evaluation of efficiency, etc. Some conclusions are as follows:

Maximum efficiencies were obtained when the stagnation point on the airfoil was at the duct-inlet opening. The best efficiencies were obtained when the duct inlet and outlet were made approximately the same size and the expansion of air due to a hot radiator were neglected. For maximum efficiencies, the spanwise duct openings should be as short as possible. High efficiencies could be obtained with the outlet at any position on the upper surface of the wing from 25 to 70 percent from the leading edge. Fairings were desirable on both the upper and lower inlet lips and on the lower outlet lip. Interference drag is substantially decreased and a considerably saving in total cooling power is realized by building these ducts into the wing.

TR 771 REVIEW OF FLIGHT TESTS OF NACA C AND D COWLINGS ON THE XP-42 AIRPLANE, J. Ford Johnston, 1943

The D cowlings tested were a long nose high-inlet-velocity cowling, a short nose high-inlet-velocity cowling, and a short nose low-inlet-velocity cowling. Tests were conducted with the D cowling and the results were compared with data taken with a C cowling. Small increases of the cooling pressure recovery in the full power climb condition were obtained by the long nose high- inlet-velocity and the short nose low-inlet-velocity cowlings, but the pressure recovery with the short-nose high-inlet-velocity cowling was less than that with the C cowling.

TR 784 INTERCOOLER COOLING-AIR WEIGHT FLOW AND PRESSURE DROP FOR MINIMUM DRAG LOSS, J. George Reuter and Michael F. Valerino, 1944

The optimum ratio of cooling air weight flow to charge air weight flor (that ratio which gives minimum intercooler drag loss) is found to be practically independent of the airplane flight conditions and the intercooler charge-air pressure drop. For a given value of cooling air pressure drop, an appreciable variation of cooling-air weight flow from the optimum values caused little change in the drag loss. An increase in cooling air weight flow above the optimum required an increase in the no-flow intercooler dimension, a decrease in the cooling air flow dimension, and a decrease in intercooler volume. A reduction in cooling air weight flow from the optimum value reversed these trends.

TR 818 AN EXPERIMENTAL INVESTIGATION OF RECTANGULAR EXHAUST-GAS EJECTORS APPLICABLE FOR ENGINE COOLING, Eugene J. Manganiello and Donald Bogatsky, 1945

An experimental investigation of rectangular exhaust-gas ejector pumps was conducted to provide data that would serve as a guide to the design of ejector applications for aircraft engines with marginal cooling. An equation was derived for the pressure rise across the ejector. Various designs of ejectors were investigated. Forty-five ejectors are compared in graphical form by plotting pressure rise (ΔP) against mass flow ratio (m_a/m_e). Divided, curved, and multistage ejectors were also investigated.

TR 858 COMPARISON OF SEVERAL METHODS OF PREDICTING THE PRESSURE LOSS AT ALTITUDE ACROSS A BAFFLED AIRCRAFT ENGINE CYLINDER, Joseph Neustain and Louis J. Schafer, Jr., 1946

Several methods for prediction of the pressure loss across a baffled aircraft engine cylinder were developed in this report. The pressure loss becomes a very important factor at high altitudes (low density) where, at high speeds, compressibility problems arise which adversely affect cooling of the engine. In the analysis several methods were used as follows: (1) one-dimensional flow-theory methods, (2) baffle-exit density method, and (3) characteristic Mach number method. Calculations using the aforementioned methods were made (with and without the heat transfer from the cylinders taken into consideration) and compared with experimental results.

TR 873 HIGH-ALTITUDE FLIGHT COOLING INVESTIGATION OF A RADIAL AIR-COOLED ENGINE, Eugene J. Manganiello, Michael F. Valerino, and E. Barton Bell, 1947

An investigation of the cooling air of an 18-cylinder, twin-row, radial, air-cooled engine in a high performance pursuit airplane was conducted for variable engine and flight conditions in order to provide a basis for predicting high-altitude cooling performance from sea-level or low-altitude test results. It was found that the use of the cooling air exit density in the NACA cooling-correlation equation is a sufficiently accurate approximation of the compressibility effect to give satisfactory correlation of the cooling data over the altitude range tested. It was also found that a sea-level or low-altitude correlation based on entrance density gives fairly accurate cooling prediction up to an altitude of 20,000 feet.

TR 950 INVESTIGATION OF A SYSTEMATIC GROUP OF NACA 1-SERIES COWLINGS WITH AND WITHOUT SPINNERS, M. R. Nichols and A. L. Keith, Jr., 1944

Experimental data for use in designing spinner-cowling combinations are given. Design charts for open nose cowlings and for these cowlings when used in combination with spinners of the type (elliptical and conical) tested.

TR 1020 MEASUREMENTS OF AVERAGE HEAT-TRANSFER AND FRICTION COEFFICIENTS FOR SUBSONIC FLOW OF AIR IN SMOOTH TUBES AT HIGH SURFACE AND FLUID TEMPERATURES, Leroy V. Humble, W. H. Lowdermilk and Leland G. Desmon, 1951

Data is given for measurements of average heat-transfer and friction coefficients for subsonic flow of air in smooth tubes at high surface and fluid temperatures for surface temperatures from 535 to 3050^{o} R, inlet air temperature from 535 to 1500^{o} R, Re up to 500,000, heat flux up to 150,000 btu/hr ft^{2}, and L/D ratios of

30 to 120. A good correlation was found by basing some properties on surface temperature and some on bulk temperature.

TR 1192 THEORETICAL AND EXPERIMENTAL INVESTIGATION OF MUFFLERS WITH COMMENTS ON ENGINE-EXHAUST MUFFLER DESIGN, Don D. Davis, Jr., George M. Stokes, Dewey Moore, and George L. Stevens, Jr., 1954 (Supersedes NACA TN 2893 and TN 2943)

Equations are presented for the attenuation characteristics of single-chamber and multiple-chamber mufflers of both the expansion-chamber and resonator types, for tuned side-branch tubes, and for the combination of an expansion chamber with a resonator. Experimental curves of attenuation plotted against frequency are presented for 77 different mufflers with a reflection-free tailpipe termination, and the results are compared with the theory. The experiments were made at room temperature without flow; the sound source was a loud-speaker. A method is given for including the tailpipe reflections in the calculations. Experimental attenuation curves are presented for four different muffler-tailpipe combinations, and the results are compared with the theory. The application of the theory to the design of engine-exhaust mufflers is discussed, and charts are included for the assistance of the designer.

Not Applicable NACA Technical Reports

TR 682 FLAME SPEEDS AND ENERGY CONSIDERATIONS FOR EXPLOSIONS IN A SPHERICAL BOMB, Ernest F. Fiock, Charles F. Marvin, Jr., Frank R. Caldwell, and Carl H. Roeder, 1940

TR 683 CORRELATION OF COOLING DATA FROM AN AIR-COOLED CYLINDER AND SEVERAL MULTICYLINDER ENGINES, Benjamin Pinkel and Herman H. Ellerbrock, Jr., 1940

TR 687 EFFECT OF EXIT-SLOT POSITION AND OPENING ON THE AVAILABLE COOLING PRESSURE FOR N. A. C. A. NOSE-SLOT COWLINGS, George W. Stickle, Irben Naiman, and John L. Crigler, 1940

TR 698 PISTON TEMPERATURES IN AN AIR-COOLED ENGINE FOR VARIOUS OPERATING CONDITIONS, Eugene J. Manganiello, 1940

TR 699 EFFECT OF FUEL-AIR RATIO, INLET TEMPERATURE AND EXHAUST PRESSURE ON DETONATION, E. S. Taylor, W. A. Leary and J. R. Diver, 1940

TR 704 A HIGH-SPEED MOTION-PICTURE STUDY OF NORMAL COMBUSTION, KNOCK, AND PREIGNITION IN A SPARK-IGNITION ENGINE, A. M. Rothrock, R. C. Spencer, and Cearcy D. Miller, 1941

TR 710 PREIGNITION CHARACTERISTICS OF SEVERAL FUELS UNDER SIMULATED ENGINE CONDITIONS, R. C. Spencer, 1941

TR 713 INTERNAL-FLOW SYSTEMS FOR AIRCRAFT, F. M. Rogallo, 1941

TR 714 AN APPARATUS FOR MEASURING RATES OF DISCHARGE OF A FUEL-INJECTION SYSTEM, Francis J. Dutee, 1941

TR 717 FLOW COEFFICIENTS OF MONOSLEEVE VALVES, C. D. Waldron, 1941

TR 719 THE PROBLEM OF COOLING AN AIR-COOLED CYLINDER ON AN AIRCRAFT ENGINE, M. J. Brevoort and U. T. Joyner, 1941

TR 726 THE DESIGN OF FINS FOR AIR-COOLED CYLINDERS, Arnold E. Biermann and Herman H. Ellerbrock, Jr., 1941

TR 727 A STUDY BY HIGH-SPEED PHOTOGRAPHY OF COMBUSTION AND KNOCK IN A SPARK-IGNITION ENGINE, Cearcy D. Miller, 1942

TR 729 TEST OF A SINGLE-STAGE AXIAL-FLOW FAN, E. Barton Bell, 1942

TR 745 HIGH-SPEED TESTS OF CONVENTIONAL RADIAL-ENGINE COWLINGS, Russell G. Robinson and John V. Becker, 1942

TR 746 DRAG AND PROPULSIVE CHARACTERISTICS OF AIR-COOLED ENGINE-NACELLE INSTALLATIONS FOR LARGE AIRPLANES, Abe Silverstein and Herbert A. Wilson, Jr., 1942

TR 754 OPERATING TEMPERATURES OF A SODIUM-COOLED EXHAUST VALVE AS MEASURED BY A THERMOCOUPLE, J. C. Sanders, H. D. Wilsted and B. A. Mulcahy, 1943

TR 756 THE INDUCTION OF WATER TO THE INLET AIR AS A MEANS OF INTERNAL COOLING IN AIRCRAFT-ENGINE CYLINDERS, Addison M. Rothrock, Alois Krsek, Jr., and Anthony W. Jones, 1943

TR 757 THE MEASUREMENT OF FUEL-AIR RATIO BY ANALYSIS OF THE OXIDIZED EXHAUST GAS, Harold C. Gerrish and J. Lawrence Meem, Jr., 1943

TR 758 PERFORMANCE OF NACA EIGHT-STAGE AXIAL-FLOW COMPRESSOR DESIGNED ON THE BASIS OF AIRFOIL THEORY, John T. Sinnette, Jr., Oscar W. Schey and J. Austin King, 1943

TR 760 A METHOD OF ESTIMATING THE KNOCK RATING OF HYDROCARBON FUEL BLENDS, Newell D. Sanders, 1943

TR 761 IDENTIFICATION OF KNOCK IN NACA HIGH-SPEED PHOTOGRAPHS OF COMBUSTION IN A SPARK-IGNITION ENGINE, Cearcy D. Miller and H. Lowell Olsen, 1943

TR 765 EXHAUST-STACK NOZZLE AREA AND SHAPE FOR INDIVIDUAL CYLINDER EXHAUST-GAS JET-PROPULSION SYSTEM, Benjamin Pinkel, L. Richard Turner, Fred Voss and LeRoy V. Humble, 1943

TR 773 ANALYSIS OF HEAT AND COMPRESSIBILITY EFFECTS IN INTERNAL FLOW SYSTEMS AND HIGH-SPEED TESTS OF A RAM-JET SYSTEM, John V. Becker and Donald D. Baals, 1943

TR 779 THE EFFECT OF INCREASED COOLING SURFACE ON PERFORMANCE OF AIRCRAFT-ENGINE CYLINDERS AS SHOWN BY TESTS OF THE NACA CYLINDER, Oscar W. Schey, Vern G. Rollin, and Herman H. Ellerbrock, Jr., 1944

TR 783 COMPRESSIBILITY AND HEATING EFFECTS ON PRESSURE LOSS AND COOLING OF A BAFFLED CYLINDER BARREL, Arthur W. Goldstein and Herman H. Ellerbrock, Jr., 1944

TR 785 PREKNOCK VIBRATIONS IN A SPARK-IGNITION ENGINE CYLINDER AS REVEALED BY HIGH-SPEED PHOTOGRAPHY, Cearcy D. Miller and Walter O. Logan, Jr., 1944

TR 786 PERFORMANCE OF BLOWDOWN TURBINE DRIVEN BY EXHAUST GAS OF NINE-CYLINDER RADIAL ENGINE, L. Richard Turner and Leland G. Desmon, 1944

TR 802 NACA INVESTIGATION OF A JET-PROPULSION SYSTEM APPLICABLE TO FLIGHT, Macon C. Ellis, Jr. and Clinton E. Brown, 1944

TR 804 AIR-CONSUMPTION PARAMETERS FOR AUTOMATIC MIXTURE CONTROL OF AIRCRAFT ENGINES, Sidney J. Shames, 1945

TR 806 AN INVESTIGATION OF BACKFLOW PHENOMENON IN CENTRIFUGAL COMPRESSORS, William A. Benser and Jason J. Moses, 1945

TR 811 PREIGNITION-LIMITED PERFORMANCE OF SEVERAL FUELS, Donald W. Male and John C. Evvard, 1945

TR 812 KNOCK-LIMITED PERFORMANCE OF SEVERAL INTERNAL COOLANTS, Donald R. Bellman and John C. Evvard, 1945

TR 813 CORRELATION OF EXHAUST-VALVE TEMPERATURES WITH ENGINE OPERATING CONDITIONS AND VALVE DESIGN IN AN AIR-COOLED CYLINDER, M. A. Zipkin and J. C. Sanders, 1945

TR 814 A GENERAL REPRESENTATION FOR AXIAL-FLOW FANS AND TURBINES, W. Perl and M. Tucker, 1945

TR 815 METHOD OF MATCHING PERFORMANCE OF COMPRESSOR SYSTEMS WITH THAT OF AIRCRAFT POWER SECTIONS, Robert O. Bullock, Robert C. Keetch, and Jason J. Moses, 1945

TR 817 NITRIDED-STEEL PISTON RINGS FOR ENGINES OF HIGH SPECIFIC POWER, John H. Collins, Jr., Edmond E. Bisson, and Ralph F. Schmiedlin, 1945

TR 821 EFFECT OF THE NACA INJECTION IMPELLER ON THE MIXTURE DISTRIBUTION OF DOUBLE-ROW RADIAL AIRCRAFT ENGINE, Frank E. Marble, William K. Ritter, and Mahlon A. Miller, 1945

TR 822 CALCULATIONS OF ECONOMY OF 18-CYLINDER RADIAL AIRCRAFT ENGINE WITH EXHAUST-GAST TURBINE GEARED TO THE CRANKSHAFT, Richard W. Hannum and Richard H. Zimmerman, 1945

TR 850 A VISUAL AND PHOTOGRAPHIC STUDY OF CYLINDER LUBRICATION, Milton C. Shaw and Theodore Nussdorfer, 1946

TR 853 CYLINDER-TEMPERATURE CORRELATION OF A SINGLE-CYLINDER LIQUID-COOLED ENGINE, Benjamin Pinkel, Eugene J. Manganiello and Everett Bernardo, 1946

TR 855 RELATION BETWEEN SPARK-IGNITION ENGINE KNOCK, DETONATION WAVES, AND AUTOIGNITION AS SHOWN BY HIGH-SPEED PHOTOGRAPHY, Cearcy D. Miller, 1946

TR 857 ANALYSIS OF SPARK-IGNITION ENGINE KNOCK AS SEEN BY PHOTOGRAPHS TAKEN AT 200,000 FRAMES PER SECOND, Cearcy D. Miller, H. Lowell Olsen, Walter O. Logan, Jr. and Gordon E. Osterstrom, 1946

TR 860 ANALYSIS OF COOLING LIMITATIONS AND EFFECT OF ENGINE-COOLING IMPROVEMENTS ON LEVEL-FLIGHT CRUISING PERFORMANCE OF FOUR-ENGINE HEAVY BOMBER, Frank E. Marble, Mahlon A. Miller and E. Barton Bell, 1946

TR 861 EXPERIMENTAL AND THEORETICAL STUDIES OF SURGING IN CONTINUOUS-FLOW COMPRESSORS, Robert O. Bullock, Ward W. Wilcox and Jason J. Moses, 1946

TR 866 AN ANALYSIS OF THE FULL-FLOATING JOURNAL BEARING, M. C. Shaw and T. J. Nussdorfer, 1947

TR 871 DETERMINATION OF ELASTIC STRESSES IN GAS-TURBINE DISKS, S. S. Manson, 1947

TR 878 ANALYSIS OF PERFORMANCE OF JET ENGINE FROM CHARACTERISTICS OF COMPONENTS I - AERODYNAMIC AND MATCHING CHARACTERISTICS OF TURBINE COMPONENT DETERMINED WITH COLD AIR, Arthur W. Goldstein, 1947

TR 880 ANALYSIS OF JET-PROPULSION-ENGINE COMBUSTION-CHAMBER PRESSURE LOSSES, I. Irving Pinkel and Harold Shames, 1947

TR 881 EFFECT OF COMBUSTOR-INLET CONDITIONS ON PERFORMANCE OF AN ANNULAR TURBOJET COMBUSTOR, J. Howard Childs, Richard J. McCafferty and Oakley W. Surine, 1947

TR 886 SPARK-TIMING CONTROL BASED ON CORRELATION OF MAXIMUM-ECONOMY SPARK TIMING, FLAME-FRONT TRAVEL, AND CYLINDER-PRESSURE RISE, Harvey A. Cook, Orville H. Heinicke and William H. Haynie, 1947

TR 891 A THERMODYNAMIC STUDY OF THE TURBOJET ENGINE, Benjamin Pinkel and Irving M. Karp, 1947

TR 895 ANALYSIS OF VARIATION OF PISTON TEMPERATURE WITH PISTON DIMENSIONS AND UNDERCROWN COOLING, J. C. Sanders and W. B. Schramm, 1948

TR 897 KNOCKING-COMBUSTION OBSERVED IN A SPARK-IGNITION ENGINE WITH SIMULTANEOUS DIRECT AND SCHLIEREN HIGH-SPEED MOTION PICTURES AND PRESSURE RECORDS, Gordon E. Osterstrom, 1948

TR 901 ANALYSIS OF EFFECT OF BASIC DESIGN VARIABLES ON SUBSONIC AXIAL-FLOW-COMPRESSOR PERFORMANCE, John T. Sinnette, Jr., 1948

TR 904 ESTIMATION OF F-3 AND F-4 KNOCK-LIMITED PERFORMANCE RATINGS FOR TERNARY BLENDS CONTAINING TRIPTANE OR OTHER HIGH-ANTIKNOCK AVIATION-FUEL BLENDING AGENTS, Henry C. Barnett, 1948

TR 912 THE INTERDEPENDENCE OF VARIOUS TYPES OF AUTOIGNITION AND KNOCK, H. Lowell Olsen and Cearcy D. Miller, 1948

TR 915 EXTENSION OF USEFUL OPERATING RANGE OF AXIAL-FLOW COMPRESSORS BY USE OF ADJUSTABLE STATOR BLADES, John T. Sinnette, Jr. and William J. Voss, 1948

TR 928 ANALYSIS OF PERFORMANCE OF JET ENGINE FROM CHARACTERISTICS OF COMPONENTS. II - INTERACTION OF COMPONENTS AS DETERMINED FROM ENGINE OPERATION, Arthur W. Goldstein, Sumner Alpert, William Beede, and Karl Kovach, 1949

TR 930 AN ANALYTICAL METHOD OF ESTIMATING TURBINE PERFORMANCE, Fred D. Kochendorfer and J. Cary Nettles, 1949

TR 931 CORRELATION OF CYLINDER-HEAD TEMPERATURES AND COOLANT HEAT REJECTIONS OF A MULTICYLINDER, LIQUID-COOLED ENGINE OF 1710-CUBIC-INCH DISPLACEMENT, Bruce T. Lundin, John H. Povolny, and Louis J. Chelko, 1949

TR 933 PERFORMANCE OF CONICAL JET NOZZLES IN TERMS OF FLOW AND VELOCITY COEFFICIENTS, Ralph E. Grey, Jr., and H. Dean Wilsted, 1949

TR 935 TWO-DIMENSIONAL COMPRESSIBLE FLOW IN TURBO-MACHINES WITH CONIC FLOW SURFACES, John D. Stanitz, 1949

TR 936 DESIGN AND PERFORMANCE OF FAMILY OF DIFFUSING SCROLLS WITH MIXED-FLOW IMPELLER AND VANELESS DIFFUSER, W. Byron Brown and Guy R. Bradshaw, 1949

TR 937 CONSTANT-PRESSURE COMBUSTION CHARTS INCLUDING EFFECTS OF DILUENT ADDITION, L. Richard Turner and Donald Bogart, 1949

TR 954 TWO-DIMENSIONAL COMPRESSIBLE FLOW IN CENTRIFUGAL COMPRESSORS WITH STRAIGHT BLADES, John D. Stanitz and Gaylord O. Ellis, 1950

TR 955 APPLICATION OF RADIAL-EQUILIBRIUM CONDITION TO AXIAL-FLOW COMPRESSOR AND TURBINE DESIGN, Chung-Hua Wu and Lincoln Wolfenstein, 1950

TR 980 GENERAL ALGEBRAIC METHOD APPLIED TO CONTROL ANALYSIS OF COMPLEX ENGINE TYPES, Aaron S. Boksenbom and Richard Hood, 1950

TR 981 THEORETICAL ANALYSIS OF VARIOUS THRUST-AUGMENTATION CYCLES FOR TURBOJET ENGINES, Bruce T. Lundin, 1950

TR 982 ICING-PROTECTION REQUIREMENTS FOR RECIPROCATING-ENGINE INDUCTION SYSTEMS, Willard D. Coles, Vern G. Rollin and Donald R. Mulholland, 1950

TR 987 EQUILIBRIUM OPERATING PERFORMANCE OF AXIAL-FLOW TURBOJET ENGINES BY MEANS OF IDEALIZED ANALYSIS, John C. Sanders and Edward C. Chapin, 1950

TR 992 THEORETICAL COMPARISON OF SEVERAL METHODS OF THRUST AUGMENTATION FOR TURBOJET ENGINES, Eldon W. Hall and E. Clinton Wilcox, 1950

TR 994 ANALYSIS OF SPANWISE TEMPERATURE DISTRIBUTION IN THREE TYPES OF AIR-COOLED TURBINE BLADE, John N.B. Livingood and W. Byron Brown, 1950

TR 1006 ANALYSIS OF THRUST AUGMENTATION OF TURBOJET ENGINES BY WATER INJECTION AT COMPRESSOR INLET INCLUDING CHARTS FOR CALCULATING COMPRESSION PROCESSES WITH WATER INJECTION, E. Clinton Wilcox and Arthur M. Trout, 1951

TR 1011 DYNAMICS OF A TURBOJET ENGINE CONSIDERED AS A QUASI-STATIC SYSTEM, Edward W. Otto and Burt L. Taylor, III, 1951

TR 1019 RELATION BETWEEN INFLAMMABLES AND IGNITION SOURCES IN AIRCRAFT ENVIRONMENTS, Wilfred E. Scull, 1951

TR 1026 NACA INVESTIGATION OF FUEL PERFORMANCE IN PISTON-TYPE ENGINES, Henry C. Barnett, 1951

TR 1037 GENERAL METHOD AND THERMODYNAMIC TABLES FOR COMPUTATION OF EQUILIBRIUM COMPOSITION AND TEMPERATURE OF CHEMICAL REACTIONS, Vearl N. Huff, Sanford Gordon, and Virginia E. Morrell, 1951

TR 1061 EFFECT OF INITIAL MIXTURE TEMPERATURE ON FLAME SPEED OF METHANE-AIR, PROPANE-AIR AND ETHYLENE-AIR MIXTURES, Gordon L. Dugger, 1952

TR 1062 INVESTIGATION OF WEAR AND FRICTION PROPERTIES UNDER SLIDING CONDITIONS OF SOME MATERIALS SUITABLE FOR CAGES OF ROLLING-CONTACT BEARINGS, Robert L. Johnson, Max A. Swikert, and Edmond E. Bisson, 1952

TR 1064 LUBRICATION AND COOLING STUDIES OF CYLINDRICAL-ROLLER BEARINGS AT HIGH SPEEDS, E. Fred Macks and Zolton N. Nemeth, 1952

TR 1066 ANALYSIS OF TEMPERATURE DISTRIBUTION IN LIQUID-COOLED TURBINE BLADES, John N. B. Livingood and W. Byron Brown, 1952

TR 1084 COMPARISON OF HIGH-SPEED OPERATING CHARACTERISTICS OF SIZE 215 CYLINDRICAL-ROLLER BEARINGS AS DETERMINED IN TURBOJET ENGINE AND IN LABORATORY TEST RIG, E. Fred Macks and Zolton N. Nemeth, 1952

TR 1112 HYDROCARBON AND NONHYDROCARBON DERIVATIVES OF CYCLOPROPANE, Vernon A. Slabey, Paul H. Wise, and Louis C. Gibbons, 1953

TR 1114 A THERMODYNAMIC STUDY OF THE TURBINE-PROPELLER ENGINE, Benjamin Pinkel and Irvin M. Karp, 1953

TR 1127 ONE-DIMENSIONAL ANALYSIS OF CHOKED-FLOW TURBINES, Robert E. English and Richard H. Cavicchi, 1953

TR 1134 PHOTOGRAPHIC INVESTIGATION OF COMBUSTION IN A TWO-DIMENSIONAL TRANSPARENT ROCKET ENGINE, Donald R. Bellman, Jack C. Humphrey and Theodore Male, 1953

TR 1141 METHOD AND GRAPHS FOR THE EVALUATION OF AIR-INDUCTION SYSTEMS, George B. Brajnikoff, 1953

TR 1157 ANALYTICAL DERIVATION AND EXPERIMENTAL EVALUATION OF SHORT-BEARING APPROXIMATION FOR FULL JOURNAL BEARINGS, George B. DuBois and Fred W. Ocvirk, 1953

TR 1158 PREDICTION OF FLAME VELOCITIES OF HYDROCARBON FLAMES, Gordon L. Dugger and Dorothy M. Simon, 1954

TR 1163 A VISUALIZATION STUDY OF SECONDARY FLOWS IN CASCADES, Howard Z. Herzig, Arthur G. Hansen, and George R. Costello, 1954

TR 1168 SECONDARY FLOWS AND BOUNDARY-LAYER ACCUMLATIONS IN TURBINE NOZZLES, Harold E. Rohlik, Milton G. Kofskey, Hubert W. Allen and Howard Z. Herzig, 1954

TR 1193 THEORETICAL PERFORMANCE CHARACTERISTICS OF SHARP-LIP INLETS AT SUBSONIC SPEEDS, Evan A. Fradenburgh and DeMarquis D. Wyatt, 1954

TR 1264 A THERMAL EQUATION FOR FLAME QUENCHING, A. E. Potter, Jr. and A. L. Berlad, 1956

TR 1286 PROPAGATION OF A FREE FLAME IN A TURBULENT GAS STREAM, William R. Mickelsen and Norman E. Ernstein, 1956

TR 1287 SPARK IGNITION OF FLOWING GASES, Clyde C. Swett, Jr., 1956

TR 1300 BASIC CONSIDERATIONS IN THE COMBUSTION OF HYDROCARBON FUELS WITH AIR, Propulsion Chemistry Division, Lewis Flight Propulsion Laboratory, 1957

TR 1317 CLOUD-DROPLET INGESTION IN ENGINE INLETS WITH INLET VELOCITY RATIOS OF 1.0 AND 0.7, Rinaldo J. Brun, 1957

TR 1352 EFFECT OF FUEL VARIABLES ON CARBON FORMATION IN TURBOJET-ENGINE COMBUSTORS, Edmund R. Jonash, Jerrold D. Wear and William P. Cook, 1958

TR 1354 EFFECT OF CHORD SIZE ON WEIGHT AND COOLING CHARACTERISTICS OF AIR-COOLED TURBINE BLADES, Jack B. Esgar, Eugene F. Schum and Arthur N. Curren, 1958

TR 1360 GROWTH OF DISTURBANCES IN A FLAME-GENERATED SHEAR REGION, Perry L. Blackshear, Jr., 1958

TR 1362 THEORETICAL COMBUSTION PERFORMANCE OF SEVERAL HIGH-ENERGY FUELS FOR RAMJET ENGINES, Leonard K. Tower, Roland Breitwieser, and Benson E. Gammon, 1958

TR 1368 SYSTEMATIC TWO-DIMENSIONAL CASCADE TESTS OF NACA 65-SERIES COMPRESSOR BLADES AT LOW SPEEDS, James C. Emery, L. Joseph Herrig, John R. Erwin, and A. Richard Felix, 1958

TR 1373 THEORETICAL ANALYSIS OF TOTAL-PRESSURE LOSS AND AIRFLOW DISTRIBUTION FOR TUBULAR TURBOJET COMBUSTORS WITH CONSTANT ANNULUS AND LINER CROSS-SECTIONAL AREAS, Charles C. Graves and Jack S. Grobman, 1958

TR 1384 A SUMMARY OF PRELIMINARY INVESTIGATIONS INTO THE CHARACTERISTICS OF COMBUSTION SCREECH IN DUCTED BURNERS, Lewis Laboratory Staff, 1958

TR 1388 NACA RESEARCH ON SLURRY FUELS, M. L. Pinns, W. T. Olson, II, H. C. Barnett, and R.Breitwieser, 1958

Not Applicable NASA Technical Reports

TR R 33 DESIGN OF AXISYMMETRIC EXHAUST NOZZLES BY METHOD OF CHARACTERISTICS INCORPORATING A VARIABLE ISENTROPIC EXPONENT, Eleanor Costilow Guentert and Harvey E. Neumann, 1959

TR R 34 ON FULLY DEVELOPED CHANNEL FLOWS: SOME SOLUTIONS AND LIMITATIONS, AND EFFECTS OF COMPRESSIBILITY, VARIABLE PROPERTIES, AND BODY FORCES, Stephen H. Maslen, 1959

TR R 43 ANALYSIS OF INJECTION-VELOCITY EFFECTS ON ROCKET MOTOR DYNAMICS AND STABILITY, Herbert G. Hurrell, 1959

TR R 54 FACTORS THAT AFFECT OPERATIONAL RELIABILITY OF TURBOJET ENGINES, Lewis Center Staff, 1960

TR R 61 STALL PROPAGATION IN A CASCADE OF AIRFOILS, Anthony R. Kriebel, Barry S. Seidel, and Richard G. Schwind, 1960

TR R 67 PROPELLANT VAPORIZATION AS A DESIGN CRITERION FOR ROCKET ENGINE COMBUSTION CHAMBERS, Richard J. Priem and Marcus F. Heidmann, 1960

TR R 79 FAST INTERPLANETARY MISSIONS WITH LOW-THRUST PROPULSION SYSTEMS, W. E. Moeckel, 1961

TR R 98 HOT-WIRE CALORIMETRY: THEORY AND APPLICATION TO ION ROCKET RESEARCH, Lionel V. Baldwin and Virgil A. Sandborn, 1961

TR R 111 THEORETICAL PERFORMANCE OF HYDROGEN-OXYGEN ROCKET THRUST CHAMBERS, Gilbert K. Sievers, William A. Tomazic, and George R. Kinney, 1961

TR R 114 A THEORETICAL TREATMENT OF THE STEADY-FLOW, LINEAR, CROSSED-FIELD, DIRECT-CURRENT PLASMA ACCELERATOR FOR INVISCID, ADIABATIC, ISOTHERMAL, CONSTANT-AREA FLOW, George P. Wood, Arlen F. Carter, Hubert K. Lintz, and J. Byron Pennington, 1961

TR R 116 NUMERICAL PREDICTIONS OF RADIATIVE INTERCHANGE BETWEEN CONDUCTING FINS WITH MUTUAL IRRADIATIONS, Max. A. Heaslet and Harvard Lomax, 1961

TR R 121 A THEORETICAL STUDY OF THE MOTION OF AN IDEALIZED PLASMA RING UNDER THE INFLUENCE OF VARIOUS COAXIAL MAGNETIC FIELDS, Clarence W. Matthews, 1961

TR R 132 ESTIMATED VISCOSITIES AND THERMAL CONDUCTIVITIES OF GASES AT HIGH TEMPERATURES, Roger A. Svehla, 1962

TR R 140 PERIGEE PROPULSION FOR ORBITAL LAUNCH OF NUCLEAR ROCKETS, Paul G. Johnson and Frank E. Rom, 1962

WR A 1 INVESTIGATION OF SLIPSTREAM EFFECTS ON A WING INLET OIL-COOLER DUCTING SYSTEM OF A TWIN-ENGINE AIRPLANE IN THE AMES 40- BY 80-FOOT WIND TUNNEL, Dean R. Chapman, March 1945

An investigation of the wing-inlet oil-cooler ducts on a twin-engine airplane was conducted to determine both internal and external-flow characteristics of the ducting installation. It was shown that a premature separation of internal flow occurred in both left and right wing inlets when tested with propellers removed, but occurred only in the right wing inlet when tested with propellers operating. Wing inlets which are to be placed behind upgoing propeller blades will produce approximately the same degree of pressure recovery at high angles of attack in flight that they produced when tested with propellers removed. However, the pressure recovery of an inlet which is to be placed behind the downgoing blades will be considerably better when tested at high angles of attack with power on than when tested at the same angle of attack with propellers removed.

WR A 26 A COMPARISON OF ANALYTICALLY AND EXPERIMENTALLY DETERMINED ISOTHERMAL PRESSURE LOSSES IN A HEAT-EXCHANGER INSTALLATION, Wesley H. Hillendahl, May 1945

This report contains analytically and experimentally determined values of the pressure losses in a heat-exchanger installation. The analytical values of pressure loss were determined by adding together losses calculated from published data on elbows, diffusers, and straight ducts. For duct installations similar to that tested, in which the interference effects may be reasonably assumed to be small or negligible, the summation of the calculated losses for the individual components will be in close agreement with experimentally determined values of the overall pressure loss.

WR A 29 FLIGHT TESTS OF SEVERAL EXHAUST-GAS-TO-AIR HEAT EXCHANGERS IN A B-17F AIRPLANE, Bonne C. Look and James Selna, April 1944

The flight testing of seven exhaust-gas-to-air heat exchangers is reported. The exchangers tested were all primary surface units of three general types: (1) tubular, (2) plate, and (3) flute. The heat-exchangers and their installations are covered in detail. Tests were run in several phases: (1) ground run-up, (2) take off, (3) climb, (4) rated cruise, and (5) descent with results tabulated for each run.

The performance characteristics investigated are as follows: (i) air flow rate, (ii) air temperature rise, (iii) rate of heat transfer, (iv) air and exhaust gas side pressure drops.

WR A 70 ELIMINATION OF RUMBLE FROM THE COOLING DUCTS OF A SINGLE-ENGINE PURSUIT AIRPLANE, Howard F. Matthews, August 1943

Trial and error redesign of inlet lip configuration to eliminate rumble due to separation is presented. This document might be useful as background on similar problems.

WR E 82 THE CROSS-FLOW PLATE-TYPE INTERCOOLER, Benjamin Pinkel, J. George Reuter, and Michael F. Valerino, April 1942

A mathematical analysis of plate-type intercooler design was made for both turbulent and laminar flow. Charts are presented that show how the plate-type intercooler volume, weight, plate area, frontal area, and linear dimensions can be varied without changing the intercooler operating conditions. The relations between the intercooler operating conditions and the intercooler dimensional characteristics and weight are also given.

WR E 97 PERFORMANCE TESTS OF NACA TYPE A FINNED-TUBE EXHAUST HEAT EXCHANGER, J. George Reuter and S. V. Manson, August 1944

Tests were conducted to determine the thermal and pressure-drop performance and, to a limited extent, the durability of a cross-flow, internally finned, tubular exhaust-heat exchanger. The tests covered a range of exhaust-gas flows from 3500 to 7300 pounds per hour, cooling air flows from 3500 to 9500 pounds per hour, and exhaust-gas temperatures from 800° F to 1550° F.

WR E 102 COMPARISON OF INTERCOOLER CHARACTERISTICS, J. George Reuter and Michael F. Valerino, November 1942

A method is presented of comparing the performance, weight, and general dimensional characteristics of intercoolers. The performance and dimensional characteristics covered in the comparisons are cooling effectiveness, pressure drops and weight flows of the charge and cooling air, power losses, volume, frontal area, and width.

Two types of charts are plotted: (1) a performance chart setting forth all the important characteristics of a given intercooler and (2) a replot of these characteristics for a number of intercoolers intended to assist in making a selection to satisfy a given set of installation conditions. The characteristics of commercial intercoolers obtained from manufacturers' data and of some computed designs are presented on this basis.

WR E 104 AN ANALYSIS OF THE EFFECT OF CORE STRUCTURE AND PERFORMANCE ON VOLUME AND SHAPE OF CROSS-FLOW TUBULAR INTERCOOLERS, J. George Reuter and Michael F. Valerino, December 1942

An analysis of cross-flow tubular intercoolers having a staggered-tube arrangement has been made for turbulent-flow conditions. Charts are presented that show how the overall dimensions of the intercooler vary with the tube diameter, the transverse spacing, and the wall thickness without affecting the operation of the intercooler. These charts are applicable to both the charge-across-tube and charge-through-tube intercoolers. Charts and equations relating the intercooler dimensional characteristics and the operating conditions are also given.

WR E 106 DESIGN CHARTS FOR CROSS-FLOW TUBULAR INTERCOOLERS CHARGE-THROUGH-TUBE TYPE, J. George Reuter and Michael F. Valerino, July 1941

On the basis of current (1941) heat-transfer theory, equations are developed relating the various dimensions, the air weight flow, and the performance of a cross flow tubular intercooler in which the charge flows through and the cooling air across the tubes. These equations are then presented in graphical form in a series of design charts from which the intercooler design characteristics and performance can be quickly determined. A method of determining and presenting the performance of a given intercooler at various operating conditions is indicated.

WR E 127 CORRELATION OF SINGLE-CYLINDER COOLING TESTS OF A PRATT AND WHITNEY R-2800-21 ENGINE CYLINDER WITH WIND-TUNNEL TESTS OF A PRATT AND WHITNEY R-2800-27 ENGINE, Herman H. Ellerbrock, Jr., and Vern G. Rollin, December 1943

An equation with which it is possible to correlate the cooling characteristics of an engine was developed in TR 612. The validity of this equation was checked by the correlation of data over a wide range of engine and cooling conditions from single cylinder laboratory tests of a cylinder of a Pratt and Whitney R-2800-21 engine, and comparing it with full engine data. The equation to determine the cooling characteristics of air-cooled engines was proved valid.

WR E 130 INTERCOOLER COOLING-AIR WEIGHT FLOW AND PRESSURE DROP FOR MINIMUM POWER LOSS, J. George Reuter and Michael F. Valerino, April 1944

An analysis was made of the power losses in airplane flight of cross-flow plate and tubular intercoolers to determine the cooling air weight flow and pressure drop that give minimum total power loss for any given cooling effectiveness. The optimum values of cooling-air pressure drop and weight-flow ratio are tabulated. Curves are presented to illustrate the results of the analysis. Included are curves that give the variation in intercooler volume and the sacrifice in thrust power incurred by a departure of intercooler operation from the optimum values of cooling air pressure drop and weight-flow ratio.

WR E 141 DESIGN CHARTS FOR CROSS-FLOW TUBULAR INTERCOOLERS CHARGE-ACROSS-TUBE TYPE, J. George Reuter and Michael F. Valerino, January 1941

On the basis of current (1941) heat-transfer theory, equations are presented relating the various dimensions, the air-mass flow, and the performance of a cross-flow tubular intercooler in which the charge flows across and the cooling air through the tubes.

Based on these equations, design charts are presented from which the intercooler design characteristics and the intercooler performance can be quickly determined.

WR E 201 A COOLING-CORRELATION EQUATION FOR A DOUBLE-ROW RADIAL ENGINE BASED ON THE TEMPERATURE OF THE EXHAUST-VALVE SEAT, James M. Jagger and Fred O. Black, Jr., April 1945

A satisfactory cooling-correlation equation was obtained based on the average temperature of the exhaust-valve seats of a large double-row radial engine. From this correlation equation predictions may be made of the cooling-air pressure drop required to cool the critical region of the cylinders.

WR L 84 LOW-PRESSURE BOUNDARY-LAYER CONTROL IN DIFFUSERS AND BENDS, W. J. Biebel, April 1945

Tests have shown that the small pressure differences such as are available between the inside of airplane ducts and the duct exit portion of the external surfaces are sufficient to allow boundary layer removal through slots and improve diffuser and bend performance. Two-dimensional diffusers with included angle of 15^{o} and 30^{o} and 90^{o} bends were tested. Results show that removal of 4 to 10% of duct flow could reduce total pressure losses by 50%.

WR L 207 COOLING CHARACTERISTICS OF PRATT AND WHITNEY R-2800 ENGINE INSTALLED IN AN NACA SHORT-NOSE HIGH-INLET-VELOCITY COWLING, Blake W. Corson, Jr., and Charles H. McLellan, June 1944

Tests were run to determine the cooling characteristics of a Pratt and Whitney R-2800 engine as installed in a NACA short nose high-inlet velocity cowling. The internal aerodynamics of the cowling were studied for ranges of propeller-advance ratio and inlet velocity ratio obtained by the deflection of the cowling flaps. The engine-cooling data have been presented in the form of the NACA cooling correlation curves, and an illustrative example using these curves.

WR L 208 DESIGN OF POWER-PLANT INSTALLATIONS PRESSURE-LOSS CHARACTERISTICS OF DUCT COMPONENTS, John R. Henry, June 1944

A correlation of what are believed to be the most reliable data available on duct components of aircraft power-plant installations is presented. The information is given in a convenient form as an aid in designing duct systems and estimating their performance. The design and performance data include those for straight ducts; simple bends of square, circular, and elliptical cross-sections; compound bends; diverging and converging bends; vaned bends; diffusers; branch ducts; internal inlets; and angular placement of heat exchangers. Examples are given to illustrate methods of applying these data to the analyses of duct systems.

WR L 233 RADIATOR DESIGN, M. J. Brevoort, July 1941

A design chart in coefficient form (turbulent flow) is presented from which a radiator can be chosen with any desired characteristics, whether for minimum power, particular dimensions, or pressure drop for cooling.

WR L 287 GENERALIZED SELECTION CHARTS FOR HARRISON AND TUBULAR INTERCOOLERS, George P. Wood and Arthur N. Tifford, December 1942

This report presents charts for Harrison and tubular intercoolers. These charts make it possible to select intercoolers for any set of design conditions and under any limitations on dimensions and pressure drops. They are also useful for showing what changes in the characteristics of a given intercooler will improve its performance. Examples of the use of these charts are given.

WR L 321 THE DESIGN OF COOLING DUCTS WITH SPECIAL REFERENCE TO THE BOUNDARY LAYER AT THE INLET, S. Katzoff, December 1940

A study is given of an underslung cooling duct with respect to the boundary layer problem at inlet. It was found that good duct operation could be obtained by: (1) making the inlet of such a size as to make the mean inlet velocity equal to 0.6 of the free stream velocity, and (2) putting vanes behind as well as ahead of radiator. Tables to facilitate design are included, together with an example.

WR L 328 INVESTIGATION OF AIR FLOW IN RIGHT-ANGLE ELBOWS IN A RECTANGULAR DUCT, C. H. McLellan and W. A. Bartlett, Jr., October 1941

Results of velocity profiles and pressure losses in several duct bend shapes for a particular application are given.

WR L 329 AN INVESTIGATION OF DIFFUSER-RESISTANCE COMBINATIONS IN DUCT SYSTEMS, Charles H. McLellan and Mark R. Nichols, February 1942

An investigation was conducted to determine the properties of diffuser-resistance combinations. This work applies to the design of airplane cooling ducts in which air is expanded in front of resistances, such as radiators, oil coolers, intercoolers, or the cylinders of an air cooled engine. The magnitude of the resistance and the boundary layer present at the entrance of the diffuser were systematically varied for each of a series of diffuser shapes for expansion ratios of 2:1 and 3:1. The presence of a resistance at the exit of a diffuser allowed the expansion to be made much more rapidly for a given expansion energy loss than was possible with a diffuser discharging into a straight exit tube. The diffuser losses were found to remain small for included angles up to 30° with conductivities up to 0.6.

WR L 341 DESIGN, SELECTION, AND INSTALLATION OF AIRCRAFT HEAT EXCHANGERS, George P. Wood and Maurice J. Brevoort, July 1943

A survey of the subject of aircraft heat exchangers is given in this report. The report is divided into three main parts. Part I, entitled "Design," presents the fundamental relations for calculating heat-transfer rate and pressure loss in heat exchangers, numerical data for use in applying these relations to various designs, energy-balance equations for fluid flow methods for calculating the power cost of heat exchangers, and a discussion of the application of the foregoing material to the design of heat exchangers. Part II, entitled "Selection," discusses the selection of the external dimensions of coolant radiators, air intercoolers, oil coolers, and engine fins. Part III, entitled "Installation," considers the problems of installing heat exchangers in aircraft; namely, the design of engine cowlings, wing entrances, scoops, exits, and ducts.

WR L 407 WIND-TUNNEL INVESTIGATION OF WING DUCTS ON A SINGLE-ENGINE PURSUIT AIRPLANE, W. J. Nelson and K. R. Czarnecki, October 1943

A study of several wing duct-inlet configurations were studied (full scale wind tunnel tests on a single engine pursuit plane) to determine the influence of inlet design and air flow on the pressure losses within the duct. Large variations in the total pressure recovery were found to be dependent on inlet-velocity ratio, lift coefficient, shape and position of inlet slope of diffuser axis, and the propeller slipstream effects.

WR L 408 INVESTIGATION OF FLOW THROUGH AN INTERCOOLER SET AT VARIOUS ANGLES TO THE SUPPLY DUCT, Mark R. Nichols, April 1942

Flow losses were found to be small up to about 70°. The distribution of flow through the intercooler also appeared to be fairly uniform up to about this angle. The shape of the entrance to the intercooler-flow-passage cells appeared to affect the losses of the duct intercooler combination.

WR L 492 INTERNALLY FINNED HONEYCOMB RADIATORS, Arthur N. Tifford, December 1941

In this report calculations were made of the performance of several internally finned radiators. A comparison with the performance of conventional honeycomb radiators is also made.

WR L 579 A COMPARISON OF THREE SPINNER-DIFFUSER DESIGNS IN AN NACA D_S COWLING FOR THE PRATT AND WHITNEY R-2800 ENGINE, Louis W. Habel and Peter F. Korycinski, June 1944

A study was made to determine the cooling effect of modifying the NACA D_S cowling by providing a lower inlet velocity ratio than that obtained with the original design. Thus, the cowling inlet area was increased. Both the modifications made resulted in slightly higher pressures and more uniform pressure distributions at the face of the engine than was obtainable with the original arrangement.

WR L 685 CORRELATION OF ENGINE-COOLING DATA, D. E. Brimley and Maurice J. Brevoort, January 1945

A method of correlating engine-cooling data and its application to a representative engine-cooling test is presented. Consideration is made of the effects of altitude on the engine-cooling performance. The correlation equations are developed so that application to specific-cooling problems is simple and direct. Equations are developed which relate the cooling requirements at altitude to those at test conditions.

WR L 744 SELECTION OF OIL COOLERS TO AVOID CONGEALING, Dennis J. Martin, July 1943

This report gives analytical treatment to problem of oil cooler selection from standpoint of available pressure drop, power loss, dimensions of unit and congealing tendency of the cooler. Charts are given which simplify the selection. An illustrative example is given.

WR L 771 HIGH-ALTITUDE COOLING. I - RESUME OF THE COOLING PROBLEM, Abe Silverstein, September 1944

The properties of NACA standard air and Army summer air, with corresponding stagnation conditions for a range of flight speed, are summarized in tables and figures; and the general effects of the density and temperature variations with altitude are discussed with regard to required mass flow and volume flow of cooling air, required cooling pressure, available cooling pressure, and cooling power. The general relations between the necessary heat transfer and the corresponding required flow of cooling air are summarized, together with their effects on the required cooling pressures.

WR L 772 HIGH-ALTITUDE COOLING. II - AIR-COOLED ENGINES, David T. Williams September 1944

The heat-transfer theory for air-cooled engines is summarized and an analysis of the cooling pressure drop is made for the case in which the pressure drop is an appreciable fraction of the absolute pressure.

A chart is given for the simple determination of the cooling pressure drop predicted on the basis of the usual type of sea-level cooling-correlation tests. The method is applied to predict the variation with altitude of the cooling pressure drop required by a typical engine.

WR L 773 HIGH ALTITUDE COOLING. III - RADIATORS, Jack N. Nielsen, September 1944

A detailed analysis was made to take account of the high cooling-air velocity occurring in high altitude radiators. Methods are developed for determining the heat transfer rate, the pressure drop, and the drag power. Radiator performance charts based on the analysis are presented for a wide range of the design variables. The application of the charts is shown by an example.

WR L 774 HIGH ALTITUDE COOLING. IV - INTERCOOLERS, K. F. Rubert, September 1944

The variation of intercooling requirements with altitude is discussed and the corresponding effects on intercooler design are shown. A discussion is also given of the relations among the various design parameters and of the ranges of choice in design. The important effects of the various factors on intercooler proportions are illustrated with charts for the Harrison copper cross-flow intercooler.

WR L 775 HIGH ALTITUDE COOLING. V - COWLING AND DUCTING, S. Katzoff, September 1944

A discussion is given of the variations with altitude of the air-volume requirements of the carburetor and the various cooling elements, and the effects of these variations on duct design for high-altitude airplanes are shown.

The fundamental principles in the design of efficient duct inlets, expanding passages, and outlets are presented, with special reference to the avoidance of flow separation or of compressibility effects. Data are given to show the magnitude of the effects discussed and to provide design criteria.

Conclusions:

1. The increase in air requirement with increase in altitude is in the following order:

    i. intercooler
    ii. carburetor
    iii. air-cooled engine
    iv. ethylene glycol radiator
    v. oil cooler

2. The difficulties associated with the wide variation of the air requirement with altitude for the intercooler and the carburetor may be alleviated by using a common air intake and expanding duct for the carburetor, intercooler, radiator, and oil cooler.

WR W 21 AN INVESTIGATION OF AIRCRAFT HEATERS. XIV - AN AIR AND HEAT FLOW ANALYSIS OF A RAM-OPERATED HEATER AND DUCT SYSTEM, L. M. K. Boelter, E. H. Morrin, R. C. Martinelli, and H. F. Poppendiek, March 1944

A method of graphical analysis is given which allows the prediction of the thermal and aerodynamic performance of a ram operated heater and duct system, for cabin heating or wing de-icing at any altitude and airspeed. This required that the following data be known:

1. Thermal output of heater at various air rates and exhaust gas rates.
2. Pressure drop characteristics of ducting.
3. Heat loss from discharge duct.
4. Static pressure at discharge point.

WR W 39 PRESSURE LOSS IN DUCTS WITH COMPOUND ELBOWS, J. R. Weske, February 1943

Results are presented for pressure drop in ducts with two 90° elbows arranged at three different angular positions to each other, placed adjacent to each other, or separated by various lengths of straight ducts. Data are summarized in the form of curves adapted for design computations of pressure drop in compound-duct vents.

WR W 95 AN INVESTIGATION OF AIRCRAFT HEATERS. XVIII - A DESIGN MANUAL FOR EXHAUST GAS AND AIR HEAT EXCHANGERS, L. M. K. Boelter, R. C. Martinelli, F. E. Romie, and E. H. Morrin, August 1945

The elements of design of cabin-air heaters, wing anti-icing heat exchangers, and other gas-to-gas heat exchangers are presented. This 4-part report summarizes the series of NACA Reports titled "An Investigation of Aircraft Heaters" (I to XXIII). Part I contains the basic equations for the determination of the thermal resistances involved in heat exchanger design. Part II presents several examples of the application of these basic equations to the prediction of thermal performance of a number of heaters. Part III discusses non-isothermal pressure drops. Also in Part III the heat requirements of aircraft are discussed briefly; the equations used to correct heater performance to any altitude are presented; and the equations required to predict the performance of a ram-operated heater-and-duct system at any airplane speed and altitude are summarized. Part IV is an appendix in which the physical properties of air are given for the range -100° to 1600° F.

WR W 108 HEAT-TRANSFER COEFFICIENTS FOR AIR FLOWING IN ROUND TUBES, IN RECTANGULAR DUCTS, AND AROUND FINNED CYLINDERS, R. E. Drexel and W. H. McAdams, February 1945

This report reviews published data and presents some new data on heat-transfer coefficients for air flowing in round tubes, in rectangular ducts, and around finned cylinders.

Not Applicable NACA Wartime Reports

WR A 46 FLIGHT TESTS OF SEVERAL EXHAUST-GAS-TO-AIR HEAT EXCHANGERS, Richard Jackson and Wesley H. Hillendahl, March 1944

WR A 85 TESTS OF A JET-MOTOR AIR-INTAKE DIRECT SYSTEM ON A 1/4-SCALE STUB-WING MODEL OF A PURSUIT-TYPE AIRPLANE, Frederick H. Hanson, Jr., May 1946

WR E 1 PERFORMANCE OF NACA EIGHT-STAGE AXIAL-FLOW COMPRESSOR DESIGNED ON THE BASIS OF AIRFOIL THEORY, J. T. Sinnette, Jr., O. W. Schey, and J. A. King, August 1944

WR E 2 PERFORMANCE EFFECT OF FULLY SHROUDING A CENTRIFUGAL SUPERCHARGER IMPELLER, William K. Ritter and Irving A. Johnsen, October 1945

WR E 3 PERFORMANCE CHARACTERISTICS OF A JUNKERS JUMO 211F ENGINE SUPERCHARGER WITH A DVL FULLY SHROUDED IMPELLER AND SCROLL DIFFUSER, J. Austin King and Harold Klein, February 1945

WR E 4 STANDARD METHOD OF GRAPHICAL PRESENTATION OF CENTRIFUGAL COMPRESSOR PERFORMANCE, NACA Subcommitte on Supercharger Compressors, August 1945

WR E 5 PERFORMANCE OF NACA EIGHT-STAGE AXIAL-FLOW COMPRESSOR AT SIMULATED ALTITUDES, J. Austin King and Owen W. Regan, December 1944

WR E 6 STANDARD PROCEDURES FOR RATING AND TESTING CENTRIFUGAL COMPRESSORS, NACA Subcommittee on Supercharger Compressors, August 1945

WR E 7 PRINCIPLES AND METHODS OF RATING AND TESTING CENTRIFUGAL SUPERCHARGERS, Herman H. Ellerbrock, Jr. and Arthur W. Goldstein, February 1942

WR E 8 AN INVESTIGATION OF THE BACKFLOW PHENOMENON IN CENTRIFUGAL SUPERCHARGERS, William A. Benser and Jason J. Moses, June 1945

WR E 9 PERFORMANCE COMPARISON OF TWO DEEP INDUCERS AS SEPARATE COMPONENTS AND IN COMBINATION WITH AN IMPELLER, W. K. Ritter, A. Ginsburg, and W. L. Beede, October 1945

WR E 10 A GENERAL REPRESENTATION FOR AXIAL-FLOW FANS AND TURBINES, W. Perl and M. Tucker, June 1945

WR E 11 COMPUTATION OF THE MEAN TANGENTIAL VELOCITY OF THE AIR LEAVING THE BLADE TIPS OF A CENTRIFUGAL SUPERCHARGER, W. Bryon Brown, August 1945

WR E 13 PRELIMINARY INVESTIGATION OF DEEP INDUCERS AS SEPARATE SUPERCHARGER COMPONENTS, William K. Ritter and Irving A. Johnsen, November 1945

WR E 14 AIR-CONSUMPTION PARAMETERS FOR AUTOMATIC MIXTURE CONTROL OF AIRCRAFT ENGINES, Sidney J. Shames, September 1944

WR E 16 OXYGEN BOOSTING OF AN AIRCRAFT-ENGINE CYLINDER IN CONJUNCTION WITH INTERNAL COOLANTS, R. C. Spencer, A. W. Jones, and J. F. Pfender, April 1944

WR E 17 COMPRESSIBILITY AND HEATING EFFECTS ON PRESSURE LOSS AND COOLING OF A BAFFLED CYLINDER BARREL, Arthur W. Goldstein and Herman H. Ellerbrock, Jr., July 1944

WR E 19 TEST-STAND INVESTIGATION OF COOLING CHARACTERISTICS AND FACTORS AFFECTING TEMPERATURE DISTRIBUTION OF A DOUBLE-ROW RADIAL AIRCRAFT ENGINE, M. A. Sipko, R. O. Hickel, and R. J. Jones, March 1946

WR E 20 A COOLING CORRELATION OF THE WRIGHT R-2600-8 ENGINE SHOWING THE EFFECT OF WATER AS AN INTERNAL COOLANT, Robert J. Koenig and Helmuth W. Engelman, February 1945

WR E 21 USE OF WATER INJECTION TO DECREASE GASOLINE CONSUMPTION IN AN AIRCRAFT ENGINE CRUISING AT HIGH POWER, Helmuth W. Engelman and H. Jack White, August 1944

WR E 22 THE EFFECT OF OIL CONSUMPTION AND PISTON COOLING ON KNOCK-LIMITED AIRCRAFT-ENGINE PERFORMANCE, M. C. Huppert, H. S. Imming, and Paul H. Richard, May 1944

WR E 23 THERMODYNAMIC DATA FOR THE COMPUTATION OF THE PERFORMANCE OF EXHAUST-GAS TURBINES, Benjamin Pinkel and L. Richard Turner, October 1945

WR E 24 SOME EFFECTS OF INTERNAL COOLANTS ON KNOCK-LIMITED AND TEMPERATURE-LIMITED POWER AS DETERMINED IN A SINGLE-CYLINDER AIRCRAFT TEST ENGINE, J. D. Wear, L. F. Held, and J. W. Slough, August 1944

WR E 25 SINGLE-CYLINDER OIL-CONTROL TESTS OF POROUS CHROME-PLATED CYLINDER BARRELS FOR RADIAL AIR-COOLED ENGINES, R. L. Johnson and Max Swikert, January 1946

WR E 26 RADIAL AIRCRAFT-ENGINE BEARING LOADS. I - CRANKPIN-BEARING LOADS FOR ENGINES HAVING NINE CYLINDERS PER CRANKPIN, Milton C. Shaw and E. Fred Macks, October 1945

WR E 27 METHOD OF MOUNTING CYLINDER BLOCKS OF IN-LINE ENGINES ON CUE CRANKCASES, C. D. Waldron and A. E. Biermann, July 1944

WR E 28 SINGLE-CYLINDER ENGINE TESTS OF POROUS CHROME-PLATED CYLINDER BARRELS WITH SPECIAL BORE COATINGS FOR RADIAL AIR-COOLED ENGINES, Robert L. Johnson and Roy I. Anderson, January 1946

WR E 29 EXPERIMENTAL STUDY OF THE COATING FOUND ON SCUFFED CASE-IRON PISTON RINGS DURING OPERATION IN NITRIDED-STEEL CYLINDERS, J. Howard Kittel and Walter A. Vierthaler, November 1944

WR E 30 PERFORMANCE OF AN EXHAUST-GAS "BLOWDOWN" TURBINE ON A NINE-CYLINDER RADIAL ENGINE, L. Richard Turner and Leland G. Desmon, December 1944

WR E 31 A THEORETICAL ANALYSIS OF THE PERFORMANCE OF A DIESEL ENGINE-COMPRESSOR-TURBINE COMBINATION FOR AIRCRAFT, Eldon W. Hall, April 1945

WR E 32 CALCULATIONS OF THE ECONOMY OF AN 18-CYLINDER RADIAL AIRCRAFT ENGINE WITH AN EXHAUST-GAS TURBINE GEARED TO THE CRANKSHAFT AT CRUISING SPEED, Richard W. Hannum and Richard H. Zimmerman, December 1945

WR E 33 KNOCK-LIMITED PERFORMANCE OF PURE HYDROCARBONS BLENDED WITH A BASE FUEL IN A FULL-SCALE AIRCRAFT-ENGINE CYLINDER. I - EIGHT PARAFFINS, TWO OLEFINS, Anthoy W. Jones and Arthur W. Bull, May 1944

WR E 34 CYLINDER-HEAD COOLING BY MEANS OF A SHIELD IN THE EXHAUST PASSAGE, H. W. Wilsted and B. A. Mulcahy, June 1944

WR E 35 THE EFFECT OF PISTON-HEAD TEMPERATURE ON KNOCK-LIMITED POWER, Harry S. Imming, July 1944

WR E 36 EFFECT OF SEVERAL METHODS OF INCREASING KNOCK-LIMITED POWER ON CYLINDER TEMPERATURES, H. A. Cook, J. E. Vandeman, and Kenneth D. Brown, September 1944

WR E 37 RELATIVE EFFECTS OF CYLINDER-HEAD AND INLET-MIXTURE TEMPERATURES UPON KNOCK LIMITS OF FUELS, N. D. Sanders, J. D. Wear, and R. V. Hensley, October 1944

WR E 38 THE TWO-DIMENSIONAL INCOMPRESSIBLE POTENTIAL FLOW OVER CORRUGATED AND DISTORTED INFINITE SURFACES, W. Perl and L. J. Green, January 1945

WR E 39 THE EFFECT OF HIGH TEMPERATURE OF THE CYLINDER HEAD ON THE KNOCKING TENDENCY OF AN AIR-COOLED ENGINE CYLINDER, J. C. Sanders and M. D. Peters, February 1945

WR E 40 A PRE-IGNITION INDICATOR FOR AIRCRAFT ENGINES, Thomas Dallas, Gene Hoss, and Myron L. Harries, February 1945

WR E 41 MEASUREMENT OF OPERATING STRESSES IN AN AIRCRAFT ENGINE CRANKSHAFT UNDER POWER, Douglas P. Walstrom, February 1945

WR E 42 IMPROVING ENGINE COOLING WITH SPECIAL BAFFLES, A. E. Biermann, H. A. Cook, and L. F. Held, February 1945

WR E 43 THE EFFECTS OF AN INCREASE IN THE CONCENTRATION OF ETHYLENE DIBROMIDE IN A LEADED FUEL ON LEAD DEPOSITION, CORROSION OF EXHAUST VALVES, AND KNOCK-LIMITED POWER, B. A. Mulcahy and M. A. Zipkin, June 1945

WR E 44 PISTON-RING VIBRATION AND BREAKAGE, J. C. Nettles and Andre J. Meyer, August 1945

WR E 45 TESTS OF IMPROVEMENTS IN EXHAUST-VALVE PERFORMANCE RESULTING FROM CHANGES IN EXHAUST-VALVE AND PORT DESIGN, B. A. Mulcahy and M. A. Zipkin, September 1945

WR E 46 IN-LINE AIRCRAFT-ENGINE BEARING LOADS. II - BLADE-BEARING LOADS, Milton C. Shaw and E. Fred Macks, October 1945

WR E 47 STUDY OF THE MIXTURE DISTRIBUTION OF A DOUBLE-ROW RADIAL AIRCRAFT ENGINE, F. E. Marble, H. F. Butze, and R. O. Hickel, October 1945

WR E 48 CORRELATION OF EXHAUST-VALVE TEMPERATURES WITH ENGINE OPERATING CONDITIONS AND VALVE DESIGN, M. A. Zipkin and J. C. Sanders, October 1945

WR E 49 CONSIDERATION OF AUXILIARY JET PROPULSION FOR ASSISTING TAKE-OFF, L. Richard Turner, May 1940

WR E 50 REQUIREMENTS FOR UNIT FUEL-INJECTION SYSTEMS, Edred T. Marsh, July 1940

WR E 51 EFFECT OF HUMIDITY ON SEVERAL SUPERCHARGER PARAMETERS, H. H. Ellerbrock, Jr. and A. W. Goldstein, November 1941

WR E 52 INVESTIGATION OF PERFORMANCE OF 9-CYCLINDER ENGINE USING LARGE VALVE OVERLAP AND ECLIPSE FUEL-INJECTION SYSTEM, Alfred W. Young, November 1941

WR E 53 EFFECT OF ADDITIONS OF AROMATICS ON THE KNOCKING CHARACTERISTICS OF SEVERAL 100-OCTANE FUELS AT TWO ENGINE SPEEDS, A. E. Biermann, L. C. Corrington and M. L. Harries, May 1942

WR E 54 EFFECT OF COAXIAL LAPPING OF CAST-IRON PISTON RINGS IN RING PERFORMANCE, S. J. Shames, E. S. Machlin, and John G. Wilson April 1944

WR E 55 CONTINUOUS USE OF INTERNAL COOLING TO SUPPRESS KNOCK IN AIRCRAFT ENGINES CRUISING AT HIGH POWER, Arthur H. Bell, August 1944

WR E 57 BREAKING AIRCRAFT-ENGINE OIL FOAMS BY USE OF ELECTRICALLY CHARGED CONDENSER PLATES, I. Irving Pinkel, November 1944

WR E 58 SIGNIFICANCE OF ALKYLATE-REPLACEMENT VALUES OF AVIATION FUEL COMPONENTS, Newell D. Sanders, December 1944

WR E 59 INVESTIGATION OF A METHOD OF COMPARISON OF METALLIC SURFACE CONTOURS BY MEANS OF STEROSCOPIC ELECTRON MICROGRAPHS, A. S. Powell, T. P. Clark, and M. C. Shaw, July 1945

WR E 60 CORRELATION OF WRIGHT AERONAUTICAL CORPORATION COOLING DATA ON THE R-3350-14 INTERMEDIATE ENGINE AND COMPARISON WITH DATA FROM THE LANGLEY 16-FOOT HIGH-SPEED TUNNEL, Benjamin Pinkel and Kennedy F. Rubert, January 1945

WR E 61 EFFECT OF INCREASING THE SIZE OF THE VALVE-GUIDE BOSS ON THE EXHAUST-VALVE TEMPERATURE AND THE VOLUMETRIC EFFICIENCY OF AN AIRCRAFT CYLINDER, Max D. Peters, February 1945

WR E 62 THE OXIDATION OF EXHAUST GASES AT ROOM TEMPERATURE, H. C. Gerrish, J. L. Meem, Jr. and V. C. Tuck, February 1945

WR E 63 DILUTION OF EXHAUST-GAS SAMPLES FROM A MULTICYLINDER ENGINE EQUIPPED WITH AN EXHAUST-GAS COLLECTOR, Helmut F. Butze, February 1945

WR E 64 FLIGHT TESTS OF A P-63A-1 AIRPLANE WITH AN ELECTRIC TORQUEMETER, J. Cary Nettles and Morgan P. Hanson, March 1945

WR E 65 THE EFFECT OF CARBURETOR-AIR TEMPERATURE ON THE COOLING CHARACTERISTICS OF A TYPICAL AIR-COOLED ENGINE CYLINDER, Joseph Neustein, William H. Sens, and H. A. Buckner, Jr., September 1945

WR E 66 VISUAL STUDIES OF CYLINDER LUBRICATION. I - THE LUBRICATION OF THE PISTON SKIRT, Milton C. Shaw and Theodore Nussdorfer, September 1945

WR E 67 IN-LINE AIRCRAFT-ENGINE BEARING LOADS. I - CRANKPIN-BEARING LOADS, Milton C. Shaw and E. Fred Macks, October 1945

WR E 68 ULTRAVIOLET ABSORPTION SPECTRA OF AROMATIC AMINES IN ISOOCTANE AND IN WATER, Adelbert O. Tischler and J. Nelson Howard, November 1945

WR E 69 QUANTITATIVE ANALYSIS FOR AROMATIC AMINES IN AVIATION FUELS BY ULTRAVIOLET SPECTROPHOTOMETRY, Adelbert O. Tischler, November 1945

WR E 70 THE HYDRODYNAMIC LUBRICATION OF NEAR-INFINITE SLIDERS SUCH AS PISTON RINGS, Charles P. Boegli, October 1944

WR E 71 ELIMINATION OF GALLING OF PENDULUM-VIBRATION DAMPERS USED IN AIRCRAFT ENGINES, Andre J. Meyer, Jr., August 1945

WR E 72 END-ZONE WATER INJECTION AS A MEANS OF SUPPRESSING KNOCK IN A SPARK-IGNITION ENGINE, R. J. Brun, H. L. Olsen, and C. D. Miller, September 1944

WR E 73 EFFECT OF VARIOUS CARBURETOR SETTINGS ON THE FLOW CHARACTERISTICS AT THE OUTLET OF A SUPERCHARGER INLET ELBOW, Jason J. Moses, June 1945

WR E 74 EFFECT OF PROGRESSIVE RING FAILURE ON PISTON DESTRUCTION, Max J. Tauschek and Lester C. Corrington, February 1945

WR E 75 EFFECT OF OIL FLOW TO PISTON ON PISTON-RING STICKING AND OIL CONSUMPTION IN A SINGLE-CYLINDER ENGINE, M. J. Tauschek, L. C. Corrington, and John B. Meigs, May 1945

WR E 76 OCCURRENCE OF IRON OXIDES ON CAST-IRON ENGINE SURFACES AFTER OPERATION, A. S. Nowick and L. O. Brockway, February 1946

WR E 77 THE EFFECT OF EXHAUST-STACK SHAPE ON THE DESIGN AND PERFORMANCE OF THE INDIVIDUAL CYLINDER EXHAUST-GAS JET-PROPULSION SYSTEM, L. Richard Turner and Leory V. Humble, November 1942

WR E 78 THE REACTION JET AS A MEANS OF PROPULSION AT HIGH SPEEDS, David T. Williams, June 1941

WR E 79 SUMMARY REPORT ON THE INDUCTION OF WATER TO THE INLET AIR AS A MEANS OF INTERNAL COOLING IN AIRCRAFT ENGINE CYLINDERS, A. M. Rothrock, Alois Krsek, Jr. and A. W. Jones, August 1942

WR E 80 CYLINDER BARREL COOLING WITH BONDED PREFORMED COPPER FINS, H. H. Foster and H. H. Ellerbrock, Jr., May 1941

WR E 81 CONSTRUCTION OF FINNED ALUMINUM MUFFS FOR AIRCRAFT-ENGINE CYLINDER BARRELS, Langley Memorial Aeronautical Laboratory, April 1942

WR E 83 DESIGN OF NOZZLES FOR THE INDIVIDUAL CYLINDER EXHAUST JET PROPULSION SYSTEM, Benjamin Pinkel, L. Richard Turner, and Fred Voss, April 1941

WR E 84 MAXIMUM PERMISSIBLE ENGINE PERFORMANCE OF EIGHT REPRESENTATIVE FUELS OF 100-OCTANE NUMBER, A. M. Rothrock, A. E. Biermann and L. C. Corrington, January 1942

WR E 85 COMPARATIVE COOLING OF CYLINDERS OF NONUNIFORM FIN WIDTH WITH TIGHT-FITTING BAFFLES AND WITH BAFFLES THAT PROVIDE CONSTANT FLOW-PATH AREAS, O. W. Schey, V. G. Rollin, and H. A. Buckner, Jr., April 1944

WR E 86 TENSILE-STRENGTH INVESTIGATION OF CAST-IRON PISTON RINGS OF VARIOUS STRENGTHS, Edmond E. Bisson and Harold D. Kessler, March 1945

WR E 87 EFFECT OF FUEL VOLATILITY ON PERFORMANCE OF A WRIGHT R-2600-8 ENGINE AS INFLUENCED BY MIXTURE DISTRIBUTION, H. Jack White and Helmuth W. Engelman, September 1944

WR E 88 ADDITION OF HEAT TO A COMPRESSIBLE FLUID IN MOTION, Bruce L. Hicks, February 1945

WR E 89 INFRARED-SPECTROPHOTOMETRIC ANALYSIS OF BINARY AND TERNARY MIXTURES OF LIQUID HYDROCARBONS, Alden P. Cleaves and Mildred E. Sherrick, August 1945

WR E 90 KNOCK-LIMITED PERFORMANCE OF BLENDS OF AN-F-28 FUEL CONTAINING 4 PERCENT ALIPHATIC AMINES, Leonard K. Tower, April 1945

WR E 91 AN ESTIMATION OF THE INTERNAL-COOLING REQUIREMENTS OF AN AIRCRAFT ENGINE CYLINDER WHEN USING OXYGEN BOOST, John C. Evvard and W. E. Moeckel, November 1944

WR E 92 THE KNOCK-LIMITED PERFORMANCE OF SEVERAL FUELS BLENDED WITH S-2 REFERENCE FUEL, Henry E. Alquist, November 1944

WR E 93 EXPERIMENTAL STUDIES OF THE KNOCK-LIMITED BLENDING CHARACTERISTICS OF AVIATION FUELS. I - PRELIMINARY TESTS IN AN AIR-COOLED CYLINDER, N. D. Sanders, R. V. Hensley, and Roland Breitwieser, October 1944

WR E 94 TRENDS IN SURFACE-IGNITION TEMPERATURES, Henry E. Alquist and Donald W. Male, September 1944

WR E 95 CALCULATIONS OF INTAKE-AIR COOLING RESULTING FROM WATER INJECTION AND OF WATER RECOVERY FROM EXHAUST GAS, Addison M. Rothrock, August 1944

WR E 96 RUBBER CONDUCTORS FOR AIRCRAFT IGNITION CABLES, C. C. Swett, Jr. and Joseph R. Dietrich, November 1945

WR E 98 THE EFFECT OF INCREASED COOLING SURFACE ON PERFORMANCE OF AIRCRAFT ENGINE CYLINDERS AS SHOWN BY TESTS OF THE NACA CYLINDER, O. W. Schey, V. G. Rollin, and H. H. Ellerbrock, Jr., July 1944

WR E 99 EFFECT OF AROMATICS AND SPARK ADVANCE ON THERMAL EFFICIENCY, Mitchell Gilbert, September 1942

WR E 100 FUEL CONSUMPTION CORRECTED FOR COOLING DRAG OF AN AIR-COOLED RADIAL AIRCRAFT ENGINE AT LOW FUEL-AIR RATIOS AND WITH VARIABLE SPARK ADVANCE, J. Elmo Farmer and Maurice Munger, February 1945

WR E 101 HEAT-TRANSFER TESTS OF SEVERAL ENGINE COOLANTS, E. J. Manganiello and J. R. Stalder, February 1945

WR E 103 COOLING TESTS OF AN AIR-COOLED ENGINE CYLINDER WITH COPPER FINS ON THE BARREL, J. C. Sanders, H. D. Wilsted, and B. A. Mulcahy, July 1942

WR E 105 FLIGHT TESTS OF EXHAUST-GAS JET PROPULSION, Benjamin Pinkel and L. Richard Turner, November 1940

WR E 107 A POSITIVE-REPLICA TECHNIQUE FOR EXAMINING FINISHED METAL SURFACES AND ITS APPLICATION TO AIRCRAFT-ENGINE CYLINDERS, Thomas P. Clark, September 1944

WR E 108 THE EFFECT OF CARBURETOR THROTTLE SETTINGS ON THE VELOCITY DISTRIBUTION AT THE OUTLET OF A VANED AND A VANELESS SUPERCHARGER INLET ELBOW, Donald C. Guentert and Edmund J. Baas, September 1945

WR E 109 KNOCK-LIMITED PERFORMANCE OF N-METHYLANILINE AND XYLIDINE BLENDS IN AN AIR-COOLED AIRCRAFT CYLINDER, A. W. Bull, E. G. Stricker, and J. D. Wear, February 1946

WR E 110 PISTON HEAT-TRANSFER COEFFICIENTS ACROSS AN OIL FILM IN A SMOOTH-WALLED PISTON RECIPROCATING-SLEEVE APPARATUS, Eugene J. Manganiello, and Donald Bogart, December 1945

WR E 111 A METHOD FOR THE DETERMINATION OF AROMATICS IN HYDROCARBON MIXTURES, Harold F. Hipsher, December 1945

WR E 112 THE KNOCK-LIMITED PERFORMANCE OF S REFERENCE FUEL PLUS 2 MILLILITERS OF TRIETHYLTHALLIUM PER GALLON, Carl L. Meyer, November 1945

WR E 113 FUEL-VAPORIZATION LOSS AS DETERMINED BY THE CHANGE IN THE SPECIFIC GRAVITY OF THE FUEL IN AN AIRCRAFT FUEL TANK, Charles S. Stone and Walter E. Kramer, May 1945

WR E 114 PRESSURE DROP IN TANK AND FLOAT VENT TUBES ON DIVING AIRPLANES, C. D. Waldron, January 1939

WR E 115 ULTRAVIOLET SPECTROCHEMICAL ANALYSIS FOR AROMATICS IN AIRCRAFT FUELS, Alden P. Cleaves, March 1945

WR E 116 EFFECT OF EXHAUST BACK PRESSURE ON ENGINE POWER, Benjamin Pinkel, June 1943

WR E 117 USE OF INTERNAL COOLANT AS A MEANS OF PERMITTING INCREASE IN ENGINE TAKE-OFF POWER, Addison M. Rothrock, January 1944

WR E 118 A METHOD OF ESTIMATING THE KNOCK RATING OF HYDROCARBON FUEL BLENDS, Newell D. Sanders, August 1943

WR E 119 EFFECT OF AN AROMATIC MIXTURE ADDED TO TWO 100-OCTANE FUELS ON ENGINE TEMPERATURES AND FUEL CONSUMPTION, Alois Krsek, Jr. and Anthony W. Jones, June 1942

WR E 120 EFFECT OF VARYING PERCENTAGES OF EXHAUST GAS ON ENGINE PERFORMANCE, Newell D. Sanders and Henry C. Barnett, April 1943

WR E 121 THE EFFECT OF CONTINUOUS KNOCK ON THE ENDURANCE OF AN AIRCRAFT ENGINE CYLINDER, J. C. Sanders, J. A. Hilgendorf and M. D. Peters, March 1944

WR E 122 CONSTRUCTION OF WIRE STRAIN GAGES FOR ENGINE APPLICATION, J. Cary Nettles and Maurice Tucker, December 1943

WR E 123 DETERMINATION OF IRON CONTAMINATION OF USED LUBRICATING OIL FOR USE IN MEASURING RATES OF WEAR IN AIRCRAFT ENGINES, Adelbert O. Tischler, March 1944

WR E 124 THE EFFECT OF COMPRESSION RATIO, COOLED EXHAUST GAS MIXED WITH INLET AIR, AND INLET-AIR TEMPERATURE ON THE KNOCK-LIMITED PERFORMANCE OF A FULL-SCALE SINGLE-CYLINDER ENGINE, Ray E. Bolz and Roland Breitwieser, March 1944

WR E 125 ENGINE TESTS OF PRESSURIZED SHUNT-TYPE COOLING SYSTEMS FOR A LIQUID-COOLED ENGINE, E. J. Manganiello, B. T. Lundin, and J. H. Povolny, May 1945

WR E 126 ARTIFICIAL RUNNING-IN OF PISTON RINGS, A. R. Bobrowsky and E. S. Machlin, March 1944

WR E 128 THE MEASUREMENT OF FUEL-AIR RATIO BY ANALYSIS OF THE OXIDIZED EXHAUST GAS, Harold C. Gerrish and J. Lawrence Meem, Jr., October 1943

WR E 129 EFFECT OF INLET-AIR TEMPERATURE AND CYLINDER DISPLACEMENT ON CHARGE TEMPERATURE OF INTERNAL-COMBUSTION ENGINES, N. D. Sanders, H. C. Barnett, and R. E. Bolz, January 1944

WR E 131 HEAT-TRANSFER PROCESSES IN LIQUID-COOLED ENGINE CYLINDERS. I - CORRELATION OF SINGLE-CYLINDER ENGINE TEMPERATURE UNDER FORCED-CONVECTION COOLING CONDITIONS, Benjamin Pinkel, E. J. Manganiello, and Everett Bernardo, November 1945

WR E 132 DETERMINATION OF GAS TEMPERATURES FROM THE FREQUENCY OF KNOCK-INDUCED GAS VIBRATIONS IN AN INTERNAL-COMBUSTION ENGINE, W. E. Moeckel and J. C. Evvard, January 1946

WR E 133 KNOCKING TENDENCY OF AN AIR-COOLED AIRCRAFT-ENGINE CYLINDER WITH ONE AND WITH TWO SPARK PLUGS, R. C. Spencer and A. W. Jones, July 1943

WR E 134 RELATION OF PRE-IGNITION AND KNOCK TO ALLOWABLE ENGINE TEMPERATURES, A. E. Biermann and Lester C. Corrington, July 1943

WR E 135 RECOMMENDED TEST PROCEDURE FOR AIRCRAFT ENGINE TURBOSUPERCHARGER POWER PLANTS BY NACA SUBCOMMITTEE ON RECOVERY OF POWER FROM EXHAUST GAS, NACA Subcommittee on Recovery of Power from Exhaust Gas, June 1943

WR E 136 HEAT-TRANSFER TESTS OF AQUEOUS ETHYLENE GLYCOL SOLUTIONS IN AN ELECTRICALLY HEATED TUBE, Everett Bernardo and Carroll S. Eian, August 1945

WR E 137 SMALL-ORIFICE TUBES FOR MINIMIZING DILUTION IN EXHAUST-GAS SAMPLES, Harvey A. Cook and Walter T. Olson, February 1943

WR E 138 NITRIDED-STEEL PISTON RINGS FOR ENGINES OF HIGH SPECIFIC POWER, John H. Collins, Jr., Edmond E. Bisson, and Ralph F. Schmiedlin, April 1944

WR E 139 THE NACA BALANCED-DIAPHRAGM DYNAMOMETER-TORQUE INDICATOR, Charles S. Moore, Arnold E. Biermann, and Fred Voss, March 1944

WR E 140 OPERATING TEMPERATURES OF A SODIUM-COOLED EXHAUST VALVE AS MEASURED BY A THERMOCOUPLE, J. C. Sanders, H. D. Wilsted, and B. A. Mulcahy, December 1943

WR E 142 EFFECT OF CARBURETOR-MIXTURE-CONTROL AND SUPERCHARGER CHARACTERISTICS ON FUEL KNOCK UNDER SIMULATED SEA-LEVEL FLIGHT CONDITIONS, Addison M. Rothrock and Jerrold D. Wear, March 1943

WR E 143 EXPERIMENTAL STUDY OF THE COATING FORMED ON NITRIDED-STEEL PISTON RINGS DURING OPERATION IN NITRIDED-STEEL CYLINDERS, A. R. Bobrowsky, J. Howard Kittel, and Charles P. Boegli, March 1944

WR E 144 AN ELECTRON-DIFFRACTION EXAMINATION OF CAST-IRON PISTON RINGS FROM SINGLE-CYLINDER AIRCRAFT-ENGINE TESTS, A. S. Nowick and L. O. Brockway, February 1945

WR E 145 AN ELECTRON AND X-RAY DIFFRACTION INVESTIGATION OF SURFACE CHANGES ON NITRIDED-STEEL PISTON RINGS DURING ENGINE OPERATION IN NITRIDED-STEEL CYLINDER BARRELS, J. N. Good and L. O. Brockway, March 1945

WR E 146 CYLINDER TEMPERATURES OF TWO LIQUID-COOLED AIRCRAFT CYLINDERS FOR VARIOUS ENGINE AND COOLANT CONDITIONS, Eugene J. Manganiello and Everett Bernardo, October 1945

WR E 147 FLAME-VISIBILITY TESTS WITH INDIVIDUAL EXHAUST STACKS, L. Richard Turner and Leroy V. Humble, February 1945

WR E 148 KNOCK-LIMITED PERFORMANCE OF BLENDS OF AN-F-28 FUEL CONTAINING 2 PERCENT AROMATIC AMINES - I, J. Robert Branstetter, April 1944

WR E 149 KNOCK-LIMITED PERFORMANCE OF BLENDS OF AN-F-28 FUEL CONTAINING 2 PERCENT AROMATIC AMINES - II, Henry E. Alquist and Leonard K. Tower, June 1944

WR E 150 KNOCK-LIMITED PERFORMANCE OF BLENDS OF AN-F-28 FUEL CONTAINING 2 PERCENT AROMATIC AMINES - III, Henry E. Alquist and Leonard K. Tower, August 1944

WR E 151 KNOCK-LIMITED PERFORMANCE OF BLENDS OF AN-F-28 FUEL CONTAINING 2 PERCENT AROMATIC AMINES - V, Henry E. Alquist and Leonard K. Tower, August 1945

WR E 152 KNOCK-LIMITED PERFORMANCE OF BLENDS OF AN-F-28 FUEL CONTAINING 2 PERCENT AROMATIC AMINES - IV, Henry E. Alquist and Leonard K. Tower, December 1944

WR E 153 THE LOW-TEMPERATURE SOLUBILITY OF TECHNICAL XYLIDINES IN AVIATION GASOLINE, Walter T. Olson, June 1943

WR E 154 GASOLINE-WATER DISTRIBUTION COEFFICIENTS OF XYLIDINES, Adelbert O. Tischler, Vernon A. Slabey, and Walter T. Olson, June 1943

WR E 155 WATER TOLERANCE OF AVIATION GASOLINE CONTAINING XYLIDINES, Joseph Revilock and Walter T. Olson, July 1943

WR E 156 THE EFFECT OF XYLIDINES ON THE CORROSIVENESS OF AIRCRAFT-ENGINE OIL, Emanuel Meyrowitz and Walter T. Olson, July 1943

WR E 157 THE EFFECT OF XYLIDINES ON THE LOAD-CARRYING CAPACITY OF AN AIRCRAFT-ENGINE OIL - I, Robert A. Spurr and Walter T. Olson, August 1943

WR E 158 THE EFFECT OF XYLIDINES ON THE STABILITY OF AN AIRCRAFT-ENGINE LUBRICATING OIL, Walter T. Olson and Emanuel Meyrowitz, August 1943

WR E 159 ANTIKNOCK EFFECTIVENESS OF XYLIDINES IN SMALL-SCALE ENGINES, J. Robert Branstetter and Carl L. Meyer, August 1943

WR E 160 THE EFFECT OF XYLIDINES ON THE LOAD-CARRYING CAPACITY OF AN AIRCRAFT-ENGINE OIL - II, Walter T. Olson and Robert A. Spurr, September 1943

WR E 161 LOSS OF XYLIDINES IN OVERWATER STORAGE OF XYLIDINE-BLENDED FUEL, Walter T. Olson and Adelbert O. Tischler, March 1944

WR E 162 THE LOW-TEMPERATURE SOLUBILITY OF ANILINE, THE TOLUIDINES, AND SOME OF THEIR N-ALKYL DERIVATIVES IN AVIATION GASOLINE, Walter T. Olson and Richard L. Kelley, June 1944

WR E 163 GASOLINE-WATER DISTRIBUTION COEFFICIENTS OF 27 AROMATIC AMINES, Walter T. Olson, Adelbert O. Tischler, and Irving A. Goodman, August 1944

WR E 164 THE LOW-TEMPERATURE SOLUBILITY OF 24 AROMATIC AMINES IN AVIATION GASOLINE, Richard L. Kelley, November 1944

WR E 165 KNOCK-LIMITED PERFORMANCE OF SIX AROMATIC AMINES BLENDED WITH A BASE FUEL IN A FULL-SCALE AIRCRAFT-ENGINE CYLINDER, Anthony W. Jones, Arthur W. Bull, and Edmund R. Jonash, April 1945

WR E 166 SUITABILITY OF 18 AROMATIC AMINES FOR OVERWATER STORAGE WHEN BLENDED WITH AVIATION GASOLINE, Irving A. Goodman and J. Nelson Howard, June 1945

WR E 167 THE LOW-TEMPERATURE SOLUBILITY OF 42 AROMATIC AMINES IN AVIATION GASOLINE, Richard L. Kelley, November 1945

WR E 168 INVESTIGATION OF NAPHTHALENE AS A POSSIBLE AIRCRAFT FUEL, Dana W. Lee and Alois Krsek, Jr., August 1941

WR E 169 EFFECT IN FLIGHT OF THE PROPELLER CUFFS AND SPINNER ON PRESSURE RECOVERY IN FRONT OF A DOUBLE-ROW RADIAL AIRCRAFT ENGINE IN A TWIN-ENGINE AIRPLANE, Carl Ellisman, March 1944

WR E 170 LABORATORY INVESTIGATION OF ICING IN THE CARBURETOR AND SUPER-CHARGER INLET ELBOW OF AN AIRCRAFT ENGINE. I - DESCRIPTION OF SETUP AND TESTING TECHNIQUE, D. R. Mulholland, V. G. Rollin, and H. B. Galvin, December 1945

WR E 171 LABORATORY INVESTIGATION OF ICING IN THE CARBURETOR AND SUPER-CHARGER INLET ELBOW OF AN AIRCRAFT ENGINE. II - DETERMINATION OF THE LIMITING-ICING CONDITIONS, H. A. Essex, W. C. Keith, and D. R. Mulholland, December 1945

WR E 172 LABORATORY INVESTIGATION OF ICING IN THE CARBURETOR AND SUPER-CHARGER INLET ELBOW OF AN AIRCRAFT ENGINE. II - HEATED AIR AS A MEANS OF DE-ICING THE CARBURETOR AND SUPERCHARGER INLET ELBOW, Richard E. Lyons and Willard D. Coles, December 1945

WR E 173 LABORATORY INVESTIGATION OF ICING IN THE CARBURETOR AND SUPER-CHARGER INLET ELBOW OF AN AIRCRAFT ENGINE. IV - EFFECT OF THROTTLE DESIGN AND METHOD OF THROTTLE OPERATION ON INDUCTION-SYSTEM ICING CHARACTERISTICS, G. E. Chapman and E. D. Zlotowski, January 1946

WR E 174 LABORATORY INVESTIGATION OF ICING IN THE CARBURETOR AND SUPERCHARGER INLET ELBOW OF AN AIRCRAFT ENGINE. V - EFFECT OF INJECTION OF WATER FUEL MIXTURES AND WATER-ETHANOL - FUEL MIXTURES ON THE ICING CHARACTERISTICS, Clark E. Renner, December 1945

WR E 175 LABORATORY INVESTIGATION OF ICING IN THE CARBURETOR AND SUPERCHARGER INLET ELBOW OF AN AIRCRAFT ENGINE. VI - EFFECT OF MODIFICATIONS TO FUEL-SPRAY NOZZLE ON ICING CHARACTERISTICS, D. R. Mulholland and Gilbert E. Chapman, January 1946

WR E 176 INVESTIGATION OF ICE FORMATION ON THE INDUCTION SYSTEM OF AN AIRCRAFT ENGINE. I - GROUND TESTS, H. A. Essex, E. D. Zlotowski and Carl Ellisman, March 1946

WR E 177 INVESTIGATION OF ICE FORMATION IN THE INDUCTION SYSTEM OF AN AIRCRAFT ENGINE. II - FLIGHT TESTS, H. A. Essex, E. D. Zlotowski and Carl Ellisman, June 1946

WR E 178 THE EFFECT OF LIQUID AND ICE PARTICLES ON THE EROSION OF A SUPERCHARGER-INLET COVER AND DIFFUSER VANES, Vern G. Rollin, June 1946

WR E 179 RELATION BETWEEN FUEL ECONOMY AND CRANK ANGLE FOR THE MAXIMUM RATE OF PRESSURE RISE, Harvey A. Cook and Virginia L. Brightwell, May 1945

WR E 180 THE EFFECT OF SIX AROMATIC AMINES ON THE PRE-IGNITION-LIMITED PERFORMANCE OF 28-R AVIATION FUEL IN A CFR ENGINE, Donald W. Male, May 1945

WR E 181 PROCESS OF LEAD-DEPOSIT ACCUMULATIONS ON AIRCRAFT-ENGINE SPARK PLUGS, J. L. Sloop, George R. Kinney and William H. Rowe, December 1945

WR E 182 A LABORATORY-TESTED CONSTANT-LEVEL OIL SUMP TO PREVENT AERATION OF SCAVENGED OIL FROM AN AIRCRAFT ENGINE, I. Irving Pinkel and Howard D. Plumly, April 1944

WR E 183 THE EFFECT OF ETHYLENE DIBROMIDE ON THE KNOCK-LIMITED PERFORMANCE OF LEADED AND NONLEADED S REFERENCE FUEL, George R. Kinney and Richard O. Niemi, February 1946

WR E 184 REDUCTION OF FUEL-VAPOR LOSS BY OMITTING SOME OF THE FUEL CONSTITUENTS NORMALLY LOST DURING FLIGHT, Charles S. Stone and Walter E. Kramer, August 1945

WR E 185 ANALYSIS AND CORRELATION OF DATA OBTAINED BY SIX LABORATORIES ON FUEL VAPOR LOSS FROM FUEL TANKS DURING SIMULATED FLIGHT, Charles S. Stone, Sol Baker, and Gerald W. Englert, December 1944

WR E 186 FLIGHT VARIABLES AFFECTING FUEL-VAPOR LOSS FROM A FUEL TANK, Charles S. Stone, Sol Baker, and Dugald O. Black, December 1944

WR E 187 OPERATING STRESSES IN AIRCRAFT-ENGINE CRANKSHAFTS AND CONNECTING RODS. I - SLIP-RING AND BRUSH COMBINATIONS FOR DYNAMIC-STRAIN MEASUREMENTS, Francis J. Dutee, Franklin W. Phillips and H. Kemp, March 1945

WR E 188 THE INFLUENCE OF EXHAUST PRESSURE ON KNOCK-LIMITED PERFORMANCE, Harvey A. Cook, Louis F. Held and Ernest I. Pritchard, January 1945

WR E 189 THE EFFECT OF VALVE CLEARANCE ON KNOCK-LIMITED PERFORMANCE AND ENGINE COOLING, Harvey A. Cook, Paul H. Richard, and Kenneth O. Brown, April 1945

WR E 190 SMOKING CHARACTERISTICS OF VARIOUS FUELS AS DETERMINED BY OPEN-CUP AND LABORATORY-BURNER SMOKE TESTS, Earl R. Ebersole and Henry C. Barnett, June 1945

WR E 191 OPERATING STRESSES IN AIRCRAFT-ENGINE CRANKSHAFTS AND CONNECTING RODS. II - INSTRUMENTATION AND TESTS RESULTS, Francis J. Dutee, Franklin W. Phillips and Howard F. Calvert, August 1945

WR E 192 CHARACTERISTICS OF THE BMW 801D2 AUTOMATIC ENGINE CONTROL AS DETERMINED FROM BENCH TESTS, M. E. Scharer and A. N. Addie, April 1945

WR E 193 DETERMINATION OF AIR-CONSUMPTION PARAMETERS FOR TWO RADIAL AIRCRAFT ENGINES, Sidney J. Shames and William Howes, August 1945

WR E 194 HEAT-TRANSFER TESTS OF A STEEL CYLINDER BARREL WITH ALUMINUM FINS, Herman H. Elderbrock, Jr., August 1939

WR E 195 HEAT-TRANSFER TESTS OF TWO STEEL CYLINDER BARRELS WITH ALUMINUM FINS MANUFACTURED BY FACTORY PRODUCTION METHOD, Herman H. Elderbrock, Jr., August 1940

WR E 196 HEAT-TRANSFER TESTS OF A STEEL CYLINDER BARREL WITH ALUMINUM FINS WITH IMPROVED BONDING BETWEEN STEEL BARREL AND ALUMINUM BASE, Herman H. Elderbrock, Jr., July 1949

WR E 197 PERFORMANCE CHARACTERISTICS OF MIXED-FLOW IMPELLER AND VANED DIFFUSER WITH SEVERAL MODIFICATIONS, J. Austin King and Edward Glodeck, July 1942

WR E 198 EFFECT OF ENGINE-OPERATING VARIABLES AND INTERNAL COOLANTS ON SPARK ADVANCE REQUIREMENTS OF A LIQUID-COOLED CYLINDER, John F. Pfender, Carl Dudugjian, and A. F. Lietzke, May 1945

WR E 199 NITROUS OXIDE SUPERCHARGING OF AN AIRCRAFT-ENGINE CYLINDER, Max J. Tauschek, Lester C. Corrington and Merle C. Huppert, June 1945

WR E 200 CONTROL OF CYLINDER TEMPERATURES BY THERMOSTATICALLY OPERATED INTERNAL COOLANT VALVES, Arnold E. Biermann, Hugh M. Henneberry and George R. Miller, July 1945

WR E 202 ECONOMY OF INTERNALLY COOLING ONLY THE OVERHEATED CYLINDERS OF AIRCRAFT ENGINES, Arnold E. Biermann, George R. Miller, and Hugh M. Henneberry, July 1945

WR E 203 PERFORMANCE OF TWO-STAGE TURBOSUPERCHARGER USING MIXED-FLOW IMPELLERS, Oscar W. Schey and J. Austin King, October 1942

WR E 204 HEAT-TRANSFER TESTS OF A STEEL CYLINDER BARREL WITH ALUMINUM FINS OF OPTIMUM PROPORTIONS, Herman H. Elderbrock, Jr. and Alvin H. Mann, November 1940

WR E 205 AN INVESTIGATION OF COWL INLETS FOR THE B-29 POWER-PLANT INSTALLATION, Louis L. Monroe and Martin J. Saari, January 1946

WR E 206 AN INVESTIGATION OF COWL-FLAP AND COWL-OUTLET DESIGNS FOR THE B-29 POWER-PLANT INSTALLATION, DeMarquis D. Wyatt and E. William Conrad, January 1946

WR E 207 SUITABILITY OF ETHERS AS AVIATION FUEL COMPONENTS THE KNOCK-LIMITED PERFORMANCE OF SEVERAL ETHERS BLENDED WITH AN F-28 FUEL, Henry E. Alquist and Leonard K. Tower, January 1945

WR E 208 A RELATION BETWEEN KNOCK-LIMITED OR PRE-IGNITION-LIMITED AIR-FUEL RATIO AT LEAN MIXTURES AND FUEL-AIR RATIO AT RICH MIXTURES, John C. Evvard, November 1945

WR E 209 THE EFFECT OF TWO-INLET-DUCT DESIGNS ON TURBINE EFFICIENCY, Elmer E. Trautwein and David S. Gabriel, December 1945

WR E 210 A PRELIMINARY INVESTIGATION OF EXHAUST-GAS EJECTORS FOR GROUND COOLING, Eugene J. Manganiello, July 1942

WR E 211 KNOCK-LIMITED PERFORMANCE OF SEVERAL INTERNAL COOLANTS, Donald R. Bellman and John C. Evvard, February 1944

WR E 212 STUDY OF JET-PROPULSION SYSTEM COMPRISING BLOWER BURNER AND NOZZLE, Benjamin Pinkel and Eldon W. Hall, May 1944

WR E 213 THE KNOCK-LIMITED PERFORMANCE OF SEVERAL MISCELLANEOUS FUELS BLENDED WITH A BASE FUEL, Donald R. Bellman, July 1944

WR E 214 ENGINE AND INSPECTION TESTS OF METHYL tert-BUTYL ETHER AS A COMPONENT OF AVIATION FUEL, Henry C. Barnett, Carl L. Meyer, and Anthony W. Jones, August 1944

WR E 215 SUPERCHARGED-ENGINE KNOCK TESTS OF METHYL tert-BUTYL ETHER, Henry C. Barnett and James W. Slough, Jr., August 1944

WR E 216 EFFICIENCY TESTS OF A SINGLE-STAGE IMPULSE TURBINE HAVING AN 11.0-INCH PITCH-LINE DIAMETER WHEEL WITH AIR AS THE DRIVING FLUID, David S. Gabriel and L. Robert Carman, April 1945

WR E 217 A CORRELATION OF THE EFFECTS OF COMPRESSION RATIO AND INLET-AIR TEMPERATURE ON THE KNOCK LIMITS OF AVIATION FUELS IN A CFR ENGINE - I, John C. Evvard and J. Robert Branstetter, May 1945

WR E 218 THE EFFECT OF INLET PRESSURE AND TEMPERATURE ON THE EFFICIENCY OF A SINGLE-STAGE IMPULSE TURBINE HAVING AN 11.0-INCH PITCH-LINE DIAMETER WHEEL, David S. Gabriel and L. Robert Carman, June 1944

WR E 219 KNOCK-LIMITED POWER OUTPUTS FROM A CFR ENGINE USING INTERNAL COOLANTS. II - SIX ALIPHATIC AMINES, Donald R. Bellman, W. E. Moeckel and John C. Evvard, October 1945

WR E 220 LEAD SUSCEPTIBILITY OF SEVERAL FUELS AS DETERMINED IN AN AIR-COOLED AIRCRAFT-ENGINE CYLINDER, Edward G. Stickler, Jerrold D. Wear, and Reece V. Hensley, February 1946

WR E 221 EFFECTS OF FUEL-VAPOR LOSS ON KNOCK-LIMITED PERFORMANCE AND INSPECTION PROPERTIES OF AVIATION FUELS, Henry C. Barnett and Edred T. Marsh, March 1946

WR E 222 THE KNOCK-LIMITED PERFORMANCE OF FUEL BLENDS CONTAINING SPIRO-PENTANE, METHYLENECYCLOBUTANE, DE-tert BUTYL ETHER, METHYL tert-BUTYL ETHER, AND TRIPTANE, Carl L. Meyer, May 1946

WR E 223 LEAD SUSCEPTIBILITY OF PARAFFINS, CYCLOPARAFFINS, AND OLEFINS, Henry C. Barnett, May 1943

WR E 225 KNOCK-LIMITED PERFORMANCE OF PURE HYDROCARBONS BLENDED WITH A BASE FUEL IN A FULL-SCALE AIRCRAFT-ENGINE CYLINDER. II - TWELVE AROMATICS, Arthur W. Bull and Anthony W. Jones, September 1944

WR E 226 THE EFFECT OF ENGINE CONDITIONS ON THE LEAD SUSCEPTIBILITY OF PARAFFINIC FUELS, Henry C. Barnett and Harry S. Imming, October 1944

WR E 227 THE KNOCK-LIMITED PERFORMANCE OF FUEL BLENDS CONTAINING AROMATICS. I - TOLUENE, ETHYLBENZENE, AND p-SYLENE, Carl L. Meyer and J. Robert Branstetter, October 1944

WR E 228 KNOCK-LIMITED POWER OUTPUTS FROM A CFR ENGINE USING INTERNAL COOLANTS. I - MONOMETHYLAMINE AND DIMETHYLAMINE, Donald R. Bellman, W. E. Moeckel, and John C. Evvard, December 1944

WR E 229 THE KNOCK-LIMITED PERFORMANCE OF FUEL BLENDS CONTAINING AROMATICS. II - ISOPROPYLBENZENE, BENZENE, AND o-XYLENE, J. Robert Branstetter and Carl L. Meyer, January 1945

WR E 230 THE KNOCK-LIMITED PERFORMANCE OF FUEL BLENDS CONTAINING AROMATICS. III - 1, 3, 5-TRIMETHYLBENZENE, tert-BUTYLBENZENE AND 1, 2, 4-TRIMETHYLBENZENE, Carl L. Meyer and J. Robert Branstetter, April 1945

WR E 231 THE KNOCK-LIMITED PERFORMANCE OF FUEL BLENDS CONTAINING AROMATICS. IV - DATA FOR m-DIETHYLBENZENE, 1-ETHYL-4-METHYLBENZENE SUMMARIZATION OF DATA FOR 12 AROMATIC HYDROCARBONS, Carl L. Meyer and J. Robert Branstetter, April 1945

WR E 232 THE EFFECT OF INLET TEMPERATURE AND PRESSURE ON THE EFFICIENCY OF A SINGLE-STAGE IMPULSE TURBINE HAVING A 13.2-INCH PITCH-LINE DIAMETER WHEEL, Ernest R. Chanes and L. Robert Garman, September 1945

WR E 233 THE PERFORMANCE OF A SINGLE-STAGE IMPULSE TURBINE HAVING AN 11.0-INCH PITCH-LINE DIAMETER WHEEL WITH CAST AIRFOIL-SHAPED AND BENT SHEET METAL NOZZLE BLADES, David S. Gabriel and L. Robert Garman, September 1945

WR E 234 CALCULATIONS OF THE PERFORMANCE OF A COMPRESSION-IGNITION ENGINE-COMPRESSOR TURBINE COMBINATION. I - PERFORMANCE OF A HIGHLY SUPERCHARGED COMPRESSION-IGNITION ENGINE, J. C. Sanders and Alexander Mendelson, December 1945

WR E 235 KNOCK-LIMITED PERFORMANCE OF PURE HYDROCARBONS BLENDED WITH A BASE FUEL IN A FULL-SCALE AIRCRAFT-ENGINE CYLINDER. III - FOUR AROMATICS, SIX ETHERS, Anthony W. Jones, Arthur W. Bull, and Edmund R. Jonash, March 1946

WR E 236 KNOCK-LIMITED PERFORMANCE TESTS OF 2,2,3,4-TETREMETHYLPENTANE, 2,3,3,4-TETRAMETHYLPENTANE 3,4,4-TRIMENTHYL-2-PENTENE, AND 2,3,4-TRIMETHYL-2-PENTENE IN SMALL-SCALE AND FULL-SCALE CYLINDERS, Edmund R. Jonash, Carl L. Meyer, and J. Robert Branstetter, March 1946

WR E 237 THE KNOCK-LIMITED PERFORMANCE OF FUEL BLENDS CONTAINING AROMATICS V - n-PROPYLBENZENE, n-BUTYLBENZENE, ISOBUTYLBENZENE m-XYLENE, AND 1-ISOPROPYL-4-METHYLBENZENE, Carl L. Meyer and J. Robert Barnstetter, March 1946

WR E 238 RELATION BETWEEN SPARK-IGNITION ENGINE KNOCK, DETONATION WAVES, AND AUTO-IGNITION AS SHOWN BY HIGH-SPEED PHOTOGRAPHY, Cearcy D. Miller, April 1946

WR E 239 ANALYSIS OF SPARK-IGNITION ENGINE KNOCK AS SEEN IN PHOTOGRAPHS TAKEN AT 200,000 FRAMES A SECOND, Cearcy D. Miller, H. Lowell Olsen, Walter O. Logan, Jr. and Gordon E. Osterstrom, May 1946

WR E 240 A CORRELATION OF THE EFFECTS OF COMPRESSION RATIO AND INLET-AIR TEMPERATURE ON THE KNOCK LIMITS OF AVIATION FUELS IN A CFR ENGINE. II, Henry E. Alquist, Leon O'Dell and John C. Evvard, June 1946

WR E 241 PERFORMANCE CHARTS FOR A TURBOJET SYSTEM, Benjamin Pinkel and Irving M. Karp, June 1946

WR E 242 KNOCK-LIMITED BLENDING CHARACTERISTICS OF BLENDS OF TRIPTANE AND 28-R AVIATION FUEL, John C. Evvard, Harry S. Imming, and Russell S. Genco, April 1944

WR E 243 A PRELIMINARY EVALUATION OF THE EXPLOSION JET-PROPULSION ENGINE, J. C. Sanders, August 1944

WR E 244 EFFECT OF WATER INJECTION ON KNOCK-LIMITED PERFORMANCE OF A V-TYPE 12-CYLINDER LIQUID-COOLED ENGINE, Myron L. Harries, R. Lee Nelson, and Howard E. Berguson, September 1944

WR E 245 F-3 AND F-4 ENGINE TESTS OF SEVERAL HIGH-ANTIKNOCK COMPONENTS OF AVIATION FUEL, Henry E. Alquist and Leonard K. Tower, October 1944

WR E 246 F-3 AND F-4 ENGINE TESTS OF SEVERAL HIGH ANTIKNOCK COMPONENTS OF AVIATION FUEL, Harry S. Imming and Henry C. Barrett and Russell S. Genco, November 1944

WR E 247 FLIGHT AND TEST-STAND INVESTIGATION OF HIGH-PERFORMANCE FUELS IN DOUBLE-ROW RADIAL AIR-COOLED ENGINES. I - DETERMINATION OF COOLING CHARACTERISTICS OF FLIGHT ENGINE, C. C. Blackman, H. J. White, and P. C. Pragliola, December 1944

WR E 248 FLIGHT AND TEST-STAND INVESTIGATIONS OF HIGH-PERFORMANCE FUELS IN DOUBLE-ROW RADIAL AIR-COOLED ENGINES. II - FLIGHT KNOCK DATA AND COMPARISON OF FUEL KNOCK LIMITS WITH ENGINE COOLING LIMITS IN FLIGHT, H. Jack White, Calvin C. Blackman and Milton Werner, December 1944

WR E 249 THE EFFECT OF COMPRESSION RATIO ON KNOCK LIMITS OF HIGH-PERFORMANCE FUELS IN A CFR ENGINE. II - BLENDS OF 2,2,3,-TRIMETHYLPENTANE WITH 28-R, Henry E. Alquist and Leonard K. Tower, January 1945

WR E 250 ESTIMATION OF F-3 AND F-4 KNOCK-LIMITED PERFORMANCE RATINGS FOR TERNARY AND QUATERNARY BLENDS CONTAINING TRIPTANE OR OTHER HIGH-ANTIKNOCK AVIATION-FUEL BLENDING AGENTS, Henry C. Barnett, January 1945

WR E 251 KNOCK-LIMITED BLENDING CHARACTERISTICS OF BENZENE, TOLUENE, MIXED XYLENES, AND CUMENE IN AN AIR-COOLED CYLINDER, Reece V. Hensley and Roland Breitwieser, February 1945

WR E 252 THE EFFECT OF COMPRESSION RATIO ON KNOCK LIMITS OF HIGH-PERFORMANCE FUELS IN A CFR ENGINE. III - BLENDS OF 2,3-DIMETHYLPENTANE WITH 28-R, Henry E. Alquist and Leonard K. Tower, February 1945

WR E 253 FLIGHT AND TEST-STAND INVESTIGATION OF HIGH-PERFORMANCE FUELS IN DOUBLE-ROW RADIAL AIR-COOLED ENGINES. III - COMPARISON OF COOLING CHARACTERISTICS OF FLIGHT AND TEST-STAND ENGINES, H. J. White, C. C. Blackman and Marcel Dandois, February 1945

WR E 254 COOLING OF A DOUBLE-ROW RADIAL ENGINE BY WATER INJECTION TO THE INDIVIDUAL CYLINDERS, Louis L. Monroe and Harold E. Friedman, February 1945

WR E 255 THE EFFECT OF MODIFIED BAFFLES AND AUXILIARY-COOLING DUCTS ON THE COOLING OF A DOUBLE-ROW RADIAL ENGINE. S. L. Gendler, R. M. Geisenheyner, C. C. Blackman and Marcel Dandois, March 1945

WR E 256 EFFECT OF NACA INJECTION IMPELLER AND DUCTED HEAT BAFFLES ON FLIGHT COOLING PERFORMANCE OF DOUBLE-ROW RADIAL ENGINE IN FOUR-ENGINE HEAVY BOMBER, Frank E. Marble, Mahlon A. Miller and Joseph R. Vensel, April 1945

WR E 257 EFFECT OF FUEL VOLATILITY AND MIXTURE TEMPERATURE ON THE KNOCKING CHARACTERISTICS OF A LIQUID-COOLED SINGLE-CYLINDER TEST ENGINE, Max J. Tauschek and A. F. Lietzke, April 1945

WR E 258 TESTS OF AIR VALVES FOR INTERMITTENT-JET ENGINES AT SPEEDS OF 20 AND 25 CYCLES PER SECOND, Joseph R. Bressman and Robert J. McCready, May 1945

WR E 259 COMPARISON OF THE KNOCK-LIMITED PERFORMANCE OF TRIPTANE WITH 23 OTHER PURIFIED HYDROCARBONS, J. Robert Branstetter, May 1945

WR E 260 EFFECT OF INTERNAL COOLANTS ON THE KNOCK-LIMITED PERFORMANCE OF A LIQUID-COOLED MULTICYLINDER AIRCRAFT ENGINE WITH A COMPRESSION RATIO OF 6.0, R. Lee Nelson, Myron L. Harries, and Rinaldo J. Brun, June 1945

WR E 261 FLIGHT AND TEST-STAND INVESTIGATION OF HIGH-PERFORMANCE FUELS IN MODIFIED DOUBLE-ROW RADIAL AIR-COOLED ENGINES. I - DETERMINATION OF THE COOLING CHARACTERISTICS OF THE FLIGHT ENGINE, Milton Werner, Calvin C. Blackman and H. Jack White, July 1945

WR E 262 FLIGHT AND TEST-STAND INVESTIGATION OF HIGH-PERFORMANCE FUELS IN MODIFIED DOUBLE-ROW RADIAL AIR-COOLED ENGINES. II - FLIGHT KNOCK DATA AND COMPARISON OF FUEL KNOCK LIMITS WITH ENGINE COOLING LIMITS IN FLIGHT, H. Jack White, Phillip C. Pragliola, and Calvin C. Blackman, August 1945

WR E 263 FLIGHT AND TEST-STAND INVESTIGATION OF HIGH-PERFORMANCE FUELS IN MODIFIED DOUBLE-ROW RADIAL AIR-COOLED ENGINES. III - KNOCK-LIMITED PERFORMANCE OF 33-R AS COMPARED WITH A TRIPTANE BLEND AND 28-R, Calvin C. Blackman and H. Jack White, August 1945

WR E 264 EFFECT OF WATER-ALCOHOL INJECTION AND MAXIMUM-ECONOMY SPARK ADVANCE ON KNOCK-LIMITED PERFORMANCE AND FUEL ECONOMY OF A LARGE AIR-COOLED CYLINDER, Jack E. Vandeman and Orville H. Heinicke, August 1945

WR E 265 TESTS OF AN ADJUSTABLE-AREA EXHAUST NOZZLE FOR JET-PROPULSION ENGINES, E. C. Wilcox, August 1945

WR E 266 AIR-FLOW AND PERFORMANCE CHARACTERISTICS OF THE ENGINE-STAGE SUPERCHARGER OF A DOUBLE-ROW RADIAL AIRCRAFT ENGINE. I - EFFECT OF OPERATING VARIABLES, Edmund J. Baas, William R. Monroe, and John M. Mesrobian, August 1945

WR E 267 THE EFFECT OF HIGH-RESISTANCE IGNITION CABLE ON THE EROSION OF SPARK-PLUG ELECTRODES, Clyde C. Swett, Jr., and Franklin A. Rodgers, September 1945

WR E 268 EFFECT OF MAXIMUM CRUISE-POWER OPERATION AT ULTRA-LEAN MIXTURE AND INCREASED SPARK ADVANCE ON THE MECHANICAL CONDITION OF CYLINDER COMPONENTS, Herbert B. Harris, Robert T. Duffy and Robert D. Erwin, Jr., September 1945

WR E 269 SEA-LEVEL PERFORMANCE TESTS OF A 22-INCH-DIAMETER PULSE-JET ENGINE AT VARIOUS SIMULATED RAM PRESSURES, Eugene J. Manganiello, Michael F. Valerino, and Robert H. Essig, October 1945

WR E 270 ENDURANCE TESTS OF A 22-INCH-DIAMETER PULSE-JET ENGINE WITH A NEOPRENE-COATED VALVE GRID, Eugene J. Manganiello, Michael F. Valerino, and John H. Breisch, October 1945

WR E 271 CORRELATION OF THE CHARACTERISTICS OF SINGLE-CYLINDER AND FLIGHT ENGINES IN TESTS OF HIGH-PERFORMANCE FUELS IN AN AIR-COOLED ENGINE. I - COOLING CHARACTERISTICS,, Robert W. Wilson, Paul H. Richard, and Kenneth D. Brown, October 1945

WR E 272 CORRELATION OF THE CHARACTERISTICS OF SINGLE-CYLINDER AND FLIGHT ENGINES IN TESTS OF HIGH-PERFORMANCE FUELS IN AN AIR-COOLED ENGINE. II - KNOCK-LIMITED CHARGE-AIR FLOW AND CYLINDER TEMPERATURES, Kenneth D. Brown, Paul H. Richard, and Robert W. Wilson, October 1945

WR E 273 CORRELATION OF MIXTURE TEMPERATURE DATA OBTAINED FROM BARE INTAKE-MANIFOLD THERMOCOUPLES, H. Jack White and Goldie L. Gammon, January 1946

WR E 274 ALTITUDE-WIND-TUNNEL TESTS OF POWER-PLANT INSTALLATION IN JET-PROPELLED FIGHTER, G. Merritt Preston, Fred O. Black, Jr. and James M. Jagger, February 1946

WR E 275 ANALYSIS OF COOLING LIMITATIONS AND EFFECT OF ENGINE-COOLING IMPROVEMENTS ON LEVEL-FLIGHT CRUISING PERFORMANCE OF A FOUR-ENGINE HEAVY BOMBER, Frank E. Marble, Mahlon A. Miller and E. Barton Bell, March 1946

WR E 276 AN EVALUATION OF THE KNOCK-LIMITED PERFORMANCE OF TRIPTANE, Henry C. Barnett, March 1946

WR E 277 TESTS OF CAST ALUMINUM-ALLOY MIXED-FLOW IMPELLERS, John E. Douglas and Irving B. Schwartz, April 1946

WR E 278 HYDRAULIC CHARACTERISTICS OF THE NACA INJECTION IMPELLER, William K. Ritter, Irving A. Johnson and Seymour Lieblein, May 1946

WR E 279 EFFECT OF A LOW-LOSS AIR VALVE ON PERFORMANCE OF A 22-INCH-DIAMETER PULSE-JET ENGINE, Joseph R. Bressman, June 1946

WR E 281 EFFICIENCY OF A RADIAL-FLOW EXHAUST-GAS TURBOSUPERCHARGER TURBINE WITH A 12.75-INCH TIP DIAMETER, Earl C. Coulter, Robert G. Larkin, and David S. Gabriel, July 1946

WR E 282 CHARGE-AIR DISTRIBUTION AMONG THE CYLINDERS OF A DOUBLE-ROW RADIAL AIRCRAFT ENGINE, Donald C. Guentert and John G. Ferkan, July 1946

WR E 283 THE EFFECT OF INCREASE IN COMBUSTION-AIR INLET TEMPERATURE FROM 80° TO 130°F ON THE SEA-LEVEL PERFORMANCE OF A 22-INCH-DIAMETER PULSE-JET ENGINE, Michael F. Valerino, Robert H. Essig and Richard F. Hughes, July 1946

WR E 284 A PRELIMINARY INVESTIGATION OF THE ICING CHARACTERISTICS OF A LARGE RECTANGULAR-THROAT PRESSURE-TYPE CARBURETOR, Gilbert E. Chapman, July 1946

WR E 285 AIR-FLOW AND PERFORMANCE CHARACTERISTICS OF ENGINE-STAGE SUPERCHARGER OF A DOUBLE-ROW RADIAL AIRCRAFT ENGINE. II - EFFECT OF DESIGN VARIABLES, Edmund J. Baas and Paul D. Dugan, August 1946

WR L 3 A METHOD OF DETERMINING OIL COOLER PERFORMANCE REQUIREMENTS IN SERIES OPERATIONS, H. Boyet, September 1945

WR L 6 SIMPLE CURVES FOR DETERMINING THE EFFECTS OF COMPRESSIBILITY ON PRESSURE DROP THROUGH RADIATORS, John V. Becker and Donald D. Baals, September 1944

WR L 21 HEAT CAPACITY LAG IN TURBINE WORKING FLUIDS, Arthur Kantrowitz and Paul W. Huber, May 1944

WR L 81 A SOLUTION OF THE DIRECT AND INVERSE POTENTIAL PROBLEMS FOR ARBITRARY CASCADES OF AIRFOILS, Aircraft Engine Research Laboratory, April 1942

WR L 88 DETERMINATION FROM FLIGHT TESTS OF THRUST COEFFICIENTS FOR 10 FULL-SCALE AIRPLANES IN THE GLIDING CONDITION WITH ENGINE IDLING, Donald B. Talmage, June 1945

WR L 130 APPLICATION OF THE METHOD OF LEAST SQUARES TO ENGINE-COOLING ANALYSIS, Blake W. Corson, Jr., August 1944

WR L 137 THE EFFECT OF COOLING AIR BLOWERS ON THRUST POWER, Carl B. Palmer and Maurice J. Brevoort, July 1944

WR L 166 WIND TUNNEL INVESTIGATION OF CARBURETOR AIR INLETS, W. J. Nelson and K. R. Czarnecki, February 1942

WR L 200 A PROPOSED METHOD OF MEASURING ENGINE CHARGE AIR FLOW IN FLIGHT, Robert R. Gilruth, August 1944

WR L 232 AN EXPERIMENTAL INVESTIGATION OF FLOW ACROSS TUBE BANKS, M. J. Bervoort and A. N. Tifford, March 1942

WR L 278 PERFORAMNCE OF COMPRESSOR-TURBINE JET-PROPULSION SYSTEMS, Carl B. Palmer, June 1945

WR L 298 USE OF STAGNATION TEMPERATURE IN CALCULATING RATE OF HEAT TRANSFER IN AIRCRAFT HEAT EXCHANGERS, George P. Wood, October 1943

WR L 303 TEST OF A DUAL-ROTATION AXIAL-FLOW FAN, E. Barton Bell and Lucas J. DeKoster, December 1942

WR L 304 THE EFFECT OF SOLIDITY, BLADE SECTION, AND CONTRAVANCE ANGLE ON THE CHARACTERISTICS OF AN AXIAL-FLOW FAN, E. Barton Bell and Lucas J. DeKoster, December 1942

WR L 338 THE ADVANTAGES OF UNIFORM FUEL DISTRIBUTION FOR AIR-COOLED ENGINES FROM CONSIDERATIONS OF COOLING REQUIREMENTS AND FUEL ECONOMY, K. F. Rubert, Blake W. Corson, Jr. and Jack Nelson, December 1943

WR L 342 PRESSURE-DROP CHARACTERISTICS OF ORIFICE PLATES USED TO SIMULATE RADIATORS, K. R. Czarnecki, March 1942

WR L 356 FLIGHT INVESTIGATION OF THE PERFORMANCE AND COOLING CHARACTERISTICS OF A LONG-NOSE HIGH-INLET-VELOCITY COWLING ON THE XP-42 AIRPLANE, F. J. Bailey, Jr., J. F. Johnston and T. J. Voglewede, April 1942

WR L 360 GRAPHICAL REPRESENTATION OF INTERCOOLER PARAMETERS AND PERFORMANCE AT ALTITUDES FROM 25,000 TO 60,000 FEET, D. E. Brimley, November 1942

WR L 386 THE EFFECT OF ALTITUDE ON COOLING, Maurice J. Brevoort, Upshur T. Joyner, and George P. Wood, March 1943

WR L 427 GENERALIZED EQUATIONS FOR SELECTION CHARTS FOR HEAT EXCHANGERS IN AIRCRAFT, Arthur N. Tifford and George P. Wood, April 1942

WR L 455 TESTS OF PROPELLER-SPEED COOLING BLOWERS, Abe Silverstein, July 1942

WR L 478 GROUND-COOLING AND FLIGHT TESTS OF AN AIRPLANE EQUIPPED WITH A NOSE-BLOWER ENGINE COWLING, David Biermann and L. I. Turner, Jr., October 1939

WR L 486 HIGH-SPEED TESTS OF A DUCTED BODY WITH VARIOUS AIR-OUTLET OPENINGS, John V. Becker and Donald D. Baals, May 1942

WR L 491 A METHOD FOR THE DESIGN OF COOLING SYSTEMS FOR AIRCRAFT POWER-PLANT INSTALLATIONS, Kennedy F. Rubert and George S. Knopf, March 1942

WR L 497 THE EFFECT OF SPINNER-BODY GAP ON THE PRESSURES AVAILABLE FOR COOLING IN THE NACA E-TYPE COWLING, John V. Becker and Axel T. Mattson, March 1943

WR L 508 FLIGHT INVESTIGATION OF NACA D_s COWLINGS ON THE XP-42 AIRPLANE III - LOW-INLET-VELOCITY COWLING WITHOUT FAN OR PROPELLER CUFFS, WITH AXIAL-FLOW FAN ALONE, AND WITH TWO DIFFERENT SETS OF PROPELLER CUFFS, J. Ford Johnston and T. J. Voglewede, January 1943

WR L 528 NACA INVESTIGATION OF A JET-PROPULSION SYSTEM APPLICABLE TO FLIGHT, Airflow Research Staff, September 1942

WR L 535 ANALYSIS OF HEAT AND COMPRESSIBILITY EFFECTS IN INTERNAL FLOW SYSTEMS AND HIGH-SPEED TESTS OF A RAM-JET SYSTEM, John V. Becker and Donald D. Baals, July 1942

WR L 561 AN INVESTIGATION OF THE RANGER V-770-8 ENGINE INSTALLATION FOR THE EDO XOSE-1 AIRPLANE. I - COOLING, Robert N. Conway and M. Arnold Emmons, Jr., October 1945

WR L 562 AN INVESTIGATION OF THE RANGER V-770-8 ENGINE INSTALLATION FOR THE EDO XOSE-1 AIRPLANE. II - AERODYNAMICS, Mark R. Nichols and John S. Dennard, October 1945

WR L 570 COOLING IN CRUISING FLIGHT WITH LOW FUEL-AIR RATIOS, Abe Silverstein and Herbert A. Wilson, Jr., June 1942

WR L 592 AN ESTIMATE OF THE EFFECT OF ENGINE SUPERCHARGING ON THE TAKE-OFF THRUST OF A TYPICAL HELICOPTER AT DIFFERENT ALTITUDES AND TEMPERATURES, F. J. Bailey, Jr. and T. J. Voglewede, November 1941

WR L 612 FLIGHT INVESTIGATION OF THE PERFORMANCE AND COOLING CHARACTERISTICS OF AN NACA C COWLING ON THE XP-42 AIRPLANE, J. Ford Johnston and Stefan A. Cavallo, November 1942

WR L 632 COWLING AND COOLING TESTS OF A FLEETWINGS MODEL 33 AIRPLANE IN FLIGHT, Herman H. Ellerbrock, Jr. and Herbert A. Wilson, Jr., May 1944

WR L 635 BLADE DESIGN DATA FOR AXIAL-FLOW FANS AND COMPRESSORS, Seymour M. Bogdonoff and Harriet E. Bogdonoff, July 1945

WR L 640 INVESTIGATION OF METHODS OF REDUCING THE TEMPERATURE VARIATION AMONG CYLINDERS ON AIR-COOLED AIRCRAFT ENGINES, George F. Kinghorn and William A. Mueller, July 1943

WR L 655 GENERALIZED SELECTION CHARTS FOR BOMBERS POWERED BY ONE, TWO, FOUR, AND SIX 2000-HORSEPOWER ENGINES, M. J. Brevoort, G. W. Stickle and Paul R. Hill, July 1942

WR L 658 GENERALIZED SELECTION CHARTS FOR BOMBERS POWERED BY ONE, TWO, FOUR, AND SIX 2000-HORSEPOWER ENGINES. I - CAPACITY AND ECONOMY, M. J. Brevoort, G. W. Stickle and P. R. Hill, September 1942

WR L 669 GENERALIZED SELECTION CHARTS FOR BOMBERS WITH FOUR 2000-HORSE-POWER ENGINES, M. J. Brevoort, G. W. Stickle, and P. R. Hill, May 1942

WR L 670 GENERALIZED SELECTION CHARTS FOR BOMBERS POWERED BY TWO, FOUR, AND SIX 3000-HORSEPOWER ENGINES, M. J. Brevoort, G. W. Stickle, and Paul R. Hill, August 1942

WR L 680 FLIGHT TESTS OF NACA JET-PROPULSION EXHAUST STACKS ON THE SUPER-MARINE APITFIRE AIRPLANE, L. Richard Turner and Maurice D. White, December 1942

WR L 686 THE REDUCTION OF NONUSEFUL PRESSURE LOSSES ON AIR-COOLED ENGINE CYLINDERS BY MEANS OF IMPROVED FINNING AND BAFFLING, M. J. Brevoort, U. T. Joyner and George P. Wood, February 1943

WR L 689 COOLING INVESTIGATION OF A B-24D ENGINE-NACELLE INSTALLATION IN THE NACA FULL-SCALE TUNNEL, R. R. Lehr, G. F. Kinghorn and E. R. Guryansky, November 1942

WR L 705 A STUDY OF THE EFFECT OF AFTER-COOLING ON THE POWER AND THE WEIGHT OF A 2000- HORSEPOWER AIR-COOLED ENGINE INSTALLATION, George P. Wood and D. E. Brimley, September 1944

WR L 713 PRELIMINARY INVESTIGATION OF SUPERSONIC DIFFUSERS, A. Kantrowitz and C. duP. Donaldson, May 1945

WR L 714 AN ANALYSIS OF JET-PROPULSION SYSTEMS MAKING DIRECT USE OF THE WORKING SUBSTANCE OF A THERMODYNAMIC CYCLE, Kenneth F. Rubert, February 1945

WR L 727 DEVELOPMENT OF WING INLETS, S. F. Racisz, March 1946

WR L 728 INTERNAL AND EXTERNAL AERODYNAMICS OF DUCTED BODIES AT SUPERSONIC SPEEDS, C. E. Brown, April 1946

WR L 729 THE DEVELOPMENT AND APPLICATION OF HIGH-CRITICAL-SPEED NOSE INLETS, D. D. Baals, N. F. Smith and J. B. Wright, July 1945

WR L 732 HIGH-SPEED INVESTIGATION OF LOW-DRAG WING INLETS, N. F. Smith, September 1944

WR L 733 WIND-TUNNEL INVESTIGATION OF A HIGH-CRITICAL-SPEED FUSELAGE SCOOP INCLUDING THE EFFECTS OF BOUNDARY LAYER, N. F. Smith and D. D. Baals, February 1945

WR L 740 FLIGHT INVESTIGATION OF FACTORS AFFECTING THE CARBURETOR RAM AND NACELLE DRAG ON AN A-26B AIRPLANE, J. Ford Johnson, Bernard B. Klawans and Edward C. B. Danforth, III, July 1946

WR L 749 STATIC-THRUST INVESTIGATION OF FULL-SCALE PV-2 HELICOPTER ROTORS HAVING NACA 0012.6 AND 23012.6 AIRFOIL SECTIONS, S. Lipson, May 1946

WR L 754 GROUND-STAND COOLING INVESTIGATION OF AN R-2600-22 ENGINE IN A PBM-3D NACELLE, Robert C. Spencer, F. William Petring and William R. Prince, January 1946

WR L 755 PARAMETERS DETERMINING PERFORMANCE OF SUPERSONIC PILOTLESS AIRPLANES POWERED BY RAM-COMPRESSION POWER PLANTS, Paul R. Hill, June 1946

WR L 765 CASCADE INVESTIGATION OF BUCKETS FOR A MODERN AIRCRAFT TURBO-SUPERCHARGER, Arthur Kantrowitz and John R. Erwin, November 1944

WR L 767 IMPROVED BAFFLE DESIGNS FOR AIR-COOLED ENGINE CYLINDERS, Abe Silverstein and George F. Kinghorn, August 1943

WR L 768 EFFECT OF INLET-AIR VELOCITY DISTRIBUTION ON THE METERING PRESSURE OF AN INJECTION-TYPE AIRCRAFT CARBURETOR, George F. Kinghorn, May 1942

WR L 776 HIGH-ALTITUDE COOLING. VI - AXIAL-FLOW FANS AND COOLING POWER, William Mutterperl, September 1944

WR L 782 A METHOD FOR CORRELATING THE COOLING DATA OF LIQUID-COOLED ENGINES AND ITS APPLICATION TO THE ALLISON V-3420-11 ENGINE, George F. Kinghorn, Albert H. Schroeder, and William K. Hagginbothom, Jr., May 1945

WR W 7 A METHOD FOR CALCULATING HEAT TRANSFER IN THE LAMINAR FLOW REGION OF BODIES, H. Julian Allen and Bonne C. Look, December 1942

WR W 9 AN INVESTIGATION OF AIRCRAFT HEATERS. II - PROPERTIES OF GASES, Myron Tribus and L. M. K. Boelter, October 1942

WR W 10 AN INVESTIGATION OF AIRCRAFT HEATERS. VI - HEAT TRANSFER EQUATIONS FOR THE SINGLE PASS LONGITUDINAL EXCHANGER, R. C. Martinelli, E. H. Morrin and L. M. K. Boelter, December 1942

WR W 11 AN INVESTIGATION OF AIRCRAFT HEATERS. IV - MEASURED AND PREDICTED PERFORMANCE OF LONGITUDINALLY FINNED TUBES, R. C. Martinelli, E. H. Morrin and L. M. K. Boelter, December 1942

WR W 12 AN INVESTIGATION OF AIRCRAFT HEATERS. IV - MEASURED AND PREDICTED PERFORMANCE OF LONGITUDINALLY FINNED TUBES, R. C. Martinelli, E. B. Weinberg, E. H. Morrin and L. M. K. Boelter, October 1942

WR W 13 AN INVESTIGATION OF AIRCRAFT HEATERS. VII - THERMAL RADIATION FROM ATHERMANOUS EXHAUST GASES, R. C. Martinelli, E. H. Morrin and L. M. K. Boelter, December 1942

WR W 14 AN INVESTIGATION OF AIRCRAFT HEATERS. VIII - A SIMPLIFIED METHOD FOR THE CALCULATION OF THE UNIT THERMAL CONDUCTANCE OVER WINGS, R. C. Martinelli, A. G. Guibert, E. H. Morrin and L. M. K. Boelter, March 1943

WR W 15 AN INVESTIGATION OF AIRCRAFT HEATERS. XI - MEASURED AND PREDICTED PERFORMANCE OF A SLOTTED-FIN EXHAUST GAS AND AIR HEAT EXCHANGER, L. M. K. Boelter, M. A. Miller, W. H. Sharp, and E. H. Morrin, April 1943

WR W 19 AN INVESTIGATION OF AIRCRAFT HEATERS. XV - THE EMISSIVITY OF SEVERAL MATERIALS, L. M. K. Boelter, R. Bromberg and J. T. Gier, January 1944

WR W 22 AN INVESTIGATION OF AIRCRAFT HEATERS. XVI - DETERMINATION OF THE VISCOSITY OF EXHAUST GASES FROM A GASOLINE ENGINE, L. M. K. Boelter and W. H. Sharp, June 1944

WR W 23 AN INVESTIGATION OF AIRCRAFT HEATERS. I - ELEMENTARY HEAT TRANSFER CONSIDERATIONS IN AN AIRPLANE, R. C. Martinelli, M. Tribus and L. M. K. Boelter, October 1942

WR W 24 AN INVESTIGATION OF AIRCRAFT HEATERS. XVII - EXPERIMENTAL INQUIRY INTO STEADY STATE UNIDIRECTIONAL HEAT-METER CORRECTIONS, L. M. K. Boelter, H. F. Poppendiek and J. T. Gier, August 1944

WR W 30 AN INVESTIGATION OF AIRCRAFT HEATERS. XXIV - THE HEAT METER IN THE TRANSIENT STATE FOR UNIDIRECTIONAL HEAT TRANSFER, L. M. K. Boelter, H. F. Poppendiek, R. V. Dunkle and J. T. Gier, September 1944

WR W 32 THE SIGNIFICANCE OF THE TIME CONCEPT IN ENGINE DETONATION, W. A. Leary and E. S. Taylor, January 1943

WR W 37 A METHOD FOR STUDYING PISTON FRICTION, J. E. Forbes and F. S. Taylor, March 1943

WR W 43 TESTS OF EXHAUST PROPULSION NOZZLES, Paul J. Campbell, May 1943

WR W 44 MEASUREMENTS OF FRICTION COEFFICIENTS IN A PIPE FOR SUBSONIC AND SUPERSONIC FLOW OF AIR, Joseph H. Keenan and Ernest P. Neumann, July 1943

WR W 47 A STUDY OF PISTON AND RING FRICTION, W. A. Leary and J. U. Jovellanos, November 1944

WR W 50 EFFECT OF CHANGING THE STROKE ON AIR CAPACITY, POWER OUTPUT, AND DETONATION OF A SINGLE-CYLINDER ENGINE, James C. Livengood and James V. D. Eppes, February 1945

WR W 52 FOAMING OF AIRCRAFT-ENGINE OILS AS A PROBLEM IN COLLOID CHEMISTRY - I, J. W. McBain, S. Ross, A. P. Brady, J. V. Robinson, I. M. Abrams, R. C. Thorburn and C. G. Lindquist, September 1944

WR W 54 PERFORMANCE CHARACTERISTICS OF JOURNAL BEARINGS WITH FORCED-FEED LUBRICATION, S. A. McKee, H. S. White, A. D. Bell and J. F. Swindells, August 1944

WR W 77 THE PREPARATION OF 2,2,3,4-TETRAMETHYLPENTANE, N. L. Drake, May 1942

WR W 88 AN INVESTIGATION OF AIRCRAFT HEATERS. XXV - USE OF THE THERMOPILE RADIOMETER, L. M. K. Boelter, R. Bromberg, J. T. Gier, and E. R. Dempster, April 1945

Not Applicable NACA Research Memoranda

RM A7C04 A PRELIMINARY STUDY OF RAM-ACTUATED COOLING SYSTEMS FOR SUPERSONIC AIRCRAFT, Jackson R. Stalder and Kenneth R. Wadleigh, April 1947

RM A53A13 PRELIMINARY INVESTIGATION OF A VARIABLE-AREA AUXILIARY AIR-INTAKE SYSTEM AT MACH NUMBERS FROM 0 TO 1.3, Richard Scherrer, John F. Stroud, and John T. Swift, February 1953

RM A54B08 THE EFFECT OF LIP SHAPE ON A NOSE-INLET INSTALLATION AT MACH NUMBERS FROM 0 TO 1.5 AND A METHOD FOR OPTIMIZING ENGINE-INLET COMBINATIONS, Emmet A. Mossman and Warren E. Anderson, May 1954

RM A55D27 EXPERIMENTAL INVESTIGATION AT MACH NUMBERS FROM 0 TO 1.9 OF TRAPEZOIDAL AND CIRCULAR SIDE INLETS FOR A FIGHTER-TYPE AIRPLANE, Emmet A. Mossman, Frank A. Pfyl, and Frank A. Lazzeroni, July 1955

RM A55F29 FUSELAGE SIDE INLETS - A STUDY OF SOME FACTORS AFFECTING THEIR PERFORMANCE AND A COMPARISON WITH NOSE INLETS, Emmet A. Mossman, Frank A. Pfyl, and Frank A. Lazzeroni, April 1956

RM A55L02 EFFECT OF BOUNDARY-LAYER CONTROL AND INLET LIP SHAPE ON THE PERFORMANCE OF A TWIN-SCOOP AIR-INDUCTION SYSTEM AT MACH NUMBERS FROM 0 TO 1.9, Frank A. Lazzeroni and Frank A. Pfyl, February 1956

RM A55L06 A SIMULATION STUDY OF A WINGLESS MISSILE, Henry C. Lessing and David E. Reese, Jr., February 1956

RM A55L16 A STUDY OF A SYMMETRICAL, CIRCULAR, INTERNAL COMPRESSION INLET, Emmet A. Mossman and Frank A. Pfyl, February 1956

RM A58B07 A FLIGHT-TEST STUDY OF TOTAL-PRESSURE DISTORTION IN A THICK-LIPPED NOSE INLET, Rodney C. Wingrove, June 1958

RM A58C24 INVESTIGATION OF THE PERFORMANCE AND INTERNAL FLOW OF A VARIABLE-AREA, VARIABLE-INTERNAL-CONTRACTION INLET AT MACH NUMBERS OF 2.00, 2.50,AND 2.92, Richard Scherrer and Warren E. Anderson, July 1958

RM A58D17a VISCOUS FLOWS IN INLETS, Richard Scherrer, John H. Lundell, and Lewis A. Anderson, June 1958

RM E6L02 THEORETICAL INVESTIGATION OF THRUST AUGMENTATION OF TURBOJET ENGINE BY TAIL-PIPE BURNING, H. R. Bohanon and E. C. Wilcox, January 1947

RM E6L06 PERFORMANCE OF A 20-INCH STEADY-FLOW RAM JET AT HIGH ALTITUDES AND RAM-PRESSURE RATIOS, Eugene Perchonok, William H. Sterbentz, and Fred A. Wilcox, June 1947

RM E7B01 FUEL TESTS ON AN I-16 JET PROPULSION ENGINE AT STATIC SEA-LEVEL CONDITIONS, Ray E. Bolz and John B. Meigs, April 1947

RM E7B11 INVESTIGATION OF PRESSURE LOSSES IN SEVERAL TURBOSUPERCHARGER NOZZLE BOXES, Albert M. Lord and Joseph Donnola, February 1947

RM E7G23 INVESTIGATION OF THRUST AUGMENTATION OF A 1600 POUND THRUST CENTRIFUGAL-FLOW-TYPE TURBOJET ENGINE BY INJECTION OF REFRIGERANTS AT COMPRESSOR INLETS, William L. Jones and Harry W. Dowman, August 1947

RM E7J13 PERFORMANCE OF EXPERIMENTAL TURBOJET-ENGINE COMBUSTOR. I - PERFORMANCE OF A ONE-EIGHTH SEGMENT OF AN EXPERIMENTAL TURBOJET-ENGINE COMBUSTOR, Francis U. Hill and Herman Mark, April 1948

RM E7J23 CYCLIC ENGINE TEST OF CAST VITALLIUM TURBINE BUCKETS - I, J. Elmo Farmer, F. N. Darmara, and Francis D. Poulson, February 1948

RM E7J24 CYCLIC ENGINE TEST OF CAST VITALLIUM, TURBINE BUCKETS - II, J. Elmo Farmer, George C. Deutsch, and Paul F. Sikora, January 1948

RM E8A20 EMPIRICAL MODE CONSTANTS FOR CALCULATING R FREQUENCIES OF AXIAL-FLOW COMPRESSOR BLADES, M. B. Millenson and P. I. Wilterdink, April 1948

RM E8C02 PRELIMINARY INVESTIGATION OF COMBUSTION IN FLOWING GAS WITH VARIOUS TURBULENCE PROMOTERS, Gordon W. Haddock and J. Howard Childs, June 1948

RM E8F30 INVESTIGATION OF PERFORMANCE OF SINGLE-STAGE AXIAL-FLOW COMPRESSOR USING NACA 5509-34 BLADE SECTION, Harry Mankuta and Donald C. Guentert, September 1948

RM E8G20 INVESTIGATION OF A GAS TURBINE WITH NATIONAL BUREAU OF STANDARDS BODY 4811 CERAMIC ROTOR BLADES, John C. Freche and Bob W. Sheflin, October 1948

RM E8I17 INVESTIGATION OF SPARK GAPS SUBJECTED TO ALTITUDE AND AIR-VELOCITY CONDITIONS, Clyde Swett, Jr., November 1948

RM E8I17a THEORETICAL PERFORMANCE OF DIBORANE AS A ROCKET FUEL, Vearl N. Huff, Clyde S. Calvert, and Virginia C. Erdmann, January 1949

RM E9E13 INVESTIGATION OF PERFORMANCE OF TYPICAL INLET STAGE OF MULTISTAGE AXIAL-FLOW COMPRESSOR, Jack R. Burtt, July 1949

RM E50B14 FREE-FLIGHT PERFORMANCE OF 16-INCH-DIAMETER SUPERSONIC RAM-JET UNITS. II - FIVE UNITS DESIGNED FOR COMBUSTION-CHAMBER-INLET MACH NUMBER OF 0.16 AT FREE-STREAM MACH NUMBER OF 1.60 (UNITS B-1, B-2, B-3, B-4, AND B-5), Wesley E. Messing and Scott H. Simpkinson, May 1950

RM E50C30 EFFECT OF COMBUSTION-CHAMBER PRESSURE AND NOZZLE EXPANSION RATIO ON THEORETICAL PERFORMANCE OF SEVERAL ROCKET PROPELLANT SYSTEMS, Virginia E. Morrell, May 1950

RM E50E29 ALTITUDE PERFORMANCE CHARACTERISTICS OF TAIL-PIPE BURNER WITH VARIABLE-AREA EXHAUST NOZZLE, Emmert T. Jansen and H. Carl Thorman, August 1950

RM E50F28 ALTITUDE PERFORMANCE CHARACTERISTICS OF TURBOJET-ENGINE TAIL-PIPE BURNER WITH VARIABLE-AREA EXHAUST NOZZLE USING SEVERAL FUEL SYSTEMS AND FLAME HOLDERS, LaVern A. Johnson and Carl L. Meyer, December 1950

RM E50G13 ALTITUDE PERFORMANCE CHARACTERISTICS OF TAIL-PIPE BURNER WITH CONVERGING CONICAL BURNER SECTION ON J47 TURBOJET ENGINE, William R. Prince and John E. McAulay, December 1950

RM E50G19 FREE-JET INVESTIGATION OF A 16-INCH RAM JET AT 1.35, 1.50, AND 1.73, Fred Wilcox, Sol Baker, and Eugene Perchonok, October 1950

RM E50H22 EFFECT OF RAM-JET PRESSURE PULSATIONS ON SUPERSONIC-DIFFUSER PERFORMANCE, James F. Connors, November 1950

RM E50H24 PRELIMINARY ANALYSIS OF 3 CYCLES FOR NUCLEAR PROPULSION OF AIRCRAFT, L. V. Humble, J. W. Wachtl, and R. B. Doyle, October 1950

RM E50J04 A PRELIMINARY EXPERIMENTAL AND ANALYTICAL EVALUATION OF DIBORANE AS A RAM-JET FUEL, Benson E. Gammon, Russell S. Genco, and Melvin Gerstein, December 1950

RM E50L04 INVESTIGATION AT ZERO ANGLE OF ATTACK OF A 16-INCH RAM-JET ENGINE IN 8- BY 6-FOOT SUPERSONIC WIND TUNNEL, T. Nussdorfer, F. Wilcox, and E. Perchonok, March 1951

RM E50L18 FREE-FLIGHT PERFORMANCE OF 16-INCH-DIAMETER SUPERSONIC RAM-JET UNITS: IV - PERFORMANCE OF RAM-JET UNITS DESIGNED FOR COMBUSTION-CHAMBER-INLET MACH NUMBER OF 0.2 AT FREE-STREAM MACH NUMBER OF 1.6 OVER A RANGE OF FLIGHT CONDITIONS, Leonard Rabb and Warren J. North, February 1951

RM E51C15 ALTITUDE-WIND-TUNNEL INVESTIGATION OF PERFORMANCE CHARACTERISTICS OF A J47D PROTOTYPE (RX1-1) TURBOJET ENGINE WITH VARIABLE-AREA EXHAUST NOZZLE, E. William Conrad and John E. McAulay, September 1951

RM E51E01 PERFORMANCE CHARACTERISTICS OF AIRCRAFT COOLING EJECTORS HAVING SHORT CYLINDRICAL SHROUDS, Fred D. Kochendorfer and Morris D. Rousso, May 1951

RM E51E03 ALTITUDE INVESTIGATION OF 16 FLAME-HOLDER AND FUEL-SYSTEM CONFIGURATIONS IN TAIL-PIPE BURNER, Ralph E. Gray, H. G. Krull, and A. F. Sargent, December 1951

RM E51E08 ALTITUDE OPERATIONAL CHARACTERISTICS OF A PROTOTYPE MODEL OF THE J47D (RX1-1 AND RX1-3) TURBOJET ENGINES WITH INTEGRATED ELECTRONIC CONTROL, E. William Conrad, Harry E. Bloomer, and Adam E. Sobolewski, January 1952

RM E51F25 PRELIMINARY INVESTIGATION OF THE SUPERSONIC FLOW FIELD DOWNSTREAM OF WIRE-MESH NOZZLES IN A CONSTANT-AREA DUCT, Lawrence I. Gould, August 1951

RM E51G23 FORCE AND PRESSURE CHARACTERISTICS FOR A SERIES OF NOSE INLETS AT MACH NUMBERS FROM 1.59 TO 1.99. V - ANALYSIS AND COMPARISON ON BASIS OF RAM-JET AIRCRAFT RANGE AND OPERATIONAL CHARACTERISTICS, E. Howard, R. W. Luidens, and J. L. Allen, September 1951

RM E51G26 EFFECT OF ANGLE OF ATTACK AND EXIT NOZZLE DESIGN ON THE PERFORMANCE OF A 16-INCH RAM JET AT MACH NUMBERS FROM 1.5 TO 2.0, Eugene Perchonok, Fred Wilcox, and Donald Pennington, October 1951

RM E51H02 ANALYTICAL INVESTIGATION OF RAM-JET-ENGINE PERFORMANCE IN FLIGHT MACH NUMBER RANGE FROM 3 TO 7, Philip J. Evans, Jr., October 1951

RM E51H16 EXPERIMENTAL INVESTIGATION OF TURBOJET-ENGINE THRUST AUGMENTATION BY COMBINED COMPRESSOR COOLANT INJECTION AND TAIL-PIPE BURNING, James W. Useller and John H. Povolny, October 1951

RM E51H28 INVESTIGATION OF AFTERBURNER PERFORMANCE AND AFTERBURNER FUEL SYSTEM COKING OF THE WESTINGHOUSE XJ34-WE-32 ENGINE, Lewis E. Wallner and William R. Prince, February 1952

RM E51I04 INVESTIGATION OF THE LIQUID FLUORINE - LIQUID DIBORANE PROPELLANT COMBINATION IN A 100-POUND-THRUST ROCKET ENGINE, Paul M. Ordin, Howard W. Douglass, and William H. Rowe, November 1951

RM E51I07 EFFECTS OF INTERNAL CONFIGURATION ON AFTERBURNER SHELL TEMPERATURES, E. William Conrad and Emmert T. Jansen, January 1952

RM E51I13 ALTITUDE WIND TUNNEL INVESTIGATION OF THE PERFORMANCE OF COMPRESSOR, COMBUSTOR, AND TURBINE COMPONENTS OF PROTOTYPE J47D (RX1-1) TURBOJET ENGINE, John M. Farley, December 1951

RM E51J04 FULL-SCALE INVESTIGATION OF COOLING SHROUD AND EJECTOR NOZZLE FOR A TURBO-JET ENGINE - AFTERBURNER INSTALLATION, Lewis E. Wallner and Emmert T. Jansen, December 1951

RM E51J17 PERFORMANCE COMPARISONS OF NAVY JET MIX AND MIL-F-5624A (JP-3) FUELS IN TUBULAR AND ANNULAR COMBUSTORS, Richard J. McCafferty, June 1954

RM E51K20 ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF INLET-ENGINE MATCHING FOR TURBOJET-POWERED AIRCRAFT AT MACH NUMBERS UP TO 2.0, Carl F. Schueller and Fred T. Esenwein, February 1952

RM E51L07 ALTITUDE WIND TUNNEL INVESTIGATION OF HIGH-TEMPERATURE AFTER-BURNERS, E. William Conrad and Carl E. Campbell, June 1952

RM E51L10 PERFORMANCE OF COMPONENTS OF XJ34-WE-32 TURBOJET ENGINE OVER RANGE OF ENGINE AND FLIGHT CONDITIONS, John E. McAulay, Adam E. Sobolewski, and Ivan D. Smith, June 1952

RM E51L12 ALTITUDE WIND TUNNEL INVESTIGATION OF XJ34-WE-32 ENGINE PERFORM-ANCE WITHOUT ELECTRONIC CONTROL, Harry E. Bloomer, William J. Walker, and George L. Pantages, May 1953

RM E52A16 INVESTIGATION OF TURBINES SUITABLE FOR USE IN A TURBOJET ENGINE WITH HIGH COMPRESSOR PRESSURE RATIO AND LOW COMPRESSOR-TIP SPEED. I - TURBINE-DESIGN REQUIREMENTS FOR SEVERAL ENGINE OPERATING CONDITIONS, Robert E. English, David H. Silvern, and Elmer H. Davison, March 1952

RM E52A21 AXIAL-SLOT AIR ADMISSION FOR CONTROLLING PERFORMANCE OF A ONE-QUARTER-ANNULUS TURBOJET COMBUSTOR AND COMPARISON WITH COMPLETE ENGINE, Herman Mark and Eugene V. Zettle, March 1952

RM E52A22 PERFORMANCE OF SUPERSONIC SCOOP INLETS, M. I. Weinstein, February 1952

RM E52B28 CALCULATION OF INTERNAL PRESSURES IN THE FUEL TUBE OF A NUCLEAR REACTOR, B. M. Rosenbaum and G. Allen, July 1952

RM E52B29 OVER-ALL PERFORMANCE OF THE J71 THREE-STAGE TURBINE, William E. Berkey, July 1952

RM E52C05 INVESTIGATION OF EFFECTIVE THERMAL CONDUCTIVITIES OF POWDERS, R. G. Deissler and C. S. Eian, June 1952

RM E52C26 INVESTIGATION OF INTERNAL FILM COOLING OF EXHAUST NOZZLE OF A 1000-POUND-THRUST LIQUID-AMMONIA LIQUID-OXYGEN ROCKET, Andrew E. Abramson, June 1952

RM E52D14 INVESTIGATION OF TURBINES SUITABLE FOR USE IN A TURBOJET ENGINE WITH HIGH COMPRESSOR PRESSURE RATIO AND LOW COMPRESSOR-TIP SPEED. II - VELOCITY-DIAGRAM STUDY OF TURBINE FOR ENGINE OPERATION WITH CONSTANT EXHAUST-NOZZLE AREA, Elmer H. Davison and Robert E. English, June 1952

RM E52D24 SOLUBILITY OF WATER IN HYDROCARBONS, R. R. Hibbard and R. L. Schalla, July 1952

RM E52E20 SURVEY OF SOME PRELIMINARY INVESTIGATION OF SUPERSONIC DIFFUSERS AT HIGH MACH NUMBERS, Edgar M. Cortright, Jr., and James F. Connors, July 1952

RM E52E23 EFFECT OF ENGINE AND CONTROL LIMITS ON STEADY-STATE AND TRANSIENT PERFORMANCE OF TURBOJET ENGINE WITH VARIABLE-AREA EXHAUST NOZZLE, George Vasu and William L. Hinde, January 1953

RM E52F09 PERFORMANCE CHARACTERISTICS OF A NORMAL-SHOCK SIDE INLET LOCATED DOWNSTREAM OF A CANARD CONTROL SURFACE AT MACH NUMBERS OF 1.5 AND 1.8, Murray Dryer and Andrew Beke, July 1952

RM E52G03 EFFECT OF ROTOR- AND STATOR-BLADE MODIFICATIONS ON SURGE PERFORMANCE OF AN 11-STAGE AXIAL-FLOW COMPRESSOR. I - ORIGINAL PRODUCTION COMPRESSOR OF XJ40-WE-6 ENGINE, Harold B. Finger, Robert H. Essig, and E. William Conrad, May 1953

RM E52G15 INVESTIGATION OF TURBINES SUITABLE FOR USE IN A TURBOJET ENGINE WITH HIGH COMPRESSOR PRESSURE RATIO AND LOW COMPRESSOR-TIP SPEED. III - VELOCITY-DIAGRAM STUDY OF TWO-STAGE AND DOWNSTREAM-STATOR TURBINES FOR ENGINE OPERATION AT CONSTANT ROTATIVE SPEED, Robert E. English and Elmer H. Davison, November 1952

RM E52G22 ALTITUDE PERFORMANCE CHARACTERISTICS OF THE J47-25 TURBOJET ENGINE - DATA PRESENTATION, Paul E. Renas and Emmert T. Jansen, September 1953

RM E52G29 ALTITUDE INVESTIGATION OF THREE FLAME-HOLDER AND FUEL-SYSTEMS CONFIGURATIONS IN A SHORT CONVERGING AFTERBURNER ON A TURBOJET ENGINE, Willis M. Braithwaite, Paul E. Renas, and Emmert T. Jansen, September 1952

RM E52G30 INVESTIGATION OF THRUST AUGMENTATION USING WATER-ALCOHOL INJECTION OF A 5200-POUND-THRUST AXIAL-FLOW-TYPE TURBOJET ENGINE AT STATIC SEA-LEVEL CONDITIONS, David S. Boman and William E. Mallett, September 1952

RM E52H04 SOME DYNAMIC CHARACTERISTICS OF A TURBOJET ENGINE FOR LARGE ACCELERATIONS, Herbert Heppler, David Novik, and Marcel Dandois, August 1952

RM E52H12 PERFORMANCE CHARACTERISTICS OF ONE CONVERGENT AND THREE CONVERGENT -DIVERGENT NOZZLES, H. George Krull and Fred W. Steffen, September 1952

RM E52H13 INVESTIGATION OF TURBINES SUITABLE FOR USE IN A TURBOJET ENGINE WITH HIGH COMPRESSOR PRESSURE RATIO AND LOW COMPRESSOR-TIP SPEED. IV - EFFECT OF INCREASING BLADE SPEED ON VELOCITY DIAGRAMS OF TURBINE FOR ENGINE OPERATION AT CONSTANT ROTATIVE SPEED, Elmer H. Davison and Robert E. English, November 1952

RM E52H18 MATCHED PERFORMANCE CHARACTERISTICS OF A 16-STAGE AXIAL-FLOW COMPRESSOR AND A 3-STAGE TURBINE, John J. Rebeske, Jr., and James F. Dugan, Jr., April 1953

RM E52H22 INVESTIGATION OF LIQUID FLUORINE AND HYDRAZINE-AMMONIA MIXTURE IN 100-POUND-THRUST ROCKET ENGINE, Paul M. Ordin, Edward A. Rothenberg, and William H. Rowe, October 1952

RM E52H27 INVESTIGATION OF RAM-JET AFTERBURNING AS A MEANS OF VARYING EFFECTIVE EXHAUST NOZZLE AREA, Eugene Perchonok and Fred A. Wilcox, November 1952

RM E52I02 INFLUENCE OF FUSELAGE-MOUNTED ROCKET-BOOSTERS ON FLOW FIELD AT INLET AND ON DIFFUSER PERFORMANCE OF STRUT-MOUNTED ENGINE AT MACH NUMBERS OF 1.8 AND 2.0, George A. Wise and Leonard J. Obery, October 1952

RM E52I03 INVESTIGATION OF SEVERAL TECHNIQUES FOR IMPROVING ALTITUDE-STARTING LIMITS OF TURBOJET ENGINES, John C. Armstrong and H. D. Wilsted, October 1952

RM E52I04 SOME OBSERVATIONS OF FLOW AT THE THROAT OF A TWO-DIMENSIONAL DIFFUSER AT THE MACH NUMBER OF 3.85, James F. Connors and Richard R. Woollett, November 1952

RM E52I08 EVALUATION OF OPERATING CHARACTERISTICS OF A SUPERSONIC FREE-JET FACILITY FOR FULL-SCALE RAM-JET INVESTIGATIONS, Carl B. Wentworth, Herbert G. Hurrell, and Shigeo Nakanishi, October 1952

RM E52I10 EFFECT OF ROTOR- AND STATOR-BLADE MODIFICATIONS ON SURGE PERFORMANCE OF AN 11-STAGE AXIAL-FLOW COMPRESSOR. II - REDESIGNED COMPRESSOR FOR XJ40-WE-6 ENGINE, E. William Conrad, Harold B. Finger, and Robert H. Essig, May 1953

RM E52I15 PERFORMANCE CHARACTERISTICS OF SEVERAL TYPES OF AXIALLY SYMMETRIC NOSE INLETS AT MACH NUMBER 3.85, James F. Connors and Richard R. Woollett, November 1952

RM E52I30 FORCE AND PRESSURE-RECOVERY CHARACTERISTICS OF A CONICAL-TYPE NOSE INLET OPERATING AT MACH NUMBERS OF 1.6 TO 2.0 AND AT ANGLES OF ATTACK TO 9°, Andrew Beke and J. L. Allen, November 1952

RM E52J02 MEASUREMENT OF THERMAL DISTORTION OF THE SUBMARINE INTERMEDIATE REACTOR "MARK A" MODERATOR TUBE, R. H. Kemp and W. C. Morgan, December 1952

RM E52J09 EFFECT OF LINEAR AIR-ENTRY HOLES, FUEL STATE, AND COMBUSTOR SIZE ON PERFORMANCE OF ANNULAR TURBOJET COMBUSTOR AT LOW PRESSURES AND HIGH AIR-FLOW RATES, Carl T. Norgren and J. Howard Childs, 1952

RM E52J10 EFFECTS OF INTERNAL CORNER FILLETS ON PRESSURE RECOVERY - MASS FLOW CHARACTERISTICS OF SCOOP-TYPE CONICAL SUPERSONIC INLETS, Alfred S. Valerino, December 1952

RM E52J14 EFFECTS OF FUEL TEMPERATURE AND FUEL DISTRIBUTION ON THE COMBUSTION EFFICIENCY OF A 16-INCH RAM-JET ENGINE AT A SIMULATED FLIGHT MACH NUMBER OF 2.9, E. E. Dangle, A. J. Cervenka, and D. W. Bahr, January 1953

RM E52J20 PRELIMINARY EVALUATION OF TURBINE PERFORMANCE WITH VARIABLE-AREA TURBINE NOZZLES IN A TURBOJET ENGINE, Carl E. Campbell and Henry J. Welna, May 1953

RM E52J22 CHARACTERISTICS OF A CANARD-TYPE MISSILE CONFIGURATION WITH AN UNDERSLUNG SCOOP INLET AT MACH NUMBERS FROM 1.5 TO 2.0, Evan A. Fradenburgh and Robert C. Campbell, January 1953

RM E52K06 EFFECT OF UNEVEN AIR-FLOW DISTRIBUTION TO THE TWIN INLETS OF AN AXIAL-FLOW TURBOJET ENGINE, Lewis E. Wallner, E. William Conrad, and William R. Prince, January 1953

RM E52K10 ALTITUDE WIND TUNNEL INVESTIGATION OF THE PROTOTYPE J40-WE-8 TURBOJET ENGINE WITHOUT AFTERBURNER, John E. McAulay and Harold R. Kaufman, August 1953

RM E52K14 FORCE AND PRESSURE RECOVERY CHARACTERISTICS AT SUPERSONIC SPEEDS OF A CONICAL SPIKE INLET WITH BYPASSES DISCHARGING IN AN AXIAL DIRECTION, J. L. Allen and Andrew Blake, January 1953

RM E52L02 FREE-FLIGHT PERFORMANCE OF A ROCKET-BOOSTED, AIR-LAUNCHED 16-INCH-DIAMETER RAM-JET ENGINE AT MACH NUMBERS UP TO 2.20, John H. Disher, Robert C. Kohl, and Merle L. Jones, February 1953

RM E52L03 ANALYSIS OF OFF-DESIGN PERFORMANCE OF 16-STAGE AXIAL-FLOW COMPRESSOR WITH VARIOUS BLADE MODIFICATIONS, Arthur A. Medeiros, William A. Benser, and James E. Hatch, March 1953

RM E52L04 PERFORMANCE OF A TURBOJET ENGINE WITH ADJUSTABLE FIRST-STAGE TURBINE STATOR AND VARIABLE-AREA EXHAUST NOZZLE, Carl L. Meyer, Ivan D. Smith, and Harry E. Bloomer, August 1953

RM E52L10 ALTITUDE INVESTIGATION OF SEVERAL AFTERBURNER CONFIGURATIONS FOR J40-WE-8 TURBOJET ENGINE, E. William Conrad and Carl E. Campbell, July 1953

RM E52L12 ALTITUDE INVESTIGATION OF THRUST AUGMENTATION USING WATER-ALCOHOL INJECTION INTO THE COMBUSTION CHAMBERS OF AN AXIAL-FLOW TURBOJET ENGINE, E. T. Jansen and P. E. Renas, February 1953

RM E52L16 COMPONENT AND OVER-ALL PERFORMANCE EVALUATION OF J47-GE-25 TURBOJET ENGINE OVER RANGE OF ENGINE-INLET REYNOLDS NUMBER INDICES, Curtis L. Walker, Willis M. Braithwaite, and David B. Fenn, September 1953

RM E52L19 TURBOJET-ENGINE THRUST AUGMENTATION AT ALTITUDE BY COMBINED AMMONIA INJECTION INTO THE COMPRESSOR INLET AND AFTERBURNING, James W. Useller, James L. Harp, Jr., and David B. Fenn, February 1953

RM E52L24 AIR-FLOW AND THRUST CHARACTERISTICS OF SEVERAL CYLINDRICAL COOLING-AIR EJECTORS WITH A PRIMARY TO SECONDARY TEMPERATURE RATIO OF 1.0, W. K. Greathouse and D. P. Hollister, March 1953

RM E52L29 ALTITUDE OPERATIONAL CHARACTERISTICS OF PROTOTYPE J40-WE-8 TURBOJET ENGINE, Adam E. Sobolewski and Robert J. Lubick, August 1953

RM E53A09 ACCELERATION OF HIGH-PRESSURE-RATIO SINGLE-SPOOL TURBOJET ENGINE AS DETERMINED FROM COMPONENT PERFORMANCE CHARACTERISTICS. I - EFFECT OF AIR BLEED AT COMPRESSOR OUTLET, John J. Rebeske, Jr., and Harold E. Rohlik, March 1953

RM E53A28 EFFECT OF AXIALLY STAGED FUEL INTRODUCTION ON PERFORMANCE OF ONE-QUARTER SECTOR OF ANNULAR TURBOJET COMBUSTOR, Eugene V. Zettle and Herman Mark, March 1953

RM E53A29 FORCE AND PRESSURE RECOVERY CHARACTERISTICS AT SUPERSONIC SPEEDS OF A CONICAL SPIKE INLET WITH A BYPASS DISCHARGING FROM THE TOP OR BOTTOM OF THE DIFFUSER IN AN AXIAL DIRECTION, J. L. Allen and Andrew Beke, March 1953

RM E53B03 AERODYNAMICS OF SLENDER BODIES AT MACH NUMBER OF 3.12 AND REYNOLDS NUMBERS FROM 2×10^6 TO 15×10^6. III - BOUNDARY LAYER AND FORCE MEASUREMENTS ON A SLENDER CONE-CYLINDER BODY OF REVOLUTION, John R. Jack, April 1953

RM E53B04 EFFECT OF FUEL INJECTORS AND LINEAR DESIGN ON PERFORMANCE OF ANNULAR TURBOJET COMBUSTOR WITH VAPOR FUEL, Carl T. Norgren and J. Howard Childs, April 1953

RM E53B05 EFFECT OF CAPTURE ON THE SLOWING-DOWN LENGTH OF NEUTRONS IN HYDROGENOUS MIXTURES CONTAINING URANIUM, H. C. Volkin and L. Soffer, April 1953

RM E53B16 USE OF FLAME-IMMERSED BLADES TO IMPROVE COMBUSTION LIMITS AND EFFICIENCY OF A 5-INCH DIAMETER, CONNECTED-PIPE, RAM-JET COMBUSTOR, Donald W. Male, April 1953

RM E53B26 COMPARISON OF CALCULATED AND MEASURED THERMAL DISTORTIONS IN A REACTOR CONTROL ROD FOR TEMPERATURE PATTERNS SIMULATING TWO REACTOR OPERATING CONDITIONS, Tibor F. Nagey, April 1953

RM E53D07 INVESTIGATION AT A MACH NUMBER OF 1.90 OF A DIVERTER-TYPE BOUNDARY-LAYER REMOVAL SYSTEM FOR A SCOOP INLET, Fred D. Kochendorfer, June 1953

RM E53D20 NONUNIFORM BURNUP AND POISONING EFFECTS IN REACTOR AND VALIDITY OF UNIFORM APPROXIMATION, Robert E. Spooner, June 1953

RM E53D22 ALTITUDE PERFORMANCE INVESTIGATION OF A HIGH-TEMPERATURE AFTERBURNER, S. C. Huntley, Carmom M. Auble and James W. Useller, June 1953

RM E53D29 ANALYSIS OF NUCLEAR POWERED SUPERCRITICAL-WATER CYCLE FOR AIRCRAFT PROPULSION, Irving M. Karp, June 1953

RM E53E05 EFFECT OF PRESSURE ON SMOKING TENDENCY OF DIFFUSION FLAMES, Rose L. Schalla and Glen E. McDonald, September 1953

RM E53E06 ACCELERATION OF HIGH-PRESSURE-RATIO SINGLE-SPOOL TURBOJET ENGINE AS DETERMINED FROM COMPONENT PERFORMANCE CHARACTERISTICS. II - EFFECT OF COMPRESSOR INTERSTAGE AIR BLEED, John J. Rebeske, Jr., and James F. Dugan, Jr., July 1953

RM E53E29 IGNITION-DELAY DETERMINATIONS OF FURFURYL ALCOHOL AND MIXED BUTYL MERCAPTANS WITH VARIOUS WHITE FUMING NITRIC ACIDS USING MODIFIED OPENCUP AND SMALL-SCALE ROCKET ENGINE APPARATUS, Dezso J. Ladanyi, Riley O. Miller and Glen Hennings, February 1955

RM E53F10 ALTITUDE EVALUATION OF SEVERAL AFTERBURNER DESIGN VARIABLES ON A J47-GE-17 TURBOJET ENGINE, Willis M. Braithwaite, Curtis L. Walker, and Joseph N. Sivo, October 1953

RM E53F29 PRELIMINARY INVESTIGATION OF EFFECTS OF CASCADING ON OSCILLATING LIFT FORCE OF AIRFOIL VIBRATED IN BENDING, Donald F. Johnson and Alexander Mendelson, September 1953

RM E53F30 CRITICALITY SURVEY OF HYDROXIDES AS COOLANT MODERATORS FOR AIRCRAFT NUCLEAR REACTORS, Donald Bogart and Leonard Soffer, October 1953

RM E53G01 INVESTIGATION OF LOW-PRESSURE PERFORMANCE OF EXPERIMENTAL TUBULAR COMBUSTORS DIFFERING IN AIR-ENTRY-HOLE GEOMETRY, Ralph T. Dittrich, September 1953

RM E53G06 ANALYSIS OF TURBINE STATOR ADJUSTMENT REQUIRED FOR COMPRESSOR DESIGN-POINT OPERATION IN HIGH MACH NUMBER SUPERSONIC TURBOJET ENGINES, Robert E. English and Richard H. Cavicchi, October 1953

RM E53G08 VAPOR PRESSURES OF CONCENTRATED NITRIC ACID SOLUTIONS IN COMPOSITION RANGE 83 TO 97 PERCENT NITRIC ACID 0 TO 6 PERCENT NITROGEN DIOXIDE, 0 TO 15 PERCENT WATER, AND IN TEMPERATURE RANGE 20° TO 80° C, A. B. McKeown and Frank E. Belles, September 1953

RM E53G10 INVESTIGATION OF TRANSLATING-SPIKE SUPERSONIC INLET AS MEANS OF MASS-FLOW CONTROL AT MACH NUMBERS OF 1.5, 1.8, AND 2.0, Gerald C. Gorton, October 1953

RM E53G24 PERFORMANCE OF AN ANNULAR TURBOJET COMBUSTOR HAVING REDUCED PRESSURE LOSSES AND USING PROPANE FUEL, Carl T. Norgren and J. Howard Childs, September 1953

RM E53H04 INVESTIGATION AT MACH NUMBERS 1.5 AND 1.7 OF TWIN-DUCT SIDE AIR-INTAKE SYSTEM WITH 9° COMPRESSION RAMP INCLUDING MODIFICATIONS TO BOUNDARY-LAYER-REMOVAL WEDGES AND EFFECTS OF A BYPASS SYSTEM, Leonard J. Obery and Leonard E. Stitt, October 1953

RM E53H06 EXPERIMENTAL INVESTIGATION OF SEVERAL WATER-INJECTION CONFIGURATIONS FOR TURBINE-BLADE SPRAY COOLING IN A TURBOJET ENGINE, John C. Freche and Roy A. McKinnon, October 1953

RM E53H11 PERFORMANCE COMPARISON AT SUPERSONIC SPEEDS OF INLETS SPILLING EXCESS FLOW BY MEANS OF BOW SHOCK, CONICAL SHOCK, OR BYPASS, J. L. Allen and Andrew Beke, October 1953

RM E53H14 FREE-JET INVESTIGATION OF 20-INCH RAM-JET COMBUSTOR UTILIZING HIGH-HEAT-RELEASE PILOT BURNER, James G. Henzel, Jr., and Carl B. Wentworth, October 1953

RM E53H15 EFFECT OF FLAME-HOLDER DESIGN OF ALTITUDE PERFORMANCE OF LOUVERED-LINER AFTERBURNER, Paul E. Renas and Emmert T. Jansen, October 1953

RM E53H19 INVESTIGATION AT MACH NUMBERS 1.5 AND 1.7 OF TWIN-DUCT SIDE INTAKE SYSTEM WITH TWO-DIMENSIONAL 6° COMPRESSION RAMPS MOUNTED ON A SUPERSONIC AIRPLANE, Joseph Davids and George A. Wise, October 1953

RM E53H25 JET EFFECTS ON FLOW OVER AFTERBODIES IN SUPERSONIC STREAM, Edgar M. Cortright, Jr., and Fred D. Kochendorfer, November 1953

RM E53H31 MINIMUM SPARK IGNITION ENERGIES OF 12 PURE FUELS AT ATMOSPHERIC AND REDUCED PRESSURE, Allen J. Metzler, October 1953

RM E53I08 ALTITUDE-CHAMBER INVESTIGATION OF J73-GE-1A TURBOJET ENGINE COMPONENT PERFORMANCE, Carl E. Campbell and Adam E. Sobolewski, December 1954

RM E53I11 EXPERIMENTAL INVESTIGATION OF A 0.4 HUB-TIP DIAMETER RATIO AXIAL-FLOW COMPRESSOR INLET STAGE AT TRANSONIC INLET RELATIVE MACH NUMBERS. I - ROTOR DESIGN AND OVER-ALL PERFORMANCE AT TIP SPEEDS FROM 60 TO 100 PERCENT OF DESIGN, George K. Serovy, William H. Robbins, and Frederick W. Glaser, December 1953

RM E53I14 EVAPORATION AND SPREADING OF ISOOCTANE SPRAYS IN HIGH-VELOCITY AIR STREAMS, Donald W. Bahr, November 1953

RM E53I17 SPONTANEOUS FLAMMABILITY OF PENTABORANE AND PENTABORANE - 3-METHYLPENTANE BLENDS, Edward A. Fletcher, February 1957

RM E53I18 ALTITUDE PERFORMANCE OF COMPRESSOR, TURBINE, AND COMBUSTOR COMPONENTS OF 600-B9 TURBOJET ENGINE, William R. Prince and Dorwin B. Wile, March 1954

RM E53I23 PERFORMANCE OF SEPARATION NOSE INLETS AT MACH NUMBER 5.5, Rudolph C. Haefeli and Harry Bernstein, December 1953

RM E53I24 INVESTIGATION OF A HIGH-PRESSURE-RATIO EIGHT-STAGE AXIAL-FLOW RESEARCH COMPRESSOR WITH TWO TRANSONIC INLET STAGES. I - AERODYNAMIC DESIGN, Charles H. Voit, December 1953

RM E53I25 ALTITUDE PERFORMANCE CHARACTERISTICS OF J73-GE-1A TURBOJET ENGINE, Carl E. Campbell and E. William Conrad, December 1954

RM E53I28 EXPERIMENTAL DETERMINATION OF GAS MOTION ACCOMPANYING SCREECHING COMBUSTION IN A 6-INCH SIMULATED AFTERBURNER, Perry L. Blackshear, Warren D. Rayle, and Leonard K. Tower, December 1953

RM E53I30 PRELIMINARY INVESTIGATION AT MACH NUMBER 1.91 OF DIFFUSER EMPLOYING PIVOTED CONE TO IMPROVE OPERATION AT ANGLE OF ATTACK, Milton A. Beheim, December 1953

RM E53J01 ANALYSIS OF OFF-DESIGN OPERATION OF HIGH MACH NUMBER SUPERSONIC TURBOJET ENGINES, Robert E. English and Richard H. Cavicchi, February 1954

RM E53J06 INVESTIGATION OF A HIGH-PRESSURE-RATIO EIGHT-STAGE AXIAL-FLOW RESEARCH COMPRESSOR WITH TWO TRANSONIC INLET STAGES. II - PRELIMINARY ANALYSIS OF OVER-ALL PERFORMANCE, Richard P. Geye, Ray E. Budinger, and Charles H. Voit, December 1953

RM E53J08 CORRELATION OF ISOTHERMAL CONTOURS FORMED BY PENETRATION OF JET OF LIQUID AMMONIA DIRECTED NORMAL TO AIR STREAM, David B. Fenn, February 1954

RM E53J09 FORCE, MOMENT, AND PRESSURE CHARACTERISTICS OF SEVERAL ANNULAR NOSE INLETS AT MACH NUMBER 3.85, James F. Connors and Richard R. Woollett, February 1954

RM E53J12 EFFECT OF DIFFUSION PROCESSES AND TEMPERATURES ON SMOKING TENDENCIES OF LAMINAR DIFFUSION FLAMES, Rose L. Schalla, December 1953

RM E53J14 AN INVESTIGATION OF EFFECTS OF FLAME-HOLDER GUTTER SHAPE ON AFTERBURNER PERFORMANCE, S. Nakanishi, W. W. Velie, and L. Bryant, February 1954

RM E53J20 PRELIMINARY INVESTIGATION OF PERFORMANCE AND STARTING CHARACTERISTICS OF LIQUID FLUORINE - LIQUID OXYGEN MIXTURES WITH JET FUEL, Edward A. Rothenberg and Paul M. Ordin, January 1954

RM E55K01 ZERO-ANGLE-OF-ATTACK PERFORMANCE OF TWO-DIMENSIONAL INLETS NEAR MACH NUMBER 3, Richard R. Woollett and James F. Connors, February 1956

RM E53K04 ANALYTICAL AND EXPERIMENTAL STUDIES OF A DIVIDED-FLOW RAM-JET COMBUSTOR, E. E. Dangle, Robert Friedman, and A. J. Cervenka, January 1954

RM E53K09 PRELIMINARY INVESTIGATION OF THE PERFORMANCE OF A SINGLE TUBULAR COMBUSTOR AT PRESSURES UP TO 12 ATMOSPHERES, Jerrola ` Wear and Helmut F. Butze, January 1954

RM E53K16 EXPERIMENTAL INVESTIGATION OF THE EFFECT OF FUEL-INJECTION-SYSTEM DESIGN VARIABLES ON AFTERBURNER PERFORMANCE, Emmert T. Jansen, Wallace W. Velie, and H. Dean Wilsted, February 1954

RM E53K17 SUMMARY OF FREE-FLIGHT PERFORMANCE OF A SERIES OF RAM-JET ENGINES AT MACH NUMBERS FROM 0.80 TO 2.20, Warren J. North, February 1954

RM E53K19 PERFORMANCE OF TWO AIR-COOLED TURBOJET ENGINES DETERMINED ANALYTICALLY FROM ENGINE COMPONENT PERFORMANCE FOR A RANGE OF COOLING-AIR WEIGHT FLOWS, Robert R. Ziemer, Louis J. Schafer, Jr., and Thomas R. Heaton, February 1954

RM E53K27 EXPLORATORY ENGINE TEST OF TRANSPIRATION-COOLED TURBINE-ROTOR BLADE WITH WIRE-CLOTH SHELL, Patrick L. Donoughe and Anthony J. Diaguila, January 1954

RM E53K30 FLAME QUENCHING BY VARIABLE WIDTH RECTANGULAR-SLOT BURNER AS FUNCTION OF PRESSURE FOR VARIOUS PROPANE-OXYGEN-NITROGEN MIXTURES, Abraham L. Berlad, January 1954

RM E53L01 EXPLOSION AND COMBUSTION PROPERTIES OF ALKYLSILANES: 1, TEMPERATURE COMPOSITION LIMITS OF EXPLOSION FOR METHYL, DIMETHYL-, TRIMETHYL-, TETRAMETHYL-, AND VINYLSILANE AT ATMOSPHERIC PRESSURE, Rose L. Schalla and Glen E. McDonald, February 1954

RM E53L08 EFFECT OF WATER ON CARBON MONOXIDE-OXYGEN FLAME VELOCITY, Glen E. McDonald, February 1954

RM E53L10 INVESTIGATION OF TRANSIENT COMBUSTION CHARACTERISTICS IN A SINGLE TUBULAR COMBUSTOR, Richard H. Donlon, Richard J. McCafferty, and David M. Straight, February 1954

RM E53L14 VAPOR PRESSURES AND CALCULATED HEATS OF VAPORIZATION OF CONCENTRATED NITRIC ACID SOLUTIONS IN COMPOSITION RANGE 71 TO 89 PERCENT NITRIC ACID, 7 TO 20 PERCENT NITROGEN DIOXIDE, 1 TO 10 PERCENT WATER, AND IN TEMPERATURE RANGES 10° TO 60°, A. B. McKeown and Frank E. Belles, February 1954

RM E53L14b EXPERIMENTAL INVESTIGATION AT MACH NUMBERS 1.88, 3.16, AND 3.83 OF PRESSURE DRAG OF WEDGE DIVERTERS SIMULATING BOUNDARY-LAYER-REMOVAL SYSTEMS FOR SIDE INLETS, Thomas G. Piercy and Harry W. Johnson, February 1954

RM E53L16 INVESTIGATION OF THRUST AND DRAG CHARACTERISTICS OF A PLUG-TYPE EXHAUST NOZZLE, Donald P. Hearth and Gerald C. Gorton, February 1954

RM E53L16a LOW-PRESSURE PERFORMANCE OF DIFFERENT DIAMETER EXPERIMENTAL COMBUSTOR LINERS, Ralph T. Dittrich, February 1954

RM E53L18a ALTITUDE PERFORMANCE AND OPERATIONAL CHARACTERISTICS OF AN XT38-A-2 TURBOPROP ENGINE, R. H. Essig and F. W. Schulze, March 1954

RM E53L21a EXPERIMENTAL INVESTIGATION OF A TRANSONIC AXIAL-FLOW-COMPRESSOR ROTOR WITH DOUBLE-CIRCULAR-ARC AIRFOIL BLADE SECTIONS. I - DESIGN, OVER-ALL PERFORMANCE AND STALL CHARACTERISTICS, George W. Lewis, Jr., Francis C. Schwenk, and George K. Serovy, April 1954

RM E53L21b FLOW CALORIMETER FOR DETERMINING COMBUSTION EFFICIENCY FROM RESIDUAL ENTHALPY OF EXHAUST GASES, Albert Evans and Robert R. Hibbard, March 1954

RM E53L22a ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF A FORCED-CONVECTION AIR-COOLED INTERNAL STRUT-SUPPORTED TURBINE BLADE, Eugene F. Schum and Francis S. Stepka, March 1954

RM E53L22b EVALUATION OF A COMPRESSOR BLEED SYSTEM FOR RIM COOLING THE TURBINE WHEEL OF A TURBOJET ENGINE, C. R. Morse and R. H. Kemp, March 1954

RM E53L23 THRUST CHARACTERISTICS OF A SERIES OF CONVERGENT-DIVERGENT EXHAUST NOZZLES AT SUBSONIC AND SUPERSONIC FLIGHT SPEEDS, Evan A. Fradenburgh, Gerald C. Gorton and Andrew Beke, March 1954

RM E53L23b THRUST AND DRAG CHARACTERISTICS OF A CONVERGENT-DIVERGENT NOZZLE WITH VARIOUS EXHAUST JET TEMPERATURES, Donald P. Hearth and Fred A. Wilcox, March 1954

RM E53L24b INVESTIGATION OF COMBUSTION SCREECH AND A METHOD OF ITS CONTROL, James L. Harp, Jr., Wallace W. Velie, and Lively Bryant, March 1954

RM E53L28 EFFECT OF INLET-ANNULUS AREA BLOCKAGE ON OVER-ALL PERFORMANCE AND STALL CHARACTERISTICS OF AN EXPERIMENTAL 15-STAGE AXIAL-FLOW COMPRESSOR, James G. Lucas, Harold B. Finger, and Richard E. Filippi, May 1954

RM E53L28b INTERNAL PERFORMANCE AT MACH NUMBERS TO 2.0 OF 2 AUXILIARY INLETS IMMERSED IN FUSELAGE BOUNDARY LAYER [with list of references], Donald B. Pennington and Paul C. Simon, March 1954

RM E54A07 PRESSURE RECOVERY AND MASS-FLOW PERFORMANCE OF FOUR ANNULAR NOSE INLETS OPERATING IN MACH NUMBER REGION OF 3.1 AND REYNOLDS NUMBER RANGE OF APPROXIMATELY 0.45×10^6 TO 2.20×10^6, Henry R. Hunczak, March 1954

RM E54A14 EFFECT OF IGNITOR DESIGN AND IGNITOR SPARK-GAP ENVIRONMENT ON IGNITION IN A TURBOJET COMBUSTOR, Hampton H. Foster and David M. Straight, April 1954

RM E54A15 COMBUSTION PERFORMANCE OF 2-EXPERIMENTAL TURBOJET ANNULAR COMBUSTORS AT CONDITIONS SIMULATING HIGH-ALTITUDE SUPERSONIC FLIGHT, Eugene V. Zettle, Carl T. Norgren, and Herman Mark, March 1954

RM E54A19 STARTING AND PERFORMANCE CHARACTERISTICS OF A LARGE ASYMMETRIC SUPERSONIC FREE-JET FACILITY, Ferris L. Seashore and Herbert G. Hurrell, April 1954

RM E54A21 ANALYSIS OF THE TURBOJET ENGINE FOR PROPULSION OF SUPERSONIC BOMBERS, Richard P. Krebs and E. Clinton Wilcox, April 1954

RM E54B01 TOOTH-TYPE NOISE-SUPPRESSION DEVICES ON FULL-SCALE AXIAL-FLOW TURBOJET ENGINE, Edmund E. Callaghan, Walton Howes, and Warren North, March 1954

RM E54B19 VARIATION OF SPONTANEOUS IGNITION DELAYS WITH TEMPERATURE AND COMPOSITION FOR PROPANE-OXYGEN-NITROGEN MIXTURES AT ATMOSPHERIC PRESSURE, Joseph L. Jackson and Richard S. Brokaw, May 1954

RM E54B24 PERFORMANCE OF ISENTROPIC NOSE INLETS AT MACH NUMBER OF 5.6, Harry Bernstein and Rudolph C. Haefeli, May 1954

RM E54C05 EFFECT OF CHANNEL GEOMETRY ON QUENCHING OF LAMINAR FLAMES, A. L. Berlad and A. E. Potter, Jr., May 1954

RM E54C08 EVALUATION AT SUPERSONIC SPEEDS OF TWIN-DUCT SIDE-INTAKE SYSTEM WITH TWO-DIMENSIONAL DOUBLE-SHOCK INLETS, Leonard J. Obery, Leonard E. Stitt, and George A. Wise, August 1954

RM E54C09 ANGLE-OF-ATTACK SUPERSONIC PERFORMANCE OF A CONFIGURATION CONSISTING OF A RAMP-TYPE SCOOP INLET LOCATED EITHER ON TOP OR BOTTOM OF A BODY OF REVOLUTION, Emil J. Kremzier and Robert C. Campbell, May 1954

RM E54C15 INVESTIGATION OF A HIGH-TEMPERATURE SINGLE-STAGE TURBINE SUITABLE FOR AIR COOLING AND TURBINE STATOR ADJUSTMENT. I - DESIGN OF VORTEX TURBINE AND PERFORMANCE WITH STATOR AT DESIGN SETTING, Thomas R. Heaton, Robert E. Forrette, and Donald E. Holeski, May 1954

RM E54C17 EXPERIMENTAL PERFORMANCE OF LIQUID FLUORINE - LIQUID AMMONIA PROPELLANT COMBINATION IN 1000-POUND-THRUST ROCKET ENGINES, Howard W. Douglass, May 1954

RM E54C19 IGNITION OF AMMONIA AND MIXED OXIDES OF NITROGEN IN 200-POUND-THRUST ROCKET ENGINES AT 160° F, Glen Hennings, Dezso J. Ladanyi, and John H. Enders, May 1954

RM E54C23 PERFORMANCE OF WEDGE-TYPE BOUNDARY-LAYER DIVERTERS FOR SIDE INLETS AT SUPERSONIC SPEEDS, Robert C. Campbell and Emil J. Kremzier, May 1954

RM E54C25 EFFECT OF IMMERSED SURFACES IN COMBUSTION ZONE ON EFFICIENCY AND STABILITY OF 5-INCH-DIAMETER RAM-JET COMBUSTOR, Thaine W. Reynolds and Donald W. Male, June 1954

RM E54C26 EXPERIMENTAL INVESTIGATION OF AXIAL-FLOW COMPRESSOR INLET STAGE OPERATING AT TRANSONIC RELATIVE INLET MACH NUMBERS: 4, STAGE AND BLADE-ROW PERFORMANCE OF STAGE WITH AXIAL-DISCHARGE STATORS, Donald M. Sandercock, Seymour Lieblein, and Francis C. Schwenk, October 1958

RM E54D02 EFFECT OF NOZZLE CONTOUR ON DRAG OF PARABOLIC AFTERBODIES, Donald J. Vargo and Gerald W. Englert, June 1954

RM E54D05 ANALYTICAL INVESTIGATION OF OFF-DESIGN PERFORMANCE OF A TRANSONIC TURBINE, Warren J. Whitney and Warner L. Stewart, May 1954

RM E54D08 ALTITUDE INVESTIGATION OF CAN-TYPE FLAME HOLDER IN 20-INCH-DIAMETER RAM-JET COMBUSTOR, George R. Smolak and Carl B. Wentworth, June 1954

RM E54D09 ALTITUDE COMPONENT PERFORMANCE OF THE YJ73-GE-3 TURBOJET ENGINE, John E. McAulay and Carl E. Campbell, January 1955

RM E54D20 INVESTIGATION OF SEVERAL DOUBLE-RAMP SIDE INLETS, Leonard E. Stitt and George A. Wise, August 1954

RM E54E03 EFFECT OF HIGH PRESSURE ON SMOKING TENDENCY OF DIFFUSION FLAMES [with list of references], Glen E. McDonald and Rose L. Schalla, June 1954

RM E54E11 PERFORMANCE OF A PAIR OF TUBULAR COMBUSTORS WITH AN EXTERNAL PILOT CHAMBER, Robert Friedman and Eugene V. Zettle, September 1954

RM E54E12 COMPATIBILITY OF PENTABORANE WITH MATERIALS USED FOR SEALS, GASKETS, AND CONSTRUCTION, Samuel Kaye and Frank V. Sordyl, July 1954

RM E54E13 EFFECT OF UNEQUAL AIR-FLOW DISTRIBUTION FROM TWIN INLET DUCTS ON PERFORMANCE OF AN AXIAL-FLOW TURBOJET ENGINE, Curtis L. Walker, Joseph N. Sivo and Emmert T. Jansen, August 1954

RM E54E20 EFFECT OF WEDGE-TYPE BOUNDARY-LAYER DIVERTERS ON PERFORMANCE OF HALF-CONICAL SIDE INLETS AT MACH NUMBER 2.96, Harry W. Johnson and Thomas G. Piercy, August 1954

RM E54F04 ACCELERATION OF HIGH-PRESSURE-RATIO SINGLE-SPOOL TURBOJET ENGINE AS DETERMINED FROM COMPONENT PERFORMANCE CHARACTERISTICS. III - EFFECT OF TURBINE STATOR ADJUSTMENT, Harold E. Rohlik and John J. Rebeske, August 1954

RM E54F07 PERFORMANCE CHARACTERISTICS OF SEVERAL FULL-SCALE DOUBLE-SHROUD EJECTOR CONFIGURATIONS OVER A RANGE OF PRIMARY GAS TEMPERATURES, William K. Greathouse, August 1954

RM E54F08 CHARACTERISTICS OF FLOW ABOUT AXIALLY SYMMETRIC ISENTROPIC SPIKES FOR NOSE INLETS AT MACH NUMBER 3.85, James F. Connors and Richard R. Woollett, August 1954

RM E54F17 INVESTIGATION OF A HIGH-TEMPERATURE SINGLE-STAGE TURBINE SUITABLE FOR AIR COOLING AND TURBINE STATOR ADJUSTMENT. II - PERFORMANCE OF VORTEX TURBINE AT VARIOUS STATOR SETTINGS, Thomas R. Heaton, Donald E. Holeski and Robert E. Forrette, August 1954

RM E54F21a ANALYSIS OF LIMITATIONS IMPOSED ON ONE-SPOOL TURBOJET-ENGINE DESIGNS BY COMPRESSORS AND TURBINES AT FLIGHT MACH NUMBERS OF 0, 2.0, AND 2.8, Richard H. Cavicchi and Robert E. English, September 1954

RM E54F22 PERFORMANCE OF YJ73-GE-3 TURBOJET ENGINE IN ALTITUDE TEST CHAMBER, Harold R. Kaufman and Wilbur F. Dobson, January 1955

RM E54F24 EXPERIMENTAL INVESTIGATION OF A FIVE-STAGE AXIAL-FLOW RESEARCH COMPRESSOR WITH TRANSONIC ROTORS IN ALL STAGES. I - COMPRESSOR DESIGN, Donald M. Sandercock, Karl Kovach, and Seymour Lieblein, September 1954

RM E54F24a EFFECT OF DESIGN OVER-ALL COMPRESSOR PRESSURE RATIO DIVISION ON TWO-SPOOL TURBOJET-ENGINE PERFORMANCE AND GEOMETRY, James F. Dugan, Jr., September 1954

RM E54F29 STUDY OF RADIATION FROM LAMINAR AND TURBULENT OPEN PROPANE-AIR FLAMES AS FUNCTION OF FLAME AREA, EQUIVALENT RATIO, AND FUEL FLOW RATE, Thomas P. Clark and David A. Bittker, August 1954

RM E54F29a SPARK IGNITION OF FLOWING GASES: 4. THEORY OF IGNITION IN NON-TURBULENT AND TURBULENT FLOW USING LONG-DURATION DISCHARGES, Clyde C. Swett, Jr., August 1954

RM E54G01 EXPERIMENTAL INVESTIGATION OF A FIVE-STAGE AXIAL-FLOW RESEARCH COMPRESSOR WITH TRANSONIC ROTORS IN ALL STAGES. II - COMPRESSOR OVER-ALL PERFORMANCE, Karl Kovach and Donald M. Sandercock, September 1954

RM E54G07 INVESTIGATION OF NOISE FIELD AND VELOCITY PROFILE OF AFTERBURNING ENGINE, Warren J. North, Edmund E. Callaghan, and Chester D. Lanzo, September 1954

RM E54G08 COMBINED COMPRESSOR COOLANT INJECTION AND AFTERBURNING FOR TURBOJET THRUST AUGMENTATION, James W. Useller, S. C. Huntley, and David B. Fenn, September 1954

RM E54G12 ALTITUDE INVESTIGATION OF 20-INCH-DIAMETER RAM-JET ENGINE WITH ANNULAR-PILOTED COMBUSTOR, James G. Henzel, Jr., and Arthur M. Trout, August 1954

RM E54G21 PERFORMANCE OF VAPORIZING ANNULAR TURBOJET COMBUSTOR AT SIMULATED HIGH ALTITUDES, Carl T. Norgren, September 1954

RM E54G22 ALTITUDE-WIND-TUNNEL INVESTIGATION OF SEVERAL AFTERBURNER CONFIGURATIONS HAVING MODERATELY HIGH BURNER-INLET VELOCITIES, F. W. Schulze, H. E. Bloomer, and R. R. Miller, November 1954

RM E54G23a ANALYSIS AND CONSTRUCTION OF DESIGN CHARTS FOR TURBINES WITH DOWN-STREAM STATORS, Richard H. Cavicchi and Anita B. Constantine, November 1954

RM E54G26 PRELIMINARY INVESTIGATION OF AN ASYMMETRIC SWEPT NOSE INLET OF CIRCULAR PROJECTION AT MACH NUMBER 3.85, James F. Connors and Richard R. Woollett, October 1954

RM E54G26a PERFORMANCE INVESTIGATION AND HIGH-FLIGHT-SPEED APPLICATION OF A TURBINE WITH A VARIABLE-AREA STATOR, Curtis L. Walker and Emmert T. Jansen, October 1954

RM E54G27 INVESTIGATION OF A TRANSONIC TURBINE DESIGNED FOR A MAXIMUM ROTOR-BLADE SUCTION-SURFACE RELATIVE MACH NUMBER OF 1.57, Warren J. Whitney, Robert Y. Wong and Daniel E. Monroe, October 1954

RM E54G29 INVESTIGATION AT SUPERSONIC SPEEDS OF A TRANSLATING-SPIKE INLET EMPLOYING A STEEP-LIP COWL, Gerald C. Gorton, October 1954

RM E54G30 INVESTIGATION OF TURBOJET ENGINE PERFORMANCE AT SPEEDS AND GAS TEMPERATURES ABOVE RATED USING TURBINE-BLADE EXTERNAL WATER-SPRAY COOLING FROM STATIONARY INJECTION ORIFICES, John C. Freche and Roy A. McKinnon, October 1954

RM E54H02 DRAG DATA FOR 16-INCH-DIAMETER RAM-JET ENGINE WITH DOUBLE-CONE INLET IN FREE FLIGHT AT MACH NUMBERS FROM 0.7 TO 1.8, Merle L. Jones, Leonard Rabb, and Scott H. Simpkinson, October 1954

RM E54H05 EFFECT OF PLUG DESIGN ON PERFORMANCE CHARACTERISTICS OF CONVERGENT-PLUG EXHAUST NOZZLES, H. George Krull and William T. Beale, October 1954

RM E54H10 PRELIMINARY REPORT OF EXPERIMENTAL INVESTIGATION OF RAM-JET CONTROLS AND ENGINE DYNAMICS, G. Vasu, F. A. Wilcox, and S. C. Himmel, October 1954

RM E54H11 INVESTIGATION OF ADJUSTABLE SUPERSONIC INLET IN COMBINATION WITH J34 ENGINE UP TO MACH 2.0, J. C. Nettles and L. A. Leissler, October 1954

RM E54H17 INVESTIGATION OF A HIGH-PRESSURE-RATIO EIGHT-STAGE AXIAL-FLOW RESEARCH COMPRESSOR WITH TWO TRANSONIC INLET STAGES. III - INDIVIDUAL STAGE PERFORMANCE CHARACTERISTICS, Charles H. Voit and Richard P. Geye, November 1954

RM E54H19 THRUST AND PUMPING CHARACTERISTICS OF SERIES OF EJECTOR-TYPE EXHAUST NOZZLES AT SUBSONIC AND SUPERSONIC FLIGHT SPEEDS, Donald P. Hearth and Alfred S. Valerino, November 1954

RM E54H24 EXPERIMENTAL INVESTIGATION OF ACCELERATION CHARACTERISTICS OF A TURBOJET ENGINE INCLUDING REGIONS OF SURGE AND STALL FOR CONTROL APPLICATIONS, Paul M. Stiglic, Ross D. Schmidt, and Gene J. Delio, December 1954

RM E54H25 EFFECT OF DIVERGENCE ANGLE ON THE INTERNAL PERFORMANCE CHARACTERISTICS OF SEVERAL CONICAL CONVERGENT-DIVERGENT NOZZLES, Fred W. Steffen, H. George Krull, and Ralph F. Schmiedlin, November 1954

RM E54H27 SOME SCREECHING-COMBUSTION CHARACTERISTICS OF A TRANSPIRATION-COOLED AFTERBURNER HAVING A POROUS WALL OF WIRE CLOTH, William K. Koffel, James L. Harp, Jr., and Lively Bryant, November 1954

RM E54I01 PERFORMANCE OF A SUPERSONIC RAMP INLET WITH INTERNAL BOUNDARY-LAYER SCOOP, Robert C. Campbell, November 1954

RM E54I09 EXPERIMENTAL INVESTIGATION OF STAGE PERFORMANCE OF J71 THREE-STAGE TURBINE, Robert E. Forrette, December 1954

RM E54I10 HIGH-ALTITUDE PERFORMANCE OF AN EXPERIMENTAL TUBULAR PREVAPORIZING COMBUSTOR, Helmut F. Butze, December 1954

RM E54I14 EFFECTIVENESS OF BOUNDARY-LAYER REMOVAL NEAR THROAT OF RAMP-TYPE SIDE INLET AT FREE-STREAM MACH NUMBER OF 2.0, Leonard J. Obery and Robert W. Cubbison, November 1954

RM E54I15 EXPERIMENTAL INVESTIGATION OF CONTROL SIGNALS AND THE NATURE OF STALL AND SURGE BEHAVIOR IN A TURBOJET ENGINE, G. J. Delio and P. M. Stiglic, December 1954

RM E54I16 PENTABORANE COMBUSTION PERFORMANCE IN 9.75-INCH-DIAMETER RAM-JET ENGINE IN CONNECTED-PIPE ALTITUDE FACILTY, Herschel J. Fivel, Leonard K. Tower, and James B. Gibbs, March 1957

RM E54I23 REVIEW OF STATUS, METHODS, AND POTENTIALS OF GAS-TURBINE AIR-COOLING, Jack B. Esgar and Robert R. Ziemer, February 1955

RM E54I24 PRELIMINARY INVESTIGATION AT MACH NUMBER 1.9 OF SIMULATED WING-ROOT INLETS, Thomas G. Piercy and Maynard I. Weinstein, January 1955

RM E54I27 INVESTIGATION TO MACH NUMBER 2.0 OF SHOCK-POSITIONING CONTROL SYSTEMS FOR A VARIABLE-GEOMETRY INLET IN COMBINATION WITH A J34 TURBOJET ENGINE, L. Abbott Leissler and J. Cary Nettles, December 1954

RM E54I28 STEADY-STATE AND SURGE CHARACTERISTICS OF COMPRESSOR EQUIPPED WITH VARIABLE INLET GUIDE VANES OPERATING IN TURBOJET ENGINE, Lewis E. Wallner and Robert J. Lubick, June 1955

RM E54I29 EXPERIMENTAL INVESTIGATION OF A 0.4 HUB-TIP DIAMETER RATIO AXIAL-FLOW COMPRESSOR INLET STAGE AT TRANSONIC INLET RELATIVE MACH NUMBERS. II - STAGE AND BLADE-ELEMENT PERFORMANCE, John C. Montgomery and Frederick W. Glaser, January 1955

RM E54I30 ACCELERATION CHARACTERISTICS OF A TURBO-JET ENGINE WITH VARIABLE-POSITION INLET GUIDE VANES, W. F. Dobson and Lewis E. Wallner, July 1955

RM E54J01 A STUDY OF FLAME-HOLDER ELEMENTS FOR USE IN HIGH-VELOCITY AFTER-BURNERS, E. William Conrad, W. W. Velie and Frederick W. Schulze, February 1955

RM E54J04 EFFECT OF FUSELAGE FENCES ON ANGLE-OF-ATTACK SUPERSONIC PERFORMANCE OF TOP-INLET-FUSELAGE CONFIGURATION, Emil J. Kremzier and Robert C. Campbell, January 1958

RM E54J08 EXPERIMENTAL INVESTIGATION OF A TRANSONIC AXIAL-FLOW-COMPRESSOR ROTOR WITH DOUBLE-CIRCULAR-ARC AIRFOIL BLADE SECTIONS. II - BLADE -ELEMENT PERFORMANCE, George W. Lewis, Jr., and Francis C. Schwenk, January 1955

RM E54J13 INVESTIGATION OF ROTATING COMPONENTS OF COUNTER-ROTATING TWO-SPOOL ENGINES. I - ANALYTICAL INVESTIGATION OF OFF-DESIGN PERFORMANCE OF TURBINE COMPONENT DESIGNED WITH AND WITHOUT OUTER-TURBINE STATOR, Warner L. Stewart, January 1955

RM E54J18 ROTATING-STALL AND ROTOR-BLADE-VIBRATION SURVEY OF A 13-STAGE AXIAL-FLOW COMPRESSOR IN A TURBOJET ENGINE, Howard F. Calvert, Willis M. Braithwaite, and Arthur A. Medeiros, April 1955

RM E54J25 ADDITIONAL EXPERIMENTAL HEAT-TRANSFER AND DURABILITY DATA ON SEVERAL FORCED-CONVECTION, AIR-COOLED, STRUT-SUPPORTED TURBINE BLADES OF IMPROVED DESIGN, Eugene F. Schum, January 1955

RM E54J26 THRUST AND DRAG CHARACTERISTICS OF SIMULATED VARIABLE-SHROUD NOZZLES WITH HOT AND COLD PRIMARY FLOWS AT SUBSONIC AND SUPERSONIC SPEEDS, Andrew Beke and Paul C. Simon, February 1955

RM E54K01 PRELIMINARY INVESTIGATION OF SOME INTERNAL BOUNDARY-LAYER-CONTROL SYSTEMS ON A SIDE INLET AT MACH NUMBER 2.96, Thomas G. Piercy, February 1955

RM E54K08 EFFECT OF FUEL NOZZLE PROTRUSION ON TRANSIENT AND STEADY-STATE TURBOJET COMBUSTOR PERFORMANCE, Richard J. McCafferty and Richard H. Donlon, February 1955

RM E54K10 SOME MEASUREMENTS OF BOILING BURN-OUT, Warren H. Lowdermilk and Walter F. Weiland, February 1955

RM E54K12 ALUMINUM BOROHYDRIDE-HYDROCARBON MIXTURES AS A SOURCE OF IGNITION FOR A TURBOJET COMBUSTOR, Hampton H. Foster, Edward A. Fletcher, and David M. Straight, February 1955

RM E54K22 EFFECT OF OUTER-SHELL DESIGN ON PERFORMANCE CHARACTERISTICS OF CONVERGENT-PLUG EXHAUST NOZZLES, H. George Krull and William T. Beale, April 1955

RM E54K23a EFFECT OF FREE-STREAM MACH NUMBER ON GROSS-FORCE AND PUMPING CHARACTERISTICS OF SEVERAL EJECTORS, Leonard E. Stitt and Alfred S. Valerino, March 1955

RM E54K26 INLET-AIR DISTORTION EFFECTS ON STALL, SURGE, AND ACCELERATION MARGIN OF A TURBOJET ENGINE EQUIPPED WITH VARIABLE COMPRESSOR INLET GUIDE VANES, David P. Harry, III, and Robert J. Lubick, October 1955

RM E54K26a EFFECT OF CIRCUMFERENTIAL TOTAL-PRESSURE GRADIENTS TYPICAL OF SINGLE-INLET DUCT INSTALLATIONS ON PERFORMANCE OF AN AXIAL-FLOW TURBOJET ENGINE, S. C. Huntley, Joseph N. Sivo, and Curtis L. Walker, June 1955

RM E54K29 AXIAL-FLOW COMPRESSOR ROTATING-STALL AND ROTOR-BLADE VIBRATION SURVEY, Howard F. Calvert, Arthur A. Medeiros, and Floyd B. Garrett, May 1955

RM E54K29a EXPERIMENTAL INVESTIGATION OF EXTERNAL WATER-SPRAY COOLING IN A TURBOJET ENGINE UTILIZING SEVERAL INJECTION CONFIGURATIONS INCLUDING ORIFICES IN THE ROTOR-BLADE BASES, Roy A. McKinnon and John C. Freche, March 1955

RM E54K30 NOTE ON THE SCAVENGE OF 6-INCH-DIAMETER RAM-JET EXHAUST IN MACH 3.1, 1- BY 1-FOOT SUPERSONIC TUNNEL, Warren C. Burgess, Jr., and L. Eugene Baughman, February 1955

RM E54L01 EFFECT OF COMPRESSOR-INLET AREA BLOCKAGE ON PERFORMANCE OF EXPERIMENTAL COMPRESSOR AND HYPOTHETA CAL ENGINE, Richard E. Filippi and James G. Lucas, April 1955

RM E54L03 INTERNAL PERFORMANCE OF A SERIES OF CIRCULAR AUXILIARY-AIR INLETS IMMERSED IN A TURBULENT BOUNDARY LAYER MACH NUMBER RANGE: 1.5 TO 2.0, Paul C. Simon, March 1955

RM E54L08 COMPARISON OF TWO METHODS OF MODULATING THE THROAT AREA OF CONVERGENT PLUG NOZZLES, H. George Krull and William T. Beale, May 1955

RM E54L09 EFFECTS OF SEVERAL GEOMETRIC VARIABLES ON INTERNAL PERFORMANCE OF SHORT CONVERGENT-DIVERGENT EXHAUST NOZZLES, Fred W. Steffen, H. George Krull, and Ralph F. Schmiedlin, February 1955

RM E54L17 INVESTIGATION OF A RAMP-TYPE INLET DESIGNED FOR IMPROVED ANGLE-OF-ATTACK PERFORMANCE AT MACH NUMBER 2.0, G. A. Wise and R. C. Campbell, February 1955

RM E54L21a PERFORMANCE OF EXPERIMENTAL CHANNELED-WALL ANNULAR TURBOJET COMBUSTOR AT CONDITIONS SIMULATING HIGH-ALTITUDE SUPERSONIC FLIGHT. I - U-SHAPED CHANNEL WALLS FOR SECONDARY-AIR ENTRY, Eugene V. Zettle and Robert Friedman, March 1955

RM E54L22a APPLICATION OF OBLIQUE-SHOCK SENSING SYSTEM TO RAM-JET-ENGINE FLIGHT MACH NUMBER CONTROL, Fred A. Wilcox and Donald P. Hearth, March 1955

RM E54L23a INVESTIGATION OF THE PERFORMANCE OF A TURBOJET ENGINE WITH VARIABLE-POSITION COMPRESSOR INLET GUIDE VANES, Ray E. Budinger and Harold R. Kaufman, October 1955

RM E54L24 CORRELATION OF VIBRATORY ROOT FAILURES AND STRESS DISTRIBUTION IN J65 COMPRESSOR BLADES, Andre J. Meyer, Jr., and Albert Kaufman, September 1955

RM E54L27 PERFORMANCE OF A DOUBLE-CONE INLET WITH AND WITHOUT A SHROUD AT BELOW-DESIGN MACH NUMBERS, Donald Pennington, Leonard Rabb and Scott H. Simpkinson, March 1955

RM E54L28 COMPONENT OPERATING TRENDS DURING ACCELERATION AND DECELERATION OF TWO HYPOTHETICAL TWO-SPOOL TURBOJET ENGINES, James F. Dugan, Jr., April 1955

RM E54L28a STATIC SEA-LEVEL PERFORMANCE OF AN AXIAL-FLOW-COMPRESSOR TURBOJET ENGINE WITH AN AIR-COOLED TURBINE, Reeves P. Cochran and Robert P. Dengler, March 1955

RM E54L31 EXPERIMENTAL INVESTIGATION OF A TRANSONIC COMPRESSOR ROTOR WITH A 1.5-INCH CHORD LENGTH AND AN ASPECT RATIO OF 3.0. I - DESIGN, OVER-ALL PERFORMANCE, AND ROTATING-STALL CHARACTERISTICS, Edward R. Tysl, Francis C. Schwenk, and Thomas B. Watkins, March 1955

RM E55A03 INVESTIGATION OF A HIGH-PRESSURE-RATIO EIGHT-STAGE AXIAL-FLOW RESEARCH COMPRESSOR WITH TWO TRANSONIC INLET STAGES. V - PRELIMINARY ANALYSIS OF OVER-ALL PERFORMANCE OF MODIFIED COMPRESSOR, Raymond M. Standahar and Richard P. Geye, May 1955

RM E55A07 EXPERIMENTAL PERFORMANCE OF THE MIXED-OXIDES-OF-NITROGEN - AMMONIA PROPELLANT COMBINATION WITH SEVERAL INJECTION METHODS IN A 1000-POUND-THRUST ROCKET ENGINE, William A. Tomazic and George R. Kinney, March 1955

RM E55A24 PERFORMANCE OF A TUBULAR TURBOJET COMBUSTOR AT HIGH PRESSURES AND TEMPERATURES, Helmut F. Butze and Jerrold D. Wear, April 1955

RM E55A26 STABILIZATION TECHNIQUES FOR RAMP-TYPE SIDE INLETS AT SUPERSONIC SPEEDS, L. J. Obery, R. W. Cubbison, and T. G. Mercer, April 1955

RM E55A31 ANALYTIC EVALUATION OF EFFECT OF INLET-AIR TEMPERATURE AND COMBUSTION PRESSURE ON COMBUSTION PERFORMANCE OF BORON SLURRIES AND BLENDS OF PENTABORANE IN OCTENE-1, Leonard K. Tower, June 1955

RM E55B03 SPONTANEOUS IGNITION LIMITS OF PENTABORANE, Rose L. Schalla, January 1957

RM E55B10 HIGH-ALTITUDE PERFORMANCE OF AN EXPERIMENTAL TURBOJET COMBUSTOR HAVING VARIABLE PRIMARY-AIR ADMISSION, David M. Straight and J. Dean Gernon, April 1955

RM E55B25 EFFECT ON EJECTOR PERFORMANCE OF VARYING DIAMETER RATIO BY SIMULATED IRIS FLAPS, Alfred S. Valerino and Leonard E. Stitt, April 1955

RM E55B28 INVESTIGATION OF A HIGH-PRESSURE-RATIO EIGHT-STAGE AXIAL-FLOW RESEARCH COMPRESSOR WITH TWO TRANSONIC INLET STAGES. IV - MODIFICATION OF AERODYNAMIC DESIGN AND PREDICTION OF PERFORMANCE, Richard P. Geye and Charles H. Voit, June 1955

RM E55C01 INVESTIGATION OF BOATTAIL AND BASE PRESSURES OF TWIN-JET AFTER-BODIES AT MACH NUMBER 1.91, Reino J. Salmi and John L. Klann, April 1955

RM E55C04 EFFECT OF ROTOR LEADING-EDGE SWEEPBACK ON PERFORMANCE OF A TRANSONIC TURBINE, Warner L. Stewart and Robert Y. Wong, April 1955

RM E55C07 EXPERIMENTAL EVALUATION OF BORON-HYDROCARBON SLURRY IN A 16-INCH RAM-JET COMBUSTOR, William R. Kerslake, E. E. Dangle, and A. J. Cervenka, June 1955

RM E55C25a EFFECT OF ANNULAR INLET BAFFLES ON ROTATING STALL, BLADE VIBRATION, AND PERFORMANCE OF AN AXIAL-FLOW COMPRESSOR IN A TURBOJET ENGINE, Donald F. Johnson, Andre J. Meyer, Jr., and Morgan P. Hanson, October 1955

RM E55D05a A SURVEY OF METHODS FOR TURBOJET THRUST MEASUREMENT APPLICABLE TO FLIGHT INSTALLATIONS, William A. Fleming and David S. Gabriel, June 1955

RM E55D15 EXPERIMENTAL INVESTIGATION OF DIRECT CONTROL OF DIFFUSER PRESSURE ON 16-INCH RAM-JET ENGINE, William R. Dunbar, George Vasu, and Herbert G. Hurrell, June 1955

RM E55D22 AN ANALYSIS OF RAM-JET-ENGINE TIME DELAY FOLLOWING A FUEL-FLOW DISTURBANCE, Fred A. Wilcox and Arthur R. Anderson, June 1955

RM E55E04 LOW-TEMPERATURE CHEMICAL STARTING OF 200-POUND-THRUST JP-4-NITRIC ACID ROCKET ENGINE USING 3-FLUID PROPELLANT VALUE, Glen Hennings and Gerald Morrell, June 1955

RM E55E05 EFFECT OF INLET TEMPERATURE ON ROTATING STALL AND BLADE VIBRATIONS IN A MULTISTAGE AXIAL-FLOW COMPRESSOR, Arthur A. Medeiros, Howard F. Calvert, and David B. Fenn, August 1955

RM E55E18 PERFORMANCE CHARACTERISTICS OF HEMISPHERICAL TARGET-TYPE THRUST REVERSERS, Fred W. Steffen, Jack G. McArdle, and James W. Coats, September 1955

RM E55E20a PRELIMINARY ANALYSIS OF PERFORMANCE OF TURBOJET ENGINES USED AS PUMPS FOR BOUNDARY-LAYER CONTROL, E. William Conrad, August 1955

RM E55E25 STALL AND FLAME OUT RESULTING FROM FIRING OF ARMAMENT, J. Howard Childs, Fred D. Kochendorfer, Robert J. Lubick, and Robert Friedman, August 1955

RM E55F01 EXPERIMENTAL INVESTIGATION OF A TRANSONIC AXIAL-FLOW-COMPRESSOR ROTOR WITH DOUBLE-CIRCULAR-ARC AIRFOIL BLADE SECTIONS. III - COMPARISON OF BLADE-ELEMENT PERFORMANCE WITH THREE LEVELS OF SOLIDITY, Francis C. Schwenk and George W. Lewis, Jr., July 1955

RM E55F09 PRELIMINARY PERFORMANCE DATA OF SEVERAL TAIL-PIPE-CASCADE-TYPE MODEL THRUST REVERSERS, James G. Henzel, Jr., and Jack G. McArdle, August 1955

RM E55F10 EXPERIMENTAL INVESTIGATION OF A TRANSONIC COMPRESSOR ROTOR WITH A 1.5-INCH CHORD LENGTH AND AN ASPECT RATIO OF 3.0. II - BLADE-ELEMENT PERFORMANCE, Francis C. Schwenk and Edward R. Tysl, August 1955

RM E55F20 EFFECT OF INLET FLOW DISTORTION ON COMPRESSOR STALL AND ACCELERATION CHARACTERISTICS OF A J65-B-3 TURBOJET ENGINE, David B. Fenn and Joseph N. Sivo, November 1955

RM E55F21 EXPERIMENTAL STUDY OF SHOCK-POSITIONING METHOD OF RAM-JET-ENGINE CONTROL, Herbert G. Hurrell, George Vasu, and William R. Dunbar, August 1955

RM E55F22 AIRCRAFT-FUEL-TANK DESIGN FOR LIQUID HYDROGEN, T. W. Reynolds, August 1955

RM E55F24 EXPERIMENTAL INVESTIGATION OF METHODS OF IMPROVING DIFFUSER-EXIT TOTAL-PRESSURE PROFILES FOR A SIDE-INLET MODEL AT MACH NUMBER 3.05, Thomas G. Piercy and John L. Klann, August 1955

RM E55F29 PERFORMANCE CHARACTERISTICS OF AXISYMMETRIC TWO-CONE AND ISENTROPIC NOSE INLETS AT MACH NUMBER 1.90, James F. Connors and Rudolph C. Meyer, September 1955

RM E55F30 A VARIABLE-GEOMETRY AXISYMMETRIC SUPERSONIC INLET WITH TELESCOPING CENTERBODY, James F. Connors and Rudolph C. Meyer, September 1955

RM E55G01 FLIGHT INVESTIGATION OF PENTABORANE FUEL IN 9.75-INCH-DIAMETER RAM-JET ENGINE WITH DOWNSTREAM FUEL INJECTION, John H. Disher and Merle L. Jones, April 1957

RM E55G19 INTERACTION OF A JET AND FLAT PLATE LOCATED IN AN AIRSTREAM, Gerald W. Englert, Joseph F. Wasserbauer, and Paul Whalen, September 1955

RM E55G21a PERFORMANCE CHARACTERISTICS OF SEVERAL DIVERGENT-SHROUD AIRCRAFT EJECTORS, William K. Greathouse and William T. Beale, September 1955

RM E55G27 EFFECTS OF COMPRESSOR INTERSTAGE BLEED AND ADJUSTABLE INLET GUIDE VANES ON COMPRESSOR STALL CHARACTERISTICS OF HIGH-PRESSURE-RATIO TURBOJET ENGINE AT ALTITUDE, William E. Mallett and Donald E. Groesbeck, January 1956

RM E55G27a IDEAL TEMPERATURE RISE DUE TO CONSTANT-PRESSURE COMBUSTION OF JP-4 FUEL, S. C. Huntley, September 1955

RM E55H02 FACTORS THAT AFFECT OPERATIONAL RELIABILITY OF TURBOJET ENGINES, Lewis Laboratory Staff, January 1956

RM E55H03 EXPERIMENTAL INVESTIGATION OF A SURGE CONTROL ON A TURBOJET ENGINE, David Novik, Herbert Heppler, and Paul M. Stiglic, November 1955

RM E55H03a TRANSIENT AND STEADY-STATE PERFORMANCE OF A SINGLE TURBOJET COMBUSTOR WITH FOUR DIFFERENT FUEL NOZZLES, Richard J. McCafferty and Richard H. Donlon, October 1955

RM E55H04 PRELIMINARY INVESTIGATION OF A CONICAL SPIKE INLET IN COMBINATION WITH A VERTICAL-WEDGE AUXILIARY INLET AT MACH NUMBER 1.9, Andrew Beke, John L. Allen, and Thomas Williams, September 1955

RM E55H04a ANALYSIS OF AIR-TURBOJET ENGINE PERFORMANCE INCLUDING EFFECTS OF COMPONENT CHANGES, Roger W. Luidens and Richard J. Weber, April 1956

RM E55H10 PERFORMANCE OF 4 EXPERIMENTAL HIGH-BTU-PER-GALLON FUELS IN SINGLE TURBOJET COMBUSTOR, Edmund R. Jonash, Allen J. Metzler, and Helmut F. Butze, November 1956

RM E55H11 SURVEY OF UNCLASSIFIED AXIAL-FLOW-COMPRESSOR LITERATURE, Howard Z. Herzig and Arthur G. Hansen, November 1955

RM E55H16 INVESTIGATION OF TURBINES SUITABLE FOR USE IN A TURBOJET ENGINE WITH HIGH COMPRESSOR PRESSURE RATIO AND LOW COMPRESSOR-TIP SPEED. V - EXPERIMENTAL PERFORMANCE OF TWO-STAGE TURBINE WITH DOWNSTREAM STATOR, Elmer H. Davison, Donald A. Petrash, and Harold J. Schum, October 1955

RM E55H16a EFFECT OF CENTERBODY BOUNDARY-LAYER REMOVAL NEAR THE THROAT OF THREE CONICAL NOSE INLETS AT MACH 1.6 TO 2.0, Emil J. Kremzier and George A. Wise, November 1955

RM E55H17 EFFECT OF REDUCED STATOR-BLADE TRAILING-EDGE THICKNESS ON OVER-ALL PERFORMANCE OF A TRANSONIC TURBINE, Warren J. Whitney, Warner L. Stewart, and Robert Y. Wong, November 1955

RM E55H25 MODIFIED TUBULAR COMBUSTORS AS HIGH-TEMPERATURE GAS GENERATORS, Robert Friedman and Eugene V. Zettle, October 1955

RM E55H25a THROAT-AREA DETERMINATION FOR A CASCADE OF DOUBLE-CIRCULAR-ARC BLADES, Linwood C. Wright and Richard Schwind, November 1955

RM E55H31 PERFORMANCE AND COMPONENT FRONTAL AREAS OF A HYPOTHETICAL TWO-SPOOL TURBOJET ENGINE FOR THREE MODES OF OPERATION, James F. Dugan, Jr., December 1955

RM E55I09 EFFECT OF INLET-AIR-FLOW DISTORTIONS ON STEADY-STATE PERFORMANCE OF J65-B-3 TURBOJET ENGINE, Ivan D. Smith, W. M. Braithwaite, and Howard F. Calvert, January 1956

RM E55I13 INVESTIGATION OF A HIGH-PRESSURE-RATIO EIGHT-STAGE AXIAL-FLOW RESEARCH COMPRESSOR WITH TWO TRANSONIC INLET STAGES. VI - OVER-ALL PERFORMANCE, ROTATING STALL, AND BLADE VIBRATION AT LOW AND INTERMEDIATE COMPRESSOR SPEEDS, Raymond M. Standahar, Morgan P. Hanson, and Richard P. Geye, November 1955

RM E55I14 PERFORMANCE OF SINGLE FUEL-VAPORIZING COMBUSTOR WITH 6 INJECTORS ADAPTED FOR GASEOUS HYDROGEN, Jerrold D. Wear and Arthur L. Smith, November 1955

RM E55I16 SPARK IGNITION OF FLOWING GASES: 5, APPLICATION OF FUEL-AIR-RATIO AND INITIAL-TEMPERATURE DATA TO IGNITION THEORY, Clyde C. Swett, Jr., November 1955

RM E55I19 PERFORMANCE OF A HIGH-SOLIDITY HIGH-PRESSURE-RATIO TRANSONIC ROTOR, Harvey E. Neumann, November 1955

RM E55I21 EFFECTS OF A J34 TURBOJET ENGINE ON SUPERSONIC DIFFUSER PERFORMANCE, Milton A. Beheim and Gerald W. Englert, January 1956

RM E55I23 TRANSPORTATION OF LIQUID FLUORINE, Paul M. Ordin, November 1955

RM E55I26 PRELIMINARY INVESTIGATION OF EFFECT ON PERFORMANCE OF DIVIDING CONICAL-SPIKE NOSE INLETS INTO HALVES AT MACH NUMBERS 1.5 TO 2.0, John L. Allen, December 1955

RM E55I27 EFFECT OF AN ADJUSTABLE SUPERSONIC INLET ON THE PERFORMANCE UP TO MACH NUMBER 2.0 OF A J34 TURBOJET ENGINE, Andrew Beke, Gerald Englert, and Milton Beheim, January 1956

RM E55I29 PERFORMANCE CHARACTERISTICS OF CYLINDRICAL TARGET-TYPE THRUST REVERSERS, Fred W. Steffen and Jack G. McArdle, January 1956

RM E55J04 PRELIMINARY INVESTIGATION OF SEVERAL ROOT DESIGNS FOR CERMENT TURBINE BLADES IN TURBOJET ENGINE 3. CURVED-ROOT DESIGN, Benjamin Pinkel, George C. Deutsch, and William C. Morgan, December 1955

RM E55J10 INVESTIGATION OF A CONTINUOUS NORMAL-SHOCK POSITIONING CONTROL ON THE BYPASS OF A SUPERSONIC INLET IN COMBINATION WITH THE J34 TURBOJET ENGINE, Fred A. Wilcox, January 1956

RM E55J11 ALTITUDE PERFORMANCE EVALUATION OF J71-A-11 TURBOJET ENGINE, James W. Useller and George E. Pappas, March 1956

RM E55J12a INVESTIGATION AT SUPERSONIC AND SUBSONIC MACH NUMBERS OF AUXILIARY INLETS SUPPLYING SECONDARY AIR FLOW TO EJECTOR EXHAUST NOZZLES, Donald P. Hearth and Robert W. Cubbison, January 1956

RM E55J13 COMPARISON OF PERFORMANCE AND COMPONENT FRONTAL AREAS OF HYPOTHETICAL TWO-SPOOL AND ONE-SPOOL TURBOJET ENGINES, James F. Dugan, Jr., January 1956

RM E55J13a INTERFERENCE EFFECTS AT MACH 1.9 ON A HORIZONTAL TAIL DUE TO TRAILING SHOCK WAVES FROM AN AXISYMMETRIC BODY WITH AN EXITING JET, Reino J. Salmi and John L. Klann, January 1956

RM E55J17 TURBOJET ENGINE INVESTIGATION OF EFFECT OF THERMAL SHOCK INDUCED BY EXTERNAL WATER-SPRAY COOLING ON TURBINE BLADES OF FIVE HIGH-TEMPERATURE ALLOYS, John C. Freche and Robert O. Hickel, December 1955

RM E55J17a EFFECT OF COMBUSTION GAS PROPERTIES ON TURBOJET-ENGINE PERFORMANCE WITH HYDROGEN AS FUEL, Robert E. English, April 1956

RM E55J18 EXPERIMENTAL EVALUATION OF GASEOUS HYDROGEN FUEL IN 16-INCH DIAMETER RAM-JET ENGINE, E. E. Dangle and William R. Kerslake, March 1956

RM E55J18a EFFECT OF DIAMETER OF CLOSED-END COOLANT PASSAGES ON NATURAL-CONVECTION WATER COOLING OF GAS-TURBINE BLADES, Arthur N. Curren and Charles F. Zalabak, January 1956

RM E55J19 EXPERIMENTAL INVESTIGATION OF EFFECT OF COOLING AIR ON TURBINE PERFORMANCE OF 2 TURBOJET ENGINES MODIFIED FOR AIR-COOLING, Gordon T. Smith, John C. Freche, and Reeves P. Cochran, January 1956

RM E55J20 ROCKET-ENGINE THROTTLING, William A. Tomazic, December 1955

RM E55K01 ZERO-ANGLE-OF-ATTACK PERFORMANCE OF 2-DIMENSIONAL INLETS NEAR MACH NUMBER 3, Richard R. Woollett and James F. Connors, February 1956

RM E55K02 EVAPORATION OF JP-5 FUEL SPRAYS IN AIR STREAMS, Hampton H. Foster and Robert D. Ingebo, February 1956

RM E55K03 EFFECT OF INLET-GUIDE-VANE ANGLE ON BLADE VIBRATION AND ROTATING STALL OF 13-STAGE AXIAL FLOW COMPRESSOR IN TURBOJET ENGINE, Howard F. Calvert, Arthur A. Medeiros, and Donald F. Johnson, May 1956

RM E55K04 EFFECT OF DESIGN COMPRESSOR PRESSURE RATIO ON PERFORMANCE OF HYPOTHETICAL TWO-SPOOL NUCLEAR-POWERED TURBOJET ENGINES, James F. Dugan, Jr., April 1956

RM E55K15 EFFECT OF INLET-DUCT LENGTH IN UNIFORM-FLOW FIELD ON TURBOJET-ENGINE OPERATION, Robert J. Lubick, Louis J. Chelko, and Lewis E. Wallner, April 1956

RM E55K16 WEIGHT-FLOW AND THRUST LIMITATIONS DUE TO USE OF ROTATING COMBUSTORS IN A TURBO-JET ENGINE, Erwin A. Lezberg, Perry L. Blackshear, Jr., and Warren D. Rayle, August 1956

RM E55K18 TEMPERATURE DROPS THROUGH LIQUID-COOLED TURBINE BLADES WITH VARIOUS COOLING-PASSAGE GEOMETRIES, Edward R. Bartoo, March 1956

RM E55K21a EFFECT OF BLADE-TIP CROSSOVER PASSAGES ON NATURAL-CONVECTION WATER-COOLING OF GAS-TURBINE BLADES, Charles F. Zalabak and Arthur N. Curren, March 1956

RM E55K22 EFFECTS OF ROCKET-ARMAMENT EXHAUST GAS ON THE PERFORMANCE OF A SUPERSONIC-INLET J34-TURBOJET-ENGINE INSTALLATION AT MACH 2.0, Milton A. Beheim and Philip J. Evans, February 1956

RM E55K23 EFFECT OF INLET-GUIDE VANE ANGLE ON PERFORMANCE CHARACTERISTICS OF 13-STAGE AXIAL-FLOW COMPRESSOR IN TURBOJET ENGINE, Arthur A. Medeiros and Howard F. Calvert, May 1956

RM E55K30 EFFECTIVENESS OF INHIBITORS FOR MASS TRANSFER AND CORROSION IN SODIUM HYDROXIDE - NICKEL SYSTEMS, Americo F. Forestieri and Robert A. Lad, February 1956

RM E55L01 CORRELATION BETWEEN HYDROGEN PRESSURE AND PROTECTIVE ACTION OF ADDITIVES IN THE MOLTEN SODIUM HYDROXIDE - NICKEL SYSTEM, Charles E. May, February 1956

RM E55L05 EXPERIMENTAL INVESTIGATION OF AIR-SIDE PERFORMANCE OF LIQUID-METAL TO AIR HEAT EXCHANGERS, Louis Gedeon, Charles W. Conant, and Samuel J. Kaufman, March 1956

RM E55L09 EXPERIMENTAL INVESTIGATION OF A 0.4 HUB-TIP DIAMETER RATIO AXIAL-FLOW COMPRESSOR INLET STAGE AT TRANSONIC INLET RELATIVE MACH NUMBERS. III - EFFECT OF TIP TAPER ON OVER-ALL AND BLADE-ELEMENT PERFORMANCES, John C. Montgomery and Frederick Glaser, March 1956

RM E55L09a EFFECT OF A REDUCTION IN STATOR SOLIDITY ON PERFORMANCE OF A TRANSONIC TURBINE, James W. Miser, Warner L. Stewart, and Robert Y. Wong, March 1956

RM E55L13a DYNAMICS OF A SUPERSONIC INLET WITH ADJUSTABLE BYPASS IN COMBINATION WITH A J34 TURBOJET ENGINE, Fred Wilcox and Paul Whalen, APPENDIX A: COMPRESSOR-INLET PRESSURE RESPONSE, John C. Sanders, March 1956

RM E55L14 AERODYNAMIC CONTROL OF SUPERSONIC INLETS FOR OPTIMUM PERFORMANCE, Fred A. Wilcox and Eugene Perchonok, February 1956

RM E55L14a VISUAL STUDY OF FREE CONVECTION IN NARROW VERTICAL ENCLOSURE, Ephraim M. Sparrow and Samuel J. Kaufman, February 1956

RM E55L16a SOME ASPECTS OF SUPERSONIC INLET STABILITY, James F. Connors, February 1956

RM E55L17 EFFECTS OF INTERNAL BOUNDARY-LAYER CONTROL ON THE PERFORMANCE OF SUPERSONIC AFT INLETS, Leonard J. Obery and Carl F. Schueller, March 1956

RM E55L19 FACTORS AFFECTING FLOW DISTORTIONS PRODUCED BY SUPERSONIC INLETS, Thomas G. Piercy, February 1956

RM E55L22 TEMPERATURE-CONTROL STUDY OF TURBINE REGION OF TURBOJET ENGINE, INCLUDING TURBINE-BLADE TIME CONSTANTS AND STARTING CHARACTERISTICS, W. E. Phillips, Jr., April 1956

RM E55L23 CALCULATED REACTIVITY OF URANYL-FLUORIDE WATER CRITICALITY EXPERIMENTS, Donald Bogart and Leonard Soffer, March 1956

RM E55L28 EFFECT OF DISSOLVED OXYGEN ON FILTERABILITY OF JET FUELS FOR TEMPERATURES BETWEEN 300° AND 400° F, Anderson B. J. McKeown and Robert R. Hibbard, December 1955

RM E56A13 PRELIMINARY SURVEY OF COMPRESSOR ROTOR-BLADE WAKES AND OTHER FLOW PHENOMENA WITH A HOT-WIRE ANEMOMETER, Theodore E. Fessler and Melvin J. Hartmann, June 1956

RM E56A17 PERFORMANCE OF SUPERSONIC RAMP-TYPE SIDE INLET WITH COMBINATIONS OF FUSELAGE AND INLET THROAT BOUNDARY-LAYER REMOVAL, Robert C. Campbell, April 1956

RM E56A20a TURBOJET COMBUSTOR PERFORMANCE WITH INJECTION OF HYDROGEN PEROXIDE FOR THRUST AUGMENTATION, Allen J. Metzler and Jack S. Grobman, April 1956

RM E56A24 DESIGN OF TWO TRANSPIRATION-COOLED STRUT-SUPPORTED TURBINE ROTOR BLADES, Ernst I. Prasse, John N. B. Livingood, and Patrick L. Donoughe, April 1956

RM E56A27 THEORETICAL PERFORMANCE OF JP-4 FUEL AND LIQUID OXYGEN AS ROCKET PROPELLANT: 1, FROZEN COMPOSITION, Vearl N. Huff and Anthony Fortini, April 1956

RM E56A30 FACTORS CONTROLLING AIR-INLET FLOW DISTORTIONS, William H. Sterbentz, April 1956

RM E56A31 GAS-TO-BLADE HEAT-TRANSFER COEFFICIENTS AND TURBINE HEAT-REJECTION RATES FOR A RANGE OF ONE-SPOOL COOLED-TURBINE ENGINE DESIGNS, Henry O. Slone and Jack B. Esgar, May 1956

RM E56B09 GAS-TURBINE-ENGINE PERFORMANCE WHEN HEAT FROM LIQUID-COOLED TURBINES IS REJECTED AHEAD OF, WITHIN, OR BEHIND MAIN COMPRESSOR, Jack B. Esgar and Henry O. Slone, May 1956

RM E56B14 COMPONENT PERFORMANCE OF J71-A-2(600-D1) TURBOJET ENGINE AT SEVERAL REYNOLDS NUMBER INDICES, Ferris L. Seashore and Lester C. Corrington, December 1956

RM E56B16 ALTITUDE PERFORMANCE OF J71-A-2(600-D1) TURBOJET ENGINE, Ivan D. Smith and Joseph N. Sivo, December 1956

RM E56B17 ANALYSIS OF COOLING-AIR REQUIREMENTS OF CORRUGATED-INSERT-TYPE TURBINE BLADES SUITABLE FOR A SUPERSONIC TURBOJET ENGINE, Robert R. Ziemer and Henry O. Slone, April 1956

RM E56B20 ANALYTICAL INVESTIGATION OF FACTORS AFFECTING THE PERFORMANCE OF SINGLE-STAGE TURBINES HAVING ROTOR-TIP DISCHARGE OF COOLING AIR, Gordon T. Smith and Robert O. Hickel, April 1956

RM E56C02 PRELIMINARY INVESTIGATION OF SHORT 2-DIMENSIONAL SUBSONIC DIFFUSERS, Richard R. Woolett, May 1956

RM E56C05 TEMPERATURES IN A J47-25 TURBOJET-ENGINE TURBINE SECTION DURING STEADY-STATE AND TRANSIENT OPERATION IN AN ALTITUDE TEST STAND, C. R. Morse and J. R. Johnston, May 1956

RM E56C07 EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF AN ACCELERATION REGULATING CONTROL FOR A TURBOJET ENGINE, Paul M. Stiglic, Herbert Heppler, and David Novik, June 1956

RM E56C08 ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF A TEMPERATURE-SCHEDULE ACCELERATION CONTROL FOR A TURBOJET ENGINE, Herbert Heppler, Paul M. Stiglic, and David Novik, June 1956

RM E56C10 EFFECT OF FUELS ON SCREAMING IN 200-POUND-THRUST LIQUID-OXYGEN - FUEL ROCKET ENGINE, Isaac Pass and Adelbert O. Tischler, June 1956

RM E56C14 EXTERNAL-STREAM EFFECTS ON GROSS THRUST AND PUMPING CHARACTERISTICS OF EJECTORS OPERATING AT OFF-DESIGN MACH NUMBERS, Alfred S. Valerino and Richard A. Yeager, June 1956

RM E56C15 INVESTIGATION OF TWO-STAGE COUNTER-ROTATING COMPRESSOR. I - DESIGN AND OVER-ALL PERFORMANCE OF TRANSONIC FIRST COMPRESSOR STAGE, Ward W. Wilcox and Linwood C. Wright, May 1956

RM E56C26 EXPERIMENTAL INVESTIGATION OF AIR-COOLED TURBINE ROTOR BLADE TEMPERATURES IN A TURBOJET ENGINE OPERATING AT TURBINE-INLET TEMPERATURES UP TO 2580° R AND ALTITUDES OF 50,000 AND 60,000 FEET, Henry O. Slone, Reeves P. Cochran, and Robert P. Dengler, August 1956

RM E56D02 ANALYTIC EVALUATION OF EFFECT OF INLET-AIR TEMPERATURE AND COMBUSTION PRESSURE ON COMBUSTION PERFORMANCE OF BORON SLURRIES AND BLENDS OF PENTABORANE IN OCTENE-1. SUPPLEMENT I - INFLUENCE OF NEW BORIC-OXIDE VAPOR-PRESSURE DATA ON CALCULATED PERFORMANCE OF PENTABORANE, Leonard K. Tower, May 1956

RM E56D06 EXPERIMENTAL INVESTIGATION OF A TRANSONIC COMPRESSOR ROTOR WITH A 1.5-INCH CHORD LENGTH AND AN ASPECT RATIO OF 3.0. III - BLADE-ELEMENT AND OVER-ALL PERFORMANCE AT THREE SOLIDITY LEVELS, Edward R. Tysi and Francis C. Schwenk, August 1956

RM E56D12 STABILITY OF SUPERSONIC INLETS AT MACH 1.91 WITH AIR INJECTION AND SUCTION, K. Kowalski and Thomas G. Piercy, June 1956

RM E56D16 PERFORMANCE OF SHORT TURBOJET COMBUSTOR WITH HYDROGEN FUEL IN QUARTER-ANNULUS DUCT AND COMPARISON WITH PERFORMANCE IN FULL-SCALE ENGINE, Robert Friedman, Carl T. Norgren, and Robert E. Jones, July 1956

RM E56D20 ANALYSIS OF RAM-JET ENGINE PERFORMANCE INCLUDING EFFECTS OF COMPONENT CHANGES, Richard J. Weber and Roger W. Luidens, October 1956

RM E56D23 THEORETICAL PERFORMANCE OF JP-4 FUEL AND LIQUID OXYGEN AS ROCKET PROPELLANT: 2, EQUILIBRIUM COMPOSITION, Vearl N. Huff, Anthony Fortini, and Sanford Gordon, September 1956

RM E56D23a A VARIABLE-GEOMETRY ANNULAR CASCADE-TYPE INLET AT MACH NUMBERS OF 1.9 AND 3.05, James F. Connors and Rudolph C. Meyer, July 1956

RM E56D27 PERFORMANCE CHARACTERISTICS OF AXIAL-FLOW TRANSONIC COMPRESSOR OPERATING UP TO TIP RELATIVE INLET MACH NUMBER 1.34, John W. R. Creagh, August 1956

RM E56E04 INVESTIGATION OF TURBINES SUITABLE FOR USE IN A TURBOJET ENGINE WITH HIGH COMPRESSOR PRESSURE RATIO AND LOW COMPRESSOR-TIP SPEED. VI - EXPERIMENTAL PERFORMANCE OF TWO-STAGE TURBINE, Elmer H. Davison, Harold J. Schum, and Donald A. Petrash, August 1956

RM E56E09a AN ANALOG STUDY OF A SHOCK-POSITION DIFFUSER CONTROL ON A SUPERSONIC TURBOJET ENGINE, David Novik, August 1956

RM E56E14 TURBOJET PERFORMANCE AND OPERATION AT HIGH ALTITUDES WITH HYDROGEN AND JP-4 FUELS, W. A. Fleming [and others], August 1956

RM E56E17 STUDY OF RAM-AIR HEAT EXCHANGERS FOR REDUCING TURBINE COOLING-AIR TEMPERATURE OF A SUPERSONIC AIRCRAFT TURBOJET ENGINE, Anthony J. Diaguila, John N. B. Livingood, and Ernst R. G. Eckert, August 1956

RM E56F05 USE OF SUBSONIC DIFFUSER MACH NUMBER AS A SUPERSONIC-INLET CONTROL PARAMETER, Paul P. Whalen and Fred A. Wilcox, September 1956

RM E56F22 EFFECTS OF VARIATIONS IN COMBUSTION-CHAMBER CONFIGURATION ON IGNITION DELAY IN A 50-POUND-THRUST ROCKET, Dezso J. Ladanyi, October 1956

RM E56F28 EXPERIMENTAL INVESTIGATION OF DYNAMIC RELATIONS IN 48-INCH RAM-JET ENGINE, Herbert G. Hurrell, February 1957

RM E56G03 THERMODYNAMIC PROPERTIES OF PRODUCTS OF COMBUSTION OF HYDROGEN WITH AIR FOR TEMPERATURES OF 600° TO 4400° R, Robert E. English and Cavour H. Hauser, October 1956

RM E56G09 INVESTIGATION OF TWO-STAGE COUNTERROTATING COMPRESSOR. II - FIRST -ROTOR BLADE-ELEMENT PERFORMANCE, Linwood C. Wright and Ward W. Wilcox, October 1956

RM E56G13a DEVELOPMENT OF FLOW DISTORTIONS IN A FULL-SCALE NACELLE INLET AT MACH NUMBERS 0.63 AND 1.6 TO 2.0, Thomas G. Piercy and Bruce G. Chiccine, October 1956

RM E56G17 METHODS FOR MEASURING TEMPERATURES OF THIN-WALLED GAS-TURBINE BLADES, Francis S. Stepka and Robert O. Hickel, November 1956

RM E56G24 EXPERIMENTAL INVESTIGATION OF A FIVE-STAGE AXIAL-FLOW RESEARCH COMPRESSOR WITH TRANSONIC ROTORS IN ALL STAGES. III - INTERSTAGE DATA AND INDIVIDUAL STAGE PERFORMANCE CHARACTERISTICS, Donald M. Sandercock and Karl Kovach, October 1956

RM E56G25 EXPERIMENTAL INVESTIGATION OF A HIGH SUBSONIC MACH NUMBER TURBINE HAVING LOW ROTOR SUCTION-SURFACE DIFFUSION, Cavour H. Hauser and William J. Nusbaum, October 1956

RM E56G27a SIMULATED AFTERBURNER PERFORMANCE WITH HYDROGEN PEROXIDE FOR THRUST AUGMENTATION, Allen J. Metzler and Jack S. Grobman, October 1956

RM E56G30a INVESTIGATION OF TWO-STAGE COUNTERROTATING COMPRESSOR. III - DESIGN OF SECOND-STAGE ROTOR AND PRELIMINARY OVER-ALL PERFORMANCE, Ward W. Wilcox and Linwood C. Wright, October 1956

RM E56H08 EXPERIMENTAL INVESTIGATION OF AN OVER-RIDING CONTROL TO EFFECT RECOVERY FROM SURGE AND STALL IN A TURBOJET ENGINE, Paul M. Stiglic and Herbert Heppler, October 1956

RM E56H14 INVESTIGATION OF TWO-STAGE AIR-COOLED TURBINE SUITABLE FOR FLIGHT AT MACH NUMBER OF 2.5. I - VELOCITY-DIAGRAM STUDY, James W. Miser and Warner L. Stewart, October 1956

RM E56H14a INVESTIGATION OF TURBINES SUITABLE FOR USE IN A TURBOJET ENGINE WITH HIGH COMPRESSOR PRESSURE RATIO AND LOW COMPRESSOR-TIP SPEED. VII - EXPERIMENTAL PERFORMANCE OF MODIFIED TWO-STAGE TURBINE, Elmer H. Davison, Donald A. Petrash, and Harold J. Schum, October 1956

RM E56H21 COKING OF JP-4 FUELS IN ELECTRICALLY HEATED METAL TUBES, Arthur L. Smith, William P. Cook, and Vincent F. Hlavin, November 1956

RM E56H23 PERFORMANCE OF VARIABLE 2-DIMENSIONAL INLET DESIGNED FOR ENGINE-INLET MATCHING: 1, PERFORMANCE AT DESIGN MACH NUMBER OF 3.07, M. A. Beheim and L. W. Gertsma, November 1956

RM E56I05 ANALYSIS OF LIMITATIONS IMPOSED ON ONE-SPOOL TURBOPROP-ENGINE DESIGNS BY COMPRESSORS AND TURBINES AT FLIGHT MACH NUMBERS OF 0, 0.6, AND 0.8, Richard H. Cavicchi, December 1956

RM E56I06 EFFECT OF INTERSTAGE BLEED ON ROTATING STALL AND BLADE VIBRATION IN 13-STAGE AXIAL-FLOW COMPRESSOR IN TURBOJET ENGINE, Howard F. Calvert, D. F. Johnson, and J. G. Lucas, January 1957

RM E56I17 COMPARISON OF EXPERIMENTAL WITH THEORETICAL TOTAL-PRESSURE LOSS IN PARALLEL-WALLED TURBOJET COMBUSTORS, Ralph T. Dittrich, January 1957

RM E56I18 EXPERIMENTAL INVESTIGATION OF HIGH SUBSONIC MACH NUMBER TURBINE HAVING HIGH ROTOR BLADE SUCTION-SURFACE DIFFUSION, William J. Nusbaum and Cavour H. Hauser, November 1956

RM E56I21 EVALUATION OF LIQUEFIED HYDROCARBON GASES AS TURBOJET FUELS, Robert R. Hibbard, December 1956

RM E56I26 PERFORMANCE OF SUPERSONIC RAMP-TYPE SIDE INLET WITH RAM-SCOOP THROAT BLEED AND VARYING FUSELAGE BOUNDARY-LAYER REMOVAL MACH NUMBER RANGE 1.5 TO 2.0, Glenn A. Mitchell and Robert C. Campbell, January 1957

RM E56I26a INVESTIGATION OF SHOCK - BOUNDARY-LAYER INTERACTION ON THE SPIKE OF A CONICAL-SPIKE NOSE INLET, George A. Wise and William H. Sterbentz, January 1957

RM E56J02 SOME OPERATING EXPERIENCE AND PROBLEMS ENCOUNTERED DURING OPERATION OF A FREE-JET FACILITY, John E. McAulay and William R. Prince, February 1957

RM E56J05 PRELIMINARY INVESTIGATION OF METHODS TO INCREASE BASE PRESSURE OF PLUG NOZZLES AT MACH 0.9, Reino J. Salmi, December 1956

RM E56J11 STUDY OF INJECTION PROCESSES FOR 16-PERCENT FLUORINE 85-PERCENT OXYGEN HEPTANE IN 200-POUND-THRUST ROCKET ENGINE, M. F. Heidmann, January 1957

RM E56J12 IDENTIFICATION OF FOREIGN OBJECTS DAMAGING COMPRESSOR BLADES IN TURBOJET ENGINES, A. E. Spakowski and J. Graab, January 1957

RM E56J15 EXPERIMENTAL INVESTIGATION OF WATER INJECTION IN SUBSONIC DIFFUSER OF A CONICAL INLET OPERATING AT FREE-STREAM MACH NUMBER OF 2.5, Andrew Beke, January 1957

RM E56J16 INVESTIGATION OF 0.6 HUB-TIP RADIUS RATIO TRANSONIC TURBINE DESIGNED FOR SECONDARY FLOW STUDY: 1. DESIGN AND EXPERIMENTAL PERFORMANCE OF STANDARD TURBINE, Harold E. Rohlik, William T. Wintucky, and Herbert W. Scibbe, January 1957

RM E56J17 EXPERIMENTAL INVESTIGATION OF AN AXIAL-FLOW-COMPRESSOR INLET STAGE OPERATING AT TRANSONIC RELATIVE INLET MACH NUMBERS. V - ROTOR BLADE-ELEMENT PERFORMANCE AT A REDUCED BLADE ANGLE, Francis C. Schwenk, George W. Lewis, Jr., and Seymour Lieblein, January 1957

RM E56J18 INTERNAL PERFORMANCE OF SEVERAL AUXILIARY AND INLETS IMMERSED IN A TURBULENT BOUNDARY LAYER AT MACH NUMBERS OF 1.3, 1.5, AND 2.0, Ronald G. Huff and Arthur R. Anderson, January 1957

RM E56J24 ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF EFFECTS OF COMPRESSOR INTERSTAGE AIR BLEED ON PERFORMANCE CHARACTERISTICS OF 13-STAGE AXIAL-FLOW COMPRESSOR, James G. Lucas, Richard P. Geye, and Howard E. Calvert, February 1957

RM E56J26 A SIMPLIFIED METHOD FOR EVALUATING JET-PROPULSION-SYSTEM COMPONENTS IN TERMS OF AIRPLANE PERFORMANCE, Richard J. Weber and Roger W. Luidens, December 1956

RM E56K05a EXPERIMENTAL EVALUATION OF METHODS FOR IMPROVING DIFFUSER-EXIT TOTAL-PRESSURE PROFILES FOR A SIDE-INLET MODEL AT MACH NUMBER 1.91, John L. Klann, January 1957

RM E56K06 INVESTIGATION OF TWO-STAGE AIR-COOLED TURBINE SUITABLE FOR FLIGHT AT MACH NUMBER OF 2.5. II - BLADE DESIGN, James W. Miser and Warner L. Stewart, January 1957

RM E56K08 USE OF MAIN-INLET BYPASS TO SUPPLY EJECTOR EXHAUST NOZZLE AT SUPERSONIC SPEEDS, Donald P. Hearth, February 1957

RM E56K09 COOLING PERFORMANCE AND STRUCTURAL RELIABILITY OF A MODIFIED CORRUGATED-INSERT AIR-COOLED TURBINE BLADE WITH AN INTEGRALLY CAST SHELL AND BASE, John C. Freche and Eugene F. Schum, January 1957

RM E56K09a INVESTIGATION OF AN ASYMMETRIC "PENSHAPE" EXIT HAVING CIRCULAR PROJECTIONS AND DISCHARGING INTO QUIESCENT AIR, James F. Connors and Rudolph C. Meyer, January 1957

RM E56K10 DESIGN AND EXPERIMENTAL INVESTIGATION OF A SINGLE-STAGE TURBINE WITH A DOWNSTREAM STATOR, Henry W. Plohr, Donald E. Holeski, and Robert E. Forrette, January 1957

RM E56K14 THEORETICAL ROCKET PERFORMANCE OF JP-4 FUEL WITH MIXTURES OF LIQUID OZONE AND FLUORINE, Vearl N. Huff and Sanford Gordon, January 1957

RM E56K20 EXPERIMENTAL INVESTIGATION OF EJECTOR-NOZZLE METAL TEMPERATURES, Thomas B. Shillito and William K. Koffel, February 1957

RM E56K21 MATERIAL COMPATIBILITY WITH GASEOUS FLUORINE, Harold G. Price, Jr., and Howard W. Douglass, January 1957

RM E56K23 COMPARISON OF EFFECT OF A TURBOJET ENGINE AND THREE COLD-FLOW CONFIGURATIONS ON THE STABILITY OF A FULL-SCALE SUPERSONIC INLET, Norman T. Musial, January 1957

RM E56K26a A METHOD FOR DETERMINING CORE DIMENSIONS OF HEAT EXCHANGER WITH ONE DOMINATING FILM RESISTANCE AND VERIFICATION WITH EXPERIMENTAL DATA, John N. B. Livingood and Anthony J. Diaguila, January 1957

RM E56K27 ROCKET THRUST VARIATION WITH FOAMED LIQUID PROPELLANTS, G. Morrell, February 1957

RM E56K28b AN INLET DESIGN CONCEPT TO REDUCE FLOW DISTORTION AT ANGLE OF ATTACK, Carl F. Schueller and Leonard E. Stitt, February 1957

RM E56K29 INVESTIGATION OF MASS-FLOW AND PRESSURE-RECOVERY CHARACTERISTICS OF SEVERAL UNDERSLUNG SCOOP-TYPE INLETS AT FREE-STREAM MACH NUMBERS OF 2.0, 1.8, 1.5, AND 0.66, Alfred S. Valerino and Robert F. Zappa, March 1957

RM E56K29a COMPARISON OF RESULTS OF EXPERIMENTAL AND THEORETICAL STUDIES OF BLADE-OUTLET BOUNDARY-LAYER CHARACTERISTICS OF STATOR BLADE FOR A HIGH SUBSONIC MACH NUMBER TURBINE, Cavour H. Hauser and William J. Nusbaum, February 1957

RM E56K29b INTERNAL PERFORMANCE OF TWO-DIMENSIONAL WEDGE EXHAUST NOZZLES, William T. Beale and John H. Povolny, February 1957

RM E56K30 SURVEY OF MICROSTRUCTURES AND MECHANICAL PROPERTIES OF OVER-TEMPERATURED S-816 TURBINES BUCKETS FROM J47 ENGINES, S. Floreen and R. A. Signorelli, March 1957

RM E56L06 EXPERIMENTAL INVESTIGATION OF A 014 HUB-TIP DIAMETER RATIO AXIAL-FLOW COMPRESSOR INLET STAGE AT TRANSONIC INLET RELATIVE MACH NUMBERS. IV - PERFORMANCE OF TAPERED-TIP ROTOR CONFIGURATION WITH RESET BLADE ANGLES, John C. Montgomery and Frederick Glaser, February 1957

RM E56L07a AERODYNAMIC DESIGN AND OVER-ALL PERFORMANCE OF FIRST SPOOL OF A 24-INCH TWO-SPOOL TRANSONIC COMPRESSOR, James E. Hatch and Daniel T. Bernatowicz, March 1957

RM E56L10a THEORETICAL PERFORMANCE OF LIQUID HYDROGEN AND LIQUID FLUORINE AS ROCKET PROPELLANT FOR CHAMBER PRESSURE OF 600 POUNDS PER SQUARE INCH ABSOLUTE, Anthony Fortini and Vearl M. Huff, January 1957

RM E56L11a INVESTIGATION OF EFFECTS OF REYNOLDS NUMBER ON OVER-ALL PERFORMANCE OF 8-STAGE AXIAL-FLOW RESEARCH COMPRESSOR WITH 2 TRANSONIC INLET STAGES, Richard P. Geye and James G. Lucas, February 1957

RM E56L19 PERFORMANCE OF EXTERNAL-COMPRESSION BUMP INLET AT MACH NUMBERS OF 1.5 TO 2.0, Paul C. Simon, Dennis W. Brown, and Ronald G. Huff, April 1957

RM E57A15 FOREIGN-OBJECT RETENTION AND FLOW CHARACTERISTICS OF RETRACTABLE ENGINE-INLET SCREENS, Fred W. Steffen and Lewis A. Rodert, July 1957

RM E57A21 INVESTIGATION OF A HIGH-PERFORMANCE TOP INLET TO MACH NUMBER OF 2.0 AND AT ANGLES OF ATTACK TO 20°, Donald J. Vargo, Philip N. Parks, and Owen H. Davis, March 1957

RM E57A29a EVALUATION OF USE OF ELECTRICAL RESISTANCE FOR DETECTING OVER-TEMPERATURED S-816 TURBINE BLADES, Leonard Robbins, March 1957

RM E57A30 A PRELIMINARY ANALYSIS OF THE MAGNITUDE OF SHOCK LOSSES IN TRANSONIC COMPRESSORS, Francis C. Schwenk, George W. Lewis, and Melvin J. Hartmann, March 1957

RM E57A31 FULL-SCALE FREE-JET INVESTIGATION OF A TWO-SHOCK SIDE-INLET DIFFUSER AT MACH 2.75 AND A COMPARISON WITH A SINGLE-SHOCK DIFFUSER, John E. McAulay, April 1957

RM E57B04 EXPERIMENTAL INVESTIGATION OF PERFORMANCE OF SINGLE-STAGE TRANSONIC COMPRESSOR WITH GUIDE VANES TURNING COUNTER TO DIRECTION OF ROTOR WHIRL, Lawrence J. Jahnsen and Theodore E. Fessler, April 1957

RM E57B12 EXPERIMENTAL INVESTIGATION OF A FIVE-STAGE AXIAL-FLOW RESEARCH COMPRESSOR WITH TRANSONIC ROTORS IN ALL STAGES. IV - BLADE-ELEMENT PERFORMANCE, Donald M. Sandercock, May 1957

RM E57B18 ANALYSIS OF COOLANT FLOW AND PRESSURE REQUIREMENTS FOR A RETURN-FLOW TURBINE ROTOR BLADE DESIGN USING HYDROGEN, HELIUM, OR AIR AS COOLANT, Henry O. Slone and Patrick L. Donoughe, May 1957

RM E57C05 EFFECT OF FUEL PROPERTIES ON LINER TEMPERATURES IN A SINGLE TUBULAR TURBOJET COMBUSTOR, Helmut F. Butze, June 1957

RM E57C06 INVESTIGATION OF TRANSLATING DOUBLE-CONE AXISYMMETRIC INLETS WITH COWL PROJECTED AREAS 40 AND 20 PERCENT MAXIMUM AT MACH NUMBERS FROM 3.0 TO 2.0, James F. Connors, George A. Wise, and J. Calvin Lovell, May 1957

RM E57C11 THERMAL RELATIONS FOR TWO-PHASE EXPANSION WITH PHASE EQUILIBRIUM AND EXAMPLE FOR COMBUSTION PRODUCTS OF BORON CONTAINING FUEL, Leonard K. Tower, May 1957

RM E57C12 ORIGIN AND DEVELOPMENT OF LEADING-EDGE CRACKS IN TURBOJET ENGINE BUCKETS, D. F. Springsteen, C. A. Gyorgak, and J. R. Johnston, May 1957

RM E57C21 ANALYSIS OF TWO-SPOOL TURBOPROP-ENGINE CHARACTERISTICS, Elmer H. Davison, June 1957

RM E57C22 STUDY OF TEMPERATURE TRANSIENTS AT INLET OF TURBOJET ENGINE, Lewis E. Wallner, James W. Useller, and Martin J. Saari, June 1961

RM E57C29 INVESTIGATION OF AFTERBURNING RAMJET USING GASEOUS HYDROGEN AS FUEL AT MACH NUMBER OF 3.0, Joseph Wasserbauer, June 1957

RM E57D01 SOME REYNOLDS NUMBER PHENOMENA IN A TURBOJET COMPRESSOR, Harold R. Kaufman, June 1957

RM E57D05 THEORETICAL ANALYSIS OF ONE-STAGE WINDMILLS FOR REDUCING FLOW DISTORTION, Robert E. English and Peggy L. Yohner, June 1957

RM E57D15 AERODYNAMIC PERFORMANCE OF SEVERAL TECHNIQUES FOR SPIKE-POSITION CONTROL OF A BLUNT-LIP NOSE INLET HAVING INTERNAL CONTRACTION; MACH NUMBERS OF 0.63 AND 1.5 TO 2.0, Arthur A. Anderson and Maynard I. Weinstein, September 1957

RM E57D29 DESIGN AND ENGINE EVALUATION OF A SEMI-STRUT CORRUGATED AIR-COOLED TURBINE BLADE FOR OPERATION AT A TIP SPEED OF 1300 FEET PER SECOND, Andre J. Meyer, Jr., Richard H. Kemp, and William C. Morgan, June 1957

RM E57E02 REACTION OF FLUORINE WITH CARBON AS MEANS OF FLUORINE DISPOSAL, Harold W. Schmidt, July 1957

RM E57E09 INVESTIGATION OF 0.6 HUB-TIP RADIUS-RATIO TRANSONIC TURBINE DESIGNED FOR SECONDARY-FLOW STUDY: 2, DESIGN AND EXPERIMENTAL PERFORMANCE OF TURBINE WITH LOW-VELOCITY-TURNING STATOR AND STANDARD ROTOR, Harold E. Rohlik, William T. Wintucky, and Herbert W. Scibbe, July 1957

RM E57E14 ANALYSIS OF LIMITATIONS IMPOSED ON ONE-SPOOL DUCTED-FAN-ENGINE DESIGNS BY COMPRESSORS AND TURBINES AT FLIGHT MACH NUMBERS OF 0, 0.6, AND 0.8, Richard H. Cavicchi, July 1957

RM E57E24 PRELIMINARY PERFORMANCE DATA OBTAINED IN FULL-SCALE FREE-JET INVESTIGATION OF SIDE-INLET SUPERSONIC DIFFUSER, Ferris L. Seashore and John M. Farley, January 1958

RM E57F03 EFFECTS OF INTERNAL-AREA DISTRIBUTION, SPIKE TRANSLATION, AND THROAT BOUNDARY-LAYER CONTROL ON PERFORMANCE OF A DOUBLE-CONE AXISYMMETRIC INLET AT MACH NUMBERS FROM 3.0 TO 2.0, James F. Connors, J. Calvin Lovell, and George A. Wise, August 1957

RM E57F11 DROP BURNING RATES OF HYDROCARBON AND NON-HYDROCARBON FUELS, Arthur L. Smith and Charles C. Graves, August 1957

RM E57F13 INTERNAL PERFORMANCE OF SEVERAL DIVERGENT-SHROUD EJECTOR NOZZLES WITH HIGH DIVERGENCE ANGLES, Arthur M. Trout, S. Stephen Papell, and John H. Povolny, October 1957

RM E57F13b ANALYTICAL STUDY OF THE EQUILIBRIUM THICKNESS OF BORIC OXIDE DEPOSITS ON JET-ENGINE SURFACES, Paul C. Setze, October 1957

RM E57F18 A THEORETICAL AND EXPERIMENTAL STUDY OF BORIC OXIDE DEPOSITION ON A SUAFACE IMMERSED IN AN EXHAUST GAS STREAM FROM A JET-ENGINE COMBUSTOR, INCLUDING A METHOD OF CALCULATING DEPOSITION RATES ON SURFACES, Paul C. Setze, October 1957

RM E57F27 FLIGHT INVESTIGATION OF PENTABORANE FUEL IN ROCKET BOOSTED 9.75-INCH-DIAMETER RAM-JET ENGINE WITH CONVERGENT-DIVERGENT EXHAUST NOZZLE, John H. Disher, September 1957

RM E57G08 INVESTIGATION OF 0.6 HUB-TIP RADIUS-RATIO TRANSONIC TURBINE DESIGNED FOR SECONDARY-FLOW STUDY: 3. EXPERIMENTAL PERFORMANCE WITH 2 STATOR CONFIGURATIONS DESIGNED TO ELIMINATE BLADE WAKES AND SECONDARY FLOW EFFECTS AND CONCLUSIONS FROM ENTIRE STATOR INVESTIGATION, Harold E. Rholik, William T. Wintucky, and Thomas P. Moffitt, September 1957

RM E57G16 INVESTIGATION OF A CONTINUOUS NORMAL-SHOCK POSITIONING CONTROL FOR A TRANSLATING-SPIKE SUPERSONIC INLET IN COMBINATION WITH J34 TURBOJET ENGINE, Fred A. Wilcox, October 1957

RM E57G16a THEORETICAL ROCKET PERFORMANCE OF JP-4 FUEL WITH SEVERAL FLUORINE-OXYGEN MIXTURES ASSUMING FROZEN COMPOSITION, Sanford Gordon and Kenneth S. Drellishak, November 1957

RM E57G18 NONMETALLIC MATERIAL COMPATIBILITY WITH LIQUID FLUORINE, Harold G. Price, Jr., and Howard W. Douglass, October 1957

RM E57G19 SUMMARY OF NACA RESEARCH ON IGNITION LAG OF SELF-IGNITING FUEL - NITRIC ACID PROPELLANTS, Gerald Morrell, October 1957

RM E57G25 STRUCTURAL DESIGN AND ENGINE EVALUATION OF AN AIR-COOLED TURBINE BLADE COMPOSED OF CORRUGATIONS AND A SEMISTRUT FOR OPERATION AT A TIP SPEED OF 1200 FEET PER SECOND, Richard H. Kemp, Andre J. Meyer, Jr., and William C. Morgan, October 1957

RM E57G25a PRELIMINARY INVESTIGATION OF SHIELD TO IMPROVE ANGLE-OF-ATTACK PERFORMANCE OF NACELLE-TYPE INLET, Milton A. Beheim and Thomas G. Piercy, October 1957

RM E57G26 CHEMICAL IGNITERS FOR STARTING JET FUEL-NITRIC ACID ROCKETS, Gerald Morrell and Dezo J. Ladanyi, October 1957

RM E57G26a INVESTIGATION OF ROTATING-STALL LIMITS IN SUPERSONIC TURBOFAN ENGINE, James F. Dugan, Jr., October 1957

RM E57H01 COMPARISON OF INJECTORS WITH 200-POUND THRUST AMMONIA-OXYGEN ENGINE, Richard J. Priem and Bruce J. Clark, September 1958

RM E57H07a PERFORMANCE OF EXTERNAL-INTERNAL COMPRESSION INLET WITH ABRUPT INTERNAL TURNING AT MACH NUMBERS 3.0 TO 2.0, Leonard J. Obery and Leonard E. Stitt, October 1957

RM E57H07b PERFORMANCE OF A TRANSLATING-DOUBLE-CONE AXISYMMETRIC INLET WITH COWL BYPASS AT MACH NUMBERS FROM 2.0 TO 3.5, James F. Connors and George A. Wise, November 1957

RM E57H14 PRELIMINARY ANALYSIS OF OVERALL PERFORMANCE OF 8-STAGE AXIAL-FLOW RESEARCH COMPRESSOR WITH 2 LONG-CHORD TRANSONIC INLET STAGES, Gilbert K. Sievers, Richard P. Geye, and James G. Lucas, February 1958

RM E57H28 EXPERIMENTAL RESULTS OF INVESTIGATION OF 2 METHODS OF INFLIGHT THRUST MEASUREMENT APPLICABLE TO AFTERBURNING TURBOJET ENGINES WITH EJECTORS, Harry E. Bloomer, May 1958

RM E57I03 COMPARISON OF PERFORMANCE OF TWO AERODYNAMICALLY SIMILAR 14-INCH-DIAMETER SINGLE-STAGE COMPRESSOR ROTORS OF DIFFERENT CHORD LENGTH, Marvin I. Kussoy and Daniel Bachkin, February 1958

RM E57I12 EXPERIMENTAL INVESTIGATION OF DISTORTION REMOVAL CHARACTERISTICS OF SEVERAL FREE-WHEELING FANS, Harold H. Valentine and William T. Beale, January 1958

RM E57I13 SIMPLIFIED THEORY FOR DYNAMIC RELATION OF RAMJET PRESSURES AND FUEL FLOW, Herbert G. Hurrell, 1962

RM E57I18a TEMPERATURE-SCHEDULE ACCELERATION CONTROL FOR TURBOJET ENGINE AND ITS USE WITH SPEED CONTROL, Theodore F. Gerus, Albert G. Powers, and Herbert I. Heppler, December 1957

RM E57I19 INVESTIGATION OF TURBINES SUITABLE FOR USE IN A TURBOJET ENGINE WITH HIGH COMPRESSOR PRESSURE RATIO AND LOW COMPRESSOR-TIP SPEED. VIII - INTERNAL FLOW CONDITIONS OF A TWO-STAGE TURBINE WITH A DOWNSTREAM STATOR, Donald A. Petrash, Elmer H. Davison, and Harold J. Schum, November 1957

RM E57J09 METHOD FOR RAPID SELECTION OF DESIGN CHARACTERISTICS OF 1-, 1 1/2-, AND 2-STAGE TURBINES WITH OPTIMUM ANNULUS TAPER, Peggy L. Yohner and Robert E. English, February 1958

RM E57J17 EXPERIMENTAL INVESTIGATION OF THE EFFECT OF CIRCUMFERENTIAL INLET FLOW DISTORTION ON THE PERFORMANCE OF A FIVE-STAGE AXIAL-FLOW RESEARCH COMPRESSOR WITH TRANSONIC ROTORS IN ALL STAGES, William H. Robbins and Frederick Glaser, March 1958

RM E57J27 EXPERIMENTAL INVESTIGATION OF 7-INCH-TIP-DIAMETER TRANSONIC TURBINE, Warren J. Whitney and William T. Wintucky, January 1958

RM E57K12 PRELIMINARY STUDIES OF ROLLING-CONTRACT FATIGUE LIFE OF HIGH-TEMPERATURE BEARING MATERIALS, Thomas L. Carter, April 1958

RM E57K14 EFFECT OF FORGING TEMPERATURE AND HEAT TREATMENT ON THE PERFORMANCE OF INCONEL 700 BUCKETS AT 1625° F IN A J33-9 TURBOJET ENGINE, C. A. Gyorgak, D. F. Springsteen, and J. R. Johnston, February 1958

RM E57K19b INVESTIGATION AT SUPERSONIC SPEEDS OF THE COMPRESSOR STALL AND INLET BUZZ CHARACTERISTICS OF A J34 - SPIKE-INLET COMBINATION, J. Cary Nettles and Robert C. Campbell, March 1958

RM E57K22 THEORETICAL ROCKET PERFORMANCE OF JP-4 FUEL WITH SEVERAL FLUORINE-OXYGEN MIXTURES ASSUMING EQUILIBRIUM COMPOSITION, Sanford Gordon, February 1958

RM E57K25a A METHOD FOR DETERMINING TURBINE DESIGN CHARACTERISTICS FOR ROCKET TURBODRIVE APPLICATIONS, Warner L. Stewart, David G. Evans, and Warren J. Whitney, May 1958

RM E57K26 AERODYNAMIC AND INLET-FLOW-FIELD CHARACTERISTICS AT A FREE-STREAM MACH NUMBER OF 3.0 FOR AIRPLANES WITH CIRCULAR FUSELAGE CROSS SECTIONS AND FOR TWO ENGINE LOCATIONS, Murray Dryer and Roger W. Luidens, March 1958

RM E57L06 PERFORMANCE OF A TWO-DIMENSIONAL CASCADE INLET AT A FREE-STREAM MACH NUMBER OF 3.05 AND AT ANGLES OF ATTACK OF -3°, 0°, 3°, AND 6°, Richard R. Woollett and Harold M. Ferguson, March 1958

RM E57L12a COMPARISON OF EXPERIMENTALLY AND ANALYTICALLY DETERMINED WINDMILLING CHARACTERISTICS OF A COMPRESSOR WITH LOW OVER-ALL PRESSURE RATIO, James E. Hatch, February 1958

RM E58A14b EXPERIMENTAL SHOCK CONFIGURATIONS AND SHOCK LOSSES IN A TRANSONIC-COMPRESSOR ROTOR AT DESIGN SPEED, Genevieve R. Miller and Melvin J. Hartmann, June 1958

RM E58A20a EFFECT OF FUEL DROP SIZE AND INJECTOR CONFIGURATION ON SCREAMING IN A 200-POUND-THRUST ROCKET ENGINE USING LIQUID OXYGEN AND HEPTANE, Charles E. Feiler, June 1958

RM E58A21 THEORETICAL PERFORMANCE OF LIQUID AMMONIA WITH LIQUID OXYGEN AS ROCKET PROPELLANT, Sanford Gordon and Alan R. Glueck, May 1958

RM E58A27 INVESTIGATION OF TWO-STAGE COUNTERROTATING COMPRESSOR. IV - OVER-ALL PERFORMANCE OF COMPRESSOR WITH MODIFIED SECOND-STAGE ROTOR, Ward W. Wilcox and William Stevens, May 1958

RM E58A27b INVESTIGATION OF AN UNDERSLUNG HALF-CONE INLET WITH COMPRESSION SURFACE MOUNTED OUTBOARD FROM FUSELAGE AT MACH NUMBERS OF 1.5, 1.8, AND 2.0, Richard A. Yeager and Laurence W. Gertsma, May 1958

RM E58B13 PERFORMANCE AT MACH NUMBERS 3.07, 1.89, AND 0 OF INLETS DESIGNED FOR INLET-ENGINE MATCHING UP TO MACH 3, L. W. Gertsma and M. A. Beheim, May 1958

RM E58B20 THEORETICAL ROCKET PERFORMANCE OF LIQUID METHANE WITH SEVERAL FLUORINE-OXYGEN MIXTURES ASSUMING FROZEN COMPOSITION, Sanford Gordon and Michael E. Kastner, May 1958

RM E58B24 RELATION BETWEEN FLOW RANGE AND OTHER COMPRESSOR-STAGE CHARACTERISTICS, Arthur W. Goldstein and Ralph L. Schacht, May 1958

RM E58B27 INVESTIGATION OF 0.6 HUB-TIP RADIUS-RATIO TRANSONIC TURBINE DESIGNED FOR SECONDARY-FLOW STUDY; 4, ROTOR LOSS PATTERNS AS DETERMINED BY HOT-WIRE ANEMOMETERS WITH ROTOR OPERATING IN CIRCUMFERENTIALLY UNIFORM INLET FLOW FIELD, Milton G. Kofskey and Hubert W. Allen, May 1958

RM E58C04 ANALYSIS OF TRANSONIC ROTOR-BLADE PASSAGE LOSS WITH HOT-WIRE ANEMOMETERS, George W. Lewis, Edward R. Tysl, and Theodore E. Fessler, June 1958

RM E58C12 PERFORMANCE OF BASIC XJ79-GE-1 TURBOJET ENGINE AND ITS COMPONENTS, Carl E. Campbell, May 1958

RM E58C19 EFFECT OF SCREENS IN REDUCING DISTORTION AND DIFFUSION LENGTH FOR DUMP DIFFUSER AT MACH NUMBER OF 3.85, Joseph F. Wasserbauer, July 1958

RM E58C19a EXPLORATORY INVESTIGATION OF PERFORMANCE OF EXPERIMENT FUEL-RICH HYDROGEN COMBUSTION SYSTEM, Arthur L. Smith and Jack S. Grobman, June 1958

RM E58C25 EFFECT OF DISSOCIATION ON EXHAUST-NOZZLE PERFORMANCE, T. W. Reynolds, June 1958

RM E58D01 EFFECT OF PRESSURE LEVEL ON AFTERBURNER-WALL TEMPERATURES, Thomas B. Shillito and George R. Smolak, June 1958

RM E58D03 CHEMICAL AND PHYSICAL FACTORS AFFECTING COMBUSTION IN FUEL-NITRIC ACID SYSTEMS, Louis Baker, Jr., July 1958

RM E58D03a STUDY OF COMBUSTION RATES OF HYDROCARBON FUELS WITH RED FUMING NITRIC ACID IN SMALL ROCKET ENGINE, Louis Baker, Jr., August 1958

RM E58D04a EXPERIMENTAL PERFORMANCE OF 0.35 HUB-TIP RADIUS RATIO TRANSONIC AXIAL-FLOW-COMPRESSOR STAGE DESIGNED FOR 40 POUNDS PER SECOND PER UNIT FRONTAL AREA, Richard R. Cullom, John C. Montgomery, and Paul T. Yasaki, September 1958

RM E58D11 COMPATIBILITY OF METALS WITH LIQUID FLUORINE AT HIGH PRESSURES AND FLOW VELOCITIES, Harold W. Schmidt, July 1958

RM E58D17 DESIGN AND EXPERIMENTAL PERFORMANCE OF 0.35 HUB-TIP RADIUS RATIO TRANSONIC AXIAL-FLOW-COMPRESSOR ROTOR DESIGN FOR 40 POUNDS PER SECOND PER UNIT FRONTAL AREA, John C. Montgomery and Paul T. Yasaki, September 1958

RM E58D24 USE OF SHOCK-TRAP BLEED TO IMPROVE PRESSURE RECOVERY OF FIXED-AND-VARIABLE-CAPTURE-AREA INTERNAL-CONTRACTION INLETS, MACH NUMBER 2.0 TO 3.0, Roger W. Luidens and Richard J. Flaherty, August 1958

RM E58E09 SCREAMING TENDENCY OF THE GASEOUS-HYDROGEN - LIQUID-OXYGEN PROPELLANT COMBINATION, Louis Baker, Jr., and Fred W. Steffen, September 1958

RM E58E12 THERMAL REACTION OF DIBORANE WITH TRIMETHYLBORANE, John H. Lamneck, Jr., and Samuel Kaye, September 1958

RM E58E20 COMPARISON OF CALCULATED AND EXPERIMENTAL TEMPERATURES AND COOLANT PRESSURES LOSSES FOR CASCADE OF SMALL AIR-COOLED TURBINE ROTOR BLADES, Francis S. Stepka, September 1958

RM E58E21 COMBUSTOR PERFORMANCE WITH VARIOUS HYDROGEN-OXYGEN INJECTION METHODS IN A 200-POUND-THRUST ROCKET ENGINE, M. F. Heidmann and Louis Baker, Jr., September 1958

RM E58G10a OFF-DESIGN PERFORMANCE OF DIVERGENT EJECTORS, Milton A. Beheim, September 1958

RM E58G11a A PIVOTING-COWL-AND-SPIKE TECHNIQUE FOR EFFICIENT ANGLE-OF-ATTACK OPERATION OF SUPERSONIC INLETS, Nick E. Samanich and Robert W. Cubbison, September 1958

RM H57C22 FLIGHT-DETERMINED INDUCTION-SYSTEM AND SURGE CHARACTERISTICS OF THE YF-102 AIRPLANE WITH A TWO-SPOOL TURBOJET ENGINE, Edwin J. Saltzman, June 1957

RM H57J09 IN-FLIGHT GAINS REALIZED BY MODIFYING TWIN SIDE-INLET INDUCTION SYSTEM, Edwin J. Saltzman, December 1957

RM L6J18b INFLUENCE OF WALL BOUNDARY LAYER UPON THE PERFORMANCE OF AN AXIAL-FLOW FAN ROTOR, Emanuel Boxer, May 1947

RM L8F18 EXPERIMENTAL DATA CONCERNING THE EFFECT OF A HIGH HEAT-INPUT RATES ON THE PRESSURE DROP THROUGH RADIATOR TUBES, James J. Gallagher and Louis W. Habel, September 1948

RM L9B28 INVESTIGATIONS OF AN ANNULAR DIFFUSER-FAN COMBINATION HANDLING ROTATING FLOW, Ira R. Schwartz, April 1949

RM L50I20 EXPERIMENTAL INVESTIGATION OF A FLAT-PLATE PADDLE JET VANE OPERATING ON A ROCKET JET, Aleck C. Bond, November 1950

RM L52E05b A PROPOSED RAM-JET CONTROL SYSTEM OPERATED BY USE OF DIFFUSER PRESSURE RECOVERY, Maxime A. Faget, September 1952

RM L52I19 EVALUATION OF END- AND RADIAL-BURNING SOLID FUELS IN RAM JETS MOUNTED IN FREE JET AT MACH NUMBERS OF 2.0, 2.2, AND 2.3, Walter A. Bartlett, Jr., November 1952

RM L52J02 PRELIMINARY INVESTIGATION OF A RECTANGULAR SUPERSONIC SCOOP INLET WITH SWEPT SIDES DESIGNED FOR LOW DRAG AT A MACH NUMBER OF 2.7, Raymond J. Comenzo and Ernest A. Mackley, November 1952

RM L52K03 FLIGHT TEST OF A RADIAL-BURNING SOLID-FUEL RAM JET, Walter A. Bartlett, Jr., and H. Rudolph Dettwyler, December 1952

RM L52K10 PRELIMINARY INVESTIGATION OF THE TOTAL-PRESSURE-RECOVERY CHARACTERISTICS OF A 15° SEMIANGLE MOVABLE-CONE VARIABLE-GEOMETRY RAM-JET INLET AT FREE-JET MACH NUMBERS OF 1.62, 2.00, 2.53, AND 3.05, Arthur H. Hinners, Jr., and John B. Lee, January 1953

RM L53H28 PREFLIGHT TESTS AND FLIGHT PERFORMANCE OF A 6.5-INCH-DIAMETER RAM-JET ENGINE, Arthur H. Hinners, Jr., and Douglas H. Foland, November 1953

RM L53I14a THE PERFORMANCE OF CONICAL SUPERSONIC SCOOP INLETS ON CIRCULAR FUSELAGES, Lowell E. Hasel, November 1953

RM L53K13 FLIGHT AND PREFLIGHT EVALUATION OF AN AUTOMATIC THRUST-COEFFICIENT CONTROL SYSTEM IN A TWIN-ENGINE RAM-JET MISSILE, H. Rudolph Dettwyler and Otto F. Trout, Jr., January 1954

RM L54D14 A PRELIMINARY INVESTIGATION OF THE PRESSURE RECOVERY OF SEVERAL TWO-DIMENSIONAL SUPERSONIC INLETS AT A MACH NUMBER OF 2.01, Raymond J. Comenzo, June 1954

RM L54G22 EFFECT OF YAW AND ANGLE OF ATTACK ON PRESSURE RECOVERY AND MASS-FLOW CHARACTERISTICS OF A RECTANGULAR SUPERSONIC SCOOP INLET AT A MACH NUMBER OF 2.71, Raymond J. Comenzo and Ernest A. Mackley, September 1954

RM L54I16 INVESTIGATION AT SUPERSONIC SPEEDS OF THE EFFECT OF JET MACH NUMBER AND DIVERGENCE ANGLE OF THE NOZZLE UPON THE PRESSURE OF THE BASE ANNULUS OF A BODY OF REVOLUTION, August F. Bromm, Jr., and Robert M. O'Donnell, December 1954

RM L54K04 INVESTIGATION AT MACH NUMBERS OF 1.41, 1.61, AND 1.82 OF TWO VARIABLE-GEOMETRY INLETS HAVING TWO-DIMENSIONAL COMPRESSION SURFACES, Lowell E. Hasel, February 1956

RM L54L29 AN ANALYSIS OF THE TRANSONIC AND SUPERSONIC PERFORMANCE OF SEVERAL FIXED-GEOMETRY AIR INLETS, Robert E. Pendley and Robert R. Howell, March 1955

RM L55A05 INVESTIGATION OF A HIGH-PERFORMANCE AXIAL-FLOW COMPRESSOR TRANSONIC INLET ROTOR DESIGNED FOR 37.5 POUNDS PER SECOND PER SQUARE FOOT OF FRONTAL AREA. AERODYNAMIC DESIGN AND OVERALL PERFORMANCE, Melvyn Savage and A. Richard Felix, March 1955

RM L55C16 EFFECT OF SEVERAL MODIFICATIONS TO CENTER BODY AND COWLING ON SUBCRITICAL PERFORMANCE OF A SUPERSONIC INLET AT MACH NUMBER OF 2.02, Robert L. Trimpi and Nathaniel B. Cohen, May 1955

RM L55G27 INVESTIGATION OF A THREE-STAGE TRANSONIC RESEARCH AXIAL-FLOW COMPRESSOR. AERODYNAMIC DESIGN AND OVERALL PERFORMANCE, Melvyn Savage and Loren A. Beatty, October 1955

RM L55H22a FLIGHT DETERMINATION OF DRAG AND PRESSURE RECOVERY OF TWO SCOOP INLETS LOCATED AT MAXIMUM-BODY-DIAMETER STATION AT MACH NUMBERS FROM 0.8 TO 1.8, Leonard W. Putland, January 1956

RM L55I08 HIGH-SPEED CASCADE TESTS OF THE NACA 65-($12A_{10}$)10 AND NACA 65-($12A_2I_{8b}$)10 COMPRESSOR BLADE SECTIONS, James C. Dunavant, James C. Emery, Howard C. Walch, and Willard R. Westphal, December 1955

RM L55I09 THE EFFECT OF INLET INSTALLATION ON THE ZERO-LIFT DRAG OF A 60° DELTA-WING - BODY CONFIGURATION FROM FLIGHT TESTS AT MACH NUMBERS FROM 0.8 TO 1.86, Charles F. Merlet, December 1955

RM L55L13 INVESTIGATION OF JET EFFECTS ON A FLAT SURFACE DOWNSTREAM OF THE EXIT OF A SIMULATED TURBOJET NACELLE AT A FREE-STREAM MACH NUMBER OF 1.39, Walter E. Bressette and Abraham Leiss, April 1956

RM L55L13a BYPASS-DUCT DESIGN FOR USE WITH SUPERSONIC INLETS, Charles C. Wood and John R. Henry, March 1956

RM L55L20b EXPERIMENTAL TECHNIQUES FOR PREDICTING STORE MOTIONS DURING RELEASE OR EJECTION, Maxime A. Faget and Harry W. Carlson, February 1956

RM L56C28 TRANSONIC-WIND-TUNNEL INVESTIGATION OF THE EFFECTS OF LIP BLUNTNESS AND SHAPE ON THE DRAG AND PRESSURE RECOVERY OF A NORMAL-SHOCK NOSE INLET IN A BODY OF REVOLUTION, Walter B. Olstad, July 1956

RM L56E07 SOME EXPERIMENTS RELATING TO THE PROBLEM OF SIMULATION OF HOT JET ENGINES IN STUDIED OF JET EFFECTS ON ADJACENT SURFACES AT FREE-STREAM MACH NUMBER OF 1.80, Walter E. Bressette, July 1956

RM L56F05 SUMMARY OF SUBSONIC-DIFFUSER DATA, John R. Henry, Charles C. Wood, and Stafford W. Wilbur, October 1956

RM L56F14 EXPERIMENTAL INVESTIGATION OF A TRANSONIC AXIAL-FLOW-COMPRESSOR ROTOR DESIGNED FOR SONIC INLET VELOCITY WITH AN INLET HUB-TIP RADIUS RATIO OF 0.35, Emanuel Boxer and Peter T. Bernot, September 1956

RM L56J01 PERFORMANCE OF AN IMPULSE-TYPE SUPERSONIC-COMPRESSOR ROTOR HAVING A MEAN TURNING OF 114°, Theodore J. Goldberg and John R. Erwin, January 1957

RM L56J31 BASIC PERFORMANCE CHARACTERISTICS OF SEVERAL SUBSONIC-DIFFUSER-BYPASS-DUCT COMBINATIONS FOR USE WITH SUPERSONIC INLETS, Charles C. Wood, January 1957

RM L56K01 FLIGHT PERFORMANCE OF 2.8 KS 8100 CAJUN SOLID PROPELLANT ROCKET MOTOR, Dorothy B. Lee, January 1957

RM L56K23 INVESTIGATION OF A HIGH-PERFORMANCE AXIAL-FLOW COMPRESSOR TRANSONIC INLET ROTOR DESIGNED FOR 37.5 POUNDS PER SECOND PER SQUARE FOOT OF FRONTAL AREA. DETAILED BLADE-ELEMENT PERFORMANCE, A. Richard Felix and Melvyn Savage, April 1957

RM L57A10 DESIGN AND INVESTIGATION OF A TRANSONIC AXIAL-FLOW COMPRESSOR ROTOR WITH AN INLET HUB-TIP RADIUS RATIO OF ESSENTIALLY ZERO, Willard R. Westphal and John W. Maynard, Jr., March 1957

RM L57A29 TRANSONIC INVESTIGATION OF INTERNAL-FLOW CHARACTERISTICS OF A SQUARE-SHAPED SCOOP INLET MOUNTED AT THREE CHORDWISE POSITIONS ABOVE A HIGH 45° SWEPTBACK WING AND BODY COMBINATION, Arvid L. Keith, Jr., April 1957

RM L57B07 A TRANSONIC INVESTIGATION OF THE MASS-FLOW AND PRESSURE RECOVERY CHARACTERISTICS OF SEVERAL TYPES OF AUXILIARY AIR INLETS, John S. Dennard, April 1957

RM L57E10a DESIGN AND EVALUATION OF A TURBOJET-EXHAUST SIMULATOR WITH A SOLID-PROPELLANT ROCKET MOTOR FOR FREE-FLIGHT RESEARCH, Abraham Leiss, July 1957

RM L57E16 INVESTIGATION AT TRANSONIC SPEEDS OF EFFECTS OF INLET-LIP SWEEP ON INTERNAL-FLOW CHARACTERISTICS OF SEMIELLIPTICAL AIR INLET WITH INLET-LIP STAGGER OF 30°, Charles D. Trescot, Jr., July 1957

RM L57G12a ANALYTICAL AND EXPERIMENTAL STUDIES OF SPHERICAL SOLID-PROPELLANT ROCKET MOTORS, Joseph G. Thibodaux, Jr., Robert L. Swain, and George Wright, August 1957

RM L57H02 A PRELIMINARY INVESTIGATION OF METHODS FOR IMPROVING THE PRESSURE-RECOVERY CHARACTERISTICS OF VARIABLE-GEOMETRY SUPERSONIC-SUBSONIC DIFFUSER SYSTEMS, Lowell E. Hasel and Archibald R. Sinclair, October 1957

RM L57H05 TWO-DIMENSIONAL CASCADE TESTS OF NACA 65-$(C_{l_o}A_{10})$10 BLADE SECTIONS AT TYPICAL COMPRESSOR HUB CONDITIONS FOR SPEEDS UP TO CHOKING, James C. Emery and James C. Dunavant, October 1957

RM L57H08 TRANSONIC INVESTIGATION OF AN AXIAL-FLOW COMPRESSOR ROTOR WITH A HUB-TIP RATIO OF 0.75 AND BLADES HAVING NACA A_2I_{8b} MEAN LINES, Peter T. Bernot and Melvyn Savage, September 1957

RM L57H15 A HYDROGEN PEROXIDE TURBOJET-ENGINE SIMULATOR FOR WIND-TUNNEL POWERED-MODEL INVESTIGATIONS, Jack F. Runckel and John M. Swihart, November 1957

RM L57J07 EFFECT OF INLET ASPECT RATIO ON THE STARTING AND PRESSURE RECOVERY CHARACTERISTICS OF A RECTANGULAR SWEPT SCOOP INLET TESTED AT A MACH NUMBER OF 3.1, Ernest A. Mackley, January 1958

RM L57K08 WIND-TUNNEL INVESTIGATION OF THE EFFECTS OF LIP GEOMETRY ON DRAG AND PRESSURE RECOVERY OF A NORMAL-SHOCK NOSE INLET ON A BODY OF REVOLUTION AT MACH NUMBERS OF 1.41 AND 1.81, A. Warner Robins, February 1958

RM L57K14 INVESTIGATION OF FIXED-GEOMETRY SUPERSONIC INLETS WITH BYPASS DUCTS FOR MATCHING TURBOJET-ENGINE AIR-FLOW REQUIREMENTS OVER A RANGE OF TRANSONIC AND SUPERSONIC SPEEDS, Abraham Leiss and Walter L. Kouyoumjian, February 1958

RM L57K27 TRANSONIC INVESTIGATION OF AN AXIAL-FLOW COMPRESSOR ROTOR WITH A CONTRACTED EXIT ANNULUS, Robert S. Babington, February 1958

RM L57L10a INVESTIGATION AT TRANSONIC SPEEDS OF A FIXED DIVERGENT EJECTOR INSTALLED IN A SINGLE-ENGINE FIGHTER MODEL, John M. Swihart and Charles E. Mercer, March 1958

RM L58A02 TWO-DIMENSIONAL CASCADE INVESTIGATION AT MACH NUMBERS UP TO 1.0 OF NACA 65-SERIES BLADE SECTIONS AT CONDITIONS TYPICAL OF COMPRESSOR TIPS, James C. Dunavant and James C. Emery, March 1958

RM L58A08 INVESTIGATION OF A HIGH-FLOW TRANSONIC-COMPRESSOR INLET STAGE HAVING A HUB-TIP RADIUS RATIO OF 0.35, A. Richard Felix, March 1958

RM L58G25 EFFECT OF CONVERGENT EJECTOR NOZZLES ON THE BOATTAIL DRAG OF A 16° CONICAL AFTERBODY AT MACH NUMBERS OF 0.6 TO 1.26, James M. Cubbage, Jr., September 1958

Not Applicable NACA Technical Memoranda

TM 923 MEASUREMENT OF THE AIR-FLOW VELOCITY IN THE CYLINDER OF AN AIRPLANE ENGINE, Hermann Wenger, February 1939

TM 924 MODERN METHODS OF FUEL TESTING, F. Seeber, August 1939

TM 927 CONSTANT-PRESSURE BLOWERS, E. Sorenson, August 1939

TM 928 KNOCKING IN AN INTERNAL COMBUSTION ENGINE, A. Sokolik and A. Voinov, January 1940

TM 930 EXPERIMENTAL CONTRIBUTION TO THE STUDY OF COMBUSTION IN COMPRESSION-IGNITION ENGINES, R. Duchene, February 1940

TM 931 TESTING OF HIGH-OCTANE FUELS IN THE SINGLE-CYLINDER AIRPLANE ENGINE, Fritz Seeber, February 1940

TM 936 MEASUREMENT OF KNOCK CHARACTERISTICS IN SPARK-IGNITION ENGINES, R. Schutz, March 1940

TM 940 THE LEAD SUSCEPTIBILITY OF FUELS AND ITS DEPENDENCE ON THE CHEMICAL COMPOSITION, O. Widmaier, April 1940

TM 943 TESTS OF LEAD-BRONZE BEARINGS IN THE DVL BEARING-TESTING MACHINE, G. Fischer, June 1940

TM 944 ITALIAN HIGH-SPEED AIRPLANE ENGINES, C. F. Bona, June 1940

TM 945 EXPERIMENTS ON BALL AND ROLLER BEARINGS UNDER CONDITIONS OF HIGH SPEED AND SMALL OIL SUPPLY, Gunter Getzlaff, July 1940

TM 949 THE MAXIMUM DELIVERY PRESSURE OF SINGLE-STAGE RADIAL SUPERCHARGERS FOR AIRCRAFT ENGINES, W. von der Null, August 1940

TM 952 STANDARDS FOR DISCHARGE MEASUREMENT WITH STANDARDIZED NOZZLES AND ORIFICES. From German Industrial Standard 1952, Fourth Edition, September 1940

TM 953 PRESSURE AND TEMPERATURE MEASUREMENTS IN SUPERCHARGER INVESTIGATIONS, A. Franz, September 1940

TM 954 LIMITS OF SINGLE-STAGE COMPRESSION IN CENTRIFUGAL SUPERCHARGERS FOR AIRCRAFT, K. Kollmann, September 1940

TM 957 RESONANCE VIBRATIONS IN INTAKE AND EXHAUST PIPES OF IN-LINE ENGINES. PART 3 - THE INLET PROCESS OF A FOUR-STROKE-CYCLE ENGINE, O. Lutz, October 1940

TM 970 EXPERIMENTAL INVESTIGATIONS ON FREELY EXPOSED DUCTED RADIATORS, W. Linke, March 1941

TM 972 USE OF CHARTS FOR FLOW DISCHARGE CALCULATIONS, O. Lutz, March 1941

TM 973 POTENTIAL FLOW THROUGH CENTRIFUGAL PUMPS AND TURBINES, E. Sorensen, April 1941

TM 975 THE EFFICIENCY OF COMBUSTION TURBINES WITH CONSTANT-PRESSURE COMBUSTION, Werner Piening, April 1941

TM 976 PRESENT AND FUTURE PROBLEMS OF AIRPLANE PROPULSION, J. Ackeret, May 1941

TM 977 HEAT TRANSFER IN GEOMETRICALLY SIMILAR CYLINDERS, P. Riekert and A. Held, May 1941

TM 978 DYNAMIC SIMILITUDE IN INTERNAL-COMBUSTION ENGINES, O. Lutz, May 1941

TM 981 NEW METHOD OF CALCULATING THE POWER AT ALTITUDE OF AIRCRAFT ENGINES EQUIPPED WITH SUPERCHARGERS ON THE BASIS OF TESTS MADE UNDER SEA-LEVEL CONDITIONS, Marcello Sarracino, July 1941

TM 982 THE DESIGN OF JET PUMPS, Gustav Flugel, July 1941

TM 986 NEW FRICTIONAL RESISTANCE LAW FOR SMOOTH PLATES, F. Schultz-Grunow, September 1941

TM 993 DIRECT INJUNCTION IN INTERNAL-COMBUSTION ENGINES, Jean E. Tuscher, November 1941

TM 1010 ANALYTICAL THEORY OF THE CAMPINI PROPULSION SYSTEM, S. Campini, March 1942

TM 1012 RECENT RESULTS IN ROCKET FLIGHT TECHNIQUE, E. Sanger, April 1942

TM 1014 INVESTIGATION OF LUBRICANTS UNDER BOUNDARY FRICTION, E. Heidebroek and E. Pietsch, May 1942

TM 1024 THERMAL THEORY OF COMBUSTION AND EXPLOSION, N. N. Semenov, August 1942

TM 1025 SELF-IGNITION AND COMBUSTION OF GASES, A. S. Sokolik, August 1942

TM 1026 THERMAL THEORY OF COMBUSTION AND EXPLOSION. III - THEORY OF NORMAL FLAME PROPAGATION, N. N. Semenov, September 1942

TM 1034 AERODYNAMIC HEAT-POWER ENGINE OPERATING ON A CLOSED CYCLE, J. Ackeret and D. C. Keller, November 1942

TM 1037 THEORY OF HEAT TRANSFER IN SMOOTH AND ROUGH PIPES, G. D. Mattioli, December 1942

TM 1038 THE PERFORMANCE OF VANELESS DIFFUSER FAN, V. Polikovsky and M. Nevelson, December 1942

TM 1042 THEORETICAL DETERMINATION OF AXIAL FAN PERFORMANCE, E. Struve, April 1943

TM 1043 EXPERIMENTAL INVESTIGATION OF A MODEL OF A TWO-STAGE TURBOBLOWER, S. Dovjik and W. Polikovsky, April 1943

TM 1049 RESEARCHES ON PRELIMINARY CHEMICAL REACTIONS IN SPARK-IGNITION ENGINES, E. Muhlner, June 1943

TM 1056 PISTON RING PRESSURE DISTRIBUTION, M. Kuhn, December 1943

TM 1057 RESEARCHES ON THE PISTON RING, Keikiti Ebihara, February 1944

TM 1059 AN EXPERIMENTAL INVESTIGATION OF THE FLOW OF AIR IN A FLAT BROADENING CHANNEL, A. N. Vedernikoff, January 1944

TM 1062 INVESTIGATION OF SINGLE STAGE AXIAL FANS, P. Ruden, April 1944

TM 1063 GAS JETS, S. Chaplygin, August 1944

TM 1066 COMPARATIVE RESULTS OF TESTS ON SEVERAL DIFFERENT TYPES OF NOZZLES, M. S. Kisenko, June 1944

TM 1069 THE FRICTION OF PISTON RINGS, Hans W. Tischbein, March 1945

TM 1073 AXIAL SUPERCHARGERS, A. Betz, August 1944

TM 1082 RECENT DEVELOPMENT OF THE TWO-STRIKE ENGINE. II - DESIGN FEATURES, J. Zeman, May 1945

TM 1084 KINETICS OF CHEMICAL REACTIONS IN FLAMES, Y. Zeldovich and N. Semenov, June 1946

TM 1089 INVESTIGATION OF FLOW IN A CENTRIFUGAL PUMP, Karl Fischer, July 1946

TM 1106 A RAM-JET ENGINE FOR FIGHTERS, E. Sanger and I. Bredt, October 1947

TM 1110 ON COMBUSTION IN A TURBULENT FLOW, K. I. Shelkin, February 1947

TM 1112 THE EFFECT OF TURBULENCE ON THE FLAME VELOCITY IN GAS MIXTURES, Gerhard Damkohler, April 1947

TM 1118 THE FLOW THROUGH AXIAL TURBINE STAGES OF LARGE RADIAL BLADE LENGTH, Eckert and Korbacher, April 1947

TM 1123 INVESTIGATIONS ON EXPERIMENTAL IMPELLERS FOR AXIAL BLOWERS, W. Encke, April 1947

TM 1124 PRACTICAL POSSIBILITIES OF HIGH-ALTITUDE FLIGHT WITH EXHAUST-GAS TURBINES IN CONNECTION WITH SPARK IGNITION ENGINES COMPARATIVE THERMODYNAMIC AND FLIGHT MECHANICAL INVESTIGATIONS, A. Weise, April 1947

TM 1125 THE INFLUENCE OF THE DIAMETER RATIO ON THE CHARACTERISTICS DIAGRAM OF THE AXIAL COMPRESSOR, B. Eckert, F. Pfluger, and F. Weinig, April 1948

TM 1128 RECENT RESULTS ON HIGH-PRESSURE AXIAL BLOWERS, B. Eckert, April 1947

TM 1131 GAS-DYNAMIC INVESTIGATIONS OF THE PULSE-JET TUBE PARTS I AND II, F. Shultz-Grunow, February 1947

TM 1132 POSSIBILITIES OF REDUCING THE LENGTH OF AXIAL SUPERCHARGERS FOR AIRCRAFT MOTORS, B. Eckert, January 1947

TM 1137 THE TURBULENT FLOW IN DIFFUSERS OF SMALL DIVERGENCE ANGLE, G. A. Gourzhienko, October 1947

TM 1141 THE COMBINATION OF INTERNAL-COMBUSTION ENGINE AND GAS TURBINE, K. Zinner, April 1947

TM 1142 FUNDAMENTALS OF THE CONTROL OF GAS-TURBINE POWER PLANTS FOR AIRCRAFT. PART I - STANDARDIZATION OF THE COMPUTATIONS RELATING TO THE CONTROL OF GAS-TURBINE POWER PLANTS FOR AIRCRAFT BY THE EMPLOYMENT OF THE LAWS OF SIMILARITY, H. Kuhl, April 1947

TM 1143 FUNDAMENTALS OF THE CONTROL OF GAS-TURBINE POWER PLANTS FOR AIRCRAFT. PART II - PRINCIPLES OF CONTROL COMMON TO JET, TURBINE-PROPELLER JET, AND DUCTED-FAN JET POWER PLANTS, H. Kuhl, April 1947

TM 1144 ROCKETS USING LIQUID OXYGEN, A. Busemann, April 1947

TM 1145 ROCKET POWER PLANTS BASED ON NITRIC ACID AND THEIR SPECIFIC PROPULSIVE WEIGHTS, H. Zborowski, May 1947

TM 1147 GENERAL CHARACTERISTICS OF THE FLOW THROUGH NOZZLES AT NEAR CRITICAL SPEEDS, R. Sauer, June 1947

TM 1149 THREE-COMPONENT FORCE AND MASS-FLOW MEASUREMENTS ON A JET NACELLE, G. Ilgmann and E. Moller, June 1947

TM 1166 FUNDAMENTALS OF THE CONTROL OF GAS-TURBINE POWER PLANTS FOR AIRCRAFT. PART III - CONTROL OF JET ENGINES, H. Kuhl, May 1947

TM 1169 DESCRIPTION OF RUSSIAN AIRCRAFT ENGINES "AM 35" AND "AM 38", H. Denkmeier and K. Gross, June 1947

TM 1170 REPORT ON ROCKET POWER PLANTS BASES ON T-SUBSTANCE, H. Walter, July 1947

TM 1171 LABORATORY REPORT ON THE INVESTIGATION OF THE FLOW AROUND TWO TURBINE-BLADE PROFILES USING THE INTERFEROMETER METHOD, K. von Vietinghoff-Scheel, July 1947

TM 1172 PRELIMINARY REPORT ON THE FUNDAMENTALS OF THE CONTROL OF TURBINE-PROPELLER JET POWER PLANTS, H. Kuhl, July 1947

TM 1173 PRESSURE DISTRIBUTION MEASUREMENTS ON A TURBINE ROTOR BLADE PASSING BEHIND A TURBINE NOZZLE LATTICE, Hausenblas, September 1947

TM 1190 TESTS OF CASCADES OF AIRFOILS FOR RETARDED FLOW, Yoshinori Shimoyama, October 1947

TM 1193 MEASUREMENTS ON COMPRESSOR-BLADE LATTICES, F. Weinig and B. Eckert, August 1948

TM 1196 NONSTATIONARY GAS FLOW IN THIN PIPES OF VARIABLE CROSS SECTION, G. Guderley, December 1948

TM 1200 MEASUREMENT OF OIL-FILM PRESSURES IN JOURNAL BEARINGS UNDER CONSTANT AND VARIABLE LOADS, A. Buske and W. Rolli, November 1949

TM 1209 EXPERIMENTAL STUDY OF FLOW PAST TURBINE BLADES, E. Eckert and K. V. Vietinghoff-Scheel, June 1949

TM 1212 ON THE THEORY OF THE LAVAL NOZZLE, S. V. Falkovich, April 1949

TM 1214 JET DIFFUSION IN PROXIMITY OF A WALL, D. Kuchemann, May 1949

TM 1215 FLOW PATTERN IN A CONVERGING-DIVERGING NOZZLE, K. Oswatitsch and W. Rothstein, March 1949

TM 1226 ON THE INSTALLATION OF JET ENGINE NACELLES ON A WING FOURTH PARTIAL REPORT: PRESSURE-DISTRIBUTION MEASUREMENTS ON A SWEPT-BACK WING WITH JET ENGINE NACELLE, R. Buschner, July 1949

TM 1236 A CLASS OF DE LAVAL NOZZLES, S. V. Falkovich, October 1949

TM 1258 FLIGHT PERFORMANCE OF A JET POWER PLANT. III - OPERATING CHARACTERISTICS OF A JET POWER PLANT AS A FUNCTION OF ALTITUDE, F. Weinig, May 1951

TM 1259 THEORETICAL INVESTIGATIONS ON THE EFFICIENCY AND THE CONDITIONS FOR THE REALIZATION OF JET ENGINES, Maurice Roy, June 1950

TM 1261 ON THE THEORY OF THE PROPAGATION OF DETONATION IN GASEOUS SYSTEMS, Y. B. Zeldovich, November 1950

TM 1267 THEORY OF PLANE, SYMMETRICAL INTAKE DIFFUSERS, Walter Brodel, April 1950

TM 1271 EFFECT OF INTENSE SOUND WAVES ON A STATIONARY GAS FLAME, H. Hahnemann and L. Ehret, July 1950

TM 1274 BEHAVIOR OF FAST MOVING FLOW OF COMPRESSIBLE GAS IN CYLINDRICAL PIPE IN PRESENCE OF COOLING, G. A. Varshasky, September 1951

TM 1279 TWO-DIMENSIONAL SYMMETRICAL INLETS WITH EXTERNAL COMPRESSION, P. Ruden, March 1950

TM 1282 THEORY OF FLAME PROPAGATION, Y. B. Zeldovich, June 1951

TM 1289 THE DEVELOPMENT OF A HOLLOW BLADE FOR EXHAUST GAS TURBINES, H. Kohlmann, December 1950

TM 1292 LAWS OF FLOW IN ROUGH PIPES, J. Nikuradse, November 1950

TM 1294 EXHAUST TURBINE AND JET PROPULSION SYSTEMS, K. Leist and E. Knornschild, April 1951

TM 1296 ON THE THEORY OF COMBUSTION OF INITIALLY UNMIXED GASES, Y. B. Zeldovich, June 1951

TM 1298 ON THE PROBLEM OF GAS FLOW OVER AN INFINITE CASCADE USING CHAPLYGIN'S APPROXIMATION, G. A. Bugaenko, May 1951

Not Applicable NASA Technical Translations

TT F 1 THE CHARACTERISTICS OF HYDROGEN AND WATER AS WORKING GASES FOR REACTOR-HEATED ROCKET MOTORS, Irene Sanger-Bredt, August 1959

TT F 21 LUBRICATING OILS FOR AVIATION GAS TURBINES, V. V. Panov and Yu. S. Sobolev, May 1960

TT F 24 THE COMPLEX CONDUCTIVITY OF PLASMA OF AN ARC DISCHARGE SUPPORTED BY A DIRECT CURRENT, Jiri Kracik, May 1960

TT F 41 CONTROL OF GAS-TURBINE AND RAMJET ENGINES, L. A. Zalmanzon and B. A. Cherkasov, July 1961

TT F 78 HYDRAULIC DESIGN OF AIR COOLING SYSTEMS FOR MULTI-STAGE GAS TURBINES BY USING ELECTRIC MODELS, I. T. Shvets, Ye. P. Dyban, and V. N. Klimenko, April 1963

TT F 79 GAS DYNAMICS AND PHYSICS OF COMBUSTION, A. S. Predvoditelev, 1962

Not Applicable NASA Technical Memoranda

TM X 9 INVESTIGATION OF EFFECTS OF LOW REYNOLDS NUMBER OPERATION ON PERFORMANCE OF SINGLE-STAGE TURBINE WITH DOWNSTREAM STATOR [with list of references], Robert E. Forette, Donald E. Holeski, and Henry W. Plohr, September 1959

TM X 25 EFFECT OF MULTIPLE-JET EXITS ON BASE PRESSURE OF SIMPLE WING-BODY COMBINATION AT MACH NUMBERS OF 0.6 TO 1.27, James M. Cubbage, Jr., August 1959

TM X 42 COLD-AIR INVESTIGATION OF 3 VARIABLE-THROAT-AREA CONVERGENT-DIVERGENT NOZZLES, John E. McAulay, September 1959

TM X 49 EFFECT OF EXTERNAL BOUNDARY LAYER ON PERFORMANCE OF AXISYMMETRIC INLET AT MACH NUMBERS OF 3.0 AND 2.5, N. E. Samanich, D. O. Barnett, and R. J. Salmi, September 1959

TM X 75 EXPERIMENTAL AND ANALYTICAL STUDY OF ROLLING-VELOCITY AMPLIFICATION DURING THE THRUSTING PROCESS FOR TWO 10-INCH-DIAMETER SPHERICAL ROCKET MOTORS IN FREE FLIGHT, C. William Martz and Robert L. Swain, September 1959

TM X 83 OVEREXPANDED PERFORMANCE OF CONICAL NOZZLES WITH AREA RATIOS OF 6 AND 9 WITH AND WITHOUT SUPERSONIC EXTERNAL FLOW, Norman T. Musial and James J. Ward, September 1959

TM X 85 CASCADE INVESTIGATION OF COOLING CHARACTERISTICS OF CORRUGATED-INSERT AIR-COOLED TURBINE BLADE FOR USE IN TURBOPROP ENGINE, Hadley T. Richards, March 1960

TM X 86 EXPERIMENTAL INVESTIGATION OF 0.35 HUB-TIP RADIUS RATIO TRANSONIC AXIAL FLOW ROTOR DESIGNED FOR 40 POUNDS PER SECOND PER SQUARE FOOT WITH FLOW ROTOR DESIGNED FOR 40 POUNDS PER SECOND PER SQUARE FOOT WITH DESIGN TIP DIFFUSION FACTOR OF 0.20, Paul T. Yasaki and John C. Montgomery, September 1959

TM X 89 MATERIALS PROBLEMS IN CHEMICAL LIQUID-PROPELLANT ROCKET SYSTEMS, L. L. Gilbert, August 1959

TM X 100 COMPARISON OF ROCKET PERFORMANCE USING EXHAUST DIFFUSER AND CONVENTIONAL TECHNIQUES FOR ALTITUDE SIMULATION, Joseph N. Sivo and Daniel J. Peters, September 1959

TM X 197 EXPERIMENTAL INVESTIGATION OF TRANSONIC COMPRESSOR CASCADE AND TEST RESULTS FOR 4 BLADE SECTIONS, James C. Emery, James C. Dunavant, and Willard R. Westphal, January 1960

TM X 254 PERFORMANCE OF TURBOJET ENGINE IN COMBINATION WITH EXTERNAL-INTERNAL-COMPRESSION INLET TO MACH 2.88, David N. Bowditch, Bernhard H. Anderson, and William K. Tabata, July 1960

TM X 281 FLIGHT TESTS OF TWIN-DUCT INDUCTION SYSTEM FOR MACH NUMBER RANGE OF 0.78 TO 2.07, Jack Nugent and Bruce G. Powers, September 1960

TM X 382 EXPERIMENTAL PERFORMANCE OF AREA RATIO 200, 25, AND 8 NOZZLES ON JP-4 FUEL AND LIQUID-OXYGEN ROCKET ENGINE, J. Calvin Lovell, Nick E. Samanich, and Donald O. Barnett, August 1960

TM X 417 PERFORMANCE OF SMALL GAS GENERATOR USING LIQUID HYDROGEN AND LIQUID OXYGEN [with list of references], Loren W. Acker, David B. Fenn, and Marshall W. Dietrich, February 1961

TM X 479 PHOTOGRAPHIC STUDY OF LIQUID HYDROGEN UNDER SIMULATED ZERO GRAVITY CONDITIONS, Irving Brazinsky and Solomon Weiss, February 1962

PART II

A STUDY OF NACA AND NASA PUBLISHED INFORMATION RELATIVE TO THE PERFORMANCE, STABILITY, AND CONTROL, PROPELLERS, AND FLIGHT SAFETY OF LIGHT AIRCRAFT

By Dennis M. Phillips

Introduction

As the title suggests, a great deal of work has been reviewed. Furthermore, for this, or any other author to presume to cover completely the work conducted by and under the auspices of the NACA/NASA in this or other fields would be most presumptuous. It could go without stating that undoubtedly much work will be glossed over, and many "favorite" reports will not receive the attention here than many readers would expect. Nevertheless, the purpose is to attempt to organize and summarize reports, notes, and memoranda in the areas listed above in such a fashion that some degree of cohesiveness appears and so that the reader may be directed to those reports of particular interest with some degree of prior knowledge. We have not attempted to summarize the total technical content in a way that data may be used for engineering analysis, but rather have taken the approach that to inform the reader of the existence of reports and data is of primary importance.

This report is subdivided into four separate subsections: Performance, Stability and Control, Propellers, and Flight Safety. A discussion of the general nature of this material is covered in the body of the report. Short summaries of the most pertinent reports are given in the appendix. Not all of the really applicable (in the context of this study) reports on these subject categories have been included in this section of the appendix. Rather, the attempt has been to present the more representative of a group of reports in order to illustrate a technique or process. This procedure has been followed to keep the volume down to something which would approach a manageable size. Thus some of the applicable reports were consigned to the not applicable list in the appendix. These reports received written reviews from the student reviewers, however. In keeping with the desire to reduce the bulk of this report as much as possible, these student reviewers were omitted in preparing the appendix. The student reviews retained have been edited for uniformity and continuity by the writer.

An obvious difficulty is presented when one attempts to categorize reports into their specific areas since a considerable degree of cross-reference exists. As an example there are several reports on the effects of propeller characteristics upon stability and control problems. Such reports are included in areas considered by the author to be the most significant insofar as the particular report is concerned.

The table below gives the initial and final number of the reports reviewed in each group by series.

	Applicable	Not Applicable
First NACA Technical Note	579	747
Last NACA Technical Note	4158	4410
First NASA Memorandum (Memo)	None	10-1-58A
Last NASA Memorandum (Memo)	None	6-12-59E
First NASA Technical Note	D- 211	D- 7
Last NASA Technical Note	D-3970	D-2645
First NACA Technical Report	301	686
Last NACA Technical Report	1336	1391
First NASA Technical Report	R- 57	R- 19
Last NASA Technical Report	R-228	R-145
First NACA Wartime Report	A- 11 L- 30 W- 5	A- 2 E- 12 L- 4 W- 3
Last NACA Wartime Report	A- 47 L-761 W-100	A- 86 E- 18 L-787 W-104
First NACA Research Memorandum	None	A7L16
Last NACA Research Memorandum	None	L58H07
First NACA Technical Memorandum	925	938
Last NACA Technical Memorandum	1219	1406
First NASA Technical Translation	None	F-17
Last NASA Technical Translation	None	F-55
First NASA Technical Memorandum	None	X- 5
Last NASA Technical Memorandum	None	X-665

Prior to discussion of the specific subject topics, several reports appear in an area which, while related indirectly to these types, can only be considered to be of general interest. These reports have been prepared to provide guidance and to establish a continuity of nomenclature and procedures throughout the NACA literature. NACA TR 837, "Standard Nomenclature for Airspeeds with Tables and Charts for Use in Calculation of Airspeed," by Aiken sets up standard symbols, terms, and definitions for use in airspeed performance. The "Manual of the ICAO Standard Atmosphere," TN 3182, has been superseded somewhat by latter NASA publications in the area, in particular NASA's "U. S. Standard Atmosphere, 1962." Of peripheral interest, but of obvious value, is NACA TR 919, "Accuracy of Airspeed Measurements and Flight Calibration Procedures." These three reports are summarized in the appendix.

Performance

One can consider the performance of an airplane to be its motion along a flight path in response to a control input (or series of control inputs), including engine power setting. The general analysis of this problem consists of finding the variation with time of six or more variables from the solution of a system of non-linear partial differential equations. From these solutions it is possible to compute the position of the aircraft in space at any time and its remaining fuel. It is also possible to use these equations in conjunction with the calculus of variations to find, for example, the minimum fuel required to cover a given distance, horizontally or vertically, or the flight speed variation at which this is achieved. It requires only a rudimentary acquaintance with mathematics, however, to appreciate the magnitude of this task. Without modern computing engines it is a task beyond the physical capacity of a sizable group of humans.

Recognizing this situation, early analysts quickly determined that small perturbations about a relatively steady flight path usually have little influence on the quantity of fuel required to reach a given point, for example. They therefore decided to consider the solutions of the equations of motion for a given disturbance under only two limiting conditions--very short times (less than 30 seconds) and very long times (several minutes to several hours). In order to treat the first special case modern stability and control theory was developed. For treatment of the second, performance prediction, as understood in the conventional sense, has arisen.

The desire for only a long time, or steady state, solution makes it possible to neglect the inertial and damping terms in the equations of motion. By neglecting in addition attitude and Mach number effects on aerodynamic characteristics and power plant performance it is usually possible to arrive at a set of very straightforward performance parameters from which one can readily determine such things as range, endurance, best climb speed, steepest climb, and ceiling. The history of the development of these "closed form" performance parameters is covered well in the reports given reviews in the appendix.

With the advent of modern computing machinery and the synchronous need for very precise trojectory calculation for missiles and spacecraft, the aerospace industry developed capability to solve the general performance problem. It was then but a small step to modify such a program to accept aircraft characteristics. This is now general practice in the large aerospace companies. Because of the comparatively small number of new aircraft under development since 1954 and the relative ease with which the problem is now handled in most of the industry, NASA has, judging from its literature in this area, devoted little effort to recording these procedures. Thus the aircraft performance prediction methods available in the NACA/NASA literature represent for the most part pre-computer technology.

It is true of course that open form, numerical solution of the general equations makes possible a degree of precision and accuracy never before possible. It is thus a requisite before committing multibillion dollar systems to flight. In the process, however, one loses his ability to manipulate and absorb the significance of the performance parameters. To be sure, the more general closed-form solutions, even when arranged by parametric groupings, present a formidable task in terms of man-hours required to generate numerical results; and, of course, no technique is of value if one cannot use that technique to obtain specific hardware data. Perhaps it was a direct result of the complexity of their equations which caused analysts to proceed to solve the direct equations of motion in open form. The rational that, if one is to go to the trouble to solve a set of equations numerically, then one might as well find a complete solution as to evaluate a set of parametric formulas, surely has applied. There is a great deal of merit in this approach. But, in general, such solutions require a certain degree of programming capability and access to a computer. Neither of these two items can be considered as cheap or inexpensive by any means of evaluation; and, while they permit a tremendous improvement at times in the level of accuracy, the overall cost of the analytic design phase must necessarily increase. One could make the point that an investment in analytical procedures will yield dividends elsewhere, but this is not so unless the computational effort is well managed.

Now, one must draw a line somewhere at the degree of sophistication, accuracy, and complexity necessary to the design of general aviation aircraft. Most certainly, with the use of pressurized cabins, etc., many of the design problems have increased at least an order of magnitude in complexity, but this is not true in all phases of the design process. Certainly at times it is less expensive to build a prototype airplane and fly it than go through a rigorous design process in order to obtain an optimum design. Furthermore, these manufacturers operate, by and large, on this approach to a new aircraft. In fine, most manufacturers would be hard-pressed to buy or lease the necessary computers, to train people to handle and operate them, and to integrate them into the design process before the company went broke.

Obviously, some middle ground must be found; and this lies in the proper use of computer techniques to the problem of light aircraft design. If there are valid techniques, well-developed and substantiated by years of practical useage, then these techniques should be applied to small general purpose computers which can perform several additional functions. These equations and techniques do exist, and with a reasonable effort they can be programmed so that reasonable design and operational data can be obtained.

The Literature of Performance Prediction

The earlier rigorous attempts at definition of the performance characteristics of airplanes resulted in generalized parametric studies in which so-called "fundamental performance parameters" were developed. This is particularly true of the foundation NACA work in this area, "General Formulas and Charts for the Calculation of Airplane Performance," NACA TR 408, by W. Bailey Oswald, written in 1932. The general approach here is to specify certain engineering parameters which relate altitude performance to basic performance points such as V_m, the maximum sea level design speed. The usual performance characteristics of the airplane are related to a "fundamental performance equation" which is stated in terms of the airplane's rate of climb. The resulting specification of airplane performance lends itself to the general computation of the most important performance characteristics. The technique is enhanced by the preparation of parametric curves and design charts which may be used either to determine the performance characteristics of unsupercharged fixed-pitch propeller aircraft or to reduce flight data to determine the aerodynamic and propulsion parameters of the airplane in question.

As compared to current general aviation aircraft, the aircraft for which Oswald's performance methods were developed are relatively unsophisticated. However, the advancements made in performance computation kept pace with advancements in propeller and engine installations, for Oswald's report is amplified by "General Airplane Performance," NACA Report 654, by W. C. Rockefeller. Rockefeller's report was published in 1939, and was preceded by NACA TN 579, "Charts for Calculating the Performance of Airplanes Having Constant-Speed Propellers," published in 1936. In the interim, Bailey had done work which expanded the coverage of his original work to include supercharged engines. Of this group, however, the two most important are Oswald's Report 408 and Rockefeller's Report 654 since the former must be considered as the foundation work and the latter includes and improves upon advancements made in the interim. Report 654 follows essentially the same method outlined in Report 408, but the extension of coverage to include constant speed propellers and supercharged engines makes TR 654 especially applicable to current general aviation class aircraft.

Insofar as computation of aircraft range is concerned, there has been extensive reliance upon the venerable Brequet range equation. One report which uses this equation as the primary function for a parametric study is WR L 546, "The Effect of Altitude on Bomber Performance," by Hill and Crigler.

While the reports listed above deal with the general performance of aircraft, and the resultant application of performance calculation techniques as presented in parametric variational studies, other reports are available which discuss the methods by which such conditions as take-off distance, time, and speed may be computed. One such report is TN 1258, "Experimental Varification of Two Methods for Computing the Take-Off Ground Run of Propeller-Driven Aircraft," by Gasich. This report compares two techniques for computing take-off distance, one which is essentially a closed form technique and the other is an iterative approach which integrates the basic equation of motion point-by-point. Another report is NACA TN 863, "Results of Landing Tests in Various Airplanes," by Hootman and Jones which establishes vertical speed, horizontal and vertical acceleration requirements for aircraft categories grouped by weight.

Some of these methods are illustrated in parametric studies of macro-performance such as War Report L 673, "Generalized Performance Charts for Single-Engine Pursuit Airplanes," by Ivey, Stickle, and Brevoort; and TM 925 "Effect of Wing Loading, Aspect Ratio, and Span Loading or Flight Performances," by B. Gothert. The first of these is representative of performance estimation techniques for a particular class of aircraft whereas the second is representative of parametric studies which have been conducted to aid in desig and sizing analysis of aircraft. Of particular interest for reports of this type is War Report L 671, "Effect of Airplane Design Efficiency and Engine Economy on Range," by Brevoort, Stickle, and Hill. Though this report is devoted to the study of bomber category aircraft, the techniques can be considered as applicable in general. TR R-228, "Estimation of Flight Performance with Closed-Form Approximations to the Equations of Motion," is a recent report which is valuable for performance calculations. One can only guess at the possible application of these earlier reports when used in conjunction with modern computing machinery. The performance equations could permit rapid solution if they were programmed for solution on even the most unsophisticated digital computers. The combination of simple iterative procedures with these closed form-parametric techniques could provide relatively inexpensive computational capability with a level of sophistication commensurate with the requirements and sophistication of design.

Introduction

One familiar with the great amount of data, both experimental and theoretical, which exists on the subject of Stability and Control within the NACA literature, will sympathize with the problems that are presented when it becomes necessary to choose among them in order to select the most representative and informative. Indeed, one of the most formidable problems has been to categorize these reports and select suitable topics for discussion. It might be said that the problems of handling qualities could more properly be presented in the section on flight safety, and the author has done this to some extent; but since the handling qualities of an airplane are so much dependent upon the stability characteristics, there will be some degree of duplication.

Longitudinal Stability and Control

One of the more important parameters used to define longitudinal stability and control characteristics of airplanes is the neutral point. The neutral point is usually related to the most aft center of gravity position of the airplane, and its specific location is of great importance to airplane designers. The neutral point location may be determined from analytical/empirical techniques, but the specific location is most often determined by flight tests. Two types of neutral points are most usually specified, these being the stick-fixed (controls locked) and the stick-free (control surfaces free to float with the relative wind). NACA WR L 116, "Estimation of Stick-fixed Neutral Points of Airplanes," by White, presents an analytical/empirical technique by which the stick-fixed neutral point may be located from data which reflects the aerodynamic characteristics of the aircraft components. Each of the primary components is shown to contribute independently to the neutral point location through its effect upon $\partial C_m/\partial C_L$.

Two reports which deal with the problem of determination of the neutral point from wind tunnel data are WR L 344, "Some Notes on the Determination of the Stick-Fixed Neutral Point from Wind-Tunnel Data," and WR L 251, "Some Notes on the Determination of Stick-Free Neutral Point from Wind-Tunnel Data," both by Schuldenfrei. These reports are careful considerations of the longitudinal and vertical locations of the stick-fixed and stick-free neutral points, and present techniques by which the points may be calculated. This is amplified somewhat by WR L 430, "A Theoretical Investigation of Longitudinal Stability of Airplanes with Free Controls Including Effect of Friction in the Control System," by Greenberg and Sternfield. This report, as its title suggests, is a most complete evaluation of the problem of control-free stability and includes an investigation of control forces and maneuvering flight problems. This report is highly detailed, and discusses the various effects of airplane control problems in light of the full dynamics of the airplane motion. This report appeared later as NACA TR 791.

The location of the neutral point is affected to a great extent by the variation of lift coefficient and, in particular, the application of power. One paper which deals with the problem of power effects upon the neutral point is NACA WR L 761, "Effect of Propeller Operation on the Pitching Moments of Single-Engine Monoplanes," by Goett and Pass. The report discusses in some detail the effects of power, and provides an engineering means of estimating these effects. The problems of power application are discussed in depth in succeeding technical notes and reports. A selection of these reports is summarized at the end of this section.

Gilruth and White have published NACA TR 711, "Analysis and Prediction of Longitudinal Stability of Airplanes," a report which must be considered as being a basic contribution to the field. This is an in-depth study of the longitudinal characteristics of several airplanes.

Other reports of general interest to longitudinal stability and control for which student reviews appear in the appendix are TN 1239, TN 1722, TND-211, and TND-632.

Lateral Stability and Control

NACA fortunately prepared a summary paper on the problem of lateral stability and control of aircraft. Technical Report 868, "Summary of Lateral-Control Research," compiled by Toll, is a review of the lateral control work conducted by the NACA Langley staff through 1945. The report is extensive both in depth and breadth of coverage and includes both analytical and experimental means of computation and design. Of particular value is the list of references which may be used as a bibliography to direct the reader to more specific areas of the problem. In addition to the charts and equations, the report includes examples which enable the reader to use the data in an analytical fashion.

In a report which parallels TR 711, Gilruth and Turner also prepared NACA TR 715, "Lateral Control Required for Satisfactory Flying Qualities Based on Flight Tests of Numerous Airplanes." This report specifies the lateral control characteristics necessary for proper handling qualities and presents charts, equations and other data which can be of value to the designer.

NACA TN 1404, "Collection of Test Data for Lateral Control with Full Span Flaps," by Fischel and Ivey, is a compilation of test data available through 1948. The data includes information on several lateral control devices, all used in conjunction with full span flaps.

Several other reports dealing with lateral stability and control were considered applicable to light aircraft. Reviews of the reports listed are available in the appendix.

Technical Notes: 1015, 1409, 1997, 2409, 3134, D-896
Technical Reports: 797
War Reports: L-30, L-210.

Dynamic Stability, Frequency Response, and Transfer Functions

The dynamical problems of longitudinal and lateral stability and control are covered to some extent in the literature already mentioned. However, there are interesting and applicable extensions of that information which may be handled by rather specialized methods. It is often difficult to separate the dynamic flight characteristics of an airplane from the measurement and data reduction techniques used to determine the value of the aerodynamic characteristics. Moreover, the analysis of dynamic flight data may often be interpreted in terms other than the standard aerodynamic parameters, that is transfer functions. The mathematical techniques in some cases may seem to be rather obtuse, and a certain amount of care and sophistication is required before one can attempt to interpret their meaning properly and in context.

Oftentimes it becomes necessary to reduce quasi-dynamic flight data in an effort to determine the steady state aerodynamic parameters and the problems involved are thereby complicated. It then becomes necessary to develop special mathematical techniques to facilitate the reduction from transient flight data.

The numbers and nature of such techniques are many and varied, and to present all of them in this summary would lead to redundancy and, possibly, confusion. Consequently, a few representative NACA documents have been selected as most indicative of the methods developed. NACA TN 2340, "A Survey of Methods for Determining Stability Parameters of an Airplane from Dynamic Flight Measurements," by Greenberg presents several methods for reducing transient data into stability parameter form. Technical Report 1169, "Matrix Methods for Determining the Longitudinal-Stability Derivatives of an Airplane from Transient Flight Data," by Donegan is an extension of NACA TN 2370, of a similar title, by Donegan and Pearson. Another such report is TR 1204, "Application of Several Methods for Determining Transfer Functions and Frequency Response of Aircraft from Flight Data," by Eggleston and Mathews. As the title implies, this report is concerned primarily with the methods for obtaining aircraft transfer functions.

As might be surmised, these reports and the techniques they discuss are of obvious value in the design of automatic flight control systems, whether these systems be full "automatic pilots," or simple stability augmentation devices. Such discussions of these flight control systems is outside the range of objectives of this study, NACA and NASA-generated documents on the subject will not be listed to any great extent. However, it is reasonable to mention two reports of more or less direct applicability. The first is NACA TR 1304, "Flight Investigation of the Effectiveness of an Automatic Aileron Trim Control Device for Personal Airplanes," by Phillips, Kuehnel, and Whitten. This report considers a rather simple device to improve the spiral stability of an airplane, typical of such devices currently referred to as "wing-levelers," are to be found in rather wide usage.

Other reports of peripheral interest are NACA TR 1197, "A Study of the Characteristics of Human-Pilot Control Response to Simulated Aircraft Lateral Motions," NACA TN 2413, "Flight Investigation of the Effect of a Control

Centering Springs on the Apparent Spiral Stability of a Personal-Owner Airplane," and WR L 210, "Flight Measurements to Determine Effect of a Spring-Loaded Tab Upon Longitudinal Stability of an Airplane," by Paul Hunter. This latter report describes a rather simple device which can be used to augment the stability characteristics of an airplane. This is followed by NASA TN D 3970, "Effects of a Simple Stability Augmentation System on the Performance of Non-Instrument Qualified Pilots during Instrument Flight," by Norman Driscoll.

Handling Qualities

Three NACA technical reports, TR 700, TR 755 and TR 927 are presented as the most informative insofar as definition of flying and handling requirements is concerned. TR 700, "Preliminary Investigation of the Flying Qualities of Airplanes," by Soule, is an early attempt to establish procedures, techniques, and instrumentation requirements by which handling characteristics may be presented in a quantitative manner. The second, TR 755, "Requirements for Satisfactory Flying Qualities of Airplanes," by Gilruth, draws upon the results of TR 700, and proceeds to set up specific guidelines and requirements by which flying qualities of airplanes may be compared in a quantitative sense. Also considered is the affect of variations in the airplane design parameters upon eventual handling qualities, and he presents some information which could be used by a designer in his attempt to develop an airplane which has acceptable qualities. This report was originally published as WR L 276. Phillips' report, NACA TR 927, "Appreciation and Prediction of Flying Qualities," originally published as TN 1670, may be considered as a summary report which presents a concise view of the NACA work dealing with the subject up to that time. TR 927 was written as a text which was used as the basis for a training course for NACA employees involved in investigations of airplane stability and control. The report is valuable because the problems of stability and control as they affect handling qualities are discussed in a conversational sense and one can obtain a good feel for the "numbers." It is not a classical study of stability and control such as one would expect to find in a textbook. Rather, it is a qualitative discussion, with reasonable technical detail and supporting data, of the basic requirements which define and describe satisfactory handling qualities and the manner by which these requirements may be satisfied.

Even with the requirements for satisfactory handling qualities having been reasonably defined and stated, one is presented with the practical and technical problem of application. Flying qualities may be determined by flight test, or they may be developed from wind tunnel test data. NACA TR 825, "Analysis of Wind-Tunnel Stability and Control Tests in Terms of Flying Qualities of Full-Scale Airplanes," by Kayten, first published as WR L 322, presents a detailed analysis of the manner by which wind tunnel data may be used to define the possible flying qualities of the subject design. Then, to present a rather comprehensive study of the technique by which handling qualities are measured in flight, the series of reports, WR L 605, WR L 606, WR L 607, "Measurement of Flying Qualities of a Douglas A-26B Airplane (AAF No. 41-39120) I, II, and III," by Crane, Sjoberg, and Hoover. Part I considers the Longitudinal Stability and Control; Part II considers the

Lateral and Directional Stability and Control; and Part III considers the Stalling Characteristics. Of course, one is not concerned at this writing with the specific characteristics of the A-26, but with the technique, analysis of data, and presentation. NASA TN D-632, "A Longitudinal Control Feel System for In-Flight Research on Response Feel," by Stanley Faber and Harold L. Crane, is an example of a report which describes a system which will evaluate handling qualities in flight based on response feel. Finally, more for purposes of reporting than for information purposes, there is NACA TN 1573, "Flight Measurements of the Flying Qualities of Five Light Aircraft," by Hunter. The report by Hunter is accompanied by a later report, on much the same topic NASA TN D-3726, "An Evaluation of the Handling Qualities of Seven General-Aviation Aircraft," by Barber et al. TN D-3726 is discussed in another section of this report.

There have already been many reports referred to in the above four sections under Stability and Control, but there were some reports reviewed which could not be classified as Longitudinal or Lateral Stability and Control alone. These reports investigated the stability and control of the total airplane configuration. In the author's opinion the reports listed below were best suited for general stability and control for light aircraft.

NACA Technical Notes: 828, 1868
NACA Technical Reports: 709, 823
NACA Wartime Reports: L-95, L-248, L-425, L-706, L-710, W-5

Since control surfaces are of major interest to the topic of Stability and Control, six reports based on calculation and measurements of hinge moments were judged applicable to light aircraft design. These reports were TN-1333, WR L-195, WR L-346, WR L-464, WR L-664, and WR A-11. Although hinge-moments are also covered in the Aerodynamics and Aerodynamic Loads of Volume II of this report, the above reports were considered valuable to stability and control and can be found in the appendix with a short resume.

Propeller Performance and Operating Characteristics

This section presents a discussion and review of theoretical and experimental data in the general area of propeller performance and operating characteristics contained in the NACA/NASA literature which has been judged by the author to be most applicable to the field of general aviation. As a consequence, certain of the data and reports which are of particular significance and interest to designers of large aircraft have not been included. To some extent, this has been intentional. The designers of large propeller-driven aircraft of the 1950's showed considerable reliance upon NACA propeller data. This does not seem to have been the case for the designers of propellers for light aircraft.

Propellers in current usage on the majority of general aviation aircraft rely to a great extent upon the earlier publications of the NACA for their performance data. A review of latter information leads to the conclusion that perhaps it is in the area of propeller design and operation that the use of NACA/NASA data could be of most value.

When one examines the propellers in present usage on most light reciprocating - engine power aircraft, he finds that, as a group, they are very sophisticated in the sense of operational mechanisms and manufacturing techniques. Most of the aircraft employ constant speed propellers in conjunction with governors, with the propeller adjusting mechanisms being operated primarily by engine oil pressure. These propellers are, in general, of similar design and are reliable pieces of equipment. With the exception of improvements in the propeller pitch adjusting mechanism, the hub and related equipment, one might draw the conclusion that any significant improvements in propeller design are not forthcoming.

But the problem must be considered in the light of propeller aerodynamic design as well as mechanical operation. Examination of current design techniques and aerodynamic data reveal that the principal suppliers of general aviation propellers rely primarily upon the report of Gray and Mastracola (WR L 286), dated 1943, which is a compilation of performance data generated up to that date. The two principal sections are the common Clark Y and the venerable RAF-6. Propeller blade plan form is usually based upon an activity factor of 90 to 120. While that report must be considered as one of the foundation efforts in that it did present a base of data from which general design computations might be performed, it must be noted that the report presents little or no comparative data on the effects of Mach number, Reynolds number, blade plan form, propeller blade section, tip speed, and blade twist. It is admitted that the effects of these parameters would be of questionable import when one considers the relative performance of general aviation aircraft in the time immediately after World War II. But such is no longer the case. With the advent of newer engines which have rather high power at altitude, primarily as a consequence of turbo- and gear driven superchargers, general aviation aircraft have been developed for which the effects of the parameters listed above can be of considerable importance.

A parallel might be drawn between the performance of today's general aviation airplane and the propeller-driven military and commercial aircraft of the postwar years and the 1950 decade. These airplanes relied somewhat upon sophisticated propeller design to obtain the maximum possible performance. One notes the presence of high solidity blade plan forms, cuffs, high blade twist and blade sections of rather high section lift coefficients. The operating speed and altitude ranges were generally in the areas of 200+ knots calibrated airspeed, and from sea level to above 20,000 feet. This compared quite favorably with today's medium twin engined aircraft which uses turbo-supercharged engines and has a calibrated airspeed in excess of 200 knots at 16,000 feet msl.

Another parallel, but of different nature, might be drawn at the other end of the scale--the take-off and landing ranges. The usual approach to propeller installation is to select a lower minimum pitch for constant speed equipment or to select a lower overall pitch distribution for fixed pitch propellers. The problem is magnified somewhat when one considers the potential of general aviation aircraft operated in the STOL mode in the light of the current and growing problems of airport congestion. Given reasonable design support in the areas of high-lift devices and propeller improvement one might see great possibilities for the use of general aviation aircraft in an interim STOL mode. The results of such performance improvements could possibly contribute to relieving airport congestion and associated problems.

In reviewing the NACA reports with respect to the comparisons made above, one finds a tremendous amount of literature on contra-rotating propellers with four, six, and eight blades. Indeed, it seems that in most propeller testing work for which performance definition was the primary objective, there is some substantial effort directed towards contra-rotating propellers. As time progressed and suitable aircraft power-plants became available, extensive work was given over to the problem of propeller tip speeds and critical Mach numbers associated with blade profiles and plan forms. While it is doubtful that propellers for general aviation class aircraft could be of the contra-rotating type because of the expense of the hub mechanism, or if blades designed for very high subsonic speed application would be of use, one finds that throughout the NACA literature a great quantity of applicable propeller test data does appear. The ranges of power coefficient/advance ratio parameters which were in use on World War or post war military aircraft are close to those found in general aviation aircraft at the high performance end of the scale. The great bulk of this work is experimental in nature, and there is a wealth of theoretical information which could be of use for either application of existing data or for research.

Valuable as the theoretical NACA investigations may be, however, the data of primary importance is experimental. These experimental investigations are concerned with the full performance and operational characteristics of almost every conceivable type of propeller. These are flight test data, wind tunnel data, and work which provides correlation between the two types. There are some for which the direct applicability to general aviation aircraft is immediately evident. For example, in addition to the numerous reports which originated at NACA Langley during the war and later are investigations conducted by Elliot Reid and others at Stanford University under NACA sponsorship. The former series appear as WR's whereas the latter are post war and appear as TN's.

Reid's report, NACA TN 947, "Studies of Blade Shank Form and Pitch Distribution for Constant-Speed Propellers" was published in 1945. The work is an experimental investigation of unusual thoroughness and excellence, and, while at the time it was written the purpose was to provide data for high performance post war aircraft, the range of parameters investigated falls directly into that of the current high performance general aviation twin-engined airplane. All blades tested were of the NACA 16-series profile with a modified Clark Y section at the outer limits of the cuffs. Three and four-blade propellers were tested.

Reid reported that the blades having faired shanks exhibited "marked superiority" to those blades having round shanks. Fairing the blade shanks had the effect of improving both the power and thrust coefficients at a given pitch setting. The net result has an improvement in the propeller efficiency. Furthermore, the differences between the performance characteristics increases as the pitch is increased.

In his discussion of blade pitch distribution, in which a comparison is drawn between two selected propellers, one having a uniform pitch distribution and the other a non-uniform pitch distribution, it is shown that while neither of the propellers was superior throughout the whole range of V/nD test values, the blade with non-uniform pitch distribution displayed higher efficiency values at the external values of the test range. The conclusion was drawn that, in the absence of body interference, the non-uniform model was slightly superior to the other for constant speed operations. He suggests that this superiority would be improved in the presence of an interfering body. The approach presented by Reid involved the variation of angle of attack along the blade.

> "In general . . . it is quite evident that for unstalled operation the most desirable form of pitch distribution is the one which leads to the smallest variation of angle of attack along the blade."

A most interesting commentary is given both in the report body and in an appendix as the effects of blade overloading and the number of blades. He points out that blades which are excessively loaded (i.e., high power coefficient per blade) have much lower efficiencies at reduced advance ratios; and that, for equal advance ratios and equal individual blade loading, propellers with geometrically similar blades but different numbers of blades obtain substantially equal fractions of the corresponding ideal efficiencies. The appendix on "Selection of Propellers with Special Reference to Overloading" should be of genuine value to designers who must make a choice between increasing either the number of propeller blades or the width of the blades of the original propellers.

Reid's 1945 report was followed four years later by NACA TN 1834, "The Influence of Blade-Width Distribution on Propeller Characteristics." This report is enhanced by a thorough wake survey study which enabled the author to perform analyses of propeller parameter by examination of the characteristics of the wake immediately behind the propeller. These measurements were made in addition to the force and power measurements made with standard equipment. The report studies blades of different activity factors which have essentially the same plan form characteristics. Two blades were relatively untapered and had slightly rounded tips as compared to the remaining four which had highly tapered blades with pointed tips. Within the range of advance ratios greater than 1.0 but less than 3.0 Reid found that the envelope efficiencies of the relatively straight blades was slightly superior to that of this tapered blade. This was not the case, however, at low values of advance ratio, when the tapered blades exhibited higher values of efficiency. In addition, for power coefficients less than 0.1, the untapered blades were superior at all advance ratios. However, as the power coefficient increased at lower advance ratios, the tapered blades showed remarked advantages over the untapered ones.

Reid further states that his results substantiated previous investigations which indicated that highly considered profiles are not generally suitable for propeller blades. This leads us to consider work which has been performed in the area of Blade section characteristics and camber and the resultant effects of tip Mach number.

The early NACA reports by Fred Weick and his associates give one a graphic picture of the historical development of propellers. While these reports may not be of current technical significance, they were reviewed and are presented here for their important early contributions. The transition from wooden to metal as the basic material and the attempts to define carefully the exact operational characteristics gives valuable insight which should not be overlooked.

These reports are followed by others written by Hartman, Biermann, Stickle, and Crigler. The primary airfoil sections considered are the standard Clark Y and the RAF-6. Both single and dual rotating propellers are discussed and the effect of number of blades is included. From this point, most of the propeller test reports are heavily involved with tip speed and Mach number effects.

However while most of the reports covered include some amount of data which could be of value to general aviation, one would be required to sift through a great deal of information on extraneous topics. Should someone undertake to combine those points of greater relevance to this specific application it appears that a most significant contribution could be made. One envisions a concise presentation in the form of the Gray-Mastracola report summary. From this perspective it appears that little or no extra experimental data would be required, and that a rather complete parametric study would be a possible and most reasonable undertaking.

Many other reports were classified as reports dealing with propeller performance and operating characteristics. These reports were judged applicable to light aircraft design and are listed below by report number. Student reviews of each of these reports can be found in the appendix.

NACA Technical Notes: 1040, 1338, 1414, 2268, 2591, 2859, 2881
NACA Technical Reports: 301, 302, 306, 326, 339, 340, 684, 712, 747, 747, 999, 1126, 1309, 1336
NACA Wartime Reports: L-144, L-177, L-316, L-359, L-362, L-369, L-384, L-385, L-404, L-483, L-529, L-530, L-568, L-569, L-582, L-634, W-100

There were some reports which were representative of theoretical propeller performance investigations. These reports (TN 750, TR 775, 776, 777, 778, 924, and WR L-753) discuss propeller section theory and should be valuable to light airplane design.

Of course not all the NACA propeller work is directed towards performance definition as such. There are reports on diverse fields such as propeller slipstream effects upon the stability and control characteristics of airplane, the effects of propeller slipstream interference upon the overall aerodynamic characteristics of configuration, and propeller structural dynamics involving flutter and dynamic effects of propeller vibration upon the airframe.

Four war reports treat the problem of propellers in yaw to some depth. WR L 83, "Comparison of Yaw Characteristics of a Single Engine Airplane Model with Single-Rotating and Dual-Rotating Propellers" by Neely and others presents an interesting comparison of single and dual rotating propellers, and will enlighten the reader concerning the relative merits of the two vis a vis stability and control characteristics. The dual rotating propeller produced much less disturbing influence upon the lateral control characteristics of the power airplane model than did the single rotating propeller. Other reports, WR L 217, "Formulas for Propellers in Yaw and Charts for the Side-Force Derivative" and WR L 219, "Propellers in Yaw," both by Ribner give concise presentations of the disturbing effects of propeller operation upon the stability characteristics of an airplane and data in chart form which may be used to predict lateral and longitudinal forces. These investigations were extended to include the effects of solidity and blade loading in Punhel's report, WR L 446, "The Effect of Pitch on Force and Moment Characteristics of Full-Scale Propellers of Five Solidities." Possible adverse effects of increasing blade solidity are seen since blades of higher solidity produced greater pitching and yawing moments. TN 2585, "Calculation of Aerodynamic Forces on a Propeller in Pitch or Yaw," by Crigler and Gitman is a theoretical treatment of the problem with supporting empirical data.

Other interesting reports which deal with propeller-airframe interaction are available. Of particular interest are NACA TR 1263, "Investigation of the Aerodynamic Characteristics of a Model Wing Propeller Combination and of the Wing and Propeller Separately at Angles of Attack to up to 90^{o}," by Kuhn and Draper and NACA TN 2192, "A Survey of the Flow at the Plane of the Propeller of a Twin-Engine Airplane," by Roberts and Yaggy. Further data on this topic is included in NACA TR 725, "Effect of Body Nose Shape on the Propulsive Efficiency of a Propeller," by Stickle and Naiman. This report describes the separate effects of propeller slipstream upon afterbody drag, and changes in propeller-plane velocity profile caused by the body.

Reports dealing with propeller dynamics and flutter are available. Theodorson's WR L 161, "Effect of the Lift Coefficient on Propeller Flutter" was written in light of problems encountered with wind tunnel tests of propellers, but has an extension which considers flutter of airplane propellers. Two classes of flutter are discussed, the mechanisms are described, and a possible solution involving the aerodynamic design are presented. Technical Notes on the subject are TN 2308, "Vibratory Stresses in Propellers Operating in the Flow Field of a Wing-Nacelle-Fuselage Combination" by Rogallo, and others and TN 1966, "Experimental Investigation of Flutter of a Propeller with Clark Y Section Operating at Zero Forward Velocity at Positive and Negative Blade Angle Settings" by Baker and Paulnock. It is noteworthy to report that the latter report was conducted as a consequence of propeller failures, the causes of which were suspected flutter at high positive and negative angles of attack.

Reports dealing with vibratory stresses of propellers are NACA TN 2308, TM 1051, TM 1016, and TR 1295.

Flight Safety

One cannot, in any degree of technical honesty, select certain groups from the vast volume of NACA reports and state that these are categorically directed towards the problems of safety in the air to the exclusion of all the others. One could state that the great majority of all the work performed by the NACA were in some way connected with the problems of flight safety. The attempt here is to approach the NACA literature from the point of view of general aviation flight safety.

Some help is obtained from recent studies by the National Transportation Safety Board of the Department of Transportation. These reports are enlightening and provide some degree of insight to the way in which one should interpret the term "flight safety" in the context of this report and the NACA literature. The NTSB Studies, "Briefs of Accidents", are brief synopses of general aviation accidents. When one reads these reports, he realizes that no design program alone could prevent a number of the accidents analyzed there. However, one does get the impression that, perhaps, certain equipment improvement could result in fewer accidents. For instance, one of the primary causes of accidents of aircraft with fixed gear is listed as "failed to obtain/maintain flying speed" and the type of accident is listed as "stall/spin." This general accident classification appears scattered throughout the accident reports, interspersed with various and sundry pilot errors indicated by such notations as "alcoholic impairment . . . ."

But what, one might ask, has this to do with the problem of "flight safety" in the NACA literature? Precisely this: The NACA have devoted countless hours and monies to the development of safe airplanes, and, from this investigation, there is sufficient information available to establish, if not to enforce, requirements for handling qualities, stall warning, and spin recovery. It would appear that there is no real excuse for poor aerodynamic characteristics, not to mention structural deficiencies.

One of the NACA reports dealing with the safety of general aircraft is NACA TN 1203, "A Flight Investigation to Increase the Safety of a Light Airplane," by Hunter and Vensel. This report considered several modifications to a circa 1947 light airplane in an attempt to improve the stall characteristics, stability and control, and spin characteristics. The only problem with this report is its age: most sophisticated general aviation operators would consider an airplane of that configuration to be little more than a man-carrying giant model airplane. It would be very interesting to see a similar study carried out for a modern single-engine retractable-gear general aviation aircraft. A complete and sophisticated evaluation of the handling qualities performed in the same manner as early NACA studies of military aircraft could possibly lead to many significant design changes and improvements.

Along this line, and in a way which reflects other work in the general aviation area currently under study by NASA, is the problem of multi-engine aircraft operated by general aviation pilots. The "two fans" concept has been used to promote a sense of flight safety. Many general aviation pilots believe that their odds against disaster will be increased significantly if they fly twin-engined airplanes, and this is somewhat encouraged by the manufacturers' advertising claims. It is not generally noted that if the single engine climb-rate is negative at low altitudes (considering gross weight, etc.), then the possibility of an off-field landing is increased by a factor of two over that for the single engine airplane. Nor, it seems upon examination of accident reports, is the engine-out take-off controllability problem fully solved. A twin-engined aircraft airborne at a speed below V_{mc} is more dangerous means of conveyance with one engine out than with both engines out, it appears.

One report of interest in this regard is NACA TN 646, "Wind Tunnel Tests of a Two-engine Airplane Model as a Preliminary Study of Flight Conditions Arising as the Failure of One Engine," by Hartman, 1936. This report gives a comparison of flight techniques which apply during and after engine failure, and most of the techniques listed seem to be in rather wide discussion, if not in successful application, today. A detailed study of this same nature applied to a current high-performance general aviation, twin-engined airplane, in conjunction with definite quantized handling qualities would be most certainly of benefit.

It must be pointed out that the NASA is currently investigating just such problems as these in general aviation aircraft. A late report, "An Evaluation of the Handling Qualities of General Aviation Aircraft," NASA TN D 3726, by Barber et al. provides quantitative and qualitative data concerning the flying characteristics of seven different aircraft. It would seem advantageous to continue this type of investigation with an eye towards establishing definite handling qualities criterion for general aviation aircraft.

One other report of interest in this area is of the same type as that discussed in TN D 3726, and this is NACA TN 1573, "Flight Measurements of the Flying Qualities of Five Light Airplanes," by Hunter, published in 1948. This paper is, of course, superseded entirely by TN D 3726. Several other commentaries may be found in the proceedings of the NACA-Industry Conference on Personal Aircraft Research, 1946.

As reported in the NTSB accident report summaries, many fatal accidents were the result of failure to obtain/maintain flying speed. This is open to some degree of interpretation. NACA work in 1953, TN 2923, "Study of Model of Personal Owner or Liaison Airplane Through the Stall and Into the Incipient Spin by Means of a Free Flight Testing Technique," by Garner and Gale, reported that "more than half of the airplane accidents are stall-spin . . . ." It is not stretching the point to conclude that this type of aircraft behavior is the direct result of failure to obtain/maintain flying speed. The NACA have published volumes on the problem of aircraft design and flight with respect to spin and spin recovery. (This, of course, must relate to the problems of stability and control.) The NACA work has encompassed both wind-tunnel and flight tests, with a great amount of effort devoted to showing direct correlation between these two types of tests, and they have provided aircraft designers with the necessary parameters and limits required to manufacture aircraft with suitable spin recovery characteristics.

The great bulk of this spin/spin recovery data has been summarized in NASA TR R-57, "Status of Spin Research for Recent Airplane Designs," by Neilhouse, Klinar, and Scher. This is a most comprehensive computation, and may be considered as a design guide for engineers and aerodynamicists seekin to incorporate the best spin recovery features in their aircraft.

There are also many other reports which are concerned with the problems of stall and spin recovery characteristics and techniaues. The listing belo contains the report numbers of the reports which would be of major interest to light aircraft designers.

NACA Technical Notes:	776, 1045, 1329, 1575, 1643, 1764, 2016, 2134, 2413, 2485
NASA Technical Notes:	D-1516, D-2181, D-2243
NACA Technical Reports:	691
NACA Wartime Reports:	L-168, L-296, L-351, L-370, L-461, L-504, L-721

There is abundant NACA literature describing the design, installation, and characteristics of equipment to remove ice formations from the engine induction system, air frame, and propellers. It is generally noted that, if the owner can afford them, quality de-icing systems for removal of air frame and propeller ice are available.

An interesting study dealing with the design of ice-free intake systems is found in NACA TN 1134, "Development of a Protected Air Scoop for the Reduction of Induction-System Icing," by von Glahn and Renner. The Objectiv of this study was to design an intake scoop which would eliminate free water from the induction system. The resultant design operated successfully (and automatically), using an airscoop which caused a curvature of this intake ai flow ahead of the scoop, thereby eliminating free water by intake air flow ahead of the scoop, thereby eliminating free water by centrifugal force. WR-45, "De-icing of an Aircraft - Engine Induction System" would also be valu ble to intake system designers.

A general description of carburetor icing phenomenon is found in WR W-97, "Icing Tests of Aircraft Engine Induction Systems," by Kimball. Th report investigates a number of possible factors dealing with icing within t induction system.

NACA TN 1790, "Investigation of Icing Characteristics of Typical Light-Airplane Engine Induction Systems," by Coles, is a study of the icing charac teristics of engines in the 65 to 185 horsepower range. Techniques for prevention and removal of induction and carburetor ice is presented. A general study, NACA TN 1993, (superseded by Report 982), "Icing-Protection Requireme for Reciprocating-Engine Induction Systems," by Coles et al. considers the overall problem, and may be considered to be a satisfactory summary of the problem.

Ice accumulation on fuselage structures during flight leads to increased weight and drag. On wing structures ice accumulation leads to increased drag, decreased lift, and altered moment coefficients. Icing is thus an extremely serious problem. The ice must be removed or the safety of the mission is jeopardized. Pneumatic boots are one means to effect ice removal. Their effect and that of ice on aerodynamic characteristics of an airfoil is discussed in TN 3564. TN D-2166 predicts results of ice accumulation on characteristics of various airfoils. The 65_1-212 airfoil with ice is discussed in TN 2962. General performance effects are treated in TN 1598. Similar data for propellers is given in TN 2212. Thermal de-icing systems are discussed in TR 862, TN 3130, WR A-17, WR A-47, TN 1434, TN 1472, TN 1520, TN 1540, and TN 1691. Measurements of the thermal conductivity of low-density ice are reported in TN 3143.

Prevention of ice on windshields is treated in TN 754. Alcohol distribution for windshield de-icing is reported in WR A-20.

Fuel vent icing and stall warning indicator operation under icing conditions are covered in TN 1789 and WR L-503 respectively.

Both theoretical and experimental studies of flight operations under conditions conducive to aircraft icing are reported in TN 1391, TN 1393, TN 1397, TN 1424, TN 1793, WR A-15, TN 1904, TN 2569, and TN 3984.

Properly operating airspeed and altitude systems are vital to safe flight. TN D-2012, TN D-1356, TN D-898, and TN D-463 are some recent reports dealing with calibration and errors of such systems.

The effect of inadvertent overspeed is treated in TR 1138.

Operation off unpaved runways is discussed by TN D-510.

The time required for a pilot to respond to an aircraft disturbance is treated in TN D-221 while TN D-1777 discussed the effect on flight operations of vortex wakes generated by other aircraft.

It is impossible to reduce the probability of an aircraft's crashing to zero. It is therefore desirable to incorporate superior crash and fire survivability when designing new aircraft. One very important aspect of this is seat design which is discussed in TR 1332 (TN 3777). The loads which are experienced in crashes of three light aircraft have been measured and are reported in TN 4158. The types of injuries received by crash victims are surveyed in TN 3775. Factors affecting survivability of water crashes are reported in TN 3946.

Fires, of course, represent possibly the most serious hazard to crash survivability. Friction spark sources are discussed in TN 4024. Protection of nonmetallic aircraft from lightning is treated in WR W-59. Discussion of crash fire hazards in general is presented in TN 2996. Crash fire prevention systems are discussed in TN 3774.

APPENDIX

TN 579 CHARTS FOR CALCULATING THE PERFORMANCE OF AIRPLANES HAVING CONSTANT-SPEED PROPELLERS, Roland J. White and Victor J. Martin, September 1936

Charts are presented for determining the performance of airplanes having variable-pitch constant-speed propellers. The charts are based on the general performance equations of NACA TR 408 and are used in a similar manner.

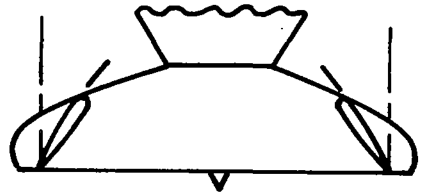
TN 646 WIND TUNNEL TESTS OF A 2-ENGINE AIRPLANE MODEL AS A PRELIMINARY STUDY OF FLIGHT CONDITIONS ARISING ON THE FAILURE OF ONE ENGINE, Edwin P. Hartman, April 1938

This investigation (wind tunnel tests), which was made early in 1936, is only a tentative approach to the study of the factors involved in the critical situation arising after engine failure. It is also an experiment to study laboratory methods and technique of handling powered models. This investigation has attempted to provide information on several related problems: (1) The transition phase, (2) Equilibrium conditions of flight on one engine, and (3) Slipstream survey and incidental power effects.

Two methods of reducing the initial yawing moment due to loss of 1 engine were investigated and the equilibrium conditions were explored for 2 basic modes of flight on 1 engine ($\beta = 0^{\circ}$ and β = several degrees). The added drag resulting from unsymmetrical attitudes required for flight on 1 engine was determined for the model airplane. The effects of the application of power upon the stability, controllability, lift, and drag of the model were measured. A dynamic pressure survey of the propeller slipstream was made in the neighborhood of the tail surfaces at 3 angles of attack. The only power condition for slipstream surveys was that of level flight.

Results showed that

1. Toeing-out the engines or toeing-in the twin rudders and fins were impractical methods of reducing yawing moment after engine failure on low-wing 2-engine airplane model tested.



2. The use of power produced destabilizing effect on pitching moment in these tests.

3. Yawed mode of flight increased drag somewhat more than banked flight on 1 engine.

4. Approximate increase in parasite drag for 3 conditions of flight with 1 engine dead was as follows:

a. Ceiling increased 30%,
b. Full-throttle at SL increased 40%,
c. High speed increased 19% (high speed of airplane = 185 mph at SL).

5. High L/D rudder would be necessary for flight with a dead engine.

6. Full-feathering controllable propellers may be important assets in flight with a dead engine, especially where the normal blade-angle settings of the propellers are low.

7. In yawed flight, yaw angle averaged about 5° and rudder became inadequate at low airspeeds.

8. In the banked mode of flight on one engine, the rudder angle required to maintain equilibrium was much less than for the yawed mode and the required angle of bank was only about 2°.

TN 750 A GENERALIZED VORTEX THEORY OF THE SCREW PROPELLER AND ITS APPLICATION, Hans Reissner, February 1940

A generalized vortex theory has been developed to handle:

1. The distribution of induced-angle changes, i, of inflow along the blade radii produced by given distributions of circulation coefficient Γ^*.

2. The determination of those distributions of Γ^* and tip radial number $\rho_A = wr_A/W$ giving minimum energy-loss where either C_Q or C_T are prescribed.

TN 754 AN INVESTIGATION OF THE PREVENTION OF ICE ON THE AIRPLANE WINDSHIELD, Lewis A. Rodert, March 1940

The purpose was to determine the method or methods most suitable for the prevention or removal of ice on airplane windshields. The three methods under investigation were: electric heating; hot-air heating; and an alcohol-dispensing, rotating wiper blade.

The electric heating apparatus was constructed as follows: two panes of glass 1/8-inch thick were mounted on a frame separated by a 1/4 - inch gap. The gap contained electric heating wires and a liquid dielectric, ethylene glycol, to aid the transmission of heat from the wires to the glass.

The hot-air heating system was constructed as follows: two panes of glass were mounted in a frame and separated by a thin air gap. Intake and output values were located in the frame. The hot air source was the exhaust gas from the engine.

The alcohol-dispensing, rotating wiper blade was constructed as follows: The rotating blade, 10-inches in diameter, was held against the windshield by means of a leaf spring connected to the center hub of the blades. Each of the shaft mountings provides for the discharge of a fluid, such as alcohol, from the center of the blade shaft upon the outside of the windshield. Several different types of wiper blades were used including (1) wiper blade with felt wick and (2) a slight modification of automobile wiper blades.

The results from experimental tests are as follows for the electric heating system.

1. Prevention of Ice: Ice was prevented over the entire section pane of glass.

2. Removal of Ice: Only about 20 to 80% of the ice due to weblike crust which forms over a glass was removed. Only the ice directly touching the glass was melted. The lower percentage of removal was found on a tunnel test model. The higher percentages were found on actual test flight models. Thus, removal was good for actual flight models.

Hot-Air Heating System

Ice was prevented and removed over 75 percent of the test panel. The 75 percent removal was at an ambient air temperature of 8^{o} F.

Rotating Wiper Blades

Ice could be prevented but not removed. Special designs of wiper blades were required for the removal of rain from windshield.

Conclusions

Ice can be prevented and removed by both electric-heating and hot-air heating but only prevented by the rotating wiper blades. The disadvantage of the heated plates only is the lack of the removal of rain on windshield.

TN 776 THE AILERON AS AN AID TO RECOVERY FROM THE SPIN, A. I. Neihouse, September 1940

This report investigates the effectiveness of various aileron settings in the recovery from a spin. Large deflections and more common aileron settings were investigated. It was found that the relative magnitudes of inertias Iy and Ix determined which aileron position proved most effective. If Iy > Ix (weight distributed along the fuselage) ailerons with the spin yielded favorable results while ailerons against the spin produces adverse effects. For configurations where Ix > Iy (weight distributed along the wings) the results are reversed. The data was not sufficient to determine at which point transition occurred. Although very large aileron deflections are somewhat more effective in bringing about recovery, special installation to make such deflections possible was not recommended because this method is not considered a dependable method for recovery from spins.

TN 828 METHODS OF ANALYZING WIND-TUNNEL DATA FOR DYNAMIC FLIGHT CONDITIONS, C. J. Donlan and I. G. Recant, October 1941

The effects of power on wind-tunnel tests are considered. A model is tested in a wind tunnel with a propeller running and without a propeller. The reliability of wind tunnel tests in determining the performance characteristics caused by modification is discussed, and an analytical method for using wind tunnel data to demonstrate the effects of these modifications is developed. The areas covered are:

1. Effect of Power on Wind Tunnel Characteristics of Model.

Curves are given which show the effects of power on the slopes of yawing-moment and rolling moment. The effect of power on rudder characteristics is shown.

2. Solutions of Lateral Equations of Motion are used to Estimate the Change in Dynamic Flight Characteristics for the use of Recommended Modifications.

The power-on wind-tunnel test data were used to tabulate the stability derivatives of both models (original model and model incorporating modifications). These were then used to determine the solutions to the lateral equations of motion. An appendix was given for use in finding the solution of the lateral equations of motion. A problem involving particular modifications on a specific aircraft was worked out in the text. An evaluation of the relative effectiveness of ailerons and rudder controls can then be obtained.

3. Determination of an Approximate Formula for Accelerations and Stick Forces Likely to Develop in Abrupt Pull-Up Maneuvers.

TN 863 RESULTS OF LANDING TESTS OF VARIOUS AIRPLANES, J. A. Hootman and A. R. Jones, September 1942

A study of a representative group of aircraft used largely for other testing purposes was conducted to investigate various landing loads. Various types of landings were carried out, and the pilot's judgment was used as a basis for determining the types which would be encountered under ordinary and severe operating conditions. Blind landings were included.

Two distinct subjects were considered:

1. Body attitude (angle between thrust axis and ground at instant of impact)
2. Vertical velocity (maximum vertical velocity for different aircraft is shown graphically)
3. Pitching velocity
4. Rolling velocity
5. Lateral velocity, or side drift.

The categories of the landing gear loads measured during the tests were:

1. Vertical loads, main and nose wheels
2. Horizontal loads, main and nose wheels

An appendix which details the procedures for calculation of ground reactions is included.

TN 925 A LEAST-SQUARES PROCEDURE FOR THE SOLUTION OF THE LIFTING-LINE INTEGRAL EQUATION, Francis B. Hildebrand, February 1944

This report presented a least-squares procedure which was adapted to numerical calculation to give an approximate solution of the Prandtel lifting-line equation. It also gives procedures for an analysis in cases where either the spanwise variation of the chord or the angle of attack is discontinuous. Its major purpose was to give a least-squares approximation which was easily adapted to a computing machine. The report gives an explicit treatment of cases involving the above-mentioned discontinuities.

TN 947 STUDIES OF BLADE SHANK FORM AND PITCH DISTRIBUTION FOR CONSTANT-SPEED PROPELLERS, Elliot G. Reid, January 1945

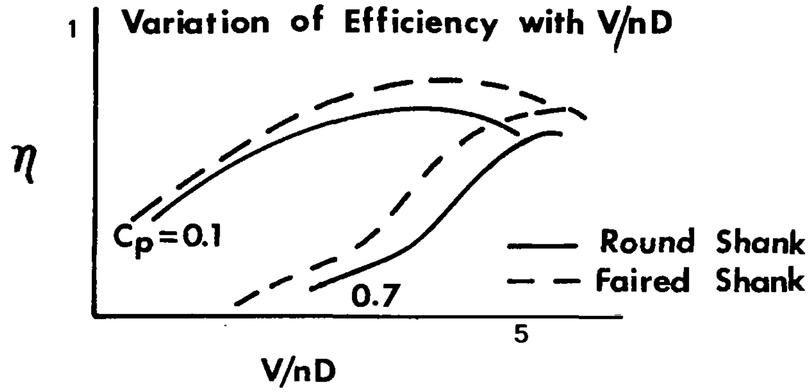
Wind tunnel tests to determine the effect of blade shank form and pitch distribution on propeller performance tests were conducted for constant-speed propellers.

Blade shank form tests yielded the following results:

1. Efficiency of constant-speed propellers is greater for faired shanks than for round ones.

2. Design pitch angles of shank sections should provide operating pitch angles of elements outside the spinner not substantially greater than 90°.

3. Shank profiles with small $C_{L_{max}}$ appear undesirable.



Test on pitch distribution showed that:

1. Uniformity of angle of attack along the blade seems to provide greater efficiency. Later stalling of the root than the tip gives greater efficiency at reduced values of V/nD.

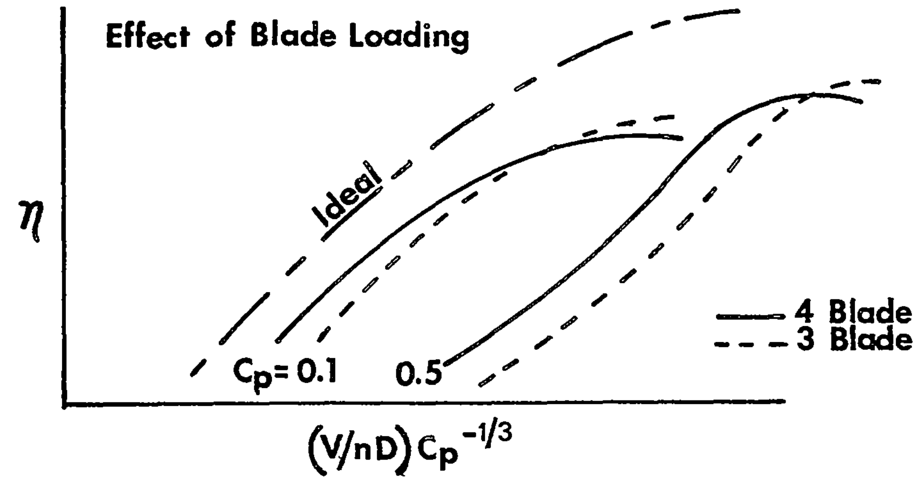
2. Blades with small angles of twist in the outer portions appear unsuitable for constant-speed operation.

3. Blades with twist curves approaching an envelope form exhibit the best constant-speed performance characteristics in the absence of substantial body interference.

Results of blade-loading tests:

1. Excessive blade loading has adverse effects upon efficiency at reduced J.

2. Differing numbers of blades do not substantially effect efficiencies as long as individual blade loadings are equal.



Extensive graphs showing test results are given as well as complete data for tests on one particular blade. A method of constructing constant speed curves from data with variable C_p and an appended section on the selection of propellers with special reference to overloading are included.

TN 1015 THE DEVELOPMENT OF A LATERAL-CONTROL SYSTEM FOR USE WITH LARGE-SPAN FLAPS, I. L. Ashkenas, January 1946

A spoiler-type lateral control system was developed for use on the Northrop P-61 airplane. The term "scoop" was used to denote a circular-arc retractable aileron in preference to the word "spoiler". The lateral-control system is to be used with large-span flaps and consists of a thin-circular arc-spoiler, linked with a short-span aileron located just outboard of the spoiler. This device produces favorable yawing moment and low wing torsional moments. Also the control is very good at and through the stall.

Lateral control was possible with very little pilot effort.

The hinge-moment problem was found to be critical. These were minimized by reducing the thickness of the scoop which reduced the inherent instability of the scoop. In this way the stability was found to be excellent.

In order to have a continuous wing flap it was decided to locate the conventional balance system (aileron) at the wing tip.

The scoop-flap section geometry was patterned closely after configurations found in the following reference:

Rogallo, Francis M. and Swanson, Robert S.: Wind-Tunnel Development of a Plug-Type Spoiler-Slot Aileron for a Wing With a Full-Span Slotted Flap and a Discussion of its Application. NACA ARR, November 1941

TN 1040 WAKE STUDIES OF EIGHT MODEL PROPELLERS, Elliot G. Reid, July 1946

Extensive wake survey studies were made on eight model propellers (Diameter 2.8 feet) in the 7.5 foot wind tunnel at the Guggenheim Aeronautical Laboratory at Stanford University. The studies were conducted to determine the influences of shank form and pitch distributions on the characteristics of constant speed propellers. It was found that:

When faired blade shanks are substituted for round ones, the consequent improvement in efficiency results from the relatively larger augmentation of thrust than of torque and, until stalling occurs, these effects are strictly confined to the modified portions of the blades.

The stalling of blade shanks, which occurs during take off and may occur at advance ratios utilized in normal climb, has an adverse effect upon efficiency which is amplified as the power coefficient C_p is increased.

Pitch should be distributed so as to preclude the operation of any blade element at a negative lift coefficient in high speed flight to minimize shank stalling at reduced advanced ratios, and to provide substantial uniformity of the section lift coefficients under conditions of normal cruising and high speed operation.

The theoretically predicted independence of blade elements has been substantially verified insofar as twist is concerned.

TN 1045 TAIL-DESIGN REQUIREMENTS FOR SATISFACTORY SPIN RECOVERY, Anshel I. Neihouse, Jacob H. Lichtenstein, and Philip W. Pepoon, April 1946

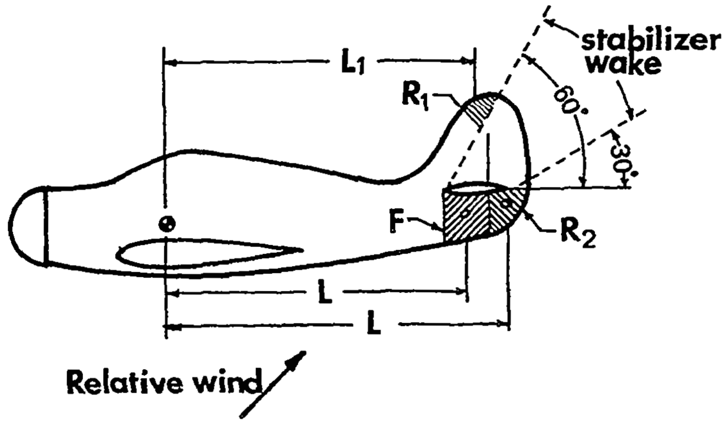
Tests to determine a reliable design requirement for airplane tail surfaces were carried out on approximately 100 military airplane models in the 15 by 20 foot Langley free-spinning wind tunnels. Various categories were included in the tests such as monoplanes and biplanes, land planes and sea planes, single and multi-engine craft. All tests were conducted with flaps up and landing gear retracted where possible. The effect of the relative distribution along the wings and fuselage (Ix/Iy) and the relative density of the airplane upon spin recoveries was investigated. Recovery was attempted with the aircraft in teo configurations:

1) Rudder reversal alone
2) Simultaneous reversal of both rudder and elevator.

Recovery from the spin within 2 turns was generally considered to be satisfactory.

The tail-damping power factor (TDPF) was used as an indicator of tail surface design. The TDPF was computed according to the following relation:

$$\text{TDPF} = \frac{FL^2}{s(b/2)^2} \times \frac{R_1L_1 + R_2L_2}{s(b/2)}$$



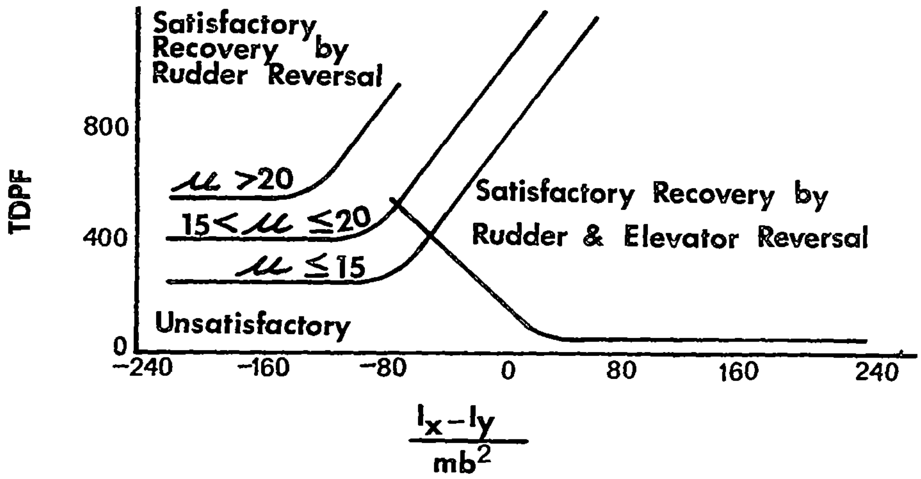
The inertia yawing-moment parameter is used to reflect the relationship between Ix + Iy and is given by

$$\frac{I_x - I_y}{mb^2} .$$

The relative density of the plane is given by $\mu = (m/\rho Sb)$.

The results of the tests are given in graphical form showing the rudder and elevator positions for both satisfactory and unsatisfactory recoveries at respective values of TDPF and $\frac{I_x - I_y}{mb^2}$.

The following graph showing spin recovery design requirements for aircraft with $0 < \mu < 35$ is presented.



$\frac{I_x - I_y}{mb^2} < 0$; $I_y > I_x$; weight distributed along fuselage

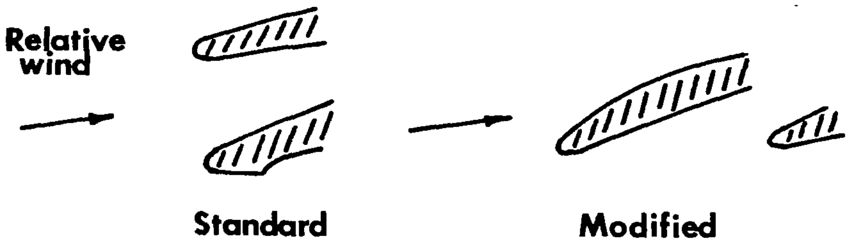
$\frac{I_x - I_y}{mb^2} > 0$; $I_x > I_y$; weight distributed along wings

The report concludes that for a TDPF of 600×10^{-6} where $\mu < 20$ the aircraft will probably display satisfactory recovery characteristics over a wide range of mass distribution by reversal of rudder and elevator.

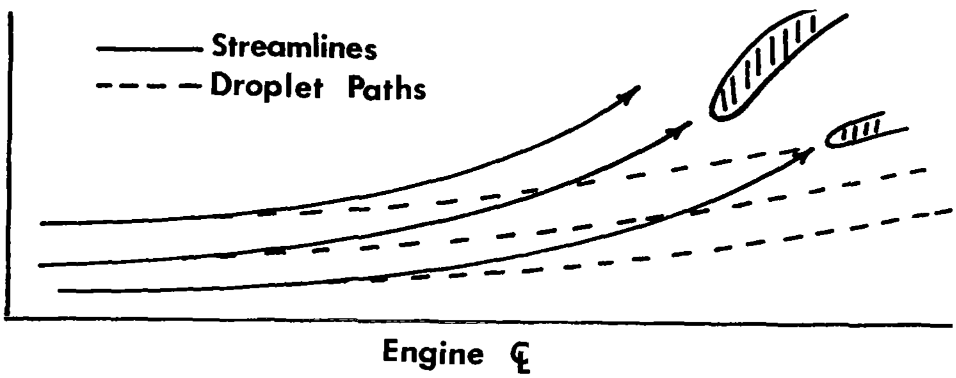
The test results substantiate flight experience which indicated that the elevator gains effectiveness in spin recovery as the rudder looses effectiveness.

TN 1134 DEVELOPMENT OF A PROTECTED AIR SCOOP FOR THE REDUCTION OF INDUCTION-SYSTEM ICING, Uwe von Glahn and Clark E. Renner, September 1946

The China-Burma-India air transport command lost several twin engine cargo planes due to induction-system icing. One possible cure rested upon the elimination of free water from the induction system by changing the design of the carburetor air scoop. Aerodynamic, rain, and icing tests were conducted on full scale models in a wind tunnel. Both the standard A modified scoops were tested. Profiles of the standard scoop and an under-cowling scoop are shown on the following page.



The basic idea behind the under-cowling scoop was that since water droplets have greater inertia than air particles they would be separated from the air stream in the manner illustrated by the figure:



The criterion for scoop design was:

1. Rate of free water ingestion should be reduced to a minimum.

2. Ram pressure recovery should be as good as standard scoop.

(Ram Pressure Recovery = $\left(1 - \frac{H_1 - H_{d_A}}{H_1}\right) 100$,

H_1 = total pressure air stream,

H_{d_A} = total pressure on carburetor top deck)

Comparative ram-pressure recovery data for three scoops is presented in the table:

Scoop	Angle of Attack	Airspeed	Charge Air Flow	Cooling Air Flow	Ram Pressure Recovery (%)
Standard	0	200	11,900	42	75.5
	4	160	7,200	26	76.0
	8	160	11,800	40	35.3
Under-Cowling	0	180	12,000	42	48.3
	4	160	9,000	26	77.2
	8	160	11,600	37	63.5
Modified Under-Cowling (Slightly different profile)	4	160	8,000	25	91.4

The under-cowling scoop had negligible water ingestion while a modified under-cowling scoop giving better aerodynamic properties held water ingestion to 5% of that of the standard scoop. Both the under-cowling and modified under-cowling scoops yielded only light icing formations due to the absence of water in the duct.

The water droplet size which determines the inertia relative to the air particles of the water droplets was larger than that found in clouds but smaller than that found in rainfall.

An appendix on calculation of droplet theoretical paths was given.

TN 1203 A FLIGHT INVESTIGATION TO INCREASE THE SAFETY OF A LIGHT AIRPLANE, P. A. Hunter and J. R. Vensel, March 1947

Several modifications were made of a typical light aircraft in an effort to increase its safety. Only modifications that could be incorporated into existing aircraft were considered. Their purposes and modifications were:

Improvement of stalling characteristics:

1. Depress the thrust axis
2. Washout of the wing was varied
3. Wing incidence was changed
4. Elevators were moved out of the propeller slipstream

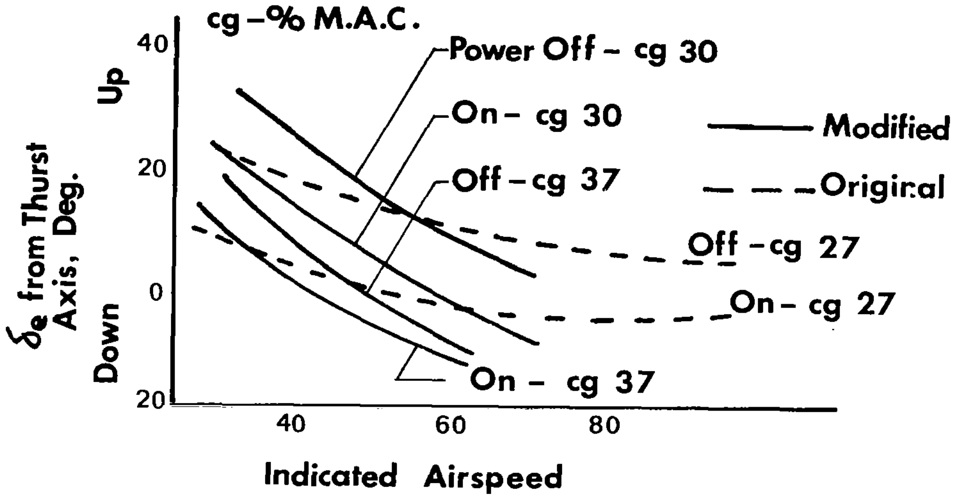
Elimination of center-section stall which caused a pitching oscillation of the airplane.

1. Balsa fillets in break behind center section.
The effects of limiting elevator travel and rudder travel were also investigated.

The modified configuration had a larger tail thus moving the c.g. rearward.

Figures showing the modifications were presented.

Longitudinal Stability and Control:
This was measured by recording elevator required to maintain steady flight and is presented in the figure.



Stall:
The stalling characteristics were improved. Motions accompanying stalling were reduced. Time histories for stalling during straight flight and turning flight where one-half of the stalling accidents occurred are presented for both the original and modified airplane.

Spinning:
The modifications made the airplane spin proof.

Lateral Stability and Control:
Angle of bank obtainable in steady sideslip was reduced due to limited rudder travel but limited rudder travel was sufficient to counteract the adverse yaw of ailerons.

Performance:
Very little decrease in performance due to modifications was noticed.

Ground Handling:
Limited rudder travel necessitated use of brakes in order to taxi satisfactorily. No cross-wind take-off and landing data was available.

TN 1239 WIND-TUNNEL INVESTIGATION OF THE EFFECT OF POWER AND FLAPS ON THE STATIC LONGITUDINAL STABILITY CHARACTERISTICS OF A SINGLE-ENGINE LOW-WING AIRPLANE MODEL, Arthur R. Wallace, Peter F. Rossi and Evalyn G. Wells, April 1947

Tests were made to determine the longitudinal stability characteristics with and without power of a typical low-wing, single-engine airplane model with flaps neutral, with a full-span single slotted flap and with a full-span double slotted flap. The horizontal tail was placed high to avoid the slipstream and had a leading-edge slot for flap-deflected conditions.

With flaps deflected, the application of power caused a marked increase in C_L increment (0.16 for the single slotted flap and 0.42 for the double slotted flap). Power increased the slope of the untrimmed lift curves (0.034 increase for the double-slotted-flap case).

Addition of a windmilling propeller shifted the neutral point forward between 1% and 5% mean aerodynamic chord (MAC), and power shifted the neutral point no more than 1% MAC with flaps neutral. With the single slotted flap, power was destabilizing and the effect varied greatly with C_L, but with the double slotted flap, power had only a very small effect on stability up to a C_L of about 2.3 when the neutral point moved rapidly forward. The success in obtaining power-on stability for most of the C_L range was attributed to the tails being out of the slipstream.

Elevator effectiveness was adequate and normal with flaps neutral and with the single slotted flap. The stabilizer nose slot, which was open with the double slotted flap deflected, caused a low elevator effectiveness.

The stabilizer nose slot delayed tail stall with the double slotted flap. Forward center-of-gravity travel would be seriously limited even with the stabilizer slot open because of excessive tail loads required for trim.

A larger tail volume would provide a more satisfactory control for the particular airplane model, especially at the forward center of gravity locations where larger down loads will be required by the tail for trim.

TN 1258 EXPERIMENTAL VERIFICATION OF TWO METHODS FOR COMPUTING THE TAKE-OFF GROUND RUN OF PROPELLER-DRIVEN AIRCRAFT, Welko E. Gasich, June 1947

This report attempts to verify and compare the accuracy of two methods of calculating airplane take-off performance. The basic equation which is used is:

$$\text{Ground Run} = S = \int_0^V \frac{W}{g} \frac{VdV}{T-C_D qS-\mu(W-C_L qS)}$$

where

W - weight of plane
g - gravity
V - velocity
T - propeller thrust
μ - coefficient of friction
S - wing area

C_D - drag coefficient
C_L - lift coefficient
$q = \frac{1}{2}\rho V^2$

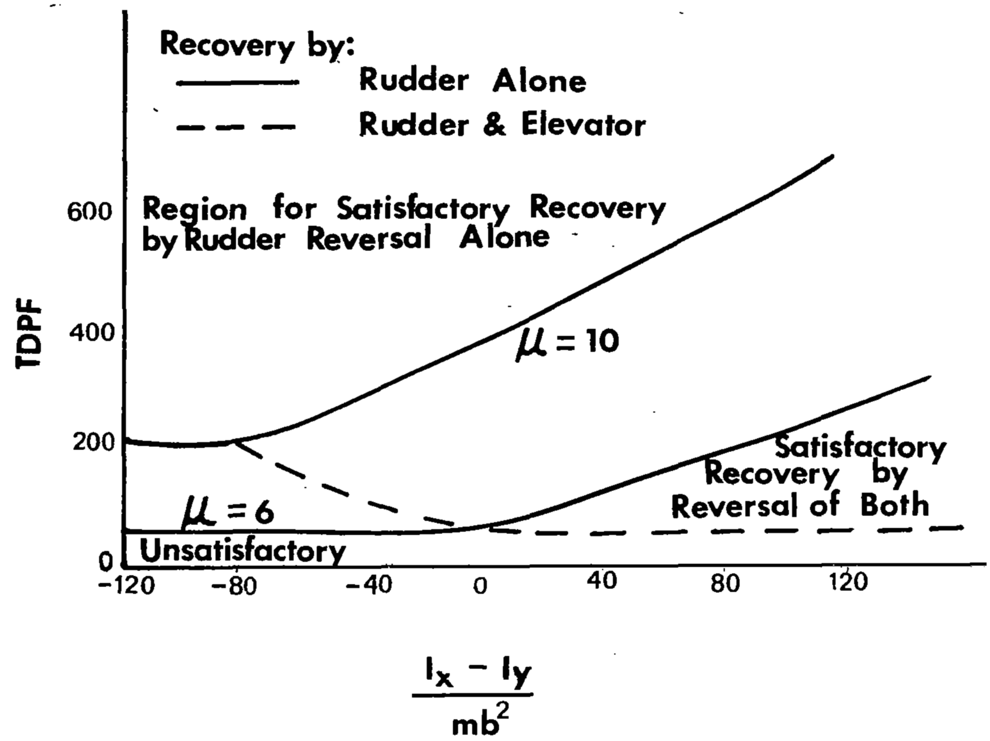
1. The Diehl Method assumes thrust varies linearly with V. C_D and C_L are functions of V. See NACA Rep. No. 450, 1932.

2. The Refined Method requires that T, C_D and C_L be determined point by point as velocity is incremented. C_D and C_L were determined by wind tunnel tests on plane. T was determined from NACA ARR. No. 3G26, 1943.

It is shown that Diehl's Method (which assumes a linear thrust/velocity curve) is as accurate as the Refined Method unless unusual conditions exist such as unfavorable propeller loadings or unorthodox propeller design. Under usual conditions, the error was within 7%.

TN 1329 TAIL-DESIGN REQUIREMENTS FOR SATISFACTORY SPIN RECOVERY FOR PERSONAL-OWNER-TYPE LIGHT AIRPLANES, A. I. Neihouse, June 1947

The design requirements for personal-owner-type light airplanes were determined from data obtained in the Langley spin tunnels. Tests were conducted on approximately 60 models where the ranges of values of the relative density $\mu(m/\rho Sb)$ and inertia yawing-moment parameter $((Ix-Iy)/mb^2)$ were considered to be representative of personal-owner type planes that were then in use or were being contemplated. Satisfactory recovery for a model was considered to have occurred when full rapid rudder reversal for all elevator settings brought about recovery in 2 1/4 turns with ailerons neutral. Tail design was represented by the tail-damping power factor (TDPF). The TDPF necessary for satisfactory recovery for various inertia yawing-moment parameters and densities can be seen from the following curves:



TN 1333 ESTIMATION OF CONTROL FORCES OF SPRING-TAB AILERONS FROM WIND-TUNNEL DATA, Owen J. Deters, June 1947

A method is presented for estimating the control forces of spring-tab ailerons from nonlinear wind tunnel data. Methods for estimating control forces for spring tab ailerons are found in such sources as:

Greenberg, Harry. Calculation of Stick Forces for an Elevator with a Spring Tab. NACA RB No. L4F07.

Two examples of the geared spring tab are considered. They are:

1. Ailerons interconnected, employing central spring unit.

2. No interconnection and individual spring units.

Wind tunnel test data in the form of rolling moment coefficients, yawing moment coefficients, and aileron hinge moment coefficient data as well as characteristics of the linkage system are needed to employ this method.

The assumptions made in this analysis are:

1. Steady rolling motion.

2. Effects of aileron and horn deflections on linkage are negligible.

3. Effects of wing deflection and friction on control forces are negligible.

The first two are considered to be good assumptions. No method of determining the factors neglected in the third assumption is given.

Techniques are developed to determine the spring unit constant and, from this, the control force. An illustrative example is presented to demonstrate these techniques and tables are given showing the results of the calculations in the several steps.

TN 1338 PROPELLER EFFICIENCY CHARTS FOR LIGHT AIRPLANES, John L. Crigler and Robert E. Jaquis, July 1947

This report presents the efficiencies of a wide selection of airplane propellers for light airplanes to aid in the required compromise between efficiency and noise reduction or any other operational or design condition. The selection of a propeller on the basis of efficiency for application to a light airplane design can be accomplished by the use of these charts.

Power values of 50, 100, 150, 225, and 300 horsepower are considered for airspeeds of 50, 100, 150, and 200 miles per hour. At high rotational speeds the blade sections for low solidity propellers are operating at or near the maximum lift/drag ratio and show the highest efficiency.

Application of the results is demonstrated by three examples:

1. The investigation of the efficiency of a wide variety of propellers for a given design condition.

2. The investigation of the efficiency of a controllable pitch constant speed propeller as a function of airspeed.

3. The investigation of the efficiency of a fixed pitch propeller as a function of airspeed and engine operation.

TN 1391 ICING PROPERTIES OF NONCYCLONIC WINTER STRATUS CLOUDS, William Lewis, September 1947

Representative temperature, dew point, liquid water, and drop size data as obtained during four flights through noncyclonic stratus clouds is presented. Such data are necessary in order to determine the conditions under which ice prevention equipment must operate. The principal physical factors determining icing conditions are:

1. Temperature
2. Liquid water concentration
3. Drop size

The liquid water concentration in a noncyclonic winter stratus is upon the temperature of the cloud base and the height above the cloud base. Assuming that no snow is falling the liquid water concentration can be approximately determined from the temperature of the base and the thickness of the layer assuming moist-adiabatic lapse rate and constant total water content within the cloud.

The method used to determine drop size will give good approximation near the top of the cloud but will overestimate drop size near the bottom. Allowances are made for this anaomaly and the data are not inconsistent with the drop size theory presented in the report but do not give positive proof of its correctness. The highest stratus top encountered was about 4500 feet off the ground although this is not believed to be the upper unit. The liquid water concentration in noncyclonic stratus clouds is not likely to exceed 1.5 grams/meter^3 at temperatures below freezing.

TN 1393 A FLIGHT INVESTIGATION OF THE METEOROLOGICAL CONDITIONS CONDUCIVE TO THE FORMATION OF ICE ON AIRPLANES, William Lewis, August 1947

Data from the C-46 flight measurements of the meteorological factors related to the intensity ofiicing conditions are presented. The physical factors that establish the distribution of liquid water in various types of clouds are discussed and the results of the analysis are used to formulate certain rules for forecasting of icing intensity and to define the physical characteristics of the maximum icing conditions for which ice prevention equipment will be expected to provide adequate protection.

The results of theory and observation will then be summarized in the form of a series of tentative rules for estimating the intensity of icing conditions.

The following quantities have been measured in the physical properties of icing conditions: (1) free air temperature, (2) liquid water content, (3) average drop diameter, (4) distribution of drop diameters, and (5) concentration of icing particles.

There are two general classes of cloud-layer clouds and cumulus clouds.

TN 1397 A METHOD FOR NUMERICALLY CALCULATING THE AREA AND DISTRIBUTION OF WATER IMPINGEMENT ON THE LEADING EDGE OF AN AIRFOIL IN A CLOUD, Norman R. Bergrun, August 1947

A method, step by step integration, is presented for determining the trajectories of water drops around any body in two dimensional flow for which the streamline velocity components are known or can be calculated. The method is considered the deviation of the water drops from Stoke's law because of speed and drop size.

The method provides a means for the relatively rapid calculation of the trajectory of a single drop without the utilization of a differential analyzer.

The critical drop size diameter corresponding to zero impingement can be determined for a two dimensional body if the velocity components are known at the stagnation point.

The area and distribution of water drop impingement on an airfoil in motion through a cloud of known drop size distribution can be obtained by calculating the area and distribution of impingement for each drop size range present.

TN 1404 COLLECTION OF TEST DATA FOR LATERAL CONTROL WITH FULL-SPAN FLAPS, Jack Fischel and Margaret F. Ivey, April 1948

This report contains all of the available test data (thru 1948) on lateral control with full-span flaps. Lateral-control effectiveness and hinge-moment data obtained from two-dimensional, three-dimensional and flight tests are presented in over 150 pages of figures with the data including the characteristics of spoiler devices and ailerons with retractable flaps.

Three types of lateral control arrangements are considered:

(a) Slot-lip and flap-trailing-edge ailerons.
(b) Spoiler-type ailerons other than slot-lip ailerons.
(c) Ailerons with retractable flaps.

The data is not presented in the form of design charts for full-span flap-aileron installations but merely illustrates the effects of full-span flaps on various lateral-control devices.

Design charts for conventional ailerons can be found in:

Langley Research Department: Summary of Lateral-Control Research. NACA TR 868.

Pearson, Henry A., and Jones, Robert T.: Theoretical Stability and Control Characteristics of Wings with Various Amounts of Taper and Twist. NACA Rep. No. 635.

Pearson, Henry A., and Aiken, William S., Jr.: Charts for the Determining of Wing Torsional Stiffness Required for Specified Rolling Characteristics or Aileron Reversal Speed. NACA Report 799, 1944.

It was expected at the time of this report that about the same relation exists for the effectiveness of spoiler-type controls as for conventional ailerons with respect to spanwise location of the control surface. Aileron effectiveness at various spanwise locations is given in NACA Report 635 and NACA Report 715.

Spoiler-control stick effectiveness is discussed for slot-lip, flat-plate, plug-type and retractable-arc-type spoilers. It was found that spoiler controls were quite effective at low speeds.

TN 1409 INVESTIGATION OF A SPOILER-TYPE LATERAL CONTROL SYSTEM ON A WING WITH FULL-SPAN FLAPS IN THE LANGLEY 19-FOOT PRESSURE TUNNEL, Owen J. Deters and Robert T. Russell, August 1947

Wind tunnel tests were conducted on a large bomber model, therefore, this report may not be directly applicable to light aircraft. However, the tests were conducted at a Reynolds number of 8,900,000 and M = 0.18, which is the range of consideration. Discussion of the following topics might then be helpful if little information is found on similar topics for light aircraft.

Aerodynamic characteristics of the wing investigated with full-span double-slotted flaps:

1. Effect of the flap and vent.
2. Stalling characteristics.

Aerodynamic characteristics of the wing investigated with various spoiler and aileron configurations:

1. Plain spoiler
2. Venting
3. Spoiler perforations
4. Spoiler slot
5. Combinations of vents, perforations and slots
6. Spoiler bevel
7. Effect of spoiler span

Numerous curves of rolling and yawing moment coefficients and spoiler and aileron hinge moment coefficients versus spoiler deflection for various flap deflections and angles of attack are also given.

TN 1414 INVESTIGATION OF THRUST LOSSES DUE TO SHANKS OF A FLARED-SHANK TWO-BLADE PROPELLER ON A SLENDER NOSE AIRPLANE, Jerome B. Hammack, August 1947

Flight measurements of thrust losses due to shanks were made on a flared-shank two-blade propeller mounted on an airplane with a streamline slender nose. Thrust losses due to the shanks were found to be high. Loss in thrust due to shanks was a function primarily of airplane Mach number and relatively independent of blade loading. An increase in spinner diameter reduced thrust losses at the shank sections. At high speeds, high efficiencies may be obtained if shank losses can be eliminated. Shank losses can be reduced either by covering the thick shank sections or by improving the sections aerodynamically.

TN 1424 A FURTHER INVESTIGATION OF THE METEOROLOGICAL CONDITIONS CONDUCIVE TO AIRCRAFT ICING, William Lewis, Dwight B. Kline, and Charles P. Steinmetz, October 1947

The present report may be regarded as a supplement to reference 1, presents the additional flight measurements made during 1946-47. Data on liquid water content, temperature, and mean effective drop diameter are shown to be consistent with values previously proposed for maximum icing conditions. Data on drop size distribution as obtained by the rotating cylinder method were found to be inconsistent with data on drop size distribution derived from the ratio of the maximum diameter to the mean effective diameter when the maximum diameter was calculated from the area of impingement on a stationary cylinder.

The relation between temperature and maximum liquid water content in layer clouds is shown as follows:

Temperature	Maximum liquid water content in layer clouds
20°F	0.8 gm/m^3
0°F	0.5
-20°F	0.25

The equipment and test methods used in the research of this report were identical to those described in reference 1 with the exception of a few changes shown in the following:

1. Rotating cylinder measurements
2. Area of drop impingement measurements
3. Icing rate meter

Reference 1
Lewis, William: A Flight Investigation of the Meteorological Conditions Conducive to the Formation of Ice on Airplanes. NACA TN 1393, 1947.

TN 1427 LABORATORY INVESTIGATION OF ICE FORMATION AND ELIMINATION IN THE INDUCTION SYSTEM OF A LARGE TWIN-ENGINE CARGO AIRCRAFT, Willard D. Coles, September 1947

An investigation of the icing and de-icing characteristics of an entire induction system from air inlet to engine was conducted under laboratory conditions. The investigation reported here is intended to establish:

1. The basic icing characteristics of the system in terms of carburetor inlet-air temperature and humidity ratio.

2. The hot-air de-icing characteristics in terms of the wet-bulb temperature of the de-icing air and the time required to restore 95% of the maximum possible hot-air flow after various degrees of initial icing.

3. The effects of carburetor-ice formations on fuel metering and mixture distribution to the cylinders.

Other information on this particular induction system, typical of those used on cargo planes, can be found in NACA TN 1134, NACA MR's E5L18a, E6B28, E6E16.

Spinner-type fuel injection at the supercharger-impeller entrance eliminated all tendencies toward fuel-evaporation icing. Warming the supercharger inlet elbow with lubricating oil reduced icing. Airflow recovery time was reduced with increase in inlet-air wet-bulb temperature. The trapping and freezing of water in carburetor metering passages and ice accretions in the carburetor caused erratic fuel metering.

TN 1434 A METHOD FOR CALCULATING THE HEAT REQUIRED FOR A WINDSHIELD THERMAL ICE PREVENTION BASED ON EXTENSIVE FLIGHT TESTS IN NATURAL ICING CONDITIONS, Alun R. Jones, George H. Holdaway, and Charles P. Steinmetz, November 1947

An equation is presented for calculating the heat flow required from the surface of an internally heated windshield in order to prevent the formation of ice accretions during flight in specified icing conditions. Comparison is made between calculated values of the heat required and measured values obtained for test windshields in actual flights in icing conditions.

Three general types of internal heated aircraft windshields were tested: flat plate, flush, and V type windshields. Two types of external heated windshields were tested: flush and V type windshields.

The total heat loss from the outer surface of a windshield during flight in icing conditions can be considered as the sum of four individual heat loss, or

$$q = q_1 + q_2 + q_3 + q_4 \qquad (1)$$

where
- q_1 heat loss due to forced convection
- q_2 heat loss due to evaporation of the impinging water
- q_3 heat loss due to warming of the impinging water
- q_4 heat loss due to radiation to the surrounding atmosphere

Equation (1) can be written as

$$q = h[t_s - t_o - 0.832r(\frac{U_o}{100})^2] + 0.622h\ L_s\ (\frac{e_s - e_o}{c_p - P_o})$$

$$+ M_{c_{pw}}[t_s - t_o - 0.198(\frac{U_o}{100})^2] + 0.173\epsilon[(\frac{T_s}{100})^4 - (\frac{T_o}{100})^4]$$

where c_{p_n} specific heat of water

e water vapor pressure

L_S *latent heat of evaporation at surface temperature*

M weight rate of water impingement per unit area

r recovery factor equal to $p_r^{1/3}$ for turbulent flow

U velocity

Subscripts

s reference to windshield external surface conditions

o reference to ambient or free stream air condition

The amount of heat required for the prevention of ice accretions on both flush and V type windshields during flight in specified icing conditions can be calculated with a degree of accuracy suitable for design purposes.

The external air discharge system of windshield thermal ice prevention is thermally inefficient and requires a heat supply approximately 20 times that required for an internal system having the same performance.

TN 1472 THE CALCULATION OF THE HEAT REQUIRED FOR WING THERMAL ICE PREVENTION ON SPECIFIED ICING CONDITIONS, Carr B. Neel, Jr., Norman R. Bergrun, David Jukoff, and Bernard A. Schlaff, December 1947

This report presents an analysis of the data obtained during the 1945-46 and 1946-47 winter seasons with two electrically heated airfoil sections. The data were analyzed using the heat transfer equations developed by Hardy (see References 1 and 2). A consideration of the area and rate of water impingement on one of the airfoil sections based on an analytical study of water drop trajectories (Reference 3) is also presented. An attempt is made to further the knowledge of the process of airfoil thermal ice prevention.

Flight tests in natural icing conditions were made with two electrically heated airfoils (NACA 0012 and NACA 65,2-016), an 8 foot chord, and a 4.7 foot span. Previously derived equations for calculating the rate of heat transfer from airfoils in icing conditions were verified. An example of calculation of extent of heated area required for NACA 0012 is shown in appendix. Knowledge of the manner in which water is deplaited on and evaporated from the surface of a heated airfoil was expanded sufficiently to allow reasonably accurate calculations of airfoil heat requirements.

It was concluded that the extent of knowledge on the meteorology of icing, the impingement of water drops on airfoil surfaces, and the processes of the heat transfer and evaporation from a wetted airfoil surface has been increased to a point where the design of heated wings on a fundamental, wet air basis now can be undertaken with reasonable certainty.

Reference 1
Hardy, J. K.: Protection of Aircraft Against Ice. Rep. No. S.M.E. 3380, British R.A.E., July 1946.

Reference 2
Hardy, J. K.: An Analysis of the Dissipation of Heat in Conditions of Icing from a Section of the Wing of the C-46 Airplane. NACA ARR No. 4I11a, 1944.

Reference 3
Bergrun, Norman R.: A Method for Numerically Calculating the Area and Distribution of Water Impingement on the Leading Edge of an Airfoil in a Cloud. NACA TN 1397, 1947.

The following conclusions are drawn based on test data and analytical studies of the processes of heat transfer and evaporation from a heated wing:

1. The heat should be concentrated as much as possible in the leading edge region of the wing in the area of water drop impingement.

2. An increase in altitude, for the same rate and area of water impingement on a wing and for the same condition of true airspeed and free air temperature, decrease the heat requirement for thermal ice prevention.

3. A wing thermal ice prevention system which has been designed to evaporate all impingement water in the leading edge region for a relatively high free air temperature (20° F) will be capable of ice prevention at low air temperature (0° F) in icing conditions nearly as severe as those upon which the design was based.

TN 1520 DE-ICING EFFECTIVENESS OF EXTERNAL ELECTRIC HEATERS FOR PROPELLER BLADES, James P. Lewis, February 1948

Icing protection provided by electrically heated, external, rubber clad propeller blade heaters at several icing, heating, and propeller operating conditions has been determined. Effects of propeller speed, ambient air temperature, liquid water concentration, heat power density, duration of heating, and total cycle time on power requirement and de-icing performance were investigated. A comparison is made of the results of the icing tunnel investigation with the results obtained during a flight investigation in natural icing conditions. The maximum ice covered area on the blade was determined and also the maximum heated area required.

Power densities of 4 ½ to 10 watts per square inch were required for effective cyclic de-icing with best chordwise power distribution approaching uniformity. Cyclic heating times of approximate 24 seconds were required for effective de-icing at the conditions investigated with a ratio of heat on to total cycle time of 1:4 giving the best performance.

TN 1540 THE EFFECT OF TIP MODIFICATION AND THERMAL DE-ICING AIR FLOW ON PROPELLER PERFORMANCE AS DETERMINED FROM WIND TUNNEL TESTS; W. H. Gray and R. E. Davidson, February 1948

The present paper is to investigate the efficiency of thermal de-icing of airplane propellers by use of internal flow through hollow blades, and to determine the actual losses, as well as the accuracy of the analytical method, in conjunction with tip nozzles of the best size and shape.

Wind tunnel tests were made of a propeller with blades embodying tip orifices. Provision was made for heating the internal flow to about 285° F.

The following conclusions have been indicated by tests:

1. The flow through the tip nozzles of good external design but with poor internal ducting caused peak efficiency losses of little more than 1%.

2. The peak efficiency losses may be estimated with fair accuracy by the use of a theoretical method.

3. When heat was added to internal flow no additional change of efficiency was found.

4. Bench tests indicated that changes in blade angle did not affect the pressure drop through the system, and the internal ducting of the blade should be faired to the tip nozzle to obtain better flow characteristics.

5. The torque of the spinner juncture seals necessary to this design was excessive and large efficiency losses resulted when this torque was charged to the propeller.

TN 1573 FLIGHT MEASUREMENT OF THE FLYING QUALITIES OF FIVE LIGHT AIRPLANES, Paul A. Hunter, May 1948

Flight tests were made of five light airplanes. It was found that all the planes showed stability of the long-period longitudinal oscillation. The static longitudinal stability was positive for all the planes tested at all conditions tested. The degree of stability varied greatly among the planes, and control friction was considered excessive.

The elevators were quite large enough for any loading condition. No problems were found with lateral oscillations. The ailerons were found to exceed the minimum limit for all planes.

The dihedral effect was positive and generally within desirable limits for all the planes. For any sideslip, sufficient bank resulted. Stall warnings were very good and were indicated by buffet, increased stick force and rearward stick travel. The ailerons were ineffective for a power-on stall, but recovery was made easily by dropping the nose.

Stalls from steady turning flight were possible in power-on condition, but stalls here with power-off were impossible because of lack of elevator power.

TN 1575 THE EFFECT OF VARIATIONS IN MOMENTS OF INERTIA ON SPIN AND RECOVERY CHARACTERISTICS OF A SINGLE-ENGINE LOW-WING MONOPLANE WITH VARIOUS TAIL ARRANGEMENTS, INCLUDING A TWIN TAIL, Anshal I. Neihouse, May 1948

An investigation was conducted in the Langley 15-foot free-spinning tunnel on a 1/5 scale research model, representative of a trainer or a four-place cabin low-wing monoplane with varied moments of inertia to determine spin characteristics. The moment of inertia variation was made while keeping the weight of the plane constant. Eight separate wing configurations; various tip shapes, airfoil sections, plan forms, thicknesses, and landing flaps; were used along with four different tail arrangements ranging from a short rudder with shallow fuselage to a full length rudder with raised horizontal tail on a deep fuselage and one twin tailed model were tested. Wing and tail changes were made without any change in mass distribution. Qualitative effects upon spin and recovery were generally the same for each tail and wing arrangement tested.

The results showed that uniformly decreasing moments of inertia led to steeper spins, higher angular velocities, and faster recoveries.

Comparison of these results with those in NACA TR 691 indicates that, for the range of mass variation considered in this investigation, systematic changes in moments of inertia will affect the recovery characteristics in a manner similar to that brought about by changes in relative density involving similar moment of inertia variations. It thus appears that changes in moments of inertia associated with a change in relative density are primary factors affecting the spin recovery.

The effects of tail and wing variables are generally similar to those obtained in TR 691. The results indicate that the twin tail is a very effective arrangement for spin recovery. Moment of inertia variations had no appreciable effect on control effectiveness in producing recoveries.

Adding weight up to 50% of the basic weight at the center of gravity led to higher rates of descent and higher angular velocities, had little effect upon recoveries when the elevators were up, and generally had a somewhat adverse effect upon recoveries when the elevators were neutral or down.

TN 1598 EFFECTS OF ICE FORMATIONS ON AIRPLANE PERFORMANCE IN LEVEL CRUISE FLIGHT, G. Merritt Preston and Calvin C. Blackman, May 1948

Some recent investigation of propeller icing in natural icing conditions indicated significant propeller performance losses, and some indicated negligible losses, because they did not permit a distinction between the effect of propeller ice and the effects of ice formations on other components of the airplane.

The present paper is to determine the effect of ice formations on propellers, wings, empennage, engine cowlings, and miscellaneous unprotected components of the airplane on airplane performance.

From a flight investigation to determine the effect of ice formation on airplane performance in level cruising flight, the following results were obtained:

1. The maximum loss in propeller efficiency encountered due to ice formation on the propeller blades was 19%.

2. During 87% of the propeller icing encounters, losses of 10% or less were observed.

3. Ice formations on all of the components of the airplane except the propellers during one icing encounter resulted in an increase in parasite drag of the airplane of 81%.

TN 1643 EFFECT OF LANDING FLAPS AND LANDING GEAR ON THE SPIN AND RECOVERY CHARACTERISTICS OF AIRPLANES, Lawrence J. Gale, June 1948

Spin tests were conducted in the Langley 15-foot and 20-foot free spinning tunnels on various models of military aircraft to determine the effect of extended flaps and landing gear upon spin and spin recovery characteristics of these aircraft. Data from 58 models was used in this set of tests and a table showing the mass and geometric characteristics of 53 (full scale) are given. The number of turns for recovery is given in terms of the inertia yawing-moment parameter $(Ix-Iy)/mb^2$ which experience has shown has a great influence upon the effect of rudder, elevator, ailerons, and slots on the spin and on the recovery. In addition to three graphs giving turns for recovery versus inertia-yawing moment, the effect of landing flaps on angle of wing inclination during the spin, angle of attack and rate of rotation are also shown in graphical form.

Extended landing flaps had an adverse effect upon spin recovery characteristics, however, for a model heavily loaded along the fuselage and ailerons set with the spin either a favorable effect or no effect upon spin recovery was generally noted. It seems advisable that landing flaps should be retracted if a spin is entered inadvertently. Lowering the flaps caused an increase in inward sideslip and angle of attack and a decrease in rate of rotation. The effect of landing gears appears negligible. The type of flap seemed to have little effect.

TN 1691 ICING AND DE-ICING OF A PROPELLER WITH INTERNAL ELECTRIC BLADE HEATERS, James P. Lewis and Howard G. Stevens, Jr., August 1948

An investigation concerned with both continuous and cyclic heating systems was conducted at NACA Cleveland Laboratory to determine the icing protection provided by an experimental configuration of an internal electric propeller blade heater and the effects of several icing, heating, and propeller operating conditions on the heater performance.

Test conditions:

1. Propeller speeds of 800 and 1000 rpm
2. Ambient air temperatures from -1° to 20° F
3. Liquid water concentrations from 0.3 to 0.9 gram per cubic meter
4. Heat on time from 5 to 54 seconds
5. Cycle time from 30 to 240 seconds
6. Blade angles of 30.5° and 34.5°
7. Power inputs from 750 to 1250 watts per blade

The largest icing formation was obtained at the higher ambient air temperatures and at low propeller speed. Blade surface temperature rates of rise of 0.2 to 0.7° F per second were obtained, and the minimum cooling period for cyclic de-icing was found to be approximately 2½ times the heating period. The chordwise extent of icing in every case was greater than that covered by blade heaters.

The extent of ice covered area on the blades for various icing and operating conditions has been determined.

TN 1722 PREDICTION OF THE EFFECTS OF PROPELLER OPERATION ON THE STATIC LONGITUDINAL STABILITY OF SINGLE ENGINE TRACTOR MONOPLANES WITH FLAPS RETRACTED, Joseph Weil and William C. Sleeman, Jr., October 1948

See TR 941 which supersedes this Technical Note.

TN 1764 INFLUENCE OF TAIL LENGTH UPON THE SPIN-RECOVERY CHARACTERISTICS OF A TRAINER-TYPE-AIRPLANE MODEL, Walter J. Klinar and Thomas L. Snyder, December 1948

A method of designing an airplane for satisfactory spin recovery based upon an empirical relationship between a tail-damping factor (TDPF) and relative density and mass distribution is presented in NACA TN 1045. This investigation was conducted to see if the effect of tail length is greater than that indicated by the TDPF. Wind tunnel tests were conducted on models with two different tail lengths. When the tail length was decreased, the horizontal tail was raised and a 0.50-inch ventral fin was added in order to maintain approximately the same values of TDPF and unshielded rudder volume coefficient for both the long and short tail lengths. Spin recovery within 2 1/4 turns was generally considered satisfactory. Comparison between model and airplane spin results (NACA Report 557, NACA MR, December 7, 1938) indicates that spin-tunnel tests are not always in complete agreement with airplane spin results.

The results of this investigation showed:

1. The recovery characteristics of an airplane may be influenced by the airplane tail length to a greater extent than is indicated by the value of TDPF.

2. An increase in tail length offers a more effective means of improving the spin-recovery characteristics than an addition of ventral fin area.

TN 1789 INVESTIGATION OF AERODYNAMIC AND ICING CHARACTERISTICS OF RECESSED FUEL-VENT CONFIGURATIONS, Robert S. Ruggeri, Uwe von Glahn, and Vern G. Rollin, March 1949

An investigation has been conducted in the NACA Cleveland icing research tunnel to determine the aerodynamic and icing characteristics of five fuel vent configurations. Aerodynamic investigations were to determine vent pressures and pressure distributions on the ramp surface as a function of tunnel air velocity and angle of attack. Icing investigations were to determine the vent tube pressure losses for several icing conditions at tunnel air velocities ranging from 220 to 440 feet per second.

The following conclusions were obtained:

1. Aerodynamic (non-icing): The configurations with diverging ramp walls maintained vent tube pressures greater than the required marginal value of 2 inches of water positive pressure differential between the fuel cell and the compartment containing the fuel cell for a range of angles of attack from 0 to 14 degrees at a tunnel air velocity of 240 feet per second. A configuration having diverging ramp sidewalls, a 7° ramp angle, and vent tubes manifolded to a common plenum chamber opening through a slot in ramp floor gave the greatest vent tube pressures for all the configurations investigated. The use of the plenum chamber resulted in uniform pressures in all vent tubes.

2. Icing: Rapid losses in vent tube pressures during the few minutes in icing conditions were caused by the ice formations on the airfoil surface ahead of the vent ramp. The larger and more rapid losses in vent tube pressures in the freezing rain conditions at small angle of attack than a cloud icing condition.

TN 1790 INVESTIGATION OF ICING CHARACTERISTICS OF TYPICAL LIGHT-AIRPLANE ENGINE INDUCTION SYSTEMS, Willard D. Coles, February 1949

The icing characteristics of two typical light airplane engine induction systems were investigated using the carburetors and manifolds of engines in the horsepower range from 65 to 85 and 165 to 185. The smaller system consisted of a float type carburetor with an unheated manifold and the larger system consisted of a single barrel pressure type carburetor with an oil jacketed manifold.

Carburetor air temperature and humidity limits of visible and serious icing were determined for various engine power conditions.

The following conclusions are obtained from the results of the investigation:

1. Conclusions from a light airplane air scoop with an exposed filter and a modified system:

   a. The system was designed to induce inertia separation of the free water from the charge air.

b. The icing conditions in which a large percentage of small droplets existed caused more rapid blocking of the filter than icing conditions in which there were large droplets.

2. The proper jacketing and heating of all parts of the carburetor and manifold exposed to the fuel spray can satisfactorily reduce or eliminate icing in the float type carburetor and the manifold.

3. Pressure type carburetors can be protected from serious icing by proper location of the fuel discharge nozzle combined with suitable application of heat to critical parts.

TN 1793 INVESTIGATION OF METEOROLOGICAL CONDITIONS ASSOCIATED WITH AIRCRAFT ICING IN LAYER-TYPE CLOUDS FOR 1947-48 WINTER, Dwight B. Kline, January 1949

The accumulation of considerable meteorological data over differing geographical and climatological regions in various weather conditions is required before the design limits for ice-prevention systems can be stated with reasonable certainty. This report is part of an attempt by the NACA to fly through natural icing conditions to measure the meteorological factors associated with supercooled clouds. The following quantities have therefore been measured in tests conducted in the area of the Great Lakes:

1. Liquid water content
2. Mean-effective drop diameter
3. Distribution of drop sizes
4. Free air temperature

No completely reliable method for measuring these quantities in flight has yet been found.

The results of these tests are listed in tabular form and agree with the results of previous investigations to a large extent.

Tentative estimates of the most severe icing conditions likely to be encountered in flight:

Liquid Water Content (g/cu. m)	Mean Effective Drop Diameter (microns)	Free-Air Temperature (°F)
0.8	15	20
0.5	25	20

The icing conditions in supercooled clouds in the Great Lakes region were found to usually be light.

TN 1834 THE INFLUENCE OF BLADE-WIDTH DISTRIBUTION ON PROPELLER CHARACTERISTICS, Elliott G. Reid, March 1949

Combined force and wake survey tests on three-blade model propellers were made to determine the effects of blade-width distribution upon constant-speed propeller efficiency characteristics. All the models exhibited substantially identical power-absorption capacities at equal pitch settings. Analysis of the thrust and torque grading curves indicates that the more efficient operation of the tapered blades at reduced advance ratios is the result of a redistribution of loading which augments the proportion of the total power input absorbed by the inboard elements which continue to function efficiently as the outboard elements approach and exceed their stalling angles.

The envelope efficiency curves for the types of blades tested differ appreciably only at advance ratios less than 1.0 and greater than 3.0; in those ranges, the envelope efficiencies of the relatively straight blades are slightly superior to those of the tapered ones. However, the constant-speed efficiency curves diverge substantially as the advance ratios are reduced below the values at which maximum efficiencies occur. At all values of power coefficients equal to or greater than 0.1, blades tapered from broad roots to narrow tips attained greater efficiencies than did those of relatively uniform width. However, at power coefficients appreciably less than 0.1, the untapered blades were found to be somewhat more efficient than tapered ones at all advance ratios.

TN 1868 CORRELATION OF PILOT OPINION OF STALL WARNING WITH FLIGHT MEASUREMENTS OF VARIOUS FACTORS WHICH PRODUCE THE WARNING, Seth B. Anderson, April 1949

Data was taken during stalls of 16 airplanes ranging from single-engine fighters to 4-engine bombers in order to establish quantitative design criteria describing the flying qualities near stalls. The planes used were in straight flight with the c.g. in the normal position at altitudes of from 4000 to 12,000 feet and the stall was approached while holding the normal acceleration factor as close to unity as possible. Current (1949) flying quality specifications state that:

Approach to a stall (complete) shall be accompanied by:

1. Buffeting and shaking of the airplane and controls.
2. Marked increase in rearward travel of control column or increase in control force for speed reduction.
3. Preliminary development of the stall thru small amplitude pitching and rolling motion.

Stall warning should occur between 1.05 and 1.15 of the stalling speed.

Quantative values of the following were considered for correlation with pilot opinions as to the adequacy of stall warning:

1. Amount of airplane buffet
2. Amount of shaking of elevator
3. Amount of elevator buffet
4. Maximum amplitude of roll and pitch velocities
5. Amount of change in elevator stick position and control force prior to the stall.

The following variations prior to stall were eliminated from consideration for various reasons:

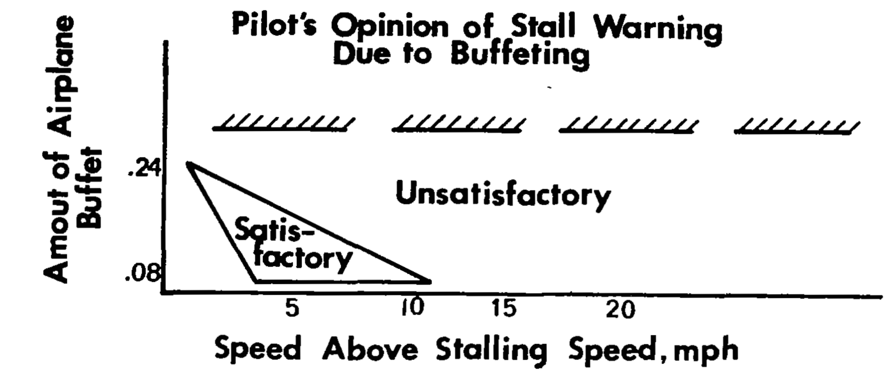
1. Control-shaking by elevator
2. Amount of buffet shown by force variation at control stick grip
3. Small amplitude pitching motions
4. Amount of increase in control force for further speed reduction

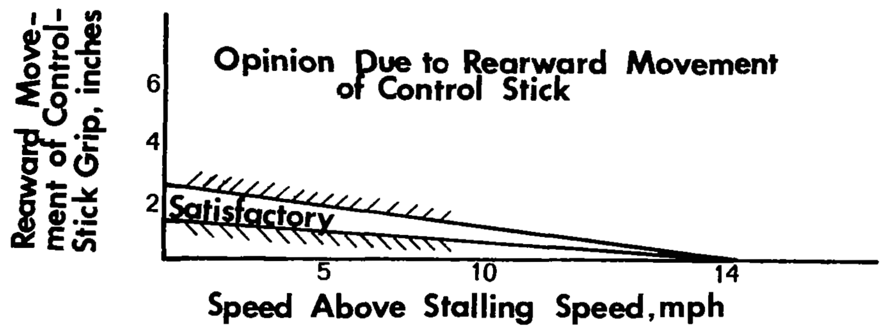
Acceptable quantative variation for the following factors were obtained:

1. Normal acceleration (in some cases buffeting prior to stall was considered an unsatisfactory stall warning because the pilots feared structural damage to the plane). - Incremental indicated acceleration factor of 0.04 to 0.22 occurring from 3 to 15 mph above stalling speed.

2. Rolling velocity - 0.04 to 0.06 rad/sec occurring from 2 to 12 mph above stalling speed.

3. Elevator control position - rearward movement of control stick of at least 2.75 inches during the 15 mph speed range prior to stall.





TN 1904 OBSERVATIONS OF ICING CONDITIONS ENCOUNTERED IN FLIGHT DURING 1948, William Lewis and Walter H. Hoecker, Jr., June 1949

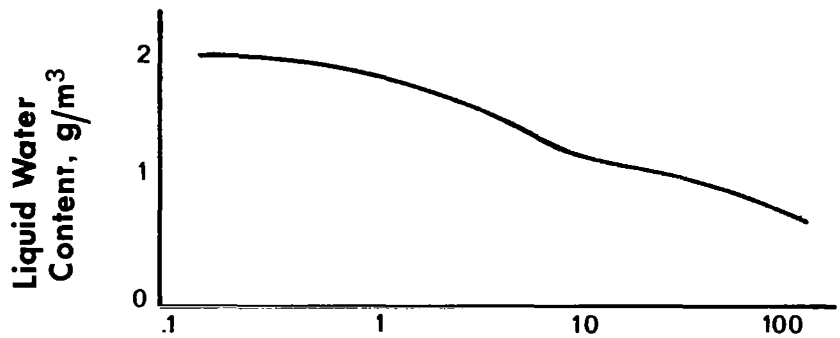
This paper reports part of a series of tests to determine the range of values of meteorological variables commonly encountered in icing conditions. By investigating the icing conditions likely to be encountered the maximum icing conditions in which ice-prevention equipment can be expected to give protection can be determined. The data contained herein is used in the following reference for just such a purpose.

Jones, Alun R. and William Lewis: Recommended Values of Meteorological Factors to Be Considered in the Design of Aircraft Ice-Prevention Equipment. NACA TN 1855, 1945.

This report contains:

1. Detailed results of the observations carried out in 1948.
2. Discussion of relation between extent of icing conditions and average liquid water content.
3. Reliability of drop size distribution measurements.
4. Geographical influence upon the size of cloud drops.

These tests showed that clouds with a predominance of liquid drops are mostly discontinuous while clouds with a predominance of snow are usually continuous. The discontinuous character of icing clouds is an important factor to be considered in the design of ice prevention equipment. The following figure and table show the estimated maximum values of average liquid-water content to be expected in 1000 flights encountering icing, assuming 5% of flights encounter cumulus clouds.



Real variations in average drop size were found to occur from year to year with the Pacific Coast having larger drops and more variable drop sizes. Drop-size distributions ordinarily encountered in clouds are usually nearly uniform. Indications given by the rotating cylinder method disputing this conclusion seem to be unreliable and of little or no value. An Appendix is given discussing the following instruments:

1. The cloud indicator
2. Maximum drop size cylinder
3. Rotating-disk icing-rate meter

TN 1966 EXPERIMENTAL INVESTIGATION OF FLUTTER OF A PROPELLER WITH CLARK Y SECTION OPERATING AT ZERO FORWARD VELOCITY AT POSITIVE AND NEGATIVE BLADE ANGLE SETTINGS, John E. Baker and Russell S. Paulnock, December 1949

An investigation was made to determine the flutter characteristics of a propeller with a Clark Y section at both positive and negative angles of attack since it was considered that propellers have failed due to stall flutter of the blades while operating at high positive and negative angles of attack. The tests were made at pressures from 0.321 to 1.0 atmospheres and over a blade-angle range, measured at 0.8 radius, from 25^{o} to -25^{o}.

Data indicates that at the angle of zero aerodynamic moment, the flutter speed shows a marked increase as C_L approaches about 0.50. This type of flutter is believed to be very similar to the classical flutter of wings. Flutter at large positive and negative blade-angle settings where the flutter speeds are much lower than classical flutter speeds, and little variation of flutter speed with pressure change occurs at these angles, is called stall flutter. This flutter is almost entirely torsional. It appears that a propeller of the type used in this investigation should not encounter stall flutter under any conditions of pitch setting and pressure included in this test. Since the maximum experimental flutter speed was 63% of the theoretical flutter speed, an appreciable factor of safety must be employed by the designer.

TN 1993 ICING-PROTECTION REQUIREMENTS FOR RECIPROCATING-ENGINE INDUCTION SYSTEMS, Willard D. Coles, Vern G. Rollin, and Donald R. Mulholland (Same as TR 982), December 1949

The effects of several factors on the icing characteristics were studied. These included atmospheric conditions, engine and air scoop configurations, type of fuel used, operating variables, mixture setting, and the use of a manifold pressure regulator, carburetor heat, and water-alcohol injection. Ice detection methods were investigated and methods of preventing and removing induction-system ice were studied. Recommendations are given for design and operation with regard to induction-system icing.

Conclusions:

The intake of free moisture, snow, and ice particles into the induction system should be reduced to minimize the formation of impact ice and to reduce the seriousness of fuel-evaporation and throttling ice. Most of the free moisture intake can be prevented by the use of inertia separation methods.

Induction system passages should be aerodynamically clean and free from protuberances, carburetor screens, and exposed metering parts that might serve as collecting points for ice.

Air metering devices should be located in a warm or dry region. Air-metering devices located in regions where free moisture may be present in the air should be designed to exclude water from the metering passages or should incorporate adequate drainage and protection against freezing of the entrained water.

Provisions should be incorporated to maintain surfaces of the throttle and the throttle body above freezing.

Fuel should be injected in a region at and beyond which the passage surfaces are maintained above freezing to prevent fuel evaporation icing. The fuel must also be injected so as to avoid splashback or eddying of fuel into colder regions.

A satisfactory heated air system must be capable of supplying not only sufficient heat for ice prevention, but also must be capable of furnishing the additional heat required for emergency ice removal. Alternate heated air must be applied before engine power is reduced to the extent that the required heat for de-icing is unavailable. Stratification of heated air in the duct, such as will occur with part opening of the heated air damper, may seriously affect fuel metering and effectiveness of icing protection.

In general, the performance of fluid de-icing system is unpredictable and slow and their use is not recommended as a sole means of protection. If a fluid de-icing system is to be used for emergency protection, it should be carefully designed both to satisfy the particular ice-prevention requirements of the induction system in which it is to be installed and to minimize the potential fire hazard common to this system.

TN 1997 ANALYSIS OF MEANS OF IMPROVING THE UNCONTROLLED LATERAL MOTIONS OF PERSONAL AIRPLANES, Marion O. McKinney, Jr., December 1949

A theoretical analysis was made of the means of improving the uncontrolled motions of personal airplanes. The purpose was to determine whether such airplanes could be made to fly uncontrolled for an indefinite period of time without getting into dangerous attitudes and for a reasonable period of time (one to three minutes) without deviating excessively from their original course. Six different models were tested.

Results

1. Most personal airplanes at the period of this report possess a slight degree of positive spiral stability for the cruising-flight condition for which good uncontrolled behavior is most desired. Freeing the rudder has almost no effect on spiral stability. The test showed that with controls fixed or free, the plane will return toward 0° bank after a gust but the heading will be changed slightly.

2. If either the ailerons or rudder are out of trim, the airplane will bank and turn at a fairly rapid rate with no tendency to return to its original attitude as regards either bank or heading.

3. An increase in spiral stability for personal planes can be obtained by increasing tail length and/or increasing the vertical tail area and dihedral angle simultaneously without adversely affecting the flying qualities of the airplane.

TN 2016 FLOATING CHARACTERISTICS OF RUDDERS AND ELEVATORS IN SPINNING ATTITUDES AS DETERMINED FROM HINGE-MOMENT-COEFFICIENT DATA WITH APPLICATION TO PERSONAL-OWNER-TYPE AIRPLANES, William Bihrle, Jr., January 1950

A study was made of available rudder and elevator hinge-moment-coefficients in order to determine the floating characteristics of various types of rudders and elevators in spinning attitudes. It was found that if the controls were released for spin recovery a plain rudder generally floated with the spin for all angles of attack. The horn balanced rudder appeared to be the most adaptable for obtaining desirable floating characteristics in spins. The rudder above the horizontal tail will generally float near neutral for low angles of attack, and float against the spin for high angles of attack.

Plain-overhang-balanced, and beveled-trailing edge elevators generally will float in an up position in spins and should float more upward as the angle of attack increases. The beveled-trailing-edge elevator should float closest to neutral, whereas the overhang-balanced elevator should float farthest up. Horn-balanced elevators may also float in the up position.

Large tabs deflected upward should cause the elevators to float down in spins.

TN 2134 COMPARISON OF MODEL AND FULL-SCALE SPIN TEST RESULTS FOR 60 AIRPLANE DESIGNS, Theodore Berman, July 1950

The results of Langley spin-tunnel investigations have been compared with corresponding full-scale results available for 60 different airplane designs. The purpose of the comparison was to determine the reliability of the model results in predicting full-scale spin and recovery characteristics. The types of designs studied range from biplanes to swept-wing airplanes.

In general the tests showed that:

1. About 90% of the time model tests satisfactorily predict full-scale recovery characteristics and the other 10% of the tests are useful in determining full scale behavior.

2. Models showed lower altitude loss than airplanes.

3. The airplane spun with the inner wing tilted down more than the model.

4. Predictions of emergency-parachute sizes based on model results were somewhat conservative.

TN 2192 A SURVEY OF THE FLOW AT THE PLANE OF THE PROPELLER OF A TWIN-ENGINE AIRPLANE, John C. Roberts and Paul F. Yaggy, September 1950

Data was taken from a full-scale wind tunnel test of a twin engine fighter. Angle of attack varied from 0^o to 10^o by 2^o increments and flap deflections were from 0^o to 40^o. Tables and graphs show the ratios of freestream to local velocity and angle between local velocity and thrust axis. The object is to determine the magnitude of oscillating loads on a propeller.

Results show that the inlet mass flow rate has little effect on propeller loading. Most significant result is that the upwash angle is much larger than the calculated wing upwash angle; indicating that the fuselage and nacelle have a large effect upon upwash.

TN 2212 THE EFFECT OF ICE FORMATIONS ON PROPELLER PERFORMANCE, Carl B. Neel, Jr., and Loren G. Bright, October 1950

Flight records made on commercial routes in icing conditions. Ice allowed to form on propeller of right engine, left kept clear. The propeller was 13½ feet in diameter and was composed of double camber Clark Y sections. Icing was measured in thickness (inches) and extent (percent of blade radius). The thickness measured varied from 0 to 1". Extent varied from 0 - 95%. It was concluded that the pilot can generally keep efficiency (of blade) losses below 10%. Maximum losses with severe icing = 15% (incompressible), = 20% (compressible).

TN 2268 TESTS OF TWO-BLADE PROPELLERS IN THE LANGLEY 8-FOOT HIGH-SPEED TUNNEL TO DETERMINE THE EFFECT ON PROPELLER PERFORMANCE OF A MODIFICATION OF INBOARD PITCH DISTRIBUTION, James B. Delano and Melvin M. Carmel, February 1951

Tests were made of two propellers differing only in the pitch distribution of the inboard sections to be used on a pusher installation.

The following conclusions were obtained:

1. The modified propeller was about 2.5% less efficient for a climb condition at all altitudes, 2% more efficient for a cruise condition, and 5% more efficient for high speed operation.

2. The modified propeller showed a 6% loss in efficiency due to compressibility, and the original propeller showed an 11% efficiency loss due to compressibility. The lower compressibility loss for the modified propeller resulted from the fact that the inboard sections of this propeller could operate at increased thrust loading after compressibility losses had occurred at the outboard sections.

3. In order to increase the high speed performance of these propellers, the best method is to increase the solidity and to reduce the operating lift coefficient in order to maintain the same load at high speeds.

TN 2308 VIBRATORY STRESSES IN PROPERTIES OPERATING IN THE FLOW FIELD OF A WING-NACELLE-FUSELAGE COMBINATION, Vernon L. Rogallo, John C. Roberts, and Merritt R. Oldaker, March 1951

There are three steps which are necessary if one is to predict first-order vibratory stresses: (1) computation of the characteristics of the flow field, (2) computation of the air load variation of the propeller operating in this flow field, and (3) computation of the stress due to this air load variation.

Two significant conclusions, which are believed to be applicable to conventional propellers when operating with low blade angle settings below stall and supercritical speed, are as follows:

1. Steady state propeller theory was adequate for the prediction of the magnitude and distribution of the oscillating air loads, provided the completed flow field characteristics were known.

2. With the known oscillating air load, an accurate prediction of nonresonant, first order vibratory stresses was obtained.

TN 2340 DYNAMIC STABILITY, FREQUENCY RESPONSE, AND TRANSFER FUNCTIONS, Harry Greenberg, April 1951

Various methods of reducing the response to sinusoidal and transient disturbances to stability parameter form are discussed, using the simplified longitudinal motion of an idealized airplane as an illustrative example. It is shown that there are basic limitations in the determination of some of the stability derivatives as compared with the transfer-function coefficients, which are certain combinations of stability derivatives directly related to the airplane response. Hence, most of the report is concerned with methods of determining transfer-function coefficients rather than stability derivatives. The method of least squares is discussed as well as certain linearization techniques.

The purpose of this report is to establish general and rigorous methods for determining aerodynamic parameters from dynamic flight measurements. The following principal and basic methods are included.

1. Relation between the number and type of applied forcing functions and measured responses and the corresponding number and type of determinable aerodynamic parameters.

2. Various methods of converting flight data to a form suitable for determination of aerodynamic parameters.

3. The correct application of the method of least square to compute the aerodynamic parameters.

The following subject areas are listed:

Computation of Dynamic Parameters (Transfer Coefficients) from Flight Data:

Principle of Least Squares
Determination of Parameters and Their Relative Accuracy by Linearization
Sinusoidal Response, Transient Response
1. Inspection of Transient
2. Fourier Transform
3. Derivative Method
4. Prony's Method
Determination of Lift Derivatives
Basic Limitations in Determination of Moment Derivatives
Information Obtained from Tail Load Tests, Use of Nonaerodynamic Forcing Functions, Relation Between Static and Dynamic Tests
Aerodynamic Lag
Appendix - Details of Calculation of Parameters from First Approximation

TN 2370 MATRIX METHOD OF DETERMINING THE LONGITUDINAL-STABILITY COEFFICIENTS AND FREQUENCY RESPONSE OF AN AIRCRAFT FROM TRANSIENT FLIGHT DATA, James J. Donegan and Henry A. Pearson, June 1951

A matrix method is presented for determination of the longitudinal-stability coefficients and frequency response of an aircraft from arbitrary maneuvers. The method is devised so that it can be applied to time-history measurements of combinations of such simple quantities as angle of attack, pitching velocity, load factor, elevator angle, and hinge moment to obtain the overall coefficients. The method has been devised primarily for the evaluation of stability coefficients which are of primary interest in most aircraft loads and stability studies.

TN 2409 SUMMARY OF METHODS FOR CALCULATING DYNAMIC LATERAL STABILITY AND RESPONSE AND FOR ESTIMATING LATERAL STABILITY DERIVATIVES, John P. Campbell and Marion O. McKinney, July 1951

The purpose of this report is to extend the methods of NACA Report 589. This paper summarizes and reduces to simple straightforward steps methods for computing the time histories of lateral motions, the period and damping of these motions, and the lateral stability boundaries. Existing methods of estimating stability derivatives for a variety of airplane configurations are summarized and, in some cases, simple new empirical formulas are presented. Reference is also made to reports presenting experimental data that should be useful in making estimates of these derivatives.

Step-by-step procedures for performing calculations of time histories of disturbed motions, period and damping of the free motions, and spiral and oscillatory stability boundaries (lines of neutral damping of the spiral mode and of the lateral oscillations) are explained and derivations and additional pertinent material are presented. The equations and methods of calculation presented in the paper deal specifically with the inherent motions of airplanes for the case of three degrees of freedom (roll, yaw and sideslip) and linear stability derivatives. In order to perform similar calculations for cases involving additional degrees of freedom, nonlinear derivatives, or autopilots with time lag, special equations are required. A list of references containing such information is presented.

An approach to a presentation of the contribution of all principal airplane components to all the derivatives for airplanes having any sweep angle or aspect ratio is made by the coordination of and reference to existing estimation methods, by reference to publications containing data which should be useful in making estimates, and by the suggestion in some cases of simple new empirical formulas. Detailed estimation methods are presented for low-subsonic-speed conditions. In general, the estimation methods presented should be expected to yield only fairly accurate values suitable for making first approximations of dynamic stability. References that should be useful in estimating the stability derivatives are presented in a table.

The effects of Mach Number and power are considered. The estimation methods presented rely on the use of force-test data and are probably more reliable than methods which do not involve the use of force-test data. Full-scale checks of low-scale data and of the estimation methods are desirable. For the subsonic case some of the checks can be obtained from large-scale wind-tunnel tests but some checks in full-scale flight tests should also be obtained when the various methods of measuring stability derivatives in flight have been developed to a satisfactory degree of accuracy.

The following appendices are presented:

Equations of Lateral Motion
Application of the Laplace Transformation to Calculating Motions
Solution of Biquadratic Equation
Special Notation Used in Calculating Motions When the Characteristic Equation Has Complex Roots

TN 2413 FLIGHT INVESTIGATION OF THE EFFECT OF CONTROL CENTERING SPRINGS ON THE APPARENT SPIRAL STABILITY OF A PERSONAL-OWNER AIRPLANE, John P. Campbell, Paul A. Hunter, Donald E. Hewes and James B. Whitten, July 1951

A flight investigation was conducted on a high-wing personal-owner airplane to determine the effect of control centering springs on apparent spiral stability (the airplane spiraling tendencies of an airplane in uncontrolled flight as affected both by the true spiral stability of the perfectly trimmed airplane and by out-of-trim control settings). Centering springs were used in both aileron and rudder control systems to provide both a positive centering action and a means of trimming the airplane.

It was felt that if an inherently spirally stable light airplane (most high - wing designs and probably low - wing designs with adequate wing dihedral) were provided with means for trimming the ailerons and rudder and if the friction in the control system is reduced to an extremely low value, the airplane might fly itself satisfactorily. The method for accomplishing this considered here is to use preload control centering springs that have a non-linear force gradient through neutral deflection and, thereby, provide a positive centering action despite friction in the control system. Records were obtained of the uncontrolled lateral motions of an airplane starting from straight and level flight and from turns and also following abrupt rudder kicks. Most flights were between 140 to 150 mph.

Results indicated that:

1. After an abrupt rudder kick the airplane diverged because friction prevented centering. (Centering springs disengaged.)

2. Control centering springs definitely improved apparent spiral stability by preventing control surfaces from being held out of trim by friction.

3. Measured spiral stability was greater than that indicated by theory.

4. Unsatisfactory recoveries from large angles of bank with elevator free indicated that the airplane might not fly satisfactorily "hands off" in very rough air.

5. The results of the investigation indicate that in order to

get completely satisfactory results with control centering springs it will probably be necessary to minimize lateral-directional trim changes due to changes in airspeed, power, and fuel loading and to increase the true spiral stability of the airplane.

TN 2485 PILOT ESCAPE FROM SPINNING AIRPLANES AS DETERMINED FROM FREE-SPINNING-TUNNEL TESTS, Stanley H. Scher, October 1951

Pilot-escape tests have been made for 21 models of different type airplanes spinning in the Langley 20-foot free-spinning tunnel. A model of the pilot was released from both the inboard and outboard sides of the cockpit during both steep and flat spins and the motion of the pilot relative to the airplane was observed. For the types of airplanes covered by this investigation, analysis indicates that the centrifugal force which would act on a pilot during a spin would probably not prevent him from leaving the cockpit. Procedures for bailing out of a cockpit (located in various positions) are given.

TN 2569 A SUMMARY OF METEOROLOGICAL CONDITIONS ASSOCIATED WITH AIRCRAFT ICING AND A PROPOSED METHOD OF SELECTING DESIGN CRITERIONS FOR ICE-PROTECTION EQUIPMENT, Paul T. Hacker and Robert G. Dorsch, November 1951

Data from various sources on the observed values of meteorological variables, liquid-water content, mean-effective droplet size, and temperature, which are pertinent to aircraft icing, are summarized; and a method is proposed for the selection of design criterions for ice prevention equipment. Data is divided into 2 broad cloud types, stratiform and cumulform. The data are summarized in such a manner as to give the frequency of occurrence of observed icing conditions according to 2 of the pertinent meteorological variables.

The proposed method of selecting values of liquid-water content and mean-effective droplet diameter as design criterions for ice protection equipment is based upon the collection efficiency of an airfoil as a function of droplet size and the frequency of occurrence of icing situations with various liquid-water contents and mean-effective droplet diameters. The method is illustrated by selecting the design criterions for ice-prevention equipment of a hypothetical airfoil. The majority of the data was collected by the NACA.

TN 2585 CALCULATION OF AERODYNAMIC FORCES ON A PROPELLER IN PITCH OR YAW, John L. Crigler and Jean Gilman, Jr., January 1952

The forces on the propeller blades are calculated first under the assumption that existing propeller theory may be used in conjunction with the instantaneous angles of attack and resultant velocities along the blades of the pitched propeller at successive blade positions around the periphery (steady-state method). The expressions of TN 1326 are used to estimate the changes of the airfoil characteristics in a compressible oscillating flow field. TN 1326 contains equations which are modification of expressions based on linearized theory for calculating the air forces on a two-dimensional thin flat-plate airfoil oscillating in angle of attack in a steady stream in a nonviscous incompressible fluid as developed in TR 496. Calculations are made for 2-blade and 3-blade single-rotating propellers and satisfactory agreement with available experimental data is obtained.

The results from the oscillating-flow theory indicate that the actual forces on the blade are somewhat lower than the values calculated by the steady-state method, particularly at low advance ratios. The turning moment on the shaft of a 2-blade propeller fluctuated between zero and its maximum value twice per revolution. Turning moment on the shaft of the 3-blade propeller remains nearly constant at about 75% of the maximum value attained with the 2-blade propeller.

TN 2591 THE EFFECTS OF REYNOLDS NUMBER ON THE APPLICATION OF NACA 16-SERIES AIRFOIL CHARACTERISTICS TO PROPELLER DESIGN, Harold E. Cleary, January 1952

In order to provide at least a qualitative answer to the question of the validity of applying small scale test data directly to larger scale designs, an analysis has been made of some data available on several NACA 16-series airfoils of both 5- and 12-inch chord. A comparison of this data has additional significance because 12-inch chord is representative of blade widths commonly used on full-scale propellers. The tests were made in the Langley 8-foot high speed tunnel and in the Langley 24-inch high-speed tunnel. The following 16-series airfoils were tested: 16-209, 16-215, 16-509, 16-515, 16-709, and 16-715. The data obtained were lift, drag, and pitching moment. Mach number varied between .2 and .7 and Reynolds Number varied between .6 and 4.0×10^6.

It was concluded that differences of less than 1% in propeller efficiency at or near the design condition will be involved in applying data from 5-inch-chord and 12-inch-chord to full scale propeller design.

TN 2859 THE LANGLEY 2,000-HORSEPOWER PROPELLER DYNANOMETER AND TESTS AT HIGH SPEED OF AN NACA 10-(3)(08)-03 TWO-BLADE PROPELLER, Blake W. Corson, Jr., and Julian D. Maynard, December 1952

The primary purpose of this investigation is to determine the effects of the propeller design parameters and compressibility upon propeller performance at high speed. [Both induced drag and profile drag losses are reduced to a minimum for the design condition (NACA 16 series airfoil section and blade angle at 7/10 radius was 45°)].

The results of these tests and comparisons with results obtained from a theoretical analysis and from previous tests made in other wind tunnels led to the following conclusions:

1. The two blade NACA 10-(3)(08)-03 propeller is very efficient at speeds where the adverse effects of compressibility are small. The maximum efficiency of 0.93, which was obtained over a range of advance ratio from 1.3 to 2.0 for a constant rotational speed of 1,350 revolutions per minute, reflects the importance of designing for a minimum induced energy loss loading and the use of efficient airfoil sections from the spinner surface to the propeller tip.

2. When the helical tip Mach number is increased from 0.90 to 1.15, the corresponding loss in propeller efficiency is about 21% at a blade angle of 45°.

There is a good agreement between experimental results and results obtained from a strip theory analysis, and from previous tests made in other wind tunnels.

Equations and procedure used in making the strip theory analysis of this propeller are presented in an appendix.

TN 2881 AERODYNAMIC CHARACTERISTICS OF A TWO BLADE NACA 10-(3)(062)-045 PROPELLER AND OF A TWO BLADE NACA 10-(3)(08)-045 PROPELLER, William Solomon, January 1953

The main purpose of this investigation is to determine the influence upon propeller performance of propeller design factor (blade section thickness ratio) and compressibility.

The propeller with the thinner airfoil section over the outboard portion of the blade has lower losses of maximum efficiency (the difference amounting to about 5% at a helical tip Mach number of 1.10) caused by compressibility because airfoil section data show that thin sections maintain their lift to higher Mach numbers than the thick sections.

Reference 1
Stack, John: Tests of Airfoil Designed to Delay the Compressibility Burble. NACA Rep. 763, 1943. (Supersedes NACA TN 976)

TN 2923 STUDY OF MOTION OF MODEL OF PERSONAL-OWNER OR LIAISON AIRPLANE THROUGH THE STALL AND INTO THE INCIPIENT SPIN BY MEANS OF A FREE-FLIGHT TESTING TECHNIQUE, Ralph W. Stone, Jr., William G. Garner, and Lawrence J. Gale, April 1953

More than half of the airplane accidents studied are the result of entry into an incipient spin the recovery from which is quite different from that associated with the fully developed spin and recovery. The result showed that the model became unstalled in inverted flight after its initial rotation of substantially 180° in roll. Since the rates of rotation were low, it may be inferred that termination of the incipient spin would be most readily obtained by proper control movements at this point.

TN 2962 EFFECT OF ICE AND FROST FORMATIONS ON DRAG OF NACA 65_1-212 AIRFOIL FOR VARIOUS MODES OF THERMAL ICE PROTECTION, Vernon H. Gray and Uwe H. von Glahn, June 1953

The effects of primary and runback icing and frost formations on the drag of an 8-foot-chord NACA 65_1-212 airfoil section were investigated over a range of angles of attack from 2° to 8° and airspeeds up to 260 mph for icing conditions with liquid-water contents ranging from 0.25 to 1.4 grams per cubic meter and datum air temperatures of -30° to 30° F. The results showed that glaze-ice formations, either primary or runback, on the upper surface near the leading edge of the airfoil caused large and rapid increases in drag, especially at datum air temperatures approaching 32° F and in the presence of high rates of water catch. Ice formations at lower temperatures (rime ice) did not appreciably increase the drag coefficient over the initial (standard roughness) drag coefficient. Cyclic de-icing of the primary ice formations on the airfoil leading-edge section permitted the drag coefficient to return almost to the bare airfoil drag value. Runback icing on the lower surface did not present a serious drag problem except when heavy spanwise ridges of runback ice occurred aft of the heatable area. Front formations caused rapid and large increases in drag with incipient stalling of the airfoil.

TN 2996 APPRAISAL OF HAZARDS TO HUMAN SURVIVAL IN AIRPLANE CRASH FIRES, Gerard J. Pesman, September 1953

The factors which affect the survival of human beings in airplane accidents followed by fire were studied by conducting full-scale crashes of transport- and cargo-type airplanes. The time interval during which occupants could escape from a burning airplane was determined by using the time of cabin temperatures and toxic gas concentrations in conjunction with data that define the environmental conditions which can be tolerated by human beings. Other hazardous factors, such as flying detached airplane parts, explosions, and crushing of the airplane structure, were also studied. The models reached speeds of 85 to 95 mph, approximately takeoff speed. The crashes simulated a take-off accident in which the likelihood of serious fire was high but the structural damage was moderate.

Thermal Injury

Of the various injuries that result from the exposure of human beings to abnormal temperature conditions, only skin injury and respiratory system damage were considered. The following toxic gases were encountered and studied: carbon monoxide, carbon dioxide, aldehydes, fuel fumes, and smoke as well as general oxygen deficiency.

Escape Times

Graphs are given showing histories of the ambient and calorimeter temperatures in passenger and crew compartments during various crashes together with escape times as determined by criteria listed in the report. Pain and second degree escape times are indicated as well as pertinent data concerning type of airplane, type of fuel, and wind velocity. The effect of insulation was studied and thermal escape time for insulated enclosure was about 8 minutes, whereas for uninsulated enclosure the escape time was 8½ minutes. These escape times show that glass wool insulation will not increase the escape time and may decrease it. Lower volability fuel was found to increase escape time some but results indicate that increasing initial fuel temperature decreases the escape time advantage of lower volability fuel.

Escape Avenues

In general, the avenues through which escape would be possible and the time interval during which these avenues remain open are determined by 3 major factors:

a. The circumstances of fuel spillage, which in turn, determine whether one or both sides of the airplane are involved in fire, the location of fire with respect to fuselage, and whether the fire receives a strong initial impetus or builds up gradually.

b. The design of the airplane, which determines the location of the bulk of fuel with respect to the occupants.

c. The wind direction with respect to the fire and fuselage.

The hazards resulting from detached propeller parts, landing gear parts, explosions, floor-structure damage, and lateral collapse of fuselage were considered.

The following results were indicated:

1. For severe crash fires, survival times are limited by pain and skin burning to about 50 to 300 seconds.

2. Hazards of skin burning, respiratory injury and toxic gases do not vary significantly.

3. Propeller fragments would have reduced chance of entering fuselage if rotating blades moved away from fuselage in their travel below the axis of rotation.

TN 3130 A PROCEDURE FOR THE DESIGN OF AIR-HEATED ICE-PREVENTION SYSTEMS, Carr B. Neel, June 1954

This report was prepared originally as one of a series of lectures presented at the Airplane Icing Information Course sponsored by the University of Michigan, 1953. This paper included the following:

1. Design procedure for wing and tail surfaces.
2. Design procedure for windshields.
3. Design procedure for raddmes.
4. Comments on the design of other components of the thermal system (propellers, air inlets and scoops, air ducts, and heat exchangers).

Required heat transfer and air pressure loss equations are presented, and methods of selecting appropriate meteorological conditions for flight over specified geographical areas and for the calculation of water drop impingement characteristics are suggested.

Theory of electrical analogy for the simulation of heat flow, practical design considerations for an analog, and a comparison of calculated and measured results using an electric model is presented in Appendix B.

TN 3134 A METHOD FOR ESTIMATING VARIATIONS IN THE ROOTS OF THE LATERAL-STABILITY QUARTIC DUE TO CHANGES IN MASS AND AERODYNAMIC PARAMETERS OF AN AIRPLANE, Ordway B. Gates, Jr., and C. H. Woodling, January 1954

The purpose of this investigation is to derive expressions from which the approximate variation of the roots of the lateral-stability characteristic-quartic equation due to small changes in one or more of the airplane parameters can be calculated. The airplane parameters considered are mass and aerodynamic parameters. The stability quartic comes from forming the determinant from the lateral nondimensional linearized airplane equations of motion for level flight and setting the characteristic equation equal to zero. The method that is developed here is applied to 3 high-speed airplanes. The coefficients of the stability quartic have been shown to be functions of the various mass and aerodynamic parameters of an airplane.

If the stability equation is expressed as

$$F(\lambda) = A\lambda^4 + B\lambda^3 + C\lambda^2 + D\lambda + E = 0$$

where λ = root

A, B, C, D, E = coefficients defined in report.

And if $x_1, x_2, x_3, \ldots x_i$ are the mass and aerodynamic parameters considered then

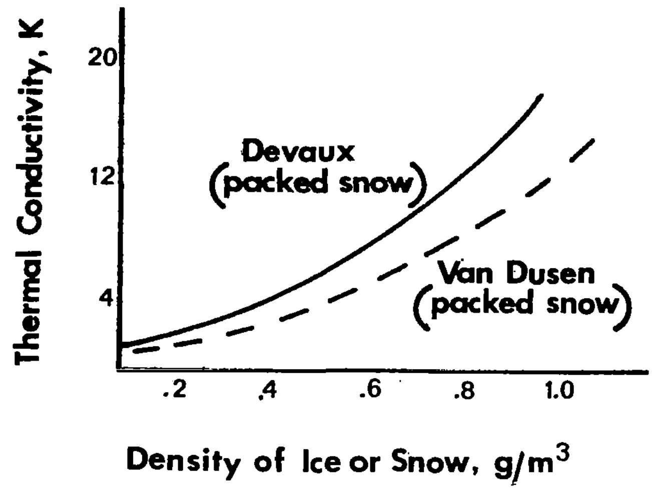
$$\frac{\partial\lambda}{\partial x_i} = -\frac{\frac{\partial A}{\partial x_i}\lambda_o^4 + \frac{\partial B}{\partial x_i}\lambda_o^3 + \frac{\partial C}{\partial x_i}\lambda_o^2 + \frac{\partial D}{\partial x_i}\lambda_o + \frac{\partial E}{\partial x_i}}{4A_o\lambda_o^3 + 3B_o\lambda_o^2 + 2C_o\lambda_o + D_o}$$

This general expression is used to determine the change in the roots of the stability equation with respect to a change in a certain variable (airplane parameter). Simplifications of this slope equation are obtained for the oscillatory root and for C_{n_r} and C_{n_p}. Application of the expressions developed indicated that satisfactory results are obtained for large variations in the ten parameters (C_{l_p}, C_{l_r}, C_{l_β}, C_{n_p}, C_{n_r}, C_{n_β}, C_{y_β}, N, $(K_{x_o})^2$ and $(K_{z_o})^2$ even though the derivation was for small variations.

A method for approximate calculation of the roots of the stability characteristic quartic is presented in an appendix.

TN 3143 EXPERIMENTAL DETERMINATION OF THERMAL CONDUCTIVITY OF LOW-DENSITY ICE, Willard D. Coles, March 1954

Values of the thermal conductivity of low density ice formed by a condensation process on a cold surface have been determined. The data show good agreement with the equation of van Dusen and Devaux for the thermal conductivity of packed snow as a function of the snow density.



TN 3182 MANUAL OF THE ICAO STANDARD ATMOSPHERE. CALCULATIONS BY THE NACA, May 1954

NACA has calculated the tables and prepared the figures of a standard atmosphere based upon the text of the "MANUAL OF THE ICAO STANDARD ATMOSPHERE," International Civil Aviation Organization (ICAO) draft of December 1952. Detailed tables of pressures and densities are given for altitudes up to 20,000 meters and to 65,000 feet. This standard atmosphere supersedes the tables and figures of NACA Report 218, "Standard Atmosphere--Tables and Data," by Walter S. Diehl.

The following are included:

1. Temperature, pressure, and density as functions of altitude.
2. Specific weight, viscosity, kinematic viscosity, and sound speed as functions of altitude.
3. Altitude in geopotential meters as a function of pressure in millibars.
4. Altitude in geopotential meters as a function of pressure in millimeters of mercury.
5. Temperature, pressure, and density, pressure ratio and density ratio against altitude.
6. Specific weight, viscosity, kinematic viscosity, sound speed and sound speed ratio against altitude.

The equations representing the relationship between meteorological and physical quantities satisfying the ICAO standard atmosphere deduced on the basis of established meterological and physical theory. The basic data and conversion factors used are in accord with latest authoritative values. Tables and figures are shown in metric and English units.

TN 3531 PILOT'S LOSS OF ORIENTATION IN INVERTED SPINS, Stanley H. Scher, October 1955

The nature of inverted spins, the optimum control technique for recovery, and some of the apparent reasons for pilot's loss of orientation are discussed.

A pilot in an inverted spin should attempt to orient himself with respect to direction of turn by referring to the airplane rate of turn indicator in order to determine properly the direction of the yawing component of the total spin rotation. Then, optimum recovery from the inverted spin should be obtainable by use of the following control technique. The rudder should be rapidly reversed from full with the yawing rotation to full against it while the stick is held full forward and laterally natural; shortly thereafter, the stick should be moved from full forward to full back.

TN 3564 EFFECT OF PNEUMATIC DE-ICERS AND ICE FORMATIONS ON AERODYNAMIC CHARACTERISTICS OF AN AIRFOIL, Dean T. Bowden, February 1956

Ice formations on aircraft wings can be removed by heating the surfaces, by mechanical removal system or by chemical means. This report is concerned with the pneumatic boot mechanical de-icing system. Two types of pneumatic de-icers (spanwise and chordwise de-icer boots) are considered. The objectives of the investigation were to determine the effects of (1) primary and residual ice formations on airfoil lift, drag, and pitch, (2) boat installation and inflation on airfoil lift and drag, and (3) various cycles, sequences, and method of de-icer operation on airfoil drag. The drag increase was found to vary almost directly with spoiler height and the local air velocity over the bare airfoil. Ice remaining after inflation of spanwise tube de-icer increased airfoil section drag 7 to 37 percent for 0^{o} to 4.6^{o} angle of attack over the speed ranges of airspeed, total air temperature, liquid water content, and cycle time covered. Drag increases due to ice remaining on the chordwise tube de-icer were similar to those for the spanwise tube de-icer. Minimum airfoil drag in icing was usually obtained with a short de-icing cycle. In dry air, alternate inflation of the spanwise boot increased airfoil drag by 10 to 16 percent. Inflating the chordwise boot had a negligible effect on average airfoil drag.

TN 3774 PROPOSED INITIATING SYSTEM FOR CRASH-FIRE PREVENTION SYSTEMS, Jacob C. Moser and Dugald O. Black, December 1956

The initial system discussed in this report is based upon the use of mechanically simple switches that detect linear movement or contact pressures and avoids the use of initial and frangible switches.

The proposed system can be modified from the arrangement shown in this report to meet the special need of various airplane configuration.

A block diagram showing how initial switch is incorporated into crash fire prevention system for twin engined airplane was shown.

There are two references which described the initiating system in detail (RM E55B11 and RM E52F06).

TN 3775 CRASH INJURY, Gerard J. Pesman and A. Martin Eiband, November 1956

People involved in an airplane crash can be injured by the crash impact or by a fire that may result from the accident. The hazards resulting from the fire were studied in TN 2996, 1953.

Data from full scale experimental airplane crashes were studied in present report to determine how impact injuries occur and how the chance of such injuries occur and how the change of such injuries may be reduced. The following hazards were considered: (1) being crushed, (2) being struck by missiles, (3) striking objects by tearing loose or flailing about, and (4) being injured by the sudden deceleration of a crash impact.

Transport, cargo, fighter, and light airplane crashes were studied.

The hazards of flying propeller parts and the front land gear can be circumvented by placing unoccupied compartments in the path of these missiles. Airplanes whose forward compartments can bend upward when the belly strikes the ground in a crash and so avoid being crushed between the main bulk of the airplane and the ground, and those lower structure can tear free along the floor line so that compartments are not pulled down under the sliding bulk, are less likely to crush the occupants.

TN 3946 DITCHING INVESTIGATIONS OF DYNAMIC MODELS AND EFFECTS OF DESIGN PARAMETERS ON DITCHING CHARACTERISTICS, Lloyd J. Fisher and Edward L. Hoffman, February 1957

The effects of design parameters on the ditching characteristics of airplanes, based on scale-model investigations and on reports of full-scale ditchings, are discussed. Various ditching aids are also discussed as a means of improving ditching behavior. 37 tables are given showing the results of model ditching investigations. The information in these tables is based on calm water ditching tests. The following design parameters were considered: Wing, Flaps, Engine installation, Tail Surfaces, Landing Gear, Fuselage Strength, Fuselage Shape, Size, Interior Arrangement, Protuberances (under wing and fuselage) as well as the safe location of personnel. The use of three different ditching aids was considered (Hydroflap, Hydrofoil, Hydro-ski). The types of aircraft tested appear to be primarily bombers, fighters, and transport planes.

On the basis of this investigation it appears possible to reduce ditching hazards by some attention to the effects of design parameters (possibly without too much effect on performance).

TN 3984 STATISTICAL STUDY OF AIRCRAFT ICING PROBABILITIES AT THE 700- AND 500-MILLIBAR LEVELS OVER OCEAN AREAS IN THE NORTHERN HEMISPHERE, Porter J. Perkins, William Lewis, and Donald R. Mulholland, May 1957

The main purpose of this report is to obtain extensive icing statistics relevant to aircraft design and operation. The data recorded provide reliable statistics on icing encounters for the specific areas, altitudes, and seasons. The results show that aircraft operators can expect icing probabilities to vary widely throughout the year from zero in the cold Arctic areas in winter up to 7 percent in areas where greater cloudiness and warmer temperatures prevail. The data also reveal a general tendency of colder cloud temperatures to reduce the probabilities of icing in equally cloudy conditions.

TN 4024 APPRAISAL OF THE HAZARDS OF FRICTION-SPARK IGNITION OF AIRCRAFT CRASH FIRES, John A. Campbell, May 1957

A study was made to determine if common aircraft metals produce friction sparks capable of igniting combustibles that might be spilled in an airplane crash. Samples of aluminum, titanium, magnesium, chromemolybdenum steel, and stainless steel were dragged over both concrete and asphalt runways while a combustible mixture of gasoline, JP-4 fuel, kerosene, or preheated oil was sprayed around the sample.

No ignitions occurred from sliding aluminum at bearing pressure up to 1455 pounds per square inch and slide speeds up to 40 miles per hour. It is believed that aluminum would not be an ignition source even at higher bearing pressures and slide speeds. An asphalt runway is slightly safer with respect to friction sparks from some metals, some fuel when spilled may dissolve the asphalt; and, if an ignition did occur, the asphalt would add fuel to the fire. Titanium instantly ignited the fuel mists at low slide speeds and bearing pressures. Magnesium, chromemolybdenum steel, and stainless steel usually had to be preheated by being dragged over the runway for a short distance before they produced sparks that would ignite the fuel mists. Fuels of low volatility may be slightly safer with respect to friction spark ignitions than fuels of high volatility.

TN 4158 ACCELERATIONS IN TRANSPORT-AIRPLANE CRASHES, G. Merritt Preston and Gerard J. Pesman, February 1958

A study of crash-impact survival in light airplanes is reported in TN 2991 and NACA Technical Film No. 25, and a similar study for fighter airplanes is reported in NACA RM E57G11. This report discussed crash-impact survival in transport airplanes. The data for this investigation were obtained by crashing 3 full-scale airplanes; (1) a pressurized low-wing transport, (2) unpressurized low-wing transport, and (3) high wing unpressurized transport.

Some results that might be applicable to light airplanes:

1. During unflared-landing crashes greater fuselage crushing will occur with high wing than with low wing airplanes.

2. Airplanes with strong fuselage structures that do not deform and produce sharp, well-supported plowing edges will have relatively low longitudinal acceleration during crashes similar to those studied.

3. Normal accelerations are greatest near the point of impact of the airplane with the ground.

4. Normal accelerations exceeding human tolerance without injury can occur in crashes in which modest fuselage damage occurs.

5. The configurations of the airplane had little effect on the normal accelerations measured in this study.

Graphs and sequence pictures of simulated crashes are presented.

NACA Technical Notes Dealing with Stability and Control But Not Judged Applicable to Light Aircraft

TN 747 PROPELLER ROTATION NOISE DUE TO TORQUE AND THRUST, Arthur F. Deming, January 1940

TN 748 PRINCIPLES, PRACTICE, AND PROGRESS OF NOISE REDUCTION IN AIRPLANES, Albert London, January 1940

TN 764 FLIGHT INVESTIGATION OF CONTROL STICK VIBRATION OF THE YG-1B AUTO GIRO, F. J. Bailey, Jr., June 1940

TN 769 SPIN TESTS OF LOW-WING MONOPLANE IN FLIGHT AND IN THE FREE-SPINNING WIND TUNNEL, Oscar Seidman and William H. McAvoy, July 1940

TN 775 ANALYSIS OF WIND-TUNNEL DATA ON DIRECTIONAL STABILITY AND CONTROL, H. R. Pass, September 1940

TN 783 A FLIGHT INVESTIGATION OF EXHAUST-HEAT DE-ICING, Lewis A. Rodert and Alun R. Jones, November 1940

TN 785 WIND-TUNNEL INVESTIGATION OF FUSELAGE STABILITY IN YAW WITH VARIOUS ARRANGEMENTS OF FINS, H. Page Hoggard, Jr., November 1940

TN 799 THE EFFECTS OF AERODYNAMIC HEATING ON ICE FORMATIONS ON AIRPLANE PROPELLERS, Lewis A. Rodert, March 1941

TN 803 SOME EFFECTS OF RAINFALL ON FLIGHT OF AIRPLANES AND ON INSTRUMENT INDICATIONS, Richard V. Rhode, April 1941

TN 807 SPIN TESTS OF A LOW-WING MONOPLANE TO INVESTIGATE SCALE EFFECT IN THE MODEL TEST RANGE, Charles J. Donlan, May 1941

TN 809 THE THEORETICAL LATERAL MOTIONS OF AN AUTOMATICALLY CONTROLLED AIRPLANE SUBJECTED TO A YAWING-MOMENT DISTURBANCE, Frederick H. Imlay, June 1941

TN 810 PRELIMINARY STABILITY AND CONTROL TESTS IN THE NACA FREE-FLIGHT WIND TUNNEL AND CORRELATION WITH FULL-SCALE FLIGHT TESTS, Joseph A. Shortal and Clayton J. Osterhout, June 1941

TN 814 EFFECT OF SOME PRESENT-DAY AIRPLANE DESIGN TRENDS ON REQUIREMENTS FOR LATERAL STABILITY, Millard J. Bamber, June 1941

TN 825 WIND-TUNNEL INVESTIGATION OF EFFECT OF YAW ON LATERAL-STABILITY CHARACTERISTICS. III - SYMMETRICALLY TAPERED WING AT VARIOUS POSITIONS ON CIRCULAR FUSELAGE WITH AND WITHOUT A VERTICAL TAIL, Isidore G. Recant and Arthur R. Wallace, September 1941

TN 827 ANALYTICAL DETERMINATION OF CONTROL SYSTEM PULLEY-AXIS ANGLES, I. H. Driggs, September 1941

TN 837 NOTES ON THE STABILITY AND CONTROL OF TAILLESS AIRPLANES, Robert T. Jones, December 1941

TN 923 PILOTING OF FLYING BOATS WITH SPECIAL REFERENCE TO PORPOISING AND SKIPPING, James M. Benson, February 1944

TN 936 PLASTIC MOUNTINGS FOR AIRCRAFT WINDSHIELDS, Kathryn H. Bradley and B. M. Axilrod, May 1944

TN 960 FORCE AND MOMENT COEFFICIENTS FOR A THIN AIRFOIL WITH FLAP AND TAB IN A FORM USEFUL FOR STABILITY AND CONTROL CALCULATIONS, Roland J. White and Dean G. Klampe, January 1945

TN 976 TESTS OF AIRFOILS DESIGNED TO DELAY THE COMPRESSIBILITY BURBLE, John Stack, December 1944

TN 1001 LIGHTING DISCHARGES TO AIRCRAFT AND ASSOCIATED METEOROLOGICAL CONDITIONS, L. P. Harrison, May 1946

TN 1025 A GENERAL METHOD OF SELECTING FOAM INHIBITORS, J. V. Robinson and W. W. Woods, May 1946

TN 1046 PRELIMINARY WIND-TUNNEL INVESTIGATION AT LOW SPEED OF STABILITY AND CONTROL CHARACTERISTICS OF SWEPT-BACK WINGS, William Letko and Alex Goodman, April 1946

TN 1052 WIND-TUNNEL INVESTIGATION OF EFFECT OF CANOPIES ON DIRECTIONAL STABILITY CHARACTERISTICS OF A SINGLE-ENGINE AIRPLANE MODEL, Robert MacLachlan and Joseph Levitt, May 1946

TN 1056 THE EFFECTS OF VARIOUS PARAMETERS ON THE LOAD AT WHICH SPRAY ENTERS THE PROPELLERS OF A FLYING BOAT, John R. Dawson and Robert C. Walter, May 1946

TN 1060 AN INVESTIGATION OF ADDITIONAL REQUIREMENTS FOR SATISFACTORY ELEVATOR CONTROL CHARACTERISTICS, William H. Phillips, June 1946

TN 1076 A SIMPLIFIED METHOD FOR DETERMINING FROM FLIGHT DATA THE RATE OF CHANGE OF YAWING-MOMENT COEFFICIENT WITH SIDESLIP, Robert C. Bishop and Harvard Lomax, June 1946

TN 1080 SUMMARY AND ANALYSIS OF DATA ON DAMPING IN YAW AND PITCH FOR A NUMBER OF AIRPLANE MODELS, William E. Cotter, Jr., May 1946

TN 1088 INFLUENCE OF LARGE AMOUNTS OF WING SWEEP ON STABILITY AND CONTROL PROBLEMS OF AIRCRAFT, Hartley A. Soule, June 1946

TN 1091 AN ANALYSIS OF THE MAIN SPRAY CHARACTERISTICS OF SOME FULL SIZE MULTI-ENGINE FLY BOATS, F. W. S. Locke, Jr., July 1946

TN 1093 EFFECT OF SWEEPBACK AND ASPECT RATIO ON LONGITUDINAL STABILITY CHARACTERISTICS OF WINGS AT LOW SPEEDS, Joseph A. Shortal and Bernard Maggin, July 1946

TN 1094 EXPERIMENTAL DETERMINATION OF THE EFFECTS OF DIHEDRAL, VERTICAL-TAIL AREA, AND LIFT COEFFICIENT ON LATERAL STABILITY AND CONTROL CHARACTERISTICS, Marion O. McKinney, Jr., July 1946

TN 1104 EXPERIMENTAL DETERMINATION OF THE EFFECTS OF DIRECTIONAL STABILITY AND ROTARY DAMPING IN YAW ON LATERAL STABILITY AND CONTROL CHARACTERISTICS, Hubert M. Drake, July 1946

TN 1111 INVESTIGATION OF THE EFFECT OF A TIP MODIFICATION AND THERMAL DE-ICING AIR FLOW ON PROPELLER PERFORMANCE, Blake W. Corson, Jr., and Julian D. Maynard, July 1946

TN 1112 ANALYSIS OF PROPELLER EFFICIENCY LOSSES ASSOCIATED WITH HEATED-AIR THERMAL DE-ICING, Blake W. Corson, Jr., and Julian D. Maynard, July 1946

TN 1123 LATERAL-CONTROL CHARACTERISTICS OF VARIOUS SPOILER ARRANGEMENTS AS MEASURED IN FLIGHT, J. Richard Spahr, January 1947

TN 1145 THE PROBLEM OF NOISE REDUCTION WITH REFERENCE TO LIGHT AIRPLANES Theodore Theodorsen and Arthur A. Regier, August 1946

TN 1146 TESTS TO DETERMINE EFFECTS OF SLIPSTREAM ROTATION ON THE LATERAL STABILITY CHARACTERISTICS OF A SINGLE-ENGINE LOW-WING AIRPLANE MODEL, Paul E. Purser and Margaret F. Spear, September 1946

TN 1178 A FLIGHT INVESTIGATION OF THE THERMAL PERFORMANCE OF AN AIR-HEATED PROPELLER, John F. Darsow and James Selna, April 1947

TN 1188 FLIGHT MEASUREMENTS OF THE LATERAL CONTROL CHARACTERISTICS OF NARROW-CHORD AILERONS ON THE TRAILING EDGE OF A FULL-SPAN SLOTTED FLAP, Richard H. Sawyer, February 1947

TN 1192 CHARTS SHOWING RELATIONS AMONG PRIMARY AERODYNAMIC VARIABLES FOR HELICOPTER-PERFORMANCE ESTIMATION, Herbert W. Talkin, February 1947

TN 1193 EFFECT OF PRODUCT OF INERTIA ON LATERAL STABILITY, Leonard Stunfield, March 1947

TN 1208 INVESTIGATION OF STABILITY AND CONTROL CHARACTERISTICS OF AN AIRPLANE MODEL WITH SKEWED WING IN THE LANGLEY FREE-FLIGHT TUNNEL, John P. Campbell and Hubert M. Drake, May 1947

TN 1224 FLIGHT TESTS OF A DOUBLE-HINGED HORIZONTAL TAIL SURFACE WITH REFERENCE TO LONGITUDINAL-STABILITY AND CONTROL CHARACTERISTICS, Carl M. Hanson and Seth B. Anderson, May 1947

TN 1229 FREQUENCY-RESPONSE METHOD FOR DETERMINATION OF DYNAMIC STABILITY CHARACTERISTICS OF AIRPLANES WITH AUTOMATIC CONTROLS, Harry Greenberg, March 1947

TN 1235 AN INVESTIGATION OF A THERMAL ICE-PREVENTION SYSTEM FOR A CARGO AIRPLANE. VIII - METALLURGICAL EXAMINATION OF THE WING LEADING-EDGE STRUCTURE AFTER 225 HOURS OF FLIGHT OPERATION OF THE THERMAL SYSTEM, Maxwell Harris and Bernard A. Schlaff, April 1947

TN 1237 TANK INVESTIGATION OF A POWERED DYNAMIC MODEL OF A LARGE LONG-RANGE FLYING BOAT - LANGLEY TANK MODEL 180, John B. Parkinson, Roland E. Olson, and Marvin I. Haar, March 1947

TN 1246 WIND-TUNNEL INVESTIGATION OF ICING OF AN ENGINE COOLING-FAN INSTALLATION, Jame P. Lewis, April 1947

TN 1250 EFFECT OF BLADE STALLING ON THE EFFICIENCY OF A HELICOPTER ROTOR AS MEASURED IN FLIGHT, F. B. Gustafson and Alfred Gessow, April 1947

TN 1253 COMPARISON OF DESIGN SPECIFICATIONS WITH THE ACTUAL STATIC TRANSVERSE STABILITY OF 25 SEAPLANES, Arthur W. Carter, April 1947

TN 1256 EFFECT OF 40° SWEEPBACK ON THE SPIN AND RECOVERY CHARACTERISTICS OF A 1/25-SCALE MODEL OF A TYPICAL FIGHTER-TYPE AIRPLANE AS DETERMINED BY FREE-SPINNING-TUNNEL TESTS, Stanley H. Scher, April 1947

TN 1260 FLIGHT INVESTIGATION OF THE EFFECTS ON AIRPLANE STATIC LONGITUDINAL STABILITY OF A BUNGEE AND ENGINE-TILT MODIFICATIONS, George A. Rathert, Jr., May 1947

TN 1278 EXPERIMENTAL DETERMINATION OF THE DAMPING IN ROLL AND AILERON ROLLING EFFECTIVENESS OF THREE WINGS HAVING 2°, 42°, AND 62° SWEEPBACK, Charles V. Bennett and Joseph L. Johnson, May 1947

TN 1282 SOME CONSIDERATIONS OF THE LATERAL STABILITY OF HIGH-SPEED AIRCRAFT, Leonard Sternfield, May 1947

TN 1284 INVESTIGATION AT LOW SPEED OF THE LONGITUDINAL STABILITY CHARACTERISTICS OF A 60° SWEPT-BACK TAPERED LOW-DRAG WING, John G. Lowry and Leslie E. Schneiter, May 1947

TN 1286 LOW-SPEED STABILITY AND DAMPING-IN-ROLL CHARACTERISTICS OF SOME HIGHLY SWEPT WINGS, Bernard Maggin and Charles V. Bennett, May 1947

TN 1294 INVESTIGATION OF EFFECT OF SPAN, SPANWISE LOCATION, AND CHORDWISE LOCATION OF SPOILERS ON LATERAL CONTROL CHARACTERISTICS OF A TAPERED WING, Jack Fischel and Vito Tamburello, May 1947

TN 1298 EFFECT OF SPOILER-TYPE LATERAL-CONTROL DEVICES ON THE TWISTING MOMENTS OF A WING OF NACA 230-SERIES AIRFOIL SECTIONS, James E. Fitzpatrick and G. Chester Furlong, May 1947

TN 1309 CORRELATION OF TWO EXPERIMENTAL METHODS OF DETERMINING THE ROLLING CHARACTERISTICS OF UNSWEPT WINGS, Robert MacLachlan and William Letko, May 1947

TN 1327 WIND-TUNNEL INVESTIGATION OF THE EFFECT OF POWER AND FLAPS ON THE STATIC LATERAL CHARACTERISTICS OF A SINGLE-ENGINE LOW-WING AIRPLANE MODEL, Vito Tamburello and Joseph Weil, June 1947

TN 1339 WIND-TUNNEL INVESTIGATION OF THE EFFECT OF POWER AND FLAPS ON THE STATIC LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS OF A SINGLE-ENGINE HIGH-WING AIRPLANE MODEL, John R. Hagerman, July 1947

TN 1354 COMPARISON OF SOUND EMISSION FROM TWO-BLADE, FOUR-BLADE, AND SEVEN-BLADE PROPELLERS, Chester W. Hicks and Harvey H. Hubbard, July 1947

TN 1358 PROPELLER-LOUDNESS CHARTS FOR LIGHT AIRPLANES, Harvey H. Hubbard and Arthur A. Regier, July 1947

TN 1359 EXPERIMENTAL VERIFICATION OF THE RUDDER-FREE STABILITY THEORY FOR AN AIRPLANE MODEL EQUIPPED WITH A RUDDER HAVING POSITIVE FLOATING TENDENCIES AND VARIOUS AMOUNTS OF FRICTION, Bernard Maggin, July 1947

TN 1370 CORRELATION OF EXPERIMENTAL AND CALCULATED EFFECTS OF PRODUCT OF INERTIA ON LATERAL STABILITY, Marion O. McKinney, Jr., and Hubert M. Drake, July 1947

TN 1379 WIND-TUNNEL INVESTIGATION OF THE EFFECT OF POWER AND FLAPS ON THE STATIC LATERAL STABILITY AND CONTROL CHARACTERISTICS OF A SINGLE-ENGINE HIGH-WING AIRPLANE MODEL, John R. Hagerman, July 1947

TN 1400 HINGE-MOMENT CHARACTERISTICS OF BALANCED ELEVATOR AND RUDDER FOR A SPECIFIC TAIL CONFIGURATION ON A FUSELAGE IN SPINNING ATTITUDES, Ralph W. Stone, Jr., and Sanger M. Burk, Jr., August 1947

TN 1438 EFFECT OF SIMULATED SERVICE CONDITIONS ON PLASTICS DURING ACCELERATED AND 2-YEAR WEATHERING TESTS, W. A. Crouse, D. C. Caudill, and F. W. Reinhart, May 1948

TN 1441 COMPARISON OF THE CONTROL-FORCE CHARACTERISTICS OF TWO TYPES OF LATERAL-CONTROL SYSTEM FOR LARGE AIRPLANES, Owen J. Peters, September 1947

TN 1450 (PART XXVI) AN INVESTIGATION OF AIRCRAFT HEATERS, L. M. K. Boelter, E. R. Dempster, R. Bromberg, and J. T. Gier, July 1948

TN 1451 (PART XXVII) AN INVESTIGATION OF AIRCRAFT HEATERS, L. M. K. Boelter, G. Young, and H. W. Iversen, July 1948

TN 1452 (PART XXVIII) AN INVESTIGATION OF AIRCRAFT HEATERS, L. M. K. Boelter, F. E. Romie, A. G. Guibert, and M. A. Miller, August 1948

TN 1453 (PART XXIX) AN INVESTIGATION OF AIRCRAFT HEATERS, L. M. K. Boelter, L. M. Grossman, R. C. Martinelli, and E. H. Morrin, October 1948

TN 1454 (PART XXX) AN INVESTIGATION OF AIRCRAFT HEATERS, L. M. K. Boelter, H. Poppendiek, G. Young, and J. R. Andersen, January 1949

TN 1455 (PART XXXI) AN INVESTIGATION OF AIRCRAFT HEATERS, L. M. K. Boelter, A. G. Guibert, F. E. Romie, V. D. Sanders, and J. M. Rademacher, July 1949

TN 1468 LOW-SPEED STATIC STABILITY AND DAMPING-IN-ROLL CHARACTERISTICS OF SOME SWEPT AND UNSWEPT LOW-ASPECT-RATIO WINGS, Louis P. Tosti, October 1947

TN 1478 WIND-TUNNEL INVESTIGATION OF THE STABILITY AND CONTROL CHARACTERISTICS OF A COMPLETE MODEL EQUIPPED WITH A VEE TAIL, Edward C. Polhamus and Robert J. Moss, November 1947

TN 1494 A METHOD FOR ESTIMATING HEAT REQUIREMENTS FOR ICE PREVENTION ON GAS-HEATED HOLLOW PROPELLER BLADES, V. H. Gray and R. G. Campbell, December 1947

TN 1511 FLIGHT MEASUREMENTS OF THE LATERAL AND DIRECTIONAL STABILITY AND CONTROL CHARACTERISTICS OF AN AIRPLANE HAVING A 35° SWEPTBACK WING WITH 40-PERCENT-SPAN SLOTS AND A COMPARISON WITH WIND-TUNNEL DATA, S. A. Sjoberg and J. P. Reeder, January 1948

TN 1541 THE EFFECT OF WING BENDING DEFLECTION ON THE ROLLING MOMENT DUE TO SIDESLIP, Powell M. Lovell, Jr., February 1948

TN 1548 THE DAMPING DUE TO ROLL OF TRIANGULAR, TRAPEZOIDAL, AND RELATED PLAN FORMS IN SUPERSONIC FLOW, Arthur L. Jones and Alberta Alksne, March 1948

TN 1554 APPLICATION OF THE LINEARIZED THEORY OF SUPERSONIC FLOW TO THE ESTIMATION OF CONTROL-SURFACE CHARACTERISTICS, Charles W. Frick, Jr., March 1948

TN 1562 CALIBRATION OF ALTIMETERS UNDER PRESSURE CONDITIONS SIMULATING DIVES AND CLIMBS, Daniel P. Johnson, March 1948

TN 1566 DAMPING IN PITCH AND ROLL OF TRIANGULAR WINGS AT SUPERSONIC SPEEDS, Clinton E. Brown and Mac C. Adams, April 1948

TN 1572 STABILITY DERIVATIVES OR TRIANGULAR WINGS AT SUPERSONIC SPEEDS, Herbert S. Ribner and Frank S. Malvestuto, Jr., May 1948

TN 1581 APPROXIMATE RELATIONS AND CHARTS FOR LOW-SPEED STABILITY DERIVATIVES OF SWEPT WINGS, Thomas A. Toll and M. J. Queijo, May 1948

TN 1586 INVESTIGATION OF EFFECTIVENESS OF AIR-HEATING A HOLLOW STEEL PROPELLER FOR PROTECTION AGAINST ICING. I - UNPARTITIONED BLADES, Donald R. Mulholland and Porter J. Perkins, May 1948

TN 1587 INVESTIGATION OF EFFECTIVENESS OF AIR-HEATING A HOLLOW STEEL PROPELLER FOR PROTECTION AGAINST ICING. II - 50-PERCENT PARTITIONED BLADES, Porter J. Perkins and Donald R. Mulholland, May 1948

TN 1588 INVESTIGATION OF EFFECTIVENESS OF AIR-HEATING A HOLLOW STEEL PROPELLER FOR PROTECTION AGAINST ICING. III - 25-PERCENT PARTITIONED BLADES, Donald R. Mulholland and Porter J. Perkins, May 1948

TN 1599 AN INVESTIGATION OF A THERMAL ICE-PREVENTION SYSTEM FOR A CARGO AIRPLANE. IX - THE TEMPERATURE OF THE WING LEADING-EDGE STRUCTURE AS ESTABLISHED IN FLIGHT, Bernard A. Schlaff and James Selna, June 1948

TN 1627 EFFECT OF STEADY ROLLING ON LONGITUDINAL AND DIRECTIONAL STABILITY, William H. Phillips, June 1948

TN 1647 SOUND-LEVEL MEASUREMENTS OF A LIGHT AIRPLANE MODIFIED TO REDUCE NOISE REACHING THE GROUND, A. W. Vogeley, July 1948

TN 1649 INVESTIGATION OF A 1/7-SCALE POWERED MODEL OF A TWIN-BOOM AIRPLANE AND A COMPARISON OF ITS STABILITY, CONTROL AND PERFORMANCE WITH THOSE OF A SIMILAR ALL-WING AIRPLANE, Gerald W. Brewer and Ralph W. May, Jr., October 1948

TN 1654 SOUND FROM DUAL-ROTATING AND MULTIPLE SINGLE-ROTATING PROPELLERS, Harvey H. Hubbard, July 1948

TN 1658 LATERAL STABILITY AND CONTROL CHARACTERISTICS OF A FREE-FLYING MODEL HAVING AN UNSWEPT WING WITH AN ASPECT RATIO OF 2, Marion D. McKinney, Jr., and Robert E. Shanks, July 1948

TN 1668 INVESTIGATION OF EFFECTS OF GEOMETRIC DIHEDRAL ON LOW-SPEED STATIC STABILITY AND YAWING CHARACTERISTICS OF AN UNTAPERED 45° SWEPTBACK-WING MODEL OF ASPECT RATIO 2.61, M. J. Queijo and Byron M. Jaquet, September 1948

TN 1669 INVESTIGATION AT LOW SPEEDS OF THE EFFECT OF ASPECT RATIO AND SWEEP ON STATIC AND YAWING STABILITY DERIVATIVES, Alex Goodman and Jack D. Brewer, August 1948

TN 1670 APPRECIATION AND PREDICTION OF FLYING QUALITIES, William H. Phillips, August 1948

TN 1671 EFFECT OF TAPER RATIO ON LOW SPEED STATIC AND YAWING STABILITY DERIVATIVES OF 45° SWEPTBACK WINGS WITH ASPECT RATIO OF 2.61, William Letko and John W. Cowan, July 1948

TN 1674 ESTIMATION OF EFFECTIVENESS OF FLAP-TYPE CONTROLS ON SWEPT-BACK WINGS, John G. Lowry and Leslie E. Schneiter, August 1948

TN 1679 FLIGHT MEASUREMENTS OF THE LONGITUDINAL STABILITY, STALLING, AND LIFT CHARACTERISTICS OF AN AIRPLANE HAVING A 35° SWEPTBACK WING WITHOUT SLOTS AND WITH 40-PERCENT-SPAN SLOTS AND A COMPARISON WITH WIND-TUNNEL DATA, S. A. Sjoberg and J. P. Reeder, August 1948

TN 1693 AN ANALYSIS OF THE AIRSPEEDS AND NORMAL ACCELERATIONS OF MARTIN M-130 AIRPLANES IN COMMERCIAL TRANSPORT OPERATION, Walter G. Walker, September 1948

TN 1700 THE ROLLING MOMENT DUE TO SIDESLIP OF TRIANGULAR, TRAPESOIDAL AND RELATED PLAN FORMS IN SUPERSONIC FLOW, Arthur L. Jones, John R. Spreiter, and Alberta Alksne, October 1948

TN 1706 STABILITY DERIVATIVES OF THIN RECTANGULAR WINGS AT SUPERSONIC SPEEDS, Sidney M. Harmon, November 1948

TN 1708 THEORETICAL CHARACTERISTICS IN SUPERSONIC FLOW OF CONSTANT CHORD PARTIAL SPAN CONTROL SURFACES ON RECTANGULAR WINGS HAVING FINITE THICKNESS, Warren A. Tucker and Robert L. Nelson, September 1948

TN 1723 A THEORETICAL INVESTIGATION OF THE EFFECT OF YAWING MOMENT DUE TO ROLLING ON LATERAL OSCILLATORY STABILITY, Joseph L. Johnson and Leonard Sternfield, October 1948

TN 1727 A SIMPLIFIED METHOD FOR THE DETERMINATION AND ANALYSIS OF THE NEUTRAL-LATERAL-OSCILLATORY-STABILITY BOUNDARY, Leonard Sternfield and Ordway B. Gates, Jr., October 1948

TN 1732 CALCULATED EFFECTS OF GEOMETRIC DIHEDRAL ON THE LOW SPEED ROLLING DERIVATIVES OF SWEPT WINGS, M. J. Queijo and Bryon M. Jaquet, October 1948

TN 1738 WIND-TUNNEL INVESTIGATION AT LOW SPEED OF THE LATERAL CONTROL CHARACTERISTICS OF AILERONS HAVING THREE SPANS AND THREE TRAILING-EDGE ANGLES ON A SEMISPAN WING MODEL, Leslie E. Schneiter and Rodger L. Naeseth, November 1948

TN 1742 STABILITY AND CONTROL CHARACTERISTICS AT LOW SPEED OF AN AIRPLANE MODEL HAVING A 38.7° SWEPTBACK WING WITH ASPECT RATIO 4.51, TAPER RATIO 0.54, AND CONVENTIONAL TAIL SURFACES, Vernon E. Lockwood and James M. Watson, December 1948

TN 1743 FLIGHT MEASUREMENTS OF THE STABILITY, CONTROL, AND STALLING CHARACTERISTICS OF AN AIRPLANE HAVING A 35° SWEPTBACK WING WITHOUT SLOTS AND WITH 80-PERCENT-SPAN SLOTS AND A COMPARISON WITH WIND-TUNNEL DATA, S. A. Sjoberg and J. P. Reeder, November 1948

TN 1761 THEORETICAL STABILITY DERIVATIVES OF THIN SWEPTBACK WINGS TAPERED TO A POINT WITH SWEPTBACK OR SWEPTFORWARD TRAILING EDGES FOR A LIMITED RANGE OF SUPERSONIC SPEEDS, Frank S. Malvestuto, Jr., and Kenneth Margolis, February 1949

TN 1766 WIND-TUNNEL INVESTIGATION OF EFFECTS OF TAIL LENGTH ON THE LONGITUDINAL AND LATERAL STABILITY CHARACTERISTICS OF A SINGLE-PROPELLER AIRPLANE MODEL, Harold S. Johnson, December 1948

TN 1769 THE FLEXIBLE RECTANGULAR WING IN ROLL AT SUPERSONIC FLIGHT SPEEDS, Warren A. Tucker and Robert L. Nelson, December 1948

TN 1779 EFFECTS OF ANTISPIN FILLETS AND DORSAL FINS ON THE SPIN AND RECOVERY CHARACTERISTICS OF AIRPLANES AS DETERMINED FROM FREE-SPINNING-TUNNEL TESTS, Lawrence J. Gale and Ira P. Jones, Jr., December 1948

TN 1784 FLIGHT INVESTIGATION IN CLIMB AND AT HIGH SPEED OF A TWO-BLADE AND A THREE-BLADE PROPELLER, Jerome B. Hammack, January 1949

TN 1791 CORROSION TESTS OF A HEATED WING UTILIZING AN EXHAUST-GAS-AIR MIXTURE FOR ICE PREVENTION, George H. Holdaway, January 1949

TN 1798 EFFECT OF THICKNESS OF THE LATERAL FORCE AND YAWING MOMENT OF A SIDESLIPPING DELTA WING AT SUPERSONIC SPEEDS, Kenneth Margolis, January 1949

TN 1799 ON THE FLYING QUALITIES OF HELICOPTERS, John P. Reeder and F. B. Gustafson, January 1949

TN 1811 THE LONGITUDINAL STABILITY OF ELASTIC WINGS AT SUPERSONIC SPEEDS, C. W. Frick and R. S. Chubb, February 1949

TN 1818 EFFECT OF AUTOMATIC STABILIZATION ON THE LATERAL OSCILLATORY STABILITY OF A HYPOTHETICAL AIRPLANE AT SUPERSONIC SPEEDS, Leonard Sternfield, March 1949

TN 1835 INVESTIGATION AT LOW SPEEDS OF THE EFFECT OF ASPECT RATIO AND SWEEP ON ROLLING STABILITY DERIVATIVES OF UNTAPERED WINGS, Alex Goodman and Lewis R. Fisher, March 1949

TN 1850 THE YAWING MOMENT DUE TO SIDESLIP OF TRIANGULAR, TRAPEZOIDAL, AND RELATED PLAN FORMS IN SUPERSONIC FLOW, Arthur L. Jones and Alberta Alksne, April 1949

TN 1854 APPROXIMATE CORRECTIONS FOR THE EFFECTS OF COMPRESSIBILITY ON THE SUBSONIC STABILITY DERIVATIVE OF SWEPT WINGS, Lewis R. Fisher, April 1949

TN 1855 RECOMMENDED VALUES OF METEOROLOGICAL FACTORS TO BE CONSIDERED IN THE DESIGN OF AIRCRAFT ICE-PREVENTION EQUIPMENT, Alun R. Jones and William Lewis, March 1949

TN 1859 A METHOD OF CALCULATING A STABILITY BOUNDARY THAT DEFINES A REGION OF SATISFACTORY PERIOD-DAMPING RELATIONSHIP OF THE OSCILLATORY MODE OF MOTION, Leonard Sternfield and Ordway B. Gates, Jr., April 1949

TN 1860 THEORETICAL LIFT AND DAMPING IN ROLL OF THIN SWEPTBACK WINGS OF ARBITRARY TAPER AND SWEEP AT SUPERSONIC SPEEDS, Frank S. Malestuto, Jr., Kenneth Margolis, and Herbert S. Ribner, April 1949

TN 1862 A SIMPLE METHOD OF ESTIMATING THE SUBSONIC LIFT AND DAMPING IN ROLL OF SWEPTBACK WINGS, Edward C. Polhamus, April 1949

TN 1866 SPIN-TUNNEL INVESTIGATION TO DETERMINE THE EFFECTIVENESS OF A ROCKET FOR SPIN RECOVERY, Anshal I. Neihouse, April 1949

TN 1869 WIND-TUNNEL INVESTIGATION OF THE OPENING CHARACTERISTICS, DRAG, AND STABILITY OF SEVERAL HEMISPHERICAL PARACHUTES, Stanley H. Scher and Lawrence J. Gale, April 1949

TN 1870 FREE-SPACE OSCILLATING PRESSURES NEAR THE TIPS OF ROTATING PROPELLERS, Harvey H. Hubbard and Arthur A. Regier, April 1949

TN 1872 HIGH-LIFT AND LATERAL CONTROL CHARACTERISTICS OF AN NACA 65_2-215 SEMISPAN WING EQUIPPED WITH PLUG AND RETRACTABLE AILERONS AND A FULL-SPAN SLOTTED FLAP, Jack Fischel and Raymond D. Vogler, April 1949

TN 1888 RESPONSE OF A HELICOPTER ROTOR TO OSCILLATORY PITCH AND THROTTLE MOVEMENTS, Paul J. Carpenter and Herbert E. Peitzer, June 1949

TN 1890 THE EFFECT OF TORSIONAL FLEXIBILITY ON THE ROLLING CHARACTERISTICS AT SUPERSONIC SPEEDS OF TAPERED UNSWEPT WINGS, Warren A. Tucker and Robert L. Nelson, June 1949

TN 1892 POSITION ERRORS OF THE SERVICE AIRSPEED INSTALLATIONS OF 10 AIRPLANES, William Gracey, June 1949

TN 1898 EFFECT OF A 90° CROSS WIND ON THE TAKE-OFF DISTANCE OF A LIGHT AIRPLANE EQUIPPED WITH A CROSS-WIND LANDING GEAR, Seth B. Anderson, Burnett L. Gadeberg, and William H. McAvoy, June 1949

TN 1901 A METHOD FOR PREDICTING THE STABILITY IN ROLL OF AUTOMATICALLY CONTROLLED AIRCRAFT BASED ON THE EXPERIMENTAL DETERMINATION OF THE CHARACTERISTICS OF AN AUTOMATIC PILOT, Robert T. Jones and Leonard Sternfield, June 1949

TN 1906 AN ANALYTICAL STUDY OF THE STEADY VERTICAL DESCENT IN AUTO-RATION OF SINGLE-ROTOR HELICOPTERS, A. A. Nikolsky and Edward Seckel, June 1949

TN 1907 AN ANALYSIS OF THE TRANSITION OF A HELICOPTER FROM HOVERING TO STEADY AUTOROTATIVE VERTICAL DESCENT, A. A. Nikolsky and Edward Seckel, June 1949

TN 1924 ESTIMATION OF THE DAMPING IN ROLL OF WINGS THROUGH THE NORMAL FLIGHT RANGE OF LIFT COEFFICIENT, Alex Goodman and Glenn H. Adair, July 1949

TN 1935 METHODS FOR DETERMINING FREQUENCY RESPONSE OF ENGINES AND CONTROL SYSTEMS FROM TRANSIENT DATA, Melvin E. La Verne and Aaron S. Boksenbom, August 1949

TN 1950 DAMPING-IN-ROLL CALCULATIONS FOR SLENDER SWEPT-BACK WINGS AND SLENDER WING-BODY COMBINATIONS, Harvard Lomax and Max. A. Heaslet, September 1949

TN 1960 AN EVALUATION OF THE USE OF GROUND RADAR FOR AVOIDING SEVERE TURBULENCE ASSOCIATED WITH THUNDERSTORMS, J. K. Thompson and V. W. Lipscomb, October 1949

TN 1964 METHOD FOR DETERMINING THE FREQUENCY-RESPONSE CHARACTERISTICS OF AN ELEMENT OR SYSTEM FROM THE SYSTEM TRANSIENT OUTPUT RESPONSE TO A KNOWN INPUT FUNCTION, Howard J. Curfman, Jr., and Robert A. Gardiner, October 1949

TN 1965 TWO MATRIX METHODS FOR CALCULATING FORCING FUNCTIONS FROM KNOWN RESPONSES, Bernard Mazelsky and Franklin W. Diederich, October 1949

TN 1968 FLIGHT TESTS OF THE HYDRODYNAMIC CHARACTERISTICS OF A JAPANESE "EMILY" FLYING BOAT, J. A. Ferguson, R. E. Seibels, Jr., and R. J. Corber, September 1949

TN 1979 A RADAR METHOD OF CALIBRATING AIRSPEED INSTALLATIONS ON AIRPLANES IN MANEUVERS AT HIGH ALTITUDES AND AT TRANSONIC AND SUPERSONIC SPEEDS (Superseded by Report 985), John A. Zalovick, November 1949

TN 1982 AN INTRODUCTION OF THE PHYSICAL ASPECTS OF HELICOPTER STABILITY, Alfred Gessow and Kenneth B. Amer, November 1949

TN 1983 LONGITUDINAL FLYING QUALITIES OF SEVERAL SINGLE-ROTOR HELICOPTERS IN FORWARD FLIGHT, F. B. Gustafson, Kenneth B. Amer, C. R. Haig, and J. P. Reeder, November 1949

TN 1984 A SEMIEMPIRICAL METHOD FOR ESTIMATING THE ROLLING MOMENT DUE TO YAWING OF AIRPLANES, John P. Campbell and Alex Goodman, December 1949

TN 2002 APPLICATION OF THE LAPLACE TRANSFORMATION TO THE SOLUTION OF THE LATERAL AND LONGITUDINAL STABILITY EQUATIONS, G. A. Mokrzycki, January 1950

TN 2004 AN INVESTIGATION OF THE STABILITY OF A SYSTEM COMPOSED OF A SUBSONIC CANARD AIRFRAME AND A CANTED-AXIS GYROSCOPE AUTOMATIC PILOT, R. A. Gardiner, J. Zarovsky, and H. O. Ankenbruck, January 1950

TN 2005 A THEORETICAL ANALYSIS OF THE EFFECT OF TIME LAG IN AN AUTOMATIC STABILIZATION SYSTEM ON THE LATERAL OSCILLATORY STABILITY OF AN AIRPLANE, Leonard Sternfield and Ordway B. Gates, Jr., January 1950

TN 2006 A THEORETICAL INVESTIGATION OF THE EFFECT ON THE LATERAL OSCILLATIONS OF AN AIRPLANE OF AN AUTOMATIC CONTROL SENSITIVE TO YAWING ACCELERATIONS, Arnold R. Beckhardt, January 1950

TN 2010 EFFECT OF HORIZONTAL TAIL ON LOW-SPEED STATIC LATERAL STABILITY CHARACTERISTICS OF A MODEL HAVING 45° SWEPTBACK WING AND TAIL SURFACES, Jack D. Brewer and Jacob H. Lichtenstein, January 1950

TN 2013 A STUDY OF THE USE OF EXPERIMENTAL STABILITY DERIVATIVES IN THE CALCULATION OF THE LATERAL DISTURBED MOTIONS OF A SWEPT-WING AIRPLANE AND COMPARISON WITH FLIGHT RESULTS (Superseded by Report 1031), John D. Bird and Byron M. Jaquet, January 1950

TN 2014 STATIC LONGITUDINAL STABILITY AND CONTROL OF A CONVERTIBLE-TYPE AIRPLANE AS AFFECTED BY ARTICULATED- AND RIGID-PROPELLER OPERATION, Roy H. Lange and Huel C. McLemore, February 1950

TN 2022 PROPELLER FLIGHT INVESTIGATION TO DETERMINE THE EFFECTS OF BLADE LOADING, Jerome B. Hammack and A. W. Vogeley, January 1950

TN 2023 DETERMINATION OF THE RATE OF ROLL OF PILOTLESS AIRCRAFT RESEARCH MODELS BY MEANS OF POLARIZED RADIO WAVES, Orville R. Harris, February 1950

TN 2024 SOUND MEASUREMENTS FOR FIVE SHROUDED PROPELLERS AT STATIC CONDITIONS, Harvey H. Hubbard, April 1950

TN 2047 PRESSURE DISTRIBUTION AND DAMPING IN STEADY ROLL AT SUPERSONIC MACH NUMBERS OF FLAT SWEPT-BACK WINGS WITH SUBSONIC EDGES, Harold J. Walker and Mary B. Ballantyne, March 1950

TN 2048 THEORETICAL LIFT AND DAMPING IN ROLL OF THIN SWEPTBACK TAPERED WINGS WITH RAKED-IN AND CROSS-STREAM WING TIPS AT SUPERSONIC SPEEDS WITH SUBSONIC LEADING EDGES, Kenneth Margolis, March 1950

TN 2051 SPIN-TUNNEL INVESTIGATION TO DETERMINE THE EFFECT ON SPIN RECOVERIES OF REDUCING THE OPENING SHOCK LOAD OF SPIN-RECOVERY PARACHUTES, Ira P. Jones, Jr., and Walter J. Klinar, March 1950

TN 2075 FREE-FLIGHT-TUNNEL INVESTIGATION OF DYNAMIC LONGITUDINAL STABILITY MEASURED IN WIND-TUNNEL FORCE TESTS UNDER CONDITIONS OF CONSTANT THRUST AND CONSTANT POWER, Robert O. Schade, April 1950

TN 2079 EXPERIMENTS IN EXTERNAL NOISE REDUCTION OF LIGHT AIRPLANES, Leo L. Beranek, Fred S. Elwell, John P. Roberts, and C. Fayette Taylor, May 1950

TN 2086 HOVERING AND LOW-SPEED PERFORMANCE AND CONTROL CHARACTERISTICS OF AN AERODYNAMIC-SERVO CONTROLLED HELICOPTER ROTOR SYSTEM AS DETERMINED ON THE LANGLEY HELICOPTER TOWER, Paul J. Carpenter and Russell S. Paulmock, May 1950

TN 2089 A COMPARISON OF THE LATERAL CONTROLLABILITY WITH FLAP AND PLUG AILERONS ON A SWEPTBACK-WING MODEL, Powell M. Lovell, Jr., and Paul P. Stassi, May 1950

TN 2098 THE EFFECTS OF STABILITY OF SPIN-RECOVERY PARACHUTES ON THE BEHAVIOR OF AIRPLANES IN GLIDING FLIGHT AND IN SPINS, Stanley H. Scher and John W. Draper, May 1950

TN 2102 REVIEW OF LITERATURE PERTINENT TO FIRE-EXTINGUISHING AGENTS AND TO BASIC MECHANISMS INVOLVED IN THEIR ACTION, George Fryburg, May 1950

TN 2103 MAXIMUM PITCHING ANGULAR ACCELERATIONS OF AIRPLANES MEASURED IN FLIGHT, Cloyce E. Matheny, May 1950

TN 2114 THEORETICAL LIFT AND DAMPING IN ROLL OF THIN WINGS WITH ARBITRARY SWEEP AND TAPER AT SUPERSONIC SPEEDS, SUPERSONIC LEADING AND TRAILING EDGES, Sidney M. Harmon and Isabella Jeffreys, May 1950

TN 2122 THEORETICAL CALCULATIONS OF THE LATERAL FORCE AND YAWING MOMENT DUE TO ROLLING AT SUPERSONIC SPEEDS FOR SWEPTBACK WINGS WITH STREAMWISE TIPS, SUBSONIC LEADING EDGES, Kenneth Margolis, June 1950

TN 2126 IMPROVEMENTS IN HEAT TRANSFER FOR ANTI-ICING OF GAS-HEATED AIRFOILS WITH INTERNAL FINS AND PARTITIONS, Vernon H. Gray, July 1950

TN 2129 METHOD OF CALCULATING THE LATERAL MOTIONS OF AIRCRAFT BASED ON THE LAPLACE TRANSFORM, Harry E. Murray and Frederick C. Grant, July 1950

TN 2136 THEORY OF HELICOPTER DAMPING IN PITCH OR ROLL AND A COMPARISON WITH FLIGHT MEASUREMENTS, Kenneth B. Amer, October 1950

TN 2146 ON THE EFFECT OF SUBSONIC TRAILING EDGES ON DAMPING IN ROLL AND PITCH OF THIN SWEPTBACK WINGS IN A SUPERSONIC STREAM, Herbert S. Ribner, August 1950

TN 2150 FLIGHT INVESTIGATION OF THE EFFECT OF TRANSIENT WING RESPONSE ON MEASURED ACCELERATIONS OF A MODERN TRANSPORT AIRPLANE IN ROUGH AIR, C. C. Shufflebarger and Harry C. Mickleboro, August 1950

TN 2156 THEORETICAL CALCULATIONS OF THE LATERAL FORCE AND YAWING MOMENT DUE TO ROLLING AT SUPERSONIC SPEEDS FOR SWEPTBACK TAPERED WINGS WITH STREAMWISE TIPS, SUPERSONIC LEADING EDGES, Sidney M. Harmon and John C. Martin, July 1950

TN 2168 EXPERIMENTAL INVESTIGATION OF THE EFFECT OF VERTICAL-TAIL SIZE AND LENGTH AND OF FUSELAGE SHAPE AND LENGTH ON THE STATIC LATERAL STABILITY CHARACTERISTICS OF A MODEL WITH 45° SWEPTBACK WING AND TAIL SURFACES, M. J. Queijo and Walter D. Wolhart, August 1950

TN 2175 EFFECT OF AN UNSWEPT WING ON THE CONTRIBUTION OF UNSWEPT-TAIL CONFIGURATIONS TO THE LOW-SPEED STATIC- AND ROLLING-STABILITY DERIVATIVES OF A MIDWING AIRPLANE MODEL, William Letko and Donald R. Riley, August 1950

TN 2181 THE AERODYNAMIC FORCES AND MOMENTS ON A 1/10 - SCALE MODEL OF A FIGHTER AIRPLANE IN SPINNING ALTITUDES AS MEASURED ON A ROTARY BALANCE IN THE LANGLEY 20-FOOT FREE-SPINNING TUNNEL, R. W. Stone, Jr., S. M. Burk, Jr., and William Bihrle, Jr., September 1950

TN 2195 A FLIGHT INVESTIGATION AND ANALYSIS OF THE LATERAL-OSCILLATION CHARACTERISTICS OF AN AIRPLANE, Carl J. Stough and William M. Kauffman, October 1950

TN 2199 WIND-TUNNEL INVESTIGATION AT LOW SPEED OF THE LATERAL CONTROL CHARACTERISTICS OF AN UNSWEPT UNTAPERED SEMISPAN WING OF ASPECT RATIO 3.13 EQUIPPED WITH VARIOUS 25-PERCENT-CHORD PLAIN AILERONS, Harold S. Johnson and John R. Hagerman, October 1950

TN 2219 THE DYNAMIC LATERAL CONTROL CHARACTERISTICS OF AIRPLANE MODELS HAVING UNSWEPT WINGS WITH ROUND- AND SHARP-LEADING-EDGE SECTIONS, James L. Hassell and Charles V. Bennett, November 1950

TN 2221 EQUATIONS AND CHARTS FOR THE RAPID ESTIMATION OF HINGE-MOMENT AND EFFECTIVENESS PARAMETERS FOR TRAILING-EDGE CONTROLS HAVING LEADING AND TRAILING EDGES SWEPT AHEAD OF THE MACH LINES, Kennith L. Glin, November 1950

TN 2226 THEORETICAL ANALYSIS OF OSCILLATIONS IN HOVERING OF HELICOPTER BLADES WITH INCLINED AND OFFSET FLAPPING AND LAGGING HINGE AXES, M. Morduchow and F. G. Hinchey, December 1950

TN 2233 SOME EFFECTS OF NONLINEAR VARIATION IN THE DIRECTIONAL-STABILITY AND DAMPING-IN-YAWING DERIVATIVES ON THE LATERAL STABILITY OF AN AIRPLANE, Leonard Sternfield, November 1950

TN 2238 EFFECTS ON LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS OF A B-29 AIRPLANE OF VARIATIONS IN STICK-FORCE AND CONTROL-RATE CHARACTERISTICS OBTAINED THROUGH USE OF A BOOSTER IN THE ELEVATOR-CONTROL SYSTEM, Charles W. Matthews, Donald B. Talmage, and James B. Whitten, February 1951

TN 2247 A COMPARISON OF THE LATERAL CONTROLLABILITY WITH FLAP AND PLUG AILERONS ON A SWEPTBACK-WING MODEL HAVING FULL-SPAN FLAPS, Powell M. Lovell, Jr., December 1950

TN 2262 ROLLING AND YAWING MOMENTS FOR SWEPT-BACK WINGS IN SIDESLIP AT SUPERSONIC SPEEDS, Seymour Lampert, January 1951

TN 2270 THEORETICAL DAMPING IN ROLL AND ROLLING EFFECTIVENESS OF SLENDER CRUCIFORM WINGS, Gaynor J. Adams, January 1951

TN 2275 A SURVEY OF STABILITY ANALYSIS TECHNIQUES FOR AUTOMATICALLY CONTROLLED AIRCRAFT, Arthur L. Jones and Benjamin R. Briggs, January 1951

TN 2280 A THEORETICAL ANALYSIS OF THE EFFECTS OF FUEL MOTION ON AIRPLANE DYNAMICS (Superseded by Report 1080), Albert A. Schy, January 1951

TN 2285 DAMPING IN ROLL OF CRUCIFORM AND SOME RELATED DELTA WINGS AT SUPERSONIC SPEEDS, Herbert S. Ribner, February 1951

TN 2294 LIFT AND PITCHING DERIVATIVES OF THIN SWEPTBACK TAPERED WINGS WITH STREAMWISE TIPS AND SUBSONIC LEADING EDGES AT SUPERSONIC SPEEDS, Frank S. Malvestuto, Jr., and Dorothy M. Hoover, February 1951

TN 2306 METEOROLOGICAL ANALYSIS OF ICING CONDITIONS ENCOUNTERED IN LOW-ALTITUDE STRATIFORM CLOUDS, Dwight B. Kline and Joseph A. Walker, March 1951

TN 2307 A THEORETICAL METHOD OF DETERMINING THE CONTROL GEARING AND THE TIME LAG NECESSARY FOR A SPECIFIED DAMPING OF AN AIRCRAFT EQUIPPED WITH A CONSTANT-TIME-LAG AUTOPILOT, Ordway B. Gates, Jr., and Albert A. Schy, March 1951

TN 2309 CHARTS FOR ESTIMATION OF LONGITUDINAL-STABILITY DERIVATIVES FOR A HELICOPTER ROTOR IN FORWARD FLIGHT, Kenneth B. Amer and F. B. Gustafson, March 1951

TN 2313 THE EFFECTS OF MASS DISTRIBUTION ON THE LOW-SPEED DYNAMIC LATERAL STABILITY AND CONTROL CHARACTERISTICS OF A MODEL WITH A 45° SWEPT-BACK WING, Donald E. Hewes, March 1951

TN 2316 WIND-TUNNEL INVESTIGATION AT LOW SPEED OF LATERAL CONTROL CHARACTERISTICS OF AN UNTAPERED 45° SWEPTBACK SEMISPAN WING OF ASPECT RATIO 1.59 EQUIPPED WITH VARIOUS 25-PERCENT-CHORD PLAIN AILERONS, Harold S. Johnson and John R. Hagerman, March 1951

TN 2332 ANALYSIS OF THE EFFECTS OF WING INTERFERENCE ON THE TAIL CONTRIBUTIONS TO THE ROLLING DERIVATIVES (Superseded by TR 1086), William H. Michael, Jr., April 1951

TN 2341 A LEAST SQUARES CURVE FITTING METHOD WITH APPLICATIONS TO THE CALCULATION OF STABILITY COEFFICIENTS FROM TRANSIENT-RESPONSE DATA, Marvin Shinbrot, April 1951

TN 2347 EFFECT OF ASPECT RATIO AND SWEEPBACK ON THE LOW-SPEED LATERAL CONTROL CHARACTERISTICS OF UNTAPERED LOW-ASPECT-RATIO WINGS EQUIPPED WITH RETRACTABLE AILERONS, Jack Fischel and John R. Hagerman, May 1951

TN 2348 EFFECT OF ASPECT RATIO ON THE LOW-SPEED LATERAL CONTROL CHARACTERISTICS OF UNSWEPT UNTAPERED LOW-ASPECT-RATIO WINGS, Rodger L. Naeseth and William O'Hare, May 1951

TN 2358 EFFECT OF VERTICAL-TAIL AREA AND LENGTH ON THE YAWING STABILITY CHARACTERISTICS OF A MODEL HAVING A 45° SWEPTBACK WING, William Letko, May 1951

TN 2359 FLOATING CHARACTERISTICS OF A PLAIN AND A HORN-BALANCED RUDDER AT SPINNING ATTITUDES AS DETERMINED FROM ROTARY TESTS ON A MODEL OF A TYPICAL LOW-WING PERSONAL-OWNER AIRPLANE, William Bihrle, Jr., May 1951

TN 2373 PRACTICAL METHODS OF CALCULATION INVOLVED IN THE EXPERIMENTAL STUDY OF AN AUTOPILOT AND THE AUTOPILOT-AIRCRAFT COMBINATION, Louis H. Smaus and Elwood C. Stewart, June 1951

TN 2378 AUTOMATIC CONTROL SYSTEMS SATISFYING CERTAIN GENERAL CRITERIONS ON TRANSIENT BEHAVIOR, Aaron S. Boksenbom and Richard Hood, June 1951

TN 2379 AN INVESTIGATION OF THE EFFECTS ON JET-OUTLET CUT-OFF ANGLE ON THRUST DIRECTION AND BODY PITCHING MOMENT, James R. Blackaby, June 1951

TN 2381 EFFECT OF HORIZONTAL-TAIL LOCATION ON LOW SPEED STATIC LONGITUDINAL STABILITY AND DAMPING IN PITCH OF A MODEL HAVING 45° SWEPTBACK WING AND TAIL SURFACES, Jacob H. Lichtenstein, June 1951

TN 2382 EFFECT OF HORIZONTAL-TAIL SIZE AND TAIL LENGTH ON LOW-SPEED STATIC LONGITUDINAL STABILITY AND DAMPING IN PITCH OF A MODEL HAVING 45° SWEPTBACK WING AND TAIL SURFACES, Jacob H. Lichtenstein, June 1951

TN 2395 BENCH-TEST INVESTIGATION OF THE TRANSIENT-RESPONSE CHARACTERISTICS OF SEVERAL SIMULATED AIRPLANES INCORPORATING AN AUTOPILOT SENSITIVE TO YAWING ACCELERATIONS, Donald A. Howard, July 1951

TN 2412 THEORETICAL FORCE AND MOMENTS DUE TO SIDESLIP OF A NUMBER OF VERTICAL TAIL CONFIGURATIONS AT SUPERSONIC SPEEDS, John C. Martin and Frank S. Malvestuto, Jr., September 1951

TN 2424 FLIGHT INVESTIGATION OF THE EFFECT OF TRANSIENT WING RESPONSE ON WING STRAINS OF A TWIN-ENGINE TRANSPORT AIRPLANE IN ROUGH AIR, Harry C. Mickelboro and C. C. Shufflebarger, July 1951

TN 2427 AN INVESTIGATION OF AIRCRAFT HEATERS. XXXV - THERMOCOUPLE CONDUCTION ERROR OBSERVED IN MEASURING SURFACE TEMPERATURES, L. M. K. Boelter and R. W. Lockhart, July 1951

TN 2428 AN INVESTIGATION OF AIRCRAFT HEATERS. XXXVL - PRELIMINARY INVESTIGATION OF A COMBUSTION-TYPE AIRCRAFT HEATER, L. M. K. Boelter, W. R. Elswick, V. D. Sanders and M. W. Rubesin, August 1951

TN 2459 SOME EFFECTS OF VARYING THE DAMPING IN PITCH AND ROLL ON THE FLYING QUALITIES OF A SMALL SINGLE-ROTOR HELICOPTER, John P. Reeder and James B. Whitten, January 1952

TN 2470 EFFECT OF AN AUTOPILOT SENSITIVE TO YAWING VELOCITY ON THE LATERAL STABILITY OF A TYPICAL HIGH-SPEED AIRPLANE, Ordway B. Gates, Jr., and Leonard Sternfield, September 1951

TN 2476 AN EMPIRICAL METHOD PERMITTING RAPID DETERMINATION OF THE AREA, RATE AND DISTRIBUTION OF WATER-DROP IMPINGEMENT ON AN AIRFOIL OF ARBITRARY SECTION AT SUBSONIC SPEEDS, Norman R. Bergrun, September 1951

TN 2480 COMPARISON OF HEAT TRANSFER FROM AIRFOIL IN NATURAL AND SIMULATED ICING CONDITIONS, Thomas F. Gelder and James P. Lewis, September 1951

TN 2482 STABILITY AND CONTROL CHARACTERISTICS OF A COMPLETE AIRPLANE MODEL HAVING A WING WITH QUARTER-CHORD LINE SWEPT BACK 40°, ASPECT RATIO 2.50, AND TAPER RATIO 0.42, Marvin Schulderfrei, Paul Comisarow, and Kenneth W. Goodson, December 1951

TN 2483 EFFECT OF FUSELAGE AND TAIL SURFACES ON LOW-SPEED YAWING CHARACTERISTICS OF A SWEPT-WING MODEL AS DETERMINED IN CURVED-FLOW TEST SECTION OF LANGLEY STABILITY TUNNEL, John D. Bird, Byron M. Jaquet and John W. Cowan, October 1951

TN 2486 THEORETICAL CHARACTERISTICS OF TWO-DIMENSIONAL SUPERSONIC CONTROL SURFACES, Robert R. Morrissette and Lester F. Oborny, October 1951

TN 2488 WIND-TUNNEL INVESTIGATION OF THE CONTRIBUTION OF A VERTICAL TAIL TO THE DIRECTIONAL STABILITY OF A FIGHTER-TYPE AIRPLANE, Alfred A. Marino and N. Mastrocola, January 1952

TN 2496 FLIGHT INVESTIGATION OF A MECHANICAL FEEL DEVICE IN AN IRREVERSIBLE ELEVATOR CONTROL SYSTEM OF A LARGE AIRPLANE, B. Porter Brown, Robert G. Chilton, and James B. Whitten, October 1951

TN 2504 EFFECTS OF WING POSITION AND HORIZONTAL-TAIL POSITION ON THE STATIC STABILITY CHARACTERISTICS OF MODELS WITH UNSWEPT AND 45° SWEPTBACK SURFACES WITH SOME REFERENCE TO MUTUAL INTERFERENCE, Alex Goodman, October 1951

TN 2517 AN INVESTIGATION OF AIRCRAFT HEATERS. XXXVII - EXPERIMENTAL DETERMINATION OF THERMAL AND HYDRODYNAMICAL BEHAVIOR OF AIR FLOWING ALONG A FLAT PLATE CONTAINING TURBULENCE PROMOTERS, L. M. K. Boelter, G. Young, M. L. Greenfield, V. D. Sanders, and M. Morgan, October 1951

TN 2522 A GRAPHICAL METHOD FOR PLOTTING AMPLITUDE AND PHASE ANGLE OF TRANSFER FUNCTIONS OF DYNAMIC SYSTEMS WITHOUT FACTORING POLYNOMIALS, Earl F. Smith, November 1951

TN 2524 AN INVESTIGATION OF AIRCRAFT HEATERS. XXXVIII - DETERMINATION OF THERMAL PERFORMANCE OF RECTANGULAR- AND TRAPEZOIDAL-SHAPED INNER-SKIN PASSAGES FOR ANTI-ICING SYSTEMS, L. M. K. Boelter, V. D. Sanders, and F. E. Romie, November 1951

TN 2534 EXPERIMENTAL INVESTIGATION OF THE LOW-SPEED STATIC AND YAWING STABILITY CHARACTERISTICS OF A 45° SWEPTBACK HIGH-WING CONFIGURATION WITH VARIOUS TWIN VERTICAL WING FINS, Alex Goodman and Walter D. Wolhart, November 1951

TN 2553 PITCHING MOMENT DERIVATIVES AT SUPERSONIC SPEEDS FOR A SLENDER DELTA WING AND SLENDER BODY COMBINATIONS, Arthur Henderson, Jr., December 1951

TN 2555 EFFECT OF TAPER RATIO ON THE LOW SPEED ROLLING STABILITY DERIVATIVES OF SWEPT AND UNSWEPT WINGS OF ASPECT RATIO 2.61, Jack D. Brewer and Lewis R. Fisher, November 1951

TN 2563 EXPERIMENTAL INVESTIGATION OF ROLLING PERFORMANCE OF STRAIGHT AND SWEPTBACK FLEXIBLE WINGS WITH VARIOUS AILERONS, Henry A. Cole, Jr., and Victor M. Ganzer, December 1951

TN 2565 A THEORETICAL ANALYSIS OF THE EFFECT OF SEVERAL AUXILIARY DAMPING DEVICES ON THE LATERAL STABILITY AND CONTROLLABILITY OF A HIGH-SPEED AIRCRAFT, Ordway B. Gates, Jr., December 1951

TN 2578 A COMPARISON OF PREDICTED AND EXPERIMENTALLY DETERMINED LONGITUDINAL DYNAMIC RESPONSES OF A STABILIZED AIRPLANE, Louis H. Smaus, Marvin R. Gore, and Merle G. Waugh, December 1951

TN 2587 INFLUENCE OF WING AND FUSELAGE ON THE VERTICAL TAIL CONTRIBUTION TO THE LOW SPEED ROLLING DERIVATIVE OF MIDWING AIRPLANE MODELS WITH 45° SWEPTBACK SURFACES, Walter D. Wolhart, December 1951

TN 2590 CALCULATIONS ON THE FORCES AND MOMENTS FOR AN OSCILLATING WING AILERON COMBINATION IN TWO DIMENSIONAL POTENTIAL FLOW AT SONIC SPEED, Herbert C. Nelson and Julian H. Berman, January 1952

TN 2615 THE CALCULATED AND MEASURED PERFORMANCE CHARACTERISTICS OF A HEATED WIRE LIQUID WATER CONTENT METER FOR MEASURING ICING SEVERITY, Carr B. Neel, Jr., and Charles P. Steinmetz, January 1952

TN 2622 A DESCRIPTION AND A COMPARISON OF CERTAIN NONLINEAR CURVE-FITTING TECHNIQUES, WITH APPLICATIONS TO THE ANALYSIS OF TRANSIENT-RESPONSE DATA, Marvin Scinbrot, February 1952

TN 2626 AN INVESTIGATION OF BENDING MOMENT DISTRIBUTION ON A MODEL HELICOPTER ROTOR BLADE AND A COMPARISON WITH THEORY, John R. Meyer, Jr., February 1952

TN 2648 EXPERIMENTAL INVESTIGATION OF TRANSITION OF A MODEL HELICOPTER ROTOR FROM HOVERING TO VERTICAL AUTOROTATION, Robert R. Lynn, S. E. Slaymaker, and Robin B. Gray, March 1952

TN 2656 A BLADE ELEMENT ANALYSIS FOR LIFTING ROTORS THAT IS APPLICABLE FOR LARGE INFLOW AND BLADE ANGLES AND REASONABLE BLADE GEOMETRY, Walters Castles, Jr., and Noah C. New, July 1952

TN 2665 AN EXTENSION OF LIFTING ROTOR THEORY TO COVER OPERATION AT LARGE ANGLES OF ATTACK AND HIGH INFLOW CONDITIONS, Alfred Gessow and Almer D. Crim, April 1952

TN 2675 MEASUREMENTS OF FLYING QUALITIES OF A F-47D-30 AIRPLANE TO DETERMINE LATERAL AND DIRECTIONAL STABILITY AND CONTROL CHARACTERISTICS, R. Fabian Goranson and Christopher C. Kratt, Jr., July 1952

TN 2689 EFFECT OF HIGH-LIFT DEVICES ON THE LOW-SPEED STATIC LATERAL AND YAWING STABILITY CHARACTERISTICS OF AN UNTAPERED 45° SWEPTBACK WING, Jacob H. Lichtenstein, May 1952

TN 2701 A SURVEY OF THE AIRCRAFT-NOISE PROBLEM WITH SPECIAL REFERENCE TO ITS PHYSICAL ASPECTS, Harvey H. Hubbard, May 1952

TN 2707 ANALOGUE-COMPUTER SIMULATION OF AN AUTOPILOT SERVO SYSTEM HAVING NONLINEAR RESPONSE CHARACTERISTICS, Arthur L. Jones and John S. White, June 1952

TN 2708 COMPARISON OF THREE MULTICYLINDER ICING METERS AND CRITIQUE OF MULTICYLINDER METHOD, Wallace E. Howell, June 1952

TN 2721 INITIAL RESULTS OF INSTRUMENT FLYING TRIALS CONDUCTED IN A SINGLE ROTOR HELICOPTER, Almer D. Crim, John P. Reeder, and James B. Whitten, June 1952

TN 2728 EXPERIMENTS TO DETERMINE NEIGHBORHOOD REACTIONS TO LIGHT AIRPLANES WITH AND WITHOUT EXTERNAL NOISE REDUCTION (Superseded by Report 1156), Fred S. Elwell, May 1952

TN 2734 SUMMARY OF AVAILABLE HAIL LITERATURE AND THE EFFECT OF HAIL ON AIRCRAFT IN FLIGHT, Robert K. Souter and Joseph B. Emerson, September 1952

TN 2738 A PROBABILITY ANALYSIS OF THE METEROLOGICAL FACTORS CONDUCIVE TO AIRCRAFT ICING IN THE UNITED STATES, William Lewis and Norman R. Bergrun, June 1952

TN 2741 INVESTIGATION OF THE INFLUENCE OF FUSELAGE AND TAIL SURFACES ON LOW-SPEED STATIC STABILITY AND ROLLING CHARACTERISTICS OF A SWEPT-WING MODEL, John D. Bird, J. H. Lichtenstein, and Byron Jaquet, July 1952

TN 2747 CHARTS AND APPROXIMATE FORMULAS FOR THE ESTIMATION OF AEROELASTIC EFFECTS ON THE LATERAL CONTROL OF SWEPT AND UNSWEPT WINGS (Superseded by Report 1139), Kenneth A. Foss and F. W. Diederich, July 1952

TN 2761 INSTRUMENT FLIGHT RESULTS OBTAINED WITH A COMBINED SIGNAL FLIGHT INDICATOR MODIFIED PER HELICOPTER USE, Almer D. Crim, John P. Reeder, and James B. Whitten, August 1952

TN 2766 SOME EFFECTS OF AMPLITUDE AND FREQUENCY ON THE AERODYNAMIC DAMPING OF A MODEL OSCILLATING CONTINUOUSLY IN YAW, Lewis R. Fisher and Walter D. Wolhart, September 1952

TN 2767 DYNAMICS OF MECHANICAL FEEDBACK-TYPE HYDRAULIC SERVOMOTORS UNDER INERTIA LOAD, Harold Gold, Edward W. Otto, and Victor L. Ransom, August 1952

TN 2775 EFFECT OF LINEAR SPANWISE VARIATIONS OF TWIST AND CIRCULAR ARC CAMBER ON LOW SPEED STATIC STABILITY, ROLLING, AND YAWING CHARACTERISTICS OF A 45° SWEPABACK WING OF ASPECT RATIO 4 AND TAPER RATIO 0.6, Byron M. Jaquet, August 1952

TN 2781 THE EFFECTS ON DYNAMIC LATERAL STABILITY AND CONTROL OF LARGE ARTIFICIAL VARIATIONS IN THE ROTARY STABILITY DERIVATIVES, Robert O. Schade and James L. Hassell, Jr., October 1952

TN 2789 SOME DYNAMIC EFFECTS OF FUEL MOTION IN SIMPLIFIED MODEL TIP TANKS ON SUDDENLY EXCITED BENDING OSCILLATIONS, Kenneth F. Merten and Bertrand H. Stephenson, September 1952

TN 2799 SIMPLE GRAPHICAL SOLUTION OF HEAT TRANSFER AND EVAPORATION FROM SURFACE HEATED TO PREVENT ICING, Vernon H. Gray, October 1952

TN 2817 A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF YAW OR PRESSURES, FORCES, AND MOMENTS DURING SEAPLANE LANDINGS AND PLANING, Robert F. Smiley, November 1952

TN 2819 EFFECT OF HIGH-LIFT DEVICES ON THE STATIC-LATERAL-STABILITY DERIVATIVES OF A 45° SWEPTBACK WING OF ASPECT RATIO 4.0 AND TAPER RATIO 0.6 IN COMBINATION WITH A BODY, Jacob H. Lichtenstein and James L. Williams, November 1952

TN 2820 AN ANALYSIS OF THE ERRORS IN CURVE-FITTING PROBLEMS WITH AN APPLICATION TO THE CALCULATION OF STABILITY PARAMETERS FROM FLIGHT DATA, Marvin Shinbrot, November 1952

TN 2852 AN INVESTIGATION UTILIZING AN ELECTRICAL ANALOGUE OF CYCLIC DE-ICING OF A HOLLOW STEEL PROPELLER WITH AN EXTERNAL BLADE SHOE, Carr B. Neel, Jr., December 1952

TN 2857 A THEORETICAL METHOD OF ANALYZING THE EFFECTS OF YAW-DAMPER DYNAMICS ON THE STABILITY OF AN AIRCRAFT EQUIPPED WITH A SECOND-ORDER YAW DAMPER, Albert A. Schy and Ordway B. Gates, Jr., December 1952

TN 2861 ANALYTICAL INVESTIGATION OF ICING LIMIT FOR DIAMOND SHAPED AIRFOIL IN TRANSONIC AND SUPERSONIC FLOW, Edmund E. Callaghan and John S. Serafini, January 1953

TN 2866 ICING PROTECTION FOR A TURBOJET TRANSPORT AIRPLANE: HEATING REQUIREMENTS, METHODS OF PROTECTION, AND PERFORMANCE PENALTIES, T. F. Gelder, J. P. Lewis, and S. L. Koutz, January 1953

TN 2882 THEORETICAL INVESTIGATION OF THE LONGITUDINAL RESPONSE CHARACTERISTICS OF A SWEPT WING FIGHTER AIRPLANE HAVING A PITCH-ATTITUDE CONTROL SYSTEM, Fred H. Stokes and J. T. Matthews, January 1953

TN 2899 MEASUREMENTS OF FLYING QUALITIES OF AN F-47D-30 AIRPLANE TO DETERMINE LONGITUDINAL STABILITY AND CONTROL AND STALLING CHARACTERISTICS, Christopher C. Kraft, Jr., R. Fabian Goranson, and John P. Reeder, February 1953

TN 2902 MATRIX METHODS FOR DETERMINING THE LONGITUDINAL-STABILITY DERIVATIVES OF AN AIRPLANE FROM TRANSIENT FLIGHT DATA, James J. Donegan, March 1953

TN 2911 A LOW SPEED EXPERIMENTAL STUDY OF THE DIRECTIONAL CHARACTERISTICS OF A SHARP-NOSED FUSELAGE THROUGH A LARGE ANGLE-OF-ATTACK RANGE AT ZERO ANGLE OF SIDESLIP, William Letko, March 1953

TN 2914 A METHOD FOR RAPID DETERMINATION OF THE ICING LIMIT OF A BODY IN TERMS OF THE STREAM CONDITIONS, Edmund E. Callaghan and John S. Serafini, March 1953

TN 2937 METHOD FOR CALCULATING THE ROLLING AND YAWING MOMENTS DUE TO ROLLING FOR UNSWEPT WINGS WITH OR WITHOUT FLAPS OR AILERONS BY USE OF NONLINEAR SECTION LIFT DATA, Albert P. Martina, May 1953

TN 2939 OPTIMUM CONTROLLERS FOR LINEAR CLOSED LOOP SYSTEMS, Aaron S. Boksenbom, David Novik, and Herbert Heppler, April 1953

TN 2948 INVESTIGATION OF LATERAL CONTROL NEAR THE STALL. FLIGHT INVESTIGATION WITH A LIGHT HIGH-WING MONOPLANE TESTED WITH VARIOUS AMOUNTS OF WASHOUT AND VARIOUS LENGTHS OF LEADING-EDGE SLOT, F. E. Weick, M. S. Sevelson, J. G. McClure, and M. D. Flanagan, May 1953

TN 2955 ESTIMATION OF FORCES AND MOMENTS DUE TO ROLLING FOR SEVERAL SLENDER TAIL CONFIGURATIONS AT SUPERSONIC SPEED, Percy J. Bobbitt and Frank S. Malvestuto, Jr., July 1953

TN 2968 PROPELLER NOISE CHARTS FOR TRANSPORT AIRPLANES, Harvey H. Hubbard, June 1953

TN 2983 LINEARIZED POTENTIAL THEORY OF PROPELLER INDUCTION IN A COMPRESSIBLE FLOW, Robert E. Davidson, September 1953

TN 2984 STUDIES OF THE LATERAL DIRECTIONAL FLYING QUALITIES OF A TANDEM HELICOPTER IN FORWARD FLIGHT, Kenneth B. Amer and Robert J. Tapscott, August 1953

TN 2985 A FLIGHT INVESTIGATION OF THE EFFECT OF STEADY ROLLING ON THE NATURAL FREQUENCIES OF A BODY TAIL COMBINATION, Norman R. Bergrun and Paul A. Nickel, August 1953

TN 2997 APPLICATION OF SEVERAL METHODS FOR DETERMINING TRANSFER FUNCTIONS AND FREQUENCY RESPONSE OF AIRCRAFT FROM FLIGHT DATA, J. M. Eggleston and C. W. Matthews, September 1953

TN 3018 A THEORETICAL STUDY OF THE EFFECT OF FORWARD SPEED ON THE FREE-SPACE SOUND-PRESSURE FIELD AROUND PROPELLERS, I. E. Garrick and C. E. Watkins, October 1953

TN 3021 A METHOD OF DERIVING FREQUENCY-RESPONSE DATA FOR MOTION OF THE CENTER OF GRAVITY FROM DATA MEASURED OF AN AIRCRAFT AT LOCATIONS OTHER THAN THE CENTER OF GRAVITY, John M. Eggleston, October 1953

TN 3022 METHOD FOR STUDYING HELICOPTER LONGITUDINAL MANEUVER STABILITY, Kenneth B. Amer, October 1953

TN 3024 MAXIMUM EVAPORATION RATES OF WATER DROPLETS APPROACHING OBSTACLES IN THE ATMOSPHERE UNDER ICING CONDITIONS, Herman H. Lowell, October 1953

TN 3025 AN INVESTIGATION UTILIZING AN ELECTRICAL ANALOGUE OF CYCLIC DE-ICING OF HOLLOW STEEL PROPELLERS WITH INTERNAL ELECTRIC HEATERS, Carr B. Neel, Jr., October 1953

TN 3026 ELECTROSTATIC SPARK IGNITION-SOURCE HAZARD IN AIRPLANE CRASHES, Arthur M. Busch, October 1953

TN 3027 INFLUENCE OF ROTOR-ENGINE TORSIONAL OSCILLATION ON CONTROL OF GAS-TURBINE ENGINE GEARED TO HELICOPTER ROTOR, John C. Sanders, October 1953

TN 3034 GRAPHICAL SOLUTION OF SOME AUTOMATIC-CONTROL PROBLEMS INVOLVING SATURATION EFFECTS WITH APPLICATION TO YAW DAMPERS FOR AIRCRAFT, William H. Phillips, October 1953

TN 3035 A PRELIMINARY STUDY OF THE PROBLEM OF DESIGNING HIGH-SPEED AIRPLANES WITH SATISFACTORY INHERENT DAMPING OF THE DUTCH ROLL-ROLL OSCILLATION, John P. Campbell and Marion O. McKinney, Jr., October 1953

TN 3063 EFFECTS OF WING POSITION AND FUSELAGE SIZE ON THE LOW-SPEED STATIC AND ROLLING STABILITY CHARACTERISTICS OF A DELTA-WING MODEL, Alex Goodman and David F. Thomas, Jr., February 1954

TN 3067 ROLLING EFFECTIVENESS AND AILERON REVERSAL OF RECTANGULAR WINGS AT SUPERSONIC SPEEDS, John M. Hedgepeth and Robert J. Kell, April 1954

TN 3068 COMPARISON OF MODEL AND FULL-SCALE SPIN RECOVERIES OBTAINED BY USE OF ROCKETS, Sanger M. Burk, Jr., and Frederick M. Healy, February 1954

TN 3083 DETERMINATION OF LATERAL-STABILITY DERIVATIVES AND TRANSFER-FUNCTION COEFFICIENTS FROM FREQUENCY-RESPONSE DATA FOR LATERAL MOTIONS, J. J. Donegan, S. W. Robinson, Jr., and Ordway B. Gates, Jr., May 1954

TN 3088 DETERMINATION OF THE FLYING QUALITIES OF THE DOUGLAS DC-3 AIRPLANE, Arthur Assadourian and John A. Harper, December 1953

TN 3121 SOME EFFECTS OF ASPECT RATIO AND TAIL LENGTH ON THE CONTRIBUTION OF A VERTICAL TAIL TO UNSTEADY LATERAL DAMPING AND DIRECTIONAL STABILITY OF A MODEL OSCILLATING CONTINUOUSLY IN YAW, Lewis R. Fisher, January 1954

TN 3125 A SIMPLE MECHANICAL ANALOGUE FOR STUDYING THE DYNAMIC STABILITY OF AIRCRAFT HAVING NONLINEAR MOMENT CHARACTERISTICS, Thomas N. Canning, February 1954

TN 3156 CHARTS FOR ESTIMATING TAIL-ROTOR CONTRIBUTION TO HELICOPTER DIRECTIONAL STABILITY AND CONTROL IN LOW-SPEED FLIGHT, Kenneth B. Amer and Alfred Gessow, May 1954

TN 3187 THE NEAR NOISE FIELD OF STATIC JETS AND SOME MODEL STUDIES OF DEVICES FOR NOISE REDUCTION, Leslie W. Lassiter and Harvey H. Hubbard, July 1954

TN 3188 AN ANALYTICAL INVESTIGATION OF AIRPLANE SPIN-RECOVERY MOTION BY USE OF ROTARY-BALANCE AERODYNAMIC DATA, Stanley H. Scher, June 1954

TN 3191 THEORETICAL INVESTIGATION OF LONGITUDINAL RESPONSE CHARACTERISTICS OF A SWEPT-WING FIGHTER AIRPLANE HAVING A NORMAL-ACCELERATION CONTROL SYSTEM AND A COMPARISON WITH OTHER TYPES OF SYSTEMS, Fred H. Stokes and Charles W. Mathews, July 1954

TN 3198 DYNAMIC STABILITY AND CONTROL CHARACTERISTICS OF A CASCADE-WING VERTICALLY RISING AIRPLANE MODEL IN TAKE-OFFS, LANDINGS, AND HOVERING FLIGHT, Marion O. McKinney, Louis P. Tosti, and Edwin E. Davenport, June 1954

TN 3201 DIRECTIONAL STABILITY CHARACTERISTICS OF TWO TYPES OF TANDEM HELICOPTER FUSELAGE MODELS, James L. Williams, May 1954

TN 3235 LOW-SPEED YAWED-ROLLING AND SOME OTHER ELASTIC CHARACTERISTICS OF TWO 56-INCH-DIAMETER, 24-PLY-RATING AIRCRAFT TIRES, Walter B. Horne, Bertrand H. Stephenson, and Robert F. Smiley, August 1951

TN 3236 WIND-TUNNEL STUDIES OF THE PERFORMANCE OF MULTIROTOR CONFIGURATIONS, Richard C. Dingeldein, August 1954

TN 3239 SOME ASPECTS OF THE HELICOPTER NOISE PROBLEM, Harvey H. Hubbard and Leslie W. Lassiter, August 1954

TN 3251 A THEORETICAL INVESTIGATION OF THE SHORT-PERIOD DYNAMIC LONGITUDINAL STABILITY OF AIRPLANE CONFIGURATIONS HAVING ELASTIC WINGS OF 0° TO 60° SWEEPBACK, Milton D. McLaughlin, December 1954

TN 3288 ON THE ANALYSIS OF LINEAR AND NONLINEAR DYNAMICAL SYSTEMS FROM TRANSIENT-RESPONSE DATA, Marvin Shinbrot, December 1954

TN 3314 A TECHNIQUE UTILIZING ROCKET-PROPELLED TEST VEHICLES FOR THE MEASUREMENT OF THE DAMPING IN ROLL OF STING-MOUNTED MODELS AND SOME INITIAL RESULTS FOR DELTA AND UNSWEPT TAPERED WINGS, William M. Bland, Jr., and Carl A. Sandahl, May 1955

TN 3316 SOME MEASUREMENTS OF NOISE FROM THREE SOLID-FUEL ROCKET ENGINES, Leslie W. Lassiter and Robert H. Heitkotter, December 1954

TN 3347 A WIND-TUNNEL TEST TECHNIQUE FOR MEASURING THE DYNAMIC ROTARY STABILITY DERIVATIVES INCLUDING THE CROSS DERIVATIVES AT HIGH MACH NUMBERS, Benjamin H. Bean, January 1955

TN 3348 A SYSTEM FOR MEASURING THE DYNAMIC LATERAL STABILITY DERIVATIVES IN HIGH-SPEED WIND TUNNELS, H. C. Lessing, T. B. Fryer, and Merrill H. Mead, December 1954

TN 3350 THE LINEARIZED EQUATIONS OF MOTION UNDERLYING THE DYNAMIC STABILITY OF AIRCRAFT, SPINNING PROJECTILES, AND SYMMETRICAL MISSILES, A. C. Charters, January 1955

TN 3356 EFFECT OF LAG OF SIDEWASH ON THE VERTICAL-TAIL CONTRIBUTION TO OSCILLATORY DAMPING IN YAW OF AIRPLANE MODELS, Lewis R. Fisher and Herman S. Fletcher, January 1955

TN 3361 AERODYNAMIC CHARACTERISTICS OF NACA 0012 AIRFOIL SECTION AT ANGLES OF ATTACK FROM 0^{o} TO 180^{o}, C. C. Critzos, H. H. Heyson, and R. W. Boswinkle, Jr., January 1955

TN 3378 ACOUSTICAL TREATMENT FOR THE NACA 8- BY 6-FOOT SUPERSONIC PROPULSION WIND TUNNEL, Leo L. Beranek, Samuel Labate, and Uno Ingard, June 1955

TN 3379 A SURVEY OF BACKGROUND AND AIRCRAFT NOISE IN COMMUNITIES NEAR AIRPORTS, K. N. Stevens, December 1954

TN 3387 USE OF NONLINEARITIES TO COMPENSATE FOR THE EFFECTS OF A RATE-LIMITED SERVO ON THE RESPONSE OF AN AUTOMATICALLY CONTROLLED AIRCRAFT, Stanley F. Schmidt and William C. Triplett, January 1955

TN 3396 ICING LIMIT AND WET-SURFACE TEMPERATURE VARIATION FOR TWO AIRFOIL SHAPES UNDER SIMULATED HIGH-SPEED FLIGHT CONDITIONS, Willard D. Coles, February 1955

TN 3410 VARIATION OF LOCAL LIQUID-WATER CONCENTRATION ABOUT AN ELLIPSOID OF FINENESS RATIO 10 MOVING IN A DROPLET FIELD, Rinaldo J. Brun and Robert G. Dorsch, April 1955

TN 3417 MEASUREMENTS OF FREE-SPACE OSCILLATING PRESSURES NEAR A PROPELLER AT FLIGHT MACH NUMBERS TO 0.72, Arthur W. Vogeley and Max C. Kurbjun, May 1955

TN 3422 NOISE SURVEY OF A 10-FOOT FOUR-BLADE TURBINE-DRIVEN PROPELLER UNDER STATIC CONDITIONS, Max C. Kurbjun, July 1955

TN 3425 SOME CALCULATIONS OF THE LATERAL RESPONSE OF TWO AIRPLANES TO ATMOSPHERIC TURBULENCE WITH RELATION TO THE LATERAL SNAKING PROBLEM, John D. Bird, May 1955

TN 3429 STATIC STABILITY OF FUSELAGES HAVING A RELATIVELY FLAT CROSS SECTION, William R. Bates, March 1955

TN 3432 CIRCUMFERENTIAL DISTRIBUTION OF PROPELLER-SLIPSTREAM TOTAL-PRESSURE RISE AT ONE RADIAL STATION OF A TWIN-ENGINE TRANSPORT AIRPLANE, A. W. Vogeley and H. A. Hart, April 1955

TN 3452 INVESTIGATION OF JET-ENGINE NOISE REDUCTION BY SCREENS LOCATED TRANSVERSELY ACROSS THE JET, Edmund E. Callaghan and Willard D. Coles, May 1955

TN 3471 THEORETICAL ANALYSES TO DETERMINE UNBALANCED TRAILING-EDGE CONTROLS HAVING MINIMUM HINGE MOMENTS DUE TO DEFLECTION AT SUPERSONIC SPEEDS, Kennith L. Goin, August 1955

TN 3480 FREE-SPINNING-TUNNEL INVESTIGATION OF GYROSCOPIC EFFECTS OF JET-ENGINE ROTATING PARTS (OR OF ROTATING PROPELLERS) ON SPIN AND SPIN RECOVERY, James S. Bowman, Jr., August 1955

TN 3496 FLIGHT TESTING BY RADIO REMOTE CONTROL-FLIGHT EVALUATION OF A BEEP-CONTROL SYSTEM, H. L. Turner, J. S. White, and R. D. Van Dyke, Jr., March 1955

TN 3516 SUMMARY EVALUATION OF TOOTHED-NOZZLE ATTACHMENTS AS A JET-NOISE-SUPPRESSION DEVICE, Warren J. North, July 1955

TN 3521 A COMPARISON OF THE MEASURED AND PREDICTED LATERAL OSCILLATORY CHARACTERISTICS OF A 35° SWEPT-WING FIGHTER AIRPLANE, Walter E. McNeill and George E. Cooper, August 1955

TN 3523 THE EFFECTIVENESS OF WING VORTEX GENERATORS IN IMPROVING THE MANEUVERING CHARACTERISTICS OF A SWEPT-WING AIRPLANE AT TRANSONIC SPEEDS, Norman F. McFadden, George A. Rathert, Jr., and Richard S. Bray, September 1955

TN 3532 LOW-SPEED STATIC LATERAL AND ROLLING STABILITY CHARACTERISTICS OF A SERIES OF CONFIGURATIONS COMPOSED OF INTERSECTING TRIANGULAR PLAN-FORM SURFACES, David F. Thomas, Jr., October 1955

TN 3534 INSTRUMENTATION FOR MEASUREMENT OF FREE-SPACE SOUND PRESSURE IN THE IMMEDIATE VICINITY OF A PROPELLER IN FLIGHT, William D. Mace, Francis J. Haney, and Edmund A. Brummer, January 1956

TN 3537 HELICOPTER INSTRUMENT FLIGHT AND PRECISION MANEUVERS AS AFFECTED BY CHANGES IN DAMPING IN ROLL, PITCH, AND YAW, James B. Whitten, John P. Reeder and Almer D. Crim, November 1955

TN 3551 EXPERIMENTAL INVESTIGATION AT LOW SPEED OF EFFECTS OF FUSELAGE CROSS SECTION ON STATIC LONGITUDINAL AND LATERAL STABILITY CHARACTERISTICS OF MODELS HAVING 0° AND 45° SWEPTBACK SURFACES, William Letko and James L. Williams, December 1955

TN 3554 A PRELIMINARY INVESTIGATION OF THE EFFECTS OF FREQUENCY AND AMPLITUDE ON THE ROLLING DERIVATIVES OF AN UNSWEPT-WING MODEL OSCILLATING IN ROLL, L. R. Fisher, J. H. Lichtenstein, and K. D. Williams, January 1956

TN 3557 A THEORETICAL ANALYSIS OF THE FIELD OF A RANDOM NOISE SOURCE ABOVE AN INFINITE PLANE, Peter A. Franken, November 1955

TN 3582 EFFECT OF CLIMB TECHNIQUE ON JET-TRANSPORT NOISE, Warren J. North, January 1956

TN 3586 IMPINGEMENT OF WATER DROPLETS ON NACA 65A004 AIRFOIL AT 0° ANGLE OF ATTACK, Rinaldo J. Brun and Dorothea E. Vogt, November 1955

TN 3587 IMPINGEMENT OF WATER DROPLETS ON A SPHERE, R. G. Dorsch, Paul G. Saper and Charles F. Kadow, November 1955

TN 3598 METHOD AND TABLES FOR DETERMINING THE TIME RESPONSE TO A UNIT IMPULSE FROM FREQUENCY-RESPONSE DATA AND FOR DETERMINING THE FOURIER TRANSFORM OF A FUNCTION OF TIME, Carl R. Huss and James J. Donegan, January 1956

TN 3602 LABORATORY INVESTIGATION OF AN AUTOPILOT UTILIZING A MECHANICAL LINKAGE WITH A DEAD SPOT TO OBTAIN AN EFFECTIVE RATE SIGNAL, Ernest C. Seaberg, December 1955

TN 3603 THEORETICAL STUDY OF THE LATERAL FREQUENCY RESPONSE TO GUSTS OF A FIGHTER PLANE, BOTH WITH CONTROLS FIXED AND WITH SEVERAL TYPES OF AUTOPILOTS, James J. Adams and Charles W. Mathews, March 1956

TN 3604 LOW-SPEED YAWED-ROLLING CHARACTERISTICS AND OTHER ELASTIC PROPERTIES OF A PAIR OF 26-INCH-DIAMETER, 12-PLY-RATING, TYPE VII AIRCRAFT TIRES, Walter B. Horne, R. F. Smiley, and B. H. Stephenson, May 1956

TN 3611 ANALYSIS OF A SPIN AND RECOVERY FROM TIME HISTORIES OF ATTITUDES AND VELOCITIES AS DETERMINED FOR A DYNAMIC MODEL OF A CONTEMPORARY FIGHTER AIRPLANE IN THE FREE-SPINNING TUNNEL, Stanley H. Scher, April 1956

TN 3635 ANALYTICAL STUDY OF MODIFICATIONS TO THE AUTOPILOT OF A FIGHTER AIRPLANE IN ORDER TO REDUCE THE RESPONSE TO SIDE GUSTS, Charles W. Mathews and James J. Adams, March 1956

TN 3645 WIND-TUNNEL INVESTIGATION OF EFFECTS OF FUSELAGE CROSS-SECTIONAL SHAPE, FUSELAGE BEND, AND VERTICAL-TAIL SIZE ON DIRECTIONAL CHARACTERISTICS OF NONOVERLAP-TYPE HELICOPTER FUSELAGE MODELS WITHOUT ROTORS, James L. William, March 1956

TN 3649 STATIC LONGITUDINAL AND LATERAL STABILITY CHARACTERISTICS AT LOW SPEED OF UNSWEPT-MIDWING MODELS HAVING WINGS WITH AN ASPECT RATIO OF 2, 4, OR 6, Walter D. Wolhart and David F. Thomas, Jr., May 1956

TN 3658 IMPINGEMENT OF WATER DROPLETS ON A RECTANGULAR HALF BODY IN A TWO-DIMENSIONAL INCOMPRESSIBLE FLOW FIELD, William Lewis and Rinaldo J. Brun, February 1956

TN 3676 INVESTIGATION OF LATERAL CONTROL NEAR THE STALL. FLIGHT TESTS WITH HIGH-WING AND LOW-WING MONOPLANES OF VARIOUS CONFIGURATIONS, Fred E. Weick and H. Norman Abramson, June 1956

TN 3677 INVESTIGATION OF LATERAL CONTROL NEAR THE STALL. ANALYSIS FOR REQUIRED LONGITUDINAL TRIM CHARACTERISTICS AND DISCUSSION OF DESIGN VARIABLES, Fred E. Weick and H. Norman Abramson, June 1956

TN 3701 COMPARISON OF SEVERAL METHODS FOR OBTAINING THE TIME RESPONSE OF LINEAR SYSTEMS TO EITHER A UNIT IMPULSE OR ARBITRARY INPUT FROM FREQUENCY-RESPONSE DATA, James J. Donegan and Carl R. Huss, July 1956

TN 3710 PRELIMINARY INVESTIGATION OF THE EFFECTS OF EXTERNAL WING FUEL TANKS ON PITCHING BEHAVIOR OF A SWEPTBACK-WING AIRPLANE, Ellis E. McBride, July 1956

TN 3737 THE MOTIONS OF ROLLING SYMMETRICAL MISSILES REFERRED TO A BODY-AXIS SYSTEM, Robert L. Nelson, November 1956

TN 3740 PRELIMINARY WIND-TUNNEL TESTS OF TRIANGULAR AND RECTANGULAR WINGS IN STEADY ROLL AT MACH NUMBERS OF 1.62 AND 1.92, Clinton E. Brown and Harry S. Heinke, Jr., June 1956

TN 3743 AN OPTIMUM SWITCHING CRITERION FOR A THIRD-ORDER CONTACTOR ACCELERATION CONTROL SYSTEM, Anthony L. Passera and Ross G. Willoh, Jr., August 1956

TN 3754 A SIMPLE METHOD FOR CALCULATING THE CHARACTERISTICS OF THE DUTCH ROLL MOTION OF AN AIRPLANE, Bernard E. Klawans, October 1956

TN 3763 NEAR NOISE FIELD OF A JET-ENGINE EXHAUST. I - SOUND PRESSURES, Walton L. Howes and Harold R. Mull, October 1956

TN 3764 NEAR NOISE FIELD OF A JET-ENGINE EXHAUST. II - CROSS CORRELATION OF SOUND PRESSURES, Edmund E. Callaghan, Walton L. Howes, and Williard D. Coles, September 1956

TN 3766 RADIATION AND RECOVERY CORRECTIONS AND TIME CONSTANTS OF SEVERAL CHROMEL-ALUMEL THERMOCOUPLE PROBES IN HIGH-TEMPERATURE, HIGH-VELOCITY GAS STREAMS, George E. Glawe, Frederick S. Simmons, and Truman M. Stickney, October 1956

TN 3777 SEAT DESIGN FOR CRASH WORTHINESS (Superseded by TR 1332), I. Irving Pinkel and Edmund G. Rosenberg, October 1956

TN 3788 STABILITY DERIVATIVES OF CONES AT SUPERSONIC SPEEDS, Murray Toback and William R. Wehrend, September 1956

TN 3791 ON A METHOD FOR OPTIMIZATION OF TIME-VARYING LINEAR SYSTEMS WITH NONSTATIONARY INPUTS, Marvin Shinbrot, September 1956

TN 3809 A METHOD FOR CALCULATION OF FREE-SPACE SOUND PRESSURES NEAR A PROPELLER IN FLIGHT INCLUDING CONSIDERATIONS OF THE CHORDWISE BLADE LOADING, Charles E. Watkins and Barbara J. Durling, November 1956

TN 3810 CHARTS FOR ESTIMATING THE HOVERING ENDURANCE OF A HELICOPTER, Robert A. Makofski, October 1956

TN 3812 FLIGHT INVESTIGATION OF THE STABILITY AND CONTROL CHARACTERISTICS OF A VERTICALLY RISING AIRPLANE RESEARCH MODEL WITH SWEPT OR UNSWEPT WINGS AND x- OR +-TAILS, Robert E. Kirby, October 1956

TN 3814 EFFECTS OF VERTICAL FINS NEAR THE NOSE OF THE FUSELAGE ON THE DIRECTIONAL AND DAMPING-IN-YAW STABILITY DERIVATIVES OF AN AIRPLANE MODEL UNDER STEADY-STATE AND OSCILLATORY CONDITIONS, M. J. Queijo and Evalyn G. Wells, December 1956

TN 3818 WIND-TUNNEL INVESTIGATION TO DETERMINE THE HORIZONTAL- AND VERTICAL-TAIL CONTRIBUTIONS TO THE STATIC LATERAL STABILITY CHARACTERISTICS OF A COMPLETE-MODEL SWEPT-WING CONFIGURATION AT HIGH SUBSONIC SPEEDS, J. W. Wiggins, R. E. Kuhn, and P. G. Fournier, November 1956

TN 3826 INVESTIGATION OF A NONLINEAR CONTROL SYSTEM, I. Flugge-Lotz and C. F. Taylor, April 1957

TN 3839 EXPERIMENTAL DROPLET IMPINGEMENT ON SEVERAL TWO-DIMENSIONAL AIRFOILS WITH THICKNESS RATIOS OF 6 TO 16 PERCENT, T. F. Geldu, W. H. Smyers, Jr., and Uwe von Glahn, December 1956

TN 3843 EXPERIMENTAL STEADY-STATE YAWING DERIVATIVES OF A 60° DELTA-WING MODEL AS AFFECTED BY CHANGES IN VERTICAL POSITION OF THE WING AND IN RATIO OF FUSELAGE DIAMETER TO WING SPAN, Byron M. Jaquet and Herman S. Fletcher, October 1956

TN 3844 THEORY OF SELF-EXCITED MECHANICAL OSCILLATIONS OF HELICOPTER ROTORS WITH HINGED BLADES. Chapter I: THEORY OF SELF-EXCITED MECHANICAL OSCILLATIONS OF HINGED ROTOR BLADES. Chapter II: THEORY OF MECHANICAL OSCILLATIONS OF ROTORS WITH TWO HINGED BLADES. Chapter III: THEORY OF GROUND VIBRATIONS OF A TWO-BLADE HELICOPTER ROTOR ON ANISOTROPIC FLEXIBLE SUPPORTS (REVISED). Appendix B: THE GENERAL EQUATIONS OF MOTION FOR TWO-BLADE ROTORS, Robert P. Coleman, Arnold M. Feingold, and George W. Brooks, February 1957

TN 3849 ANALYTICAL DETERMINATION OF THE NATURAL COUPLED FREQUENCIES AND MODE SHAPES AND THE RESPONSE TO OSCILLATING FORCING FUNCTIONS OF TANDEM HELICOPTERS, George W. Brooks and John C. Houbolt, December 1956

TN 3857 EXPERIMENTAL INVESTIGATION AT LOW SPEED OF THE EFFECTS OF WING POSITION ON THE STATIC STABILITY OF MODELS HAVING FUSELAGES OF VARIOUS CROSS SECTION AND UNSWEPT AND 45° SWEPTBACK SURFACES, William Letko, November 1956

TN 3859 COMPARISON OF FLIGHT AND WIND-TUNNEL MEASUREMENTS OF HIGH-SPEED-AIRPLANE STABILITY AND CONTROL CHARACTERISTICS, W. C. Williams, H. M. Drake, and Jack Fischel, August 1956

TN 3862 DETERMINATION OF THE STRUCTURAL DAMPING COEFFICIENTS OF SIX FULL-SCALE HELICOPTER ROTOR BLADES OF DIFFERENT MATERIALS AND METHODS OF CONSTRUCTION, Frederick W. Gibson, December 1956

TN 3864 THEORETICAL CALCULATION OF THE POWER SPECTRA OF THE ROLLING AND YAWING MOMENTS ON A WING IN RANDOM TURBULENCE, John M. Eggleston and Franklin W. Diederich, December 1956

TN 3874 EXPERIMENTAL AND PREDICTED LATERAL-DIRECTIONAL DYNAMIC-RESPONSE CHARACTERISTICS OF A LARGE FLEXIBLE 35° SWEPT-WING AIRPLANE AT AN ALTITUDE OF 35,000 FEET, Stuart C. Brown and Euclid C. Holleman, December 1956

TN 3896 SUBSONIC WIND-TUNNEL INVESTIGATION OF THE EFFECT OF FUSELAGE AFTERBODY ON DIRECTIONAL STABILITY OF WING-FUSELAGE COMBINATIONS AT HIGH ANGLES OF ATTACK, Edward C. Polhamus and Kenneth P. Spreemann, December 1956

TN 3897 INCOMPLETE TIME RESPONSE TO A UNIT IMPULSE AND ITS APPLICATION TO LIGHTLY DAMPED LINEAR SYSTEMS, James J. Donegan and Carl R. Huss, December 1956

TN 3909 VERTICAL FORCE-DEFLECTION CHARACTERISTICS OF A PAIR OF 56-INCH-DIAMETER AIRCRAFT TIRES FROM STATIC AND DROP TESTS WITH AND WITHOUT PREROTATION, Robert F. Smiley and Walter B. Horne, February 1957

TN 3912 FLIGHT TESTS OF A MODEL OF A HIGH-WING TRANSPORT VERTICAL-TAKE-OFF AIRPLANE WITH TILTING WING AND PROPELLERS AND WITH JET CONTROLS AT THE REAR OF THE FUSELAGE FOR PITCH AND YAW CONTROL, Powell M. Lovell, Jr., and Lysle P. Parlett, March 1957

TN 3926 EXPERIMENTAL COMPARISON OF SPEED-FUEL-FLOW AND SPEED-AREA CONTROLS ON A TURBOJET ENGINE FOR SMALL STEP DISTURBANCES, L. M. Wenzel, Clint E. Hart, and R. T. Craig, March 1957

TN 3936 EXPERIMENTAL INVESTIGATION OF TEMPERATURE FEEDBACK CONTROL SYSTEMS APPLICABLE TO TURBOJET-ENGINE CONTROL, Clint E. Hart, L. M. Wenzel, and R. T. Craig, March 1957

TN 3945 METHODS FOR OBTAINING DESIRED HELICOPTER STABILITY CHARACTERISTICS AND PROCEDURES FOR STABILITY PREDICTIONS, Frederic B. Gustafson and Robert J. Tapscott, February 1957

TN 3947 INSTRUMENT FLIGHT TRAILS WITH A HELICOPTER STABILIZED IN ATTITUDE ABOUT EACH AXIS INDIVIDUALLY, Seymour Salmirs and Robert J. Tapscott, January 1957

TN 3952 EFFECTS OF HORIZONTAL-TAIL POSITION AND A WING LEADING-EDGE MODIFICATION CONSISTING OF A FULL-SPAN FLAP AND A PARTIAL-SPAN CHORD-EXTENSION ON THE AERODYNAMIC CHARACTERISTICS IN PITCH AT HIGH SUBSONIC SPEEDS OF A MODEL WITH A 45° SWEPTBACK WING, William D. Morrison, Jr., and William J. Alford, June 1957

TN 3955 A COLLECTION OF DATA FOR ZERO-LIFT DAMPING IN ROLL OF WING-BODY COMBINATIONS AS DETERMINED WITH ROCKET-POWERED MODELS EQUIPPED WITH ROLL-TORQUE NOZZLES, David G. Stone, April 1957

TN 3957 SOME EFFECTS OF TAIL HEIGHT AND WING PLAN FORM ON THE STATIC LONGITUDINAL STABILITY CHARACTERISTICS OF A SMALL-SCALE MODEL AT HIGH SUBSONIC SPEEDS, Albert G. Few, Jr., and Thomas J. King, Jr., May 1957

TN 3961 EFFECTS OF FUSELAGE NOSE LENGTH AND A CANOPY ON THE STATIC LONGITUDINAL AND LATERAL STABILITY CHARACTERISTICS OF 45° SWEPT-BACK AIRPLANE MODELS HAVING FUSELAGES WITH SQUARE CROSS SECTIONS, Byron M. Jaquet and Herman S. Fletcher, April 1957

TN 3968 THE APPLICATION OF MATRIX METHODS TO COORDINATE TRANSFORMATIONS OCCURRING IN SYSTEMS STUDIES INVOLVING LARGE MOTIONS OF AIRCRAFT, Brian F. Doolin, May 1957

TN 3992 CHARTS FOR ESTIMATING THE EFFECTS OF SHORT-PERIOD STABILITY CHARACTERISTICS ON AIRPLANE VERTICAL-ACCELERATION AND PITCH-ANGLE RESPONSE IN CONTINUOUS ATMOSPHERIC TURBULENCE, Kermit G. Pratt and Floyd V. Bennett, June 1957

TN 4004 SOME EFFECTS OF VALVE FRICTION AND STICK FRICTION ON CONTROL QUALITY IN A HELICOPTER WITH HYDRAULIC-POWER CONTROL SYSTEMS, B. Porter Brown and John P. Reeder, May 1957

TN 4035 IMPINGEMENT OF CLOUD DROPLETS ON 36.5-PERCENT-THICK JOUKOWSKI AIRFOIL AT ZERO ANGLE OF ATTACK AND DISCUSSION OF USE AS CLOUD MEASURING INSTRUMENT IN DYE-TRACER TECHNIQUE, R. J. Brun and Dorothea E. Vogt, September 1957

TN 4047 A STUDY OF THE MOTION AND AERODYNAMIC HEATING OF MISSILES ENTERING THE EARTH'S ATMOSPHERE AT HIGH SUPERSONIC SPEEDS, Harry J. Allen and Alfred J. Eggers, October 1957

TN 4048 MOTION OF A BALLISTIC MISSILE ANGULARLY MISALINED WITH THE FLIGHT PATH UPON ENTERING THE ATMOSPHERE AND ITS EFFECT UPON AERODYNAMIC HEATING, AERODYNAMIC LOADS, AND MISS DISTANCE, Harry J. Allen, October 1957

TN 4058 CALCULATED EFFECT OF SOME AIRPLANE HANDLING TECHNIQUES ON THE GROUND-RUN DISTANCE IN LANDING ON SLIPPERY RUNWAYS, John A. Zalovcik, July 1957

TN 4059 NOISE SURVEY OF A FULL-SCALE SUPERSONIC TURBINE-DRIVEN PROPELLER UNDER STATIC CONDITIONS, Max C. Kurbjun, July 1957

TN 4064 REVIEW AND INVESTIGATION OF UNSATISFACTORY CONTROL CHARACTERISTICS INVOLVING INSTABILITY OF PILOT-AIRPLANE COMBINATION AND METHODS FOR PREDICTING THESE DIFFICULTIES FROM GROUND TESTS, W. H. Phillips, B. P. Brown, and J. T. Matthews, Jr., August 1957

TN 4068 EFFECTS OF BLADE PLAN FORM ON FREE-SPACE OSCILLATING PRESSURES NEAR PROPELLERS AT FLIGHT MACH NUMBERS TO 0.72, Max C. Kurbjun, August 1957

TN 4073 TABLES FOR THE NUMERICAL DETERMINATION OF THE FOURIER TRANSFORM OF A FUNCTION OF TIME AND THE INVERSE FOURIER TRANSFORM OF A FUNCTION OF FREQUENCY, WITH SOME APPLICATIONS TO OPERATIONAL CALCULUS METHODS, Carl R. Huss and James J. Donegan, October 1957

TN 4077 STATIC LONGITUDINAL AND LATERAL STABILITY CHARACTERISTICS AT LOW SPEED OF 45° SWEPTBACK-MIDWING MODELS HAVING WINGS WITH AN ASPECT RATIO OF 2, 4, OR 6, David F. Thomas, Jr., and Walter D. Wolhart, September 1957

TN 4109 LOW-SPEED YAWED-ROLLING CHARACTERISTICS AND OTHER ELASTIC PROPERTIES OF A PAIR OF 40-INCH-DIAMETER, 14-PLY-RATING, TYPE VII AIRCRAFT TIRES, Walter B. Horne and Robert F. Smiley, January 1958

TN 4110 MECHANICAL PROPERTIES OF PNEUMATIC TIRES WITH SPECIAL REFERENCE TO MODERN AIRCRAFT TIRES, Robert F. Smiley and Walter B. Horne, January 1958

TN 4119 WIND-TUNNEL INVESTIGATION OF EFFECTS OF GROUND PROXIMITY AND OF SPLIT FLAPS ON THE LATERAL STABILITY DERIVATIVES OF A 60° DELTA-WING MODEL OSCILLATING IN YAW, Byron M. Jaquet, September 1957

TN 4128 A THERMOCOUPLE SUBCARRIER OSCILLATOR FOR TELEMETERING TEMPERATURES FROM PILOTLESS AIRCRAFT, Clifford L. Fricke, December 1957

TN 4151 CORRELATIONS AMONG ICE MEASUREMENTS, IMPINGEMENT RATES, ICING CONDITIONS, AND DRAG COEFFICIENTS FOR UNSWEPT NACA 65A004 AIRFOIL, Vernon H. Gray, February 1958

TN 4171 SOME GROUND MEASUREMENTS OF THE FORCES APPLIED BY PILOTS TO A SIDE-LOCATED AIRCRAFT CONTROLLER, Roy F. Brissenden, November 1957

TN 4172 NOISE SURVEY UNDER STATIC CONDITIONS OF A TURBINE-DRIVEN FULL-SCALE MODIFIED SUPERSONIC PROPELLER WITH AN ADVANCE RATIO OF 3.2, Max C. Kurbjun, January 1958

TN 4174 WIND-TUNNEL INVESTIGATION OF THE STATIC LATERAL STABILITY CHARACTERISTICS OF WING-FUSELAGE COMBINATIONS AT HIGH SUBSONIC SPEEDS, James W. Wiggins and Paul G. Fournier, October 1957

TN 4176 EFFECT OF FLOW INCIDENCE AND REYNOLDS NUMBER ON LOW-SPEED AERODYNAMIC CHARACTERISTICS OF SEVERAL NONCIRCULAR CYLINDERS WITH APPLICATIONS TO DIRECTIONAL STABILITY AND SPINNING, Edward C. Polhamus, January 1958

TN 4177 WIND-TUNNEL INVESTIGATION OF THE STATIC LONGITUDINAL STABILITY AND TRIM CHARACTERISTICS OF A SWEPTBACK-WING JET TRANSPORT MODEL EQUIPPED WITH AN EXTERNAL-FLOW JET-AUGMENTED FLAP, Joseph L. Johnson, Jr., January 1958

TN 4179 ANALYTICAL INVESTIGATION OF ACCELERATION RESTRICTION IN A FIGHTER AIRPLANE WITH AN AUTOMATIC CONTROL SYSTEM, James T. Matthews, Jr., January 1958

TN 4185 WIND-TUNNEL INVESTIGATION OF EFFECT OF SWEEP ON ROLLING DERIVATIVES AT ANGLES OF ATTACK UP TO 13° AND AT HIGH SUBSONIC MACH NUMBERS, INCLUDING A SEMIEMPIRICAL METHOD OF ESTIMATING THE ROLLING DERIVATIVES, James W. Wiggins, January 1958

TN 4190 EXPERIMENTAL INVESTIGATION OF THE LATERAL TRIM OF A WING-PROPELLER COMBINATION AT ANGLES OF ATTACK UP TO 90° WITH ALL PROPELLERS TURNING IN THE SAME DIRECTION, William A. Newsman, Jr., January 1958

TN 4192 THREE-DEGREE-OF-FREEDOM EVALUATION OF THE LONGITUDINAL TRANSFER FUNCTIONS OF A SUPERSONIC CANARD MISSILE CONFIGURATION INCLUDING CHANGES IN FORWARD SPEED, Ernest C. Seaberg, December 1957

TN 4193 SUBSONIC FLIGHT INVESTIGATION OF METHODS TO IMPROVE THE DAMPING OF LATERAL OSCILLATIONS BY MEANS OF A VISCOUS DAMPER IN THE RUDDER SYSTEM IN CONJUNCTION WITH ADJUSTED HINGE-MOMENT PARAMETERS, H. L. Crane, G. J. Hurt, Jr., and John M. Elliott, January 1958

TN 4194 COMPARISON OF HYDRODYNAMIC-IMPACT ACCELERATION AND RESPONSE FOR SYSTEMS WITH SINGLE AND WITH MULTIPLE ELASTIC MODES, Robert William Miller, February 1958

TN 4196 A METHOD FOR THE CALCULATION OF THE LATERAL RESPONSE OF AIRPLANES TO RANDOM TURBULENCE, John M. Eggleston and William H. Phillips, February 1958

TN 4199 A FLIGHT INVESTIGATION OF THE EFFECTS OF VARIED LATERAL DAMPING ON THE EFFECTIVENESS OF A FIGHTER AIRPLANE AS A GUN PLATFORM, Helmut A. Kuehnel, Arnold R. Beckhardt, and Robert A. Champine, January 1958

TN 4212 CENTRAL AUTOMATIC DATA PROCESSING SYSTEM. Chapter I: GENERAL DESCRIPTION. Chapter II: CENTRAL RECORDING SYSTEM. Chapter III: AUTOMATIC VOLTAGE DIGITIZERS. Chapter IV: FREQUENCY DATA. Chapter V: DIGITAL AUTOMATIC MULTIPLE PRESSURE RECORDER. Chapter VI: PLAYBACK AND CONTROL ROOM EQUIPMENT, Bert A. Coss, R. L. Miller, L. Jaffe, R. L. Smith, J. Ryskamp, A. J. Gedeon, and R. N. Bell, April 1958

TN 4220 A FLIGHT EVALUATION AND ANALYSIS OF THE EFFECT OF ICING CONDITIONS ON THE ZPG-2 AIRSHIP, William Lewis and Porter J. Perkins, Jr., April 1958

TN 4249 A THEORETICAL ANALYSIS OF THE EFFECT OF ENGINE ANGULAR MOMENTUM ON LONGITUDINAL AND DIRECTIONAL STABILITY IN STEADY ROLLING MANEUVERS, Ordway B. Gates, Jr., and C. H. Woodling, April 1958

TN 4275 DYNAMIC STABILITY OF VEHICLES TRAVERSING ASCENDING OR DESCENDING PATHS THROUGH THE ATMOSPHERE, Murray Tobak and H. Julian Allen, July 1958

TN 4276 AN APPROXIMATE ANALYTICAL METHOD FOR STUDYING ENTRY INTO PLANETARY ATMOSPHERES, Dean R. Chapman, May 1958

TN 4297 FLIGHT INVESTIGATION OF THE ACCEPTABILITY OF A SMALL SIDE-LOCATED CONTROLLER USED WITH AN IRREVERSIBLE HYDRAULIC CONTROL SYSTEM, Helmut A. Keuhnel and Robbert W. Sommer, July 1958

TN 4303 MEASUREMENTS AND POWER SPECTRA OF RUNWAY ROUGHNESS AT AIRPORTS IN COUNTRIES OF THE NORTH ATLANTIC TREATY ORGANIZATION, Wilbur E. Thompson, July 1958

TN 4305 WIND-TUNNEL INVESTIGATION OF EFFECTS OF SPOILER LOCATION, SPOILER SIZE, AND FUSELAGE NOSE SHAPE ON DIRECTIONAL CHARACTERISTICS OF A MODEL OF A TANDEM-ROTOR HELICOPTER FUSELAGE, James L. Williams, July 1958

TN 4307 EXPERIMENTAL MEASUREMENTS OF THE EFFECTS OF AIRPLANE MOTIONS ON WING AND TAIL ANGLES OF ATTACK OF A SWEPT-WING BOMBER IN ROUGH AIR, Jerome N. Engel, August 1958

TN 4310 MEASUREMENTS OF THE MOTIONS OF A LARGE SWEPT-WING AIRPLANE IN ROUGH AIR, Richard H. Rhyne, September 1958

TN 4314 ICING FREQUENCIES EXPERIENCED DURING CLIMB AND DESCENT BY FIGHTER-INTERCEPTOR AIRCRAFT, Porter J. Perkins, Jr., July 1958

TN 4326 LIGHTNING HAZARDS TO AIRCRAFT FUEL TANKS, J. D. Robb, E. L. Hill, Morris M. Newman, and J. R. Stahmann, September 1958

TN 4334 LAG IN PRESSURE SYSTEMS AT EXTREMELY LOW PRESSURES, William T. Davis, September 1958

TN 4340 WIND-TUNNEL INVESTIGATION OF THE HIGH-SUBSONIC STATIC LONGITUDINAL STABILITY CHARACTERISTICS OF SEVERAL WING-BODY CONFIGURATIONS DESIGNED FOR HIGH LIFT-DRAG RATIOS AT A MACH NUMBER OF 1.4, Paul G. Fournier, July 1958

TN 4346 APPROXIMATE METHOD FOR CALCULATING MOTIONS IN ANGLES OF ATTACK AND SIDESLIP DUE TO STEP PITCHING- AND YAWING-MOMENT INPUTS DURING STEADY ROLL, Martin T. Moul and Teresa R. Brennan, September 1958

TN 4358 SUPERSONIC WAVE INTERFERENCE AFFECTING STABILITY, Eugene S. Love, September 1958

TN 4390 EFFECTS OF FREQUENCY AND AMPLITUDE ON THE YAWING DERIVATIVES OF TRIANGULAR, SWEPT, AND UNSWEPT WINGS AND OF A TRIANGULAR-WING-FUSELAGE COMBINATION WITH AND WITHOUT A TRIANGULAR TAIL PERFORMING SINUSOIDAL YAWING OSCILLATIONS, William Letko and Herman S. Fletcher, September 1958

TN 4393 SOME STATIC LONGITUDINAL STABILITY CHARACTERISTICS OF AN OVERLAPPED-TYPE TANDEM-ROTOR HELICOPTER AT LOW AIRSPEEDS, Robert J. Tapscott, September 1958

TN 4397 STATIC LONGITUDINAL AND LATERAL STABILITY CHARACTERISTICS AT LOW SPEED OF 60° SWEPTBACK-MIDWING MODELS HAVING WINGS WITH AN ASPECT RATIO OF 2, 4, OR 6, Walter D. Wolhart and David F. Thomas, Jr., September 1958

TN 4406 LOW TIRE FRICTION AND CORNERING FORCES ON A WET SURFACE, Eziaslav N. Harrin, September 1958

TN 4410 FLIGHT MEASUREMENTS OF THE VIBRATORY STRESSES ON A PROPELLER DESIGNED FOR AN ADVANCE RATIO OF 4.0 AND A MACH NUMBER OF 0.82, Thomas C. O'Bryan, September 1958

Applicable NASA Memoranda (Memo)

There were no applicable stability and control reports in the NASA memorandum, NACA research memorandum, NASA technical translation, and NASA technical memorandum series.

Not Applicable NASA Memoranda (Memo)

Memo 10-1-58A THE EFFECTS OF LONGITUDINAL CONTROL-SYSTEM DYNAMICS ON PILOT OPINION AND RESPONSE CHARACTERISTICS AS DETERMINED FROM FLIGHT TESTS AND FROM GROUND SIMULATOR STUDIES, Melvin Sadoff, October 1958

Memo 10-1-58L LONGITUDINAL AND LATERAL STABILITY AND CONTROL CHARACTERISTICS OF VARIOUS COMBINATIONS OF THE COMPONENT PARTS OF TWO CANARD AIRPLANE CONFIGURATIONS AT MACH NUMBERS OF 1.41 AND 2.01, Cornelius Driver, October 1958

Memo 10-3-58L WIND-TUNNEL INVESTIGATION OF SOME EFFECTS OF WING SWEEP AND HORIZONTAL-TAIL HEIGHT ON THE STATIC STABILITY OF AN AIRPLANE MODEL AT TRANSONIC SPEEDS, Lewis R. Fisher and James L. Williams, October 1958

Memo 10-4-58A WIND-TUNNEL INVESTIGATION OF DEVICES TO IMPROVE STATIC DIRECTIONAL STABILITY OF UNSWEPT-WING AIRPLANE MODEL AT MACH NUMBERS FROM 0.8 TO 2.2, Ralph W. Holtzclaw, December 1958

Memo 10-6-58A A FLIGHT EVALUATION OF THE FACTORS WHICH INFLUENCE THE SELECTION OF LANDING APPROACH SPEEDS, Fred J. Drinkwater, III, and George E. Cooper, December 1958

Memo 10-14-58L EFFECTS OF FOREBODY LENGTH ON THE STABILITY AND CONTROL CHARACTERISTICS AT A MACH NUMBER OF 2.01 OF A CANARD AIRPLANE CONFIGURATION WITH A TRAPEZOIDAL ASPECT-RATIO-3 WING, M. Leroy Spearman and Cornelius Driver, November 1958

Memo 10-22-58L LOW-SPEED STATIC STABILITY CHARACTERISTICS OF TWO CONFIGURATIONS SUITABLE FOR LIFTING REENTRY FROM SATELLITE ORBIT, John W. Paulson, November 1958

Memo 10-26-58L FLIGHT INVESTIGATION OF A NORMAL-ACCELERATION AUTOMATIC LONGITUDINAL CONTROL SYSTEM IN A FIGHTER AIRPLANE, S. A. Sjoberg, Walter R. Russell, and William L. Alford, December 1958

Memo 10-27-58L HOVERING AND TRANSITION FLIGHT TESTS OF A 1/5-SCALE MODEL OF A JET-POWERED VERTICAL-ATTITUDE VTOL RESEARCH AIRPLANE, Charles C. Smith, Jr., December 1958

Memo 11-3-58L FORCE-TEST INVESTIGATION OF THE STABILITY AND CONTROL CHARACTERISTICS OF A 1/4-SCALE MODEL OF A TILT-WING VERTICAL-TAKE-OFF-AND-LANDING AIRCRAFT, William A. Newsom, Jr., and Louis P. Tosti, January 1959

Memo 11-4-58L FLIGHT INVESTIGATION OF THE STABILITY AND CONTROL CHARACTERISTICS OF A 1/4-SCALE MODEL OF A TILT-WING VERTICAL-TAKE-OFF-AND-LANDING AIRCRAFT, Louis P. Tosti, January 1959

Memo 11-5-58L ANALYTICAL AND EXPERIMENTAL DETERMINATION OF THE COUPLED NATURAL FREQUENCIES AND MODE SHAPES OF A DYNAMIC MODEL OF A SINGLE-ROTOR HELICOPTER, Milton A. Silveira and George W. Brooks, December 1958

Memo 11-30-58A EXPERIMENTAL WIND-TUNNEL INVESTIGATION OF THE TRANSONIC DAMPING-IN-PITCH CHARACTERISTICS OF TWO WING-BODY COMBINATIONS, Horace F. Emerson and Robert C. Robinson, December 1958

Memo 12-1-58A ESTIMATION OF DIRECTIONAL STABILITY DERIVATIVES AT MODERATE ANGLES AND SUPERSONIC SPEEDS, George E. Kaattari, January 1959

Memo 12-1-58L EFFECT OF TAIL DIHEDRAL ON LATERAL CONTROL EFFECTIVENESS AT HIGH SUBSONIC SPEEDS OF DIFFERENTIALLY DEFLECTED HORIZONTAL-TAIL SURFACES ON A CONFIGURATION HAVING A THIN HIGHLY TAPERED WING, Paul G. Fournier, January 1959

Memo 12-2-58A ESTIMATION OF DIRECTIONAL STABILITY DERIVATIVES AT SMALL ANGLES AND SUBSONIC AND SUPERSONIC SPEEDS, Frederick K. Goodwin and George E. Kaattari, December 1958

Memo 12-4-58L PRELIMINARY MEASUREMENTS OF THE NOISE CHARACTERISTICS OF SOME JET-AUGMENTED-FLAP CONFIGURATIONS, Domenic J. Maglieri and Harvey H. Hubbard, January 1959

Memo 12-10-58A A FLIGHT INVESTIGATION TO DETERMINE THE LATERAL OSCILLATORY DAMPING ACCEPTABLE FOR AN AIRPLANE IN THE LANDING APPROACH, Walter E. McNeill and Richard F. Vomaske, February 1959

Memo 12-13-58L A TRANSONIC WIND-TUNNEL INVESTIGATION OF THE PERFORMANCE AND OF THE STATIC STABILITY AND CONTROL CHARACTERISTICS OF A MODEL OF A FIGHTER-TYPE AIRPLANE WHICH EMBODIES PARTIAL BODY INDENTATION, Ralph P. Bielat, March 1959

Memo 12-30-58L A WEIGHT COMPARISON OF SEVERAL ATTITUDE CONTROLS FOR SATELLITES, James J. Adams and Robert G. Chilton, February 1959

Memo 1-7-59L A WIND-TUNNEL INVESTIGATION OF ROTOR BEHAVIOR UNDER EXTREME OPERATING CONDITIONS WITH A DESCRIPTION OF BLADE OSCILLATIONS ATTRIBUTED TO PITCH-LAG COUPLING, John W. McKee and Rodger L. Naeseth, January 1959

Memo 1-15-59L EFFECTS OF FUSELAGE NOSE LENGTH AND A CANOPY ON THE LOW-SPEED OSCILLATORY YAWING DERIVATIVES OF A SWEPT-WING AIRPLANE MODEL WITH A FUSELAGE OF CIRCULAR CROSS SECTION, James L. Williams and Joseph R. DiCamillo, January 1959

Memo 1-17-59A ESTIMATION OF STATIC LONGITUDINAL STABILITY OF AIRCRAFT CONFIGURATIONS AT HIGH MACH NUMBERS AND AT ANGLES OF ATTACK BETWEEN 0° AND $+180^{\circ}$, Duane W. Dugan, March 1959

Memo 1-19-59E SUMMARY OF STATISTICAL ICING CLOUD DATA MEASURED OVER UNITED STATES AND NORTH ATLANTIC, PACIFIC, AND ARCTIC OCEANS DURING ROUTINE AIRCRAFT OPERATIONS, Porter J. Perkins, January 1959

Memo 1-22-59L LOW-SUBSONIC STATIC STABILITY AND DAMPING DERIVATIVES AT ANGLES OF ATTACK FROM 0^{o} TO 90^{o} FOR A MODEL WITH A LOW-ASPECT-RATIO UNSWEPT WING AND TWO DIFFERENT FUSELAGE FOREBODIES, Peter C. Boisseau, March 1959

Memo 1-29-59A A PILOT OPINION STUDY OF LATERAL CONTROL REQUIREMENTS FOR FIGHTER-TYPE AIRCRAFT, Brent Y. Creer, John D. Stewart, Robert B. Merrick, and Fred J. Drinkwater III, March 1959

Memo 2-1-59L APPLICATION OF THE METHOD OF STEIN AND SANDERS TO THE CALCULATION OF VIBRATION CHARACTERISTICS OF A 45^{o} DELTA-WING SPECIMEN, John M. Hedgepeth and Paul G. Waner, Jr., February 1959

Memo 2-2-59H FLIGHT-DETERMINED STABILITY AND CONTROL DERIVATIVES OF SUPERSONIC AIRPLANE WITH LOW-ASPECT-RATIO UNSWEPT WING AND TEE-TAIL, William H. Andrews and Herman A. Rediess, April 1959

Memo 2-2-59L EVALUATION OF THE LEVY METHOD AS APPLIED TO VIBRATIONS OF A 45^{o} DELTA WING, Edwin T. Kruszewski and Paul G. Waner, Jr., February 1959

Memo 2-3-59A EXPERIMENTAL INVESTIGATION OF TRIANGULAR WING OF ASPECT RATIO 2 AND BODY WARPED TO BE TRIMMED AT M-2.24, Gaynor J. Adams and John W. Boyd, February 1959

Memo 2-6-59L A TECHNIQUE UTILIZING FREE-FLYING RADIO-CONTROLLED MODELS TO STUDY THE INCIPIENT- AND DEVELOPED-SPIN CHARACTERISTICS OF AIRPLANES, Charles E. Libbey and Sanger M. Burk, Jr., March 1959

Memo 2-7-59L LOW-SPEED YAWED-ROLLING CHARACTERISTICS OF A PAIR OF 56-INCH-DIAMETER, 32-PLY-RATING, TYPE VII AIRCRAFT TIRES, Wilbur E. Thompson and Walter B. Horne, February 1959

Memo 2-11-59L AN INVESTIGATION OF THE PERFORMANCE OF VARIOUS REACTION CONTROL DEVICES, Paul A. Hunter, March 1959

Memo 2-15-59L GROUND SIMULATOR STUDIES OF A NONLINEAR LINKAGE IN A POWER CONTROL SYSTEM, Arthur Assadourian, April 1959

Memo 2-19-59L FLIGHT INVESTIGATION OF AN AUTOMATIC THROTTLE CONTROL IN LANDING APPROACHES, L. J. Lina, R. A. Champine, and G. J. Morris, March 1959

Memo 2-21-59L STUDY OF TAXIING PROBLEMS ASSOCIATED WITH RUNWAY ROUGHNESS, Benjamin Milwitzky, March 1959

Memo 2-22-59L SOME STATIC, OSCILLATORY, AND FREE-BODY TESTS OF BLUNT BODIES AT LOW SUBSONIC SPEEDS, Jacob H. Lichtenstein, Lewis R. Fisher, Stanley H. Scher, and George F. Lawrence, April 1959

Memo 2-23-59L TIRE-TO-SURFACE FRICTION ESPECIALLY UNDER WET CONDITIONS, Richard H. Sawyer, Sidney A. Batterson, and Eziaslav N. Harrin, March 1959

Memo 3-2-59A STUDY OF THE OSCILLATORY MOTION OF MANNED VEHICLES ENTERING THE EARTH'S ATMOSPHERE, Simon C. Sommer and Murray Tobak, April 1959

Memo 3-2-59L WIND-TUNNEL INVESTIGATION AT MACH NUMBERS FROM 1.60 TO 4.50 OF STATIC-STABILITY CHARACTERISTICS OF 2 NONLIFTING VEHICLES SUITABLE FOR REENTRY, Kenneth L. Turner and David S. Shaw, March 1959

Memo 3-4-59A THE STATIC LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS IN THE PRESENCE OF THE GROUND OF A MODEL HAVING A TRIANGULAR WING AND CANARD, Donald A. Buell and Bruce E. Tinling, March 1959

Memo 3-6-59A USE OF FLIGHT SIMULATORS FOR PILOT-CONTROL PROBLEMS, George A. Rathert, Jr., Brent Y. Creer, and Joseph G. Douvillier, Jr., February 1959

Memo 3-7-59A PITCH-UP PROBLEM - A CRITERION AND METHOD OF EVALUATION, Melvin Sadoff, February 1959

Memo 4-2-59L STABILITY CHARACTERISTICS FROM MACH NUMBERS 1.0 TO 3.2 OF MISSILE OF FINENESS RATIO 11.5 WITH 10° FLARED-SKIRT AFTERBODY, Hal T. Baber, Jr., and Allen B. Henning, March 1959

Memo 4-4-59L EFFECTS OF FOREBODY DEFLECTION ON THE STABILITY AND CONTROL CHARACTERISTICS OF A CANARD AIRPLANE CONFIGURATION WITH A HIGH TRAPEZOIDAL WING AT A MACH NUMBER OF 2.01, M. Leroy Spearman and Cornelius Driver, March 1959

Memo 4-11-59L LOW-SPEED STATIC STABILITY AND CONTROL CHARACTERISTICS OF A MODEL OF A RIGHT TRIANGULAR PYRAMID REENTRY CONFIGURATION, John W. Paulson, April 1959

Memo 4-14-59A SAMPLED-DATA TECHNIQUES APPLIED TO A DIGITAL CONTROLLER FOR AN ALTITUDE AUTO-PILOT, Stanley F. Schmidt and Eleanor V. Harper, June 1959

Memo 4-15-59A A FLIGHT INVESTIGATION OF THE LOW-SPEED HANDLING QUALITIES OF A TAILLESS DELTA-WING FIGHTER AIRPLANE, Maurice D. White and Robert C. Innis, May 1959

Memo 4-18-59L NOISE SURVEY UNDER STATIC CONDITIONS OF A TURBINE-DRIVEN TRANSONIC PROPELLER WITH AN ADVANCE RATIO OF 4.0, Max C. Kurbjun, May 1959

Memo 4-19-59L FLIGHT PERFORMANCE OF A TRANSONIC TURBINE-DRIVEN PROPELLER DESIGNED FOR MINIMUM NOISE, Thomas C. O'Bryan and Jerome B. Hammack, May 1959

Memo 4-20-59A STATIC STABILITY AND CONTROL OF CANARD CONFIGURATIONS AT MACH NUMBERS FROM 0.70 TO 2.22 - LATERAL-DIRECTIONAL CHARACTERISTICS OF AN UNSWEPT WING AND CANARD, Victor L. Peterson, April 1959

Memo 4-21-59A LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS AT MACH NUMBERS FROM 0.70 TO 2.22 OF A TRIANGULAR WING CONFIGURATION EQUIPPED WITH A CANARD CONTROL, A TRAILING-EDGE FLAP CONTROL, OR A CAMBERED FOREBODY, John W. Boyd and Gene P. Menees, April 1959

Memo 4-22-59L LOW-SPEED LONGITUDINAL CHARACTERISTICS OF AN AIRPLANE CONFIGURATION INCLUDING EFFECTS OF CANARD AND WING TRAILING-EDGE FLAP CONTROLS IN COMBINATION, Bernard Spencer, Jr., and William C. Sleeman, Jr., April 1959

Memo 4-23-59L ANALYTICAL INVESTIGATION OF A FLICKER-TYPE ROLL CONTROL FOR A MACH NUMBER 6 MISSILE WITH AERODYNAMIC CONTROLS OVER AN ALTITUDE RANGE OF 82,000 TO 282,000 FEET, Reginald R. Lundstrom and Ruth I. Whitman, May 1959

Memo 5-5-59L EFFECT OF ARTIFICIAL PITCH DAMPING ON THE LONGITUDINAL AND ROLLING STABILITY OF AIRCRAFT WITH NEGATIVE STATIC MARGINS, Martin T. Moul and Lawrence W. Brown, June 1959

Memo 5-7-59L FLIGHT INVESTIGATION OF EFFECTS OF TRANSITION, LANDING APPROACHES, PARTIAL-POWER VERTICAL DESCENTS, AND DROOP-STOP POUNDING ON THE BENDING AND TORSIONAL MOMENTS ENCOUNTERED BY A HELICOPTER ROTOR BLADE, LeRoy H. Ludi, May 1959

Memo 5-16-59A STATIC AND DYNAMIC ROTARY STABILITY DERIVATIVES AT SUBSONIC SPEEDS OF AIRPLANE MODEL HAVING WING AND TAIL SURFACES SWEPT BACK 45°, Armando E. Lopez, Donald A. Buell, and Bruce E. Tinling, May 1959

Memo 5-20-59L LOW-SUBSONIC MEASUREMENTS OF THE STATIC AND OSCILLATORY LATERAL STABILITY DERIVATIVES OF A SWEPTBACK-WING AIRPLANE CONFIGURATION AT ANGLES OF ATTACK FROM -10° TO 90°, Donald E. Hewes, June 1959

Memo 5-25-59L INVESTIGATION OF THE STABILITY OF VERY FLAT SPINS AND ANALYSIS OF EFFECTS OF APPLYING VARIOUS MOMENTS UTILIZING THE THREE MOMENT EQUATIONS OF MOTION, Walter J. Klinar and William D. Grantham, June 1959

Memo 6-5-59A WIND-TUNNEL INVESTIGATION AT SUBSONIC AND SUPERSONIC SPEEDS OF STATIC AND DYNAMIC STABILITY DERIVATIVES OF AIRPLANE MODEL WITH UNSWEPT WING AND HIGH HORIZONTAL TAIL, Henry C. Lessing and James K. Butler, June 1959

Memo 6-11-59A STATIC LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS OF AN UNSWEPT WING AND UNSWEPT HORIZONTAL-TAIL CONFIGURATION AT MACH NUMBERS FROM 0.70 TO 2.22, Victor L. Peterson and Gene P. Menees, May 1959

Memo 6-12-59E CRASH-FIRE PROTECTION SYSTEM FOR T-56 TURBOPROPELLER ENGINE USING WATER AS COOLING AND INERTING AGENT, Arthur M. Busch and John A. Campbell, May 1959

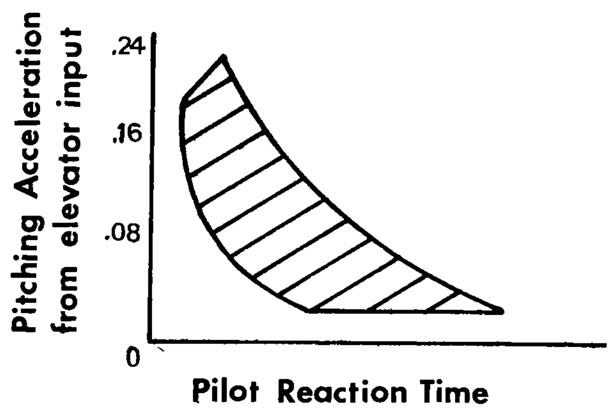
TN D 211 FLIGHT INVESTIGATION OF PILOT'S ABILITY TO CONTROL AN AIRPLANE HAVING POSITIVE AND NEGATIVE STATIC LONGITUDINAL STABILITY COUPLED WITH VARIOUS EFFECTIVE LIFT-CURVE SLOPES, R. F. Brissenden, W. L. Alford, and D. L. Mallick, February 1960

A flight investigation was made of an airplane having an automatic control system capable of varying static longitudinal stability and lift curve slope. The control system operated wing flaps which were geared to a portion of the elevator and produced a variation in both the static stability and lift curve slope of the airplane. The ability of human pilots to control the airplane without aid of stability augmentation was investigated at various values of positive and negative static stability and lift curve slope.

Results indicated that neutral or very slightly unstable static stability was tolerable in the presence of some lift capability.

TN D 221 IN FLIGHT MEASUREMENT OF THE TIME REQUIRED FOR A PILOT TO RESPOND TO AN AIRCRAFT DISTURBANCE, Helmut A. Kuehnel, March 1960

The time lapse from the start of an applied disturbance to the start of the pilot correction was measured for 3 pilots performing a total of 51 data runs. Results indicate that the average pilot's reaction time for moderate to large lateral airplane disturbances is 0.23 sec and that the average reaction time for moderate longitudinal airplane disturbances is 0.33 sec.



TN D 463 MEASUREMENT OF THE ERRORS OF SERVICE ALTIMETER INSTALLATIONS DURING LANDING-APPROACH AND TAKE OFF OPERATIONS, William Gracey, Joseph W. Jewel, Jr., and Gene T. Carpenter, November 1960

An analysis of data from 196 airplanes during 415 landing approaches and from 70 airplanes during 152 take-offs showed that:

1. Overall error of altimeters in landing approach had a probable value of ± 36 ft and maximum probable value of ± 159 feet.

2. Overall error in take-off condition had a probable error of ± 47 ft and maximum probable value of ± 207 ft.

TN D 510 RESPONSE OF A LIGHT AIRPLANE TO ROUGHNESS OF UNPAVED RUNWAYS, Garland J. Morris and Joseph W. Stickle, September 1960

An airplane with a landing gear using cantilever spring-type struts for the main and tail wheels was taxied over a concrete and a smooth and rough unpaved runway. Mean deviation for the rough runway was 0.254 ft and 0.066 ft for the smoother unpaved one. 1000 foot runs were made at constant speeds from 5 to 45 mph in increments of 5 mph. Aircraft incremental cg acceleration increased from about 0.07g at 5 mph to 0.23g at 40 mph on the rough runway and from 0.06g at 15 mph to 0.14g at 40 mph on the smooth grassy runway. Maximum response on the concrete taxiway was 0.04g at 40 to 50 mph.

Mean-square acceleration response to runways increased approximately linearly with speed up to about 25 to 30 mph, but increased more rapidly at higher speeds.

TN D 632 A LONGITUDINAL CONTROL FEEL SYSTEM FOR IN-FLIGHT RESEARCH ON RESPONSE FEEL, Stanley Faber and Harold I. Crane, January 1961

The purpose of this paper is to describe an electrohydraulic feel system with which it is possible to produce feel forces proportional to normal acceleration, pitching acceleration, pitching velocity, stick position and stick velocity, and to give a preliminary evaluation of its performance. This system is used on a transonic fighter airplane with irreversible power-actuated control surfaces and nonaerodynamic feel forces.

Results showed:

1. Moderate increase in control force due to pitching acceleration was found to increase the stability of the short-period longitudinal airplane response mode.

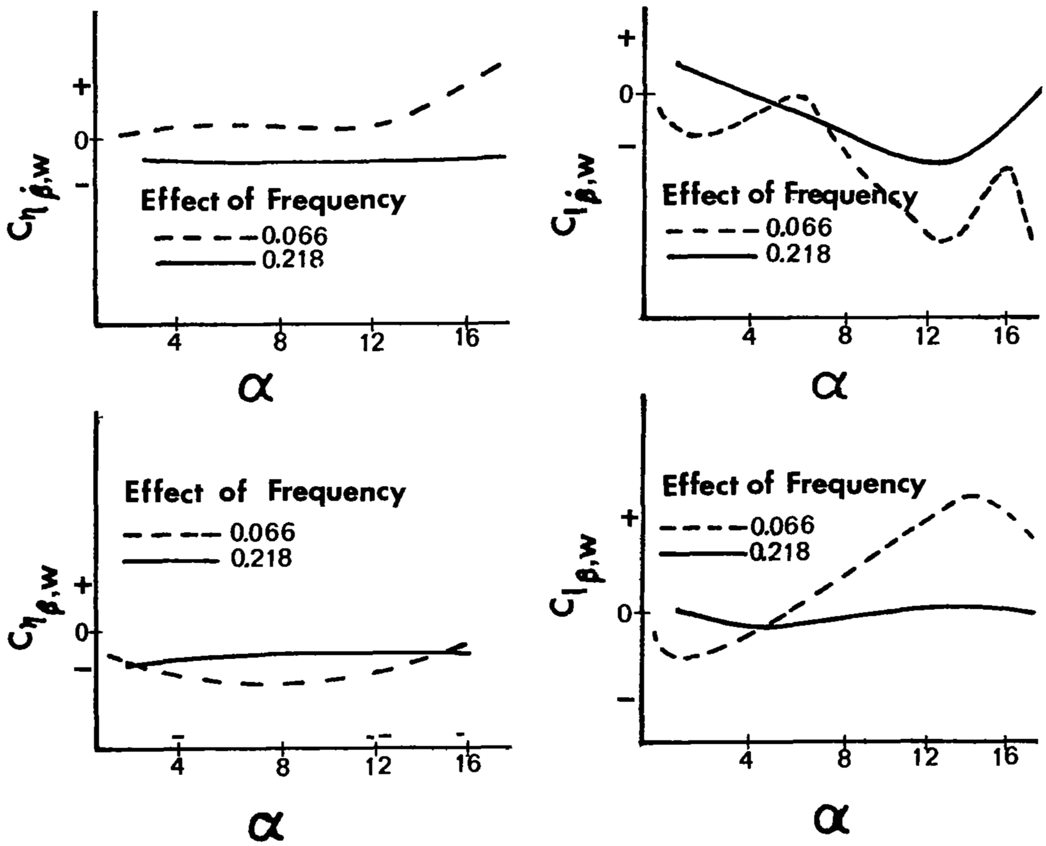
2. Addition of a sizeable force component due to either normal acceleration or pitching velocity caused a tendency to oscillate at the short period frequency.

3. Since normal acceleration and pitching acceleration were found to be 180° out of phast at the short period frequency, these parameters can be used together in a longitudinal-control feel system to eliminate largely the tendency of either one alone to force a control free oscillation.

TN D 896 LOW-SPEED INVESTIGATION OF THE EFFECTS OF FREQUENCY AND AMPLITUDE OF OSCILLATION IN SIDESLIP ON THE LATERAL STABILITY DERIVATIVES OF A 60° SWEPT WING AND AN UNSWEPT WING, Jacob H. Lichtenstein and James L. Williams, May 1961

The purpose of this low speed investigation was to obtain information about the effects of frequency and amplitude of pure sideslipping oscillations by the forced-oscillation technique of two swept wings and an unswept. The airfoil section was essentially a flat plate.

For the unswept wing $\frac{\omega b}{2y}$



TN D 898 REPEATABILITY OF THE OVER-ALL ERRORS OF AN AIRPLANE ALTIMETER INSTALLATION IN LANDING-APPROACH OPERATIONS, William Gracey and Joseph W. Stickle, May 1961

Flight tests were conducted to determine the repeatability of the over-all altimetry errors in the landing-approach condition of 2 sensitive altimeters (Air Force type C-12) installed in the cockpit of a transport airplane and of 4 precision altimeters (Air Force type MA-1) installed in a photo observer. Data was obtained during 42 landing-approach operations. The repeatability errors are defined as one-half the difference between the minimum and maximum errors measured in 2 or more landings.

Repeatability errors depend on (1) variation of static-pressure error with airspeed and aircraft configuration, (2) any instrument errors varying in a random manner, (3) variations in rate of descent and altitude from which descent was initiated, (4) errors in measurement and reporting measurements, (5) errors in setting barometric dial and reading altimeter. The repeatability of overall altimetry errors was determined as $\pm$ 35 ft for the pilot's altimeter and $\pm$ 39 ft for the copilot's. The mean values of the data obtained in the present tests shifted by relatively large amounts on successive flights, apparently because of the interaction of the stability and aftereffect recovery characteristics of the instruments.

From concurrent measurements of the over-all errors, for comparable installations, repeatability errors for these four precision altimeter errors would be smaller than those measured with the sensitive altimeters.

TN D 1356 FLIGHT CALIBRATIONS OF FUSELAGE STATIC-PRESSURE-VENT INSTALLATIONS FOR THREE TYPES OF TRANSPORTS, Norman S. Silsby and Joseph W. Stickle, May 1962

The flight calibrations of the copilot's fuselage static-pressure-vent installations for 16 different airplanes representing 3 types of military transports showed that for cruise condition, the sea-level values of the altitude error of the static-pressure source differed from the manufacturer's calibrations by as much as 30 feet for a 2 engine piston powered airplane. The errors of the 2-engine piston-powered airplanes and 4 engine turbojet airplanes appeared small with respect to the applicable vertical separation criteria.

TN D 1516 SPIN INVESTIGATION OF A 1/20 SCALE MODEL OF AN UNSWEPT WING, TWIN ENGINE, OBSERVATION AIRPLANE, Henry A. Lee, January 1963

An investigation was made in the Langley free spinning tunnel to determine the spin and recovery characteristics of a model of a typical observation airplane. The model was representative of a

1/20 scale model of a midwing, twin turboprop-engine aircraft with an unswept wing and 3 vertical tails. Erect spin and recovery characteristics of the model were determined for the most rearward c.g. loading.

1. Recoveries from erect spins for the normal loading will be satisfactory by rudder reversal to full against the spin, aileron movement to with the spin, and forward movement of the stick to neutral about 1/2 turn later.

2. For erect spins the rearward c.g. recoveries will be slow to unsatisfactory.

3. If spin is entered on landing, the flaps, slats, and landing gear should be retracted and recovery should be attempted immediately by using the procedure specified for the normal loading.

4. Satisfactory recoveries for inverted spins can be obtained by rudder reversal followed by neutralization of the longitudinal and lateral controls.

TN D 1777 AIRCRAFT VORTEX WAKES IN RELATION TO TERMINAL OPERATIONS, Joseph W. Wetmore and John P. Reeder, April 1963

An analysis was made to provide an indication of the possible effects on aircraft encountering trailing edge vortices, the circumstances under which encounters might occur in terminal-area operations, and some means of dealing with the vortex problem in operations planning and traffic control. The problems will arise when light aircraft encounter the vortices of heavier aircraft. These vortices of the heavier aircraft will be larger and stronger than the vortices of the light aircraft. The parts of flight in which the highest lifts were produced were considered the most hazardous. Landing and take-off was felt the most important because the light aircraft encountered heavy aircraft and because greatest lifts are produced during these two periods.

As an alternative to allowing 2 to 3 minutes for vortex dissipation in separating terminal-area traffic, procedures were suggested which, in many cases, would give reasonable assurance that vortices would not be encountered and would thereby permit shorter separation times. By insuring that a following airplane remains on or above the flight path of a preceding one, if of equal or greater size and weight, serious vortex effects could not occur even at separation times as short as ½ minute. This result could frequently be achieved if traffic control procedures could be developed which, in arranging the sequence of traffic, would take account of the varying runway length requirements, climbout and glideslope capabilities, and susceptibility to vortex effects of the various aircraft involved. Visual glideslope systems could be of substantial benefit in providing positive control of flight path for vortex avoidance in landing.

It was felt that:

Although vortex encounter can be a real hazard, such an encounter requires that an airplane be in a certain limited spatial region at a certain time and under suitable atmospheric conditions. Such a combination of circumstances apparently occurs rather infrequently, as attested by the still relatively few serious incidents attributed to vortices despite the frequent high-density traffic in some terminal areas.

The exposure to the vortex hazard, particularly in the sensitive take-off and landing operations, can be substantially reduced by suitable air-traffic control procedures which emphasize appropriate sequencing and spacing of traffic and control of flight paths.

TN D 2012 CALIBRATIONS OF AIRCRAFT STATIC-PRESSURE SYSTEMS BY GROUND-CAMERA AND GROUND-RADAR METHODS, William Gracey and Joseph W. Stickle, August 1963

Calibrations of two static-pressure systems were determined by a low-level flyover method, in which a ground-based camera was used, and by a high-altitude method based pressure-altitude surveys of the atmospheres, in which a ground based radar was used.

TN D 2166 PREDICTION OF AERODYNAMIC PENALTIES CAUSED BY ICE FORMATIONS ON VARIOUS AIRFOILS, Vernon H. Gray, February 1964

An equation is developed which gives changes in drag coefficients due to ice formations on an NACA 65A004 airfoil from known icing and flight conditions; this equation is extended to include available data for other airfoils with thickness ratios up to 15 percent.

TN D 2181 ANALYTICAL STUDY OF AIRCRAFT-DEVELOPED SPINS AND DETERMINATION OF MOMENTS REQUIRED FOR A SATISFACTORY SPIN RECOVERY, Ernie L. Anglin and Stanley H. Scher, February 1964

A study was made of fairly steady developed spins and recoveries of a sweptback-wing aircraft configuration. A nondimensional spin-energy factor based on the kinetic energy of spin rotation was devised. A method was also presented for estimating the approximate nature of steady developed spin characteristics.

TN D 2243 EFFECTS OF AIRCRAFT RELATIVE DENSITY ON SPIN AND RECOVERY CHARACTERISTICS OF SOME CURRENT CONFIGURATIONS, William D. Grantham and Sue B. Grafton, March 1965

A high-speed digital computer was used to examine the effects of relative density on the spin and recovery characteristics of four configurations which are representative of modern airplanes. Results indicate that an increase in relative density gave faster rotating spins, higher rates of descent, lower values of the spin coefficient, little change in angles of attack and sideslip, and recoveries, if obtained, were slower.

TN D 3970 EFFECTS OF A SIMPLE STABILITY AUGMENTATION SYSTEM ON THE PERFORMANCE OF NON-INSTRUMENT-QUALIFIED LIGHT-AIRCRAFT PILOTS DURING INSTRUMENT FLIGHT, Norman Driscoll, May 1967

An investigation of the effect of a simple stability augmentation device upon non-instrument-qualified pilots operating under instrument conditions was conducted. These pilots were not able to operate the airplane properly when the system was disconnected. With the system operative, pilots were able to perform in a sufficiently safe manner to permit recovery to visual flight conditions.

Tests made with the system disconnected showed that pilots were not able to perform satisfactorily, since the airplane required the pilot's complete attention. Any outside distraction such as communications requirements or navigation resulted in turning and climbing or descending flight.

Not Applicable NASA Technical Notes

TN D 7 — WING-ON AND WING-OFF LONGITUDINAL CHARACTERISTICS OF AN AIRPLANE CONFIGURATION HAVING A THIN UNSWEPT WING OF ASPECT RATIO 3, AS OBTAINED FROM ROCKET-PROPELLED MODELS AT MACH NUMBERS FROM 0.8 TO 1.4, Clarence L. Gillis and A. James Vitale, March 1960

TN D 20 — THE ANALYSIS AND DESIGN OF CONTINUOUS AND SAMPLED-DATA FEEDBACK CONTROL SYSTEMS WITH A SATURATION TYPE NONLINEARITY, Stanley Francis Schmidt, August 1959

TN D 26 — MOVING-COCKPIT SIMULATOR INVESTIGATION OF THE MINIMUM TOLERABLE LONGITUDINAL MANEUVERING STABILITY, B. Porter Brown and Harold I. Johnson, September 1959

TN D 32 — A LIMITED FLIGHT AND WIND-TUNNEL INVESTIGATION OF PADDLE SPOILERS AS LATERAL CONTROLS, Robert G. Munfall, Harold I. Johnson, and William L. Alford, September 1959

TN D 35 — FULL-SCALE WIND-TUNNEL INVESTIGATION OF THE LONGITUDINAL CHARACTERISTICS OF A TILTING-ROTOR CONVERTIPLANE, David G. Koenig, Richard K. Greif, and Mark W. Kelly, December 1959

TN D 42 — INVESTIGATION AT TRANSONIC SPEEDS TO DETERMINE LATERAL CONTROL EFFECTIVENESS OF BLOWING LATERALLY OVER SURFACES OF 30° AND 45° SWEPT WINGS, Alexander D. Hammond and Linwood W. McKinney, October 1959

TN D 44 — FORCE-TEST INVESTIGATION OF THE STABILITY AND CONTROL CHARACTERISTICS OF A 1/8-SCALE MODEL OF A TILT-WING VERTICAL-TAKE-OFF-AND-LANDING AIRPLANE, Louis P. Tosti, March 1960

TN D 45 — FLIGHT INVESTIGATION OF STABILITY AND CONTROL CHARACTERISTICS OF A 1/8-SCALE MODEL OF A TILT-WING VERTICAL-TAKE-OFF-AND-LANDING AIRPLANE, Louis P. Tosti, March 1960

TN D 47 — DYNAMIC ANALYSIS OF A SIMPLE REENTRY MANEUVER FOR A LIFTING SATELLITE, Frederick C. Grant, September 1959

TN D 55 — WIND-TUNNEL INVESTIGATION OF LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF THREE PROPELLER-DRIVEN VTOL CONFIGURATIONS IN THE TRANSITION SPEED RANGE, INCLUDING EFFECTS OF GROUND PROXIMITY, Richard E. Kuhn and William C. Hayes, Jr., February 1960

TN D 58 — THE EFFECTS OF VARIOUS COMBINATIONS OF DAMPING AND CONTROL POWER ON HELICOPTER HANDLING QUALITIES DURING BOTH INSTRUMENT AND VISUAL FLIGHT, Seymour Salmirs and Robert J. Tapscott, October 1959

TN D 218 LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF A HIGH-SUBSONIC-SPEED TRANSPORT AIRPLANE MODEL WITH A CAMBERED 40° SWEPTBACK WING OF ASPECT RATIO 8 AT MACH NUMBERS TO 0.96, Atwood R. Heath, Jr., February 1960

TN D 221 IN-FLIGHT MEASUREMENT OF THE TIME REQUIRED FOR A PILOT TO RESPOND TO AN AIRCRAFT DISTURBANCE, Helmut A. Kuehnel, March 1960

TN D 228 FIXED-BASE SIMULATION STUDY OF A PILOT'S ABILITY TO CONTROL A WINGED-SATELLITE VEHICLE DURING HIGH-DRAG VARIABLE-LIFT ENTRIES, John M. Eggleston, Sheldon Baron, and Donald C. Cheatham, April 1960

TN D 232 EXPERIMENTAL DETERMINATION OF THE EFFECTS OF FREQUENCY AND AMPLITUDE OF OSCILLATION ON THE ROLL-STABILITY DERIVATIVES FOR A 60° DELTA-WING AIRPLANE MODEL, Lewis R. Fisher, March 1960

TN D 233 DETERMINATION OF AZIMUTH ANGLE AT BURN-OUT FOR PLACING A SATELLITE OVER A SELECTED EARTH POSITION, T. H. Skopinski and Katherine G. Johnson, September 1960

TN D 246 AN EXPERIMENTAL INVESTIGATION TO DETERMINE THE EFFECT OF SPEED-BRAKE POSITION ON THE LONGITUDINAL STABILITY AND TRIM OF A SWEPT-WING FIGHTER AIRPLANE, Robert T. Taylor, February 1960

TN D 248 LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF A FOUR-PROPELLER DEFLECTED SLIP-STREAM VTOL MODEL INCLUDING THE EFFECTS OF GROUND PROXIMITY, Richard E. Kuhn and Kalman J. Grunwald, November 1960

TN D 253 LONGITUDINAL RANGE CONTROL DURING THE ATMOSPHERIC PHASE OF A MANNED SATELLITE REENTRY, Arthur Assadourian and Donald C. Cheatham, May 1960

TN D 255 REQUIREMENTS OF TRAJECTORY CORRECTIVE IMPUSLES DURING THE APPROACH PHASE OF AN INTERPLANETARY MISSION, Alan L. Friedlander and David P. Harry III, January 1960

TN D 268 EXPLORATORY STATISTICAL ANALYSIS OF PLANET APPROACH-PHASE GUIDANCE SCHEMES USING RANGE, RANGE-RATE, AND ANGULAR-RATE MEASUREMENTS, Daivd P. Harry III and Alan L. Friedlander, March 1960

TN D 281 ANALYSIS OF TRAJECTORY PARAMETERS FOR PROBE AND ROUND-TRIP MISSIONS TO MARS, James F. Dugan, Jr., June 1960

TN D 284 EFFECTS OF JET BILLOWING ON STABILITY OF MISSILE-TYPE BODIES AT MACH 3.85, Reino J. Salmi, June 1960

TN D 305 ON THE DESIGN OF A HIGH-GAIN SATURATING CONTROL SYSTEM FOR USE AS AN ADAPTIVE AUTOPILOT, John D. McLean and Stanley F. Schmidt, February 1960

TN D 322 INVESTIGATION OF THE ERRORS OF AN INERTIAL GUIDANCE SYSTEM DURING SATELLITE RE-ENTRY, John S. White, August 1960

TN D 323 A FLIGHT STUDY OF A POWER-OFF LANDING TECHNIQUE APPLICABLE TO RE-ENTRY VEHICLES, Richard S. Bray, Fred J. Drinkwater III, and Maurice D. White, July 1960

TN D 324 THE DESIGN OF FEEDBACK CONTROL SYSTEMS CONTAINING A SATURATION TYPE NONLINEARITY, Stanley F. Schmidt and Eleanor V. Harper, September 1960

TN D 325 AN ANALYTICAL METHOD FOR STUDYING THE LATERAL MOTION OF ATMOSPHERE ENTRY VEHICLES, Robert E. Slye, September 1960

TN D 330 AERODYNAMIC PERFORMANCE AND STATIC STABILITY AT MACH NUMBER 3.3 OF AN AIRCRAFT CONFIGURATION EMPLOYING THREE TRIANGULAR WING PANELS AND A BODY OF EQUAL LENGTH, Carlton S. James, August 1960

TN D 331 AN EXAMINATION OF HANDLING QUALITIES CRITERIA FOR V/STOL AIRCRAFT, Seth B. Anderson, July 1960

TN D 337 CENTRIFUGE STUDY OF PILOT TOLERANCE TO ACCELERATION AND THE EFFECTS OF ACCELERATION ON PILOT PERFORMANCE, Brent Y. Creer, Harald A. Smedal, and Rodney C. Wingrove, November 1960

TN D 343 A SELF-ADAPTIVE MISSILE GUIDANCE SYSTEM FOR STATISTICAL INPUTS, H. Rodney Peery, November 1960

TN D 345 PHYSIOLOGICAL EFFECTS OF ACCELERATION OBSERVED DURING A CENTRIFUGE STUDY OF PILOT PERFORMANCE, Harald A. Smedal, Brent Y. Creer, and Rodney C. Wingrove, December 1960

TN D 348 A STUDY OF LONGITUDINAL CONTROL PROBLEMS AT LOW AND NEGATIVE DAMPING AND STABILITY WITH EMPHASIS ON EFFECTS OF MOTION CUES, Melvin Sadoff, Norman M. McFadden, and Donovan R. Heinle, January 1961

TN D 366 POWER SPECTRAL ANALYSIS OF SOME AIRPLANE RESPONSE QUANTITIES OBTAINED DURING OPERATIONAL TRAINING MISSIONS OF A FIGHTER AIR-PLANE, Harold A. Hamer and John P. Mayer, March 1960

TN D 367 SIMULATOR MOTION EFFECTS ON A PILOT'S ABILITY TO PERFORM A PRECISE LONGITUDINAL FLYING TASK, B. Porter Brown, Harold I. Johnson, and Robert G. Mungall, May 1960

TN D 369 INVESTIGATION OF THE LOW-SUBSONIC FLIGHT CHARACTERISTICS OF A MODEL OF AN ALL-WING HYPERSONIC BOOST-GLIDE CONFIGURATION HAVING VERY HIGH SWEEP, Robert E. Shanks, June 1960

TN D 370 HELICOPTER-ENGINE ACCELERATION-TIME REQUIREMENTS BASED ON PILOT DEMAND DURING RECOVERY FROM LANDING FLAREOUTS, Andrew B. Connor, May 1960

TN D 375 A MANUAL FREQUENCY SWEEP TECHNIQUE FOR THE MEASUREMENT OF AIRPLANE FREQUENCY RESPONSE, Harold L. Crane, April 1960

TN D 386 STATISTICAL DATA ON CONTROL MOTIONS AND AIRPLANE RESPONSE OF A REPUBLIC F-84F AIRPLANE DURING OPERATIONAL TRAINING MISSIONS, Harold A. Hamer and John P. Mayer, March 1960

TN D 393 MEASUREMENTS OF THE TIME-AVERAGED AND INSTANTANEOUS INDUCED VELOCITIES IN THE WAKE OF A HELICOPTER ROTOR HOVERING AT HIGH TIP SPEEDS, Harry H. Heyson, July 1960

TN D 398 EFFECT OF REYNOLDS NUMBER ON THE LATERAL-STABILITY DERIVATIVES AT LOW SPEED OF SWEPTBACK- AND DELTA-WING - FUSELAGE COMBINATIONS OSCILLATING IN YAW, Charles P. Llewellyn and Walter D. Wolhart, August 1960

TN D 416 ANALYTICAL INVESTIGATION OF THE DYNAMIC BEHAVIOR OF A NONLIFTING MANNED REENTRY VEHICLE, Jacob H. Lichtenstein, September 1960

TN D 428 INVESTIGATION OF THIRD-ORDER CONTACTOR CONTROL SYSTEMS WITH TWO COMPLEX POLES WITHOUT ZEROS, Irmgard Flugge-Lotz and Tomo Ishikawa, June 1960

TN D 433 LOW-SPEED MEASUREMENTS OF STATIC AND OSCILLATORY LATERAL STABILITY DERIVATIVES OF A 1/5-SCLAE MODEL OF A JET-POWERED VERTICAL-ATTITUDE VTOL RESEARCH AIRPLANE, Robert E. Shanks and Charles C. Smith, Jr., September 1960

TN D 438 PROBLEMS INVOLVED IN AN EMERGENCY METHOD OF GUIDING A GLIDING VEHICLE FROM HIGH ALTITUDES TO A HIGH KEY POSITION, Joseph W. Jewel, Jr., and James B. Whitten, August 1960

TN D 444 LATERAL STABILITY AND CONTROL CHARACTERISTICS OF A FOUR-PROPELLER DEFLECTED-SLIPSTREAM VTOL MODEL INCLUDING THE EFFECTS OF GROUND PROXIMITY, Richard E. Kuhn and Kalman J. Grunwald, January 1961

TN D 445 INVESTIGATION OF LONGITUDINAL AND LATERAL STABILITY CHARACTERISTICS OF A SIX-PROPELLER DEFLECTED-SLIPSTREAM VTOL MODEL WITH BOUNDARY-LAYER CONTROL INCLUDING EFFECTS OF GROUND PROXIMITY, Kalman J. Grunwald, November 1960

TN D 450 NOISE CONSIDERATION FOR MANNED REENTRY VEHICLES, David A. Hilton, William H. Mayes, and Harvey H. Hubbard, September 1960

TN D 454 THEORETICAL ANALYSIS OF THE LONGTITUDINAL BEHAVIOR OF AN AUTOMATICALLY CONTROLLED SUPERSONIC INTERCEPTOR DURING THE ATTACK PHASE AGAINST MANEUVERING AND NONMANEUVERING TARGETS, C. H. Woodling and Ordway B. Gates, Jr., June 1960

TN D 464 EFFECTS OF CONTROL-RESPONSE CHARACTERISTICS ON THE CAPABILITY OF A HELICOPTER FOR USE AS A GUN PLATFORM, Robert J. Pegg and Andrew B. Connor, September 1960

TN D 484 TELEMETRY CODE AND CALIBRATIONS FOR SATELLITE 1959 IOTA (EXPLORER VII), I. L. Cherrick, May 1960

TN D 485 A LOW-RESOLUTION UNCHOPPED RADIOMETER FOR SATELLITES, R. A. Hanel, February 1961

TN D 496 VANGUARD SATELLITE SPIN-REDUCTION MECHANISM, Robert C. Baumann, April 1961

TN D 510 RESPONSE OF A LIGHT AIRPLANE TO ROUGHNESS OF UNPAVED RUNWAYS, Garland J. Morris and Joseph W. Stickle, September 1960

TN D 511 SIMULATOR INVESTIGATION OF CONTROLS AND DISPLAY REQUIRED FOR TERMINAL PHASE OF COPLANAR ORBITAL RENDEZVOUS, Chester H. Wolowicz, Hubert M. Drake, and Edward N. Videan, October 1960

TN D 514 STATIC LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS AT A MACH NUMBER OF 1.09 OF A LENTICULAR-SHAPED REENTRY VEHICLE, Charlie M. Jackson, Jr., and Roy V. Harris, Jr., October 1960

TN D 517 NEAR-FIELD AND FAR-FIELD NOISE MEASUREMENTS FOR A BLOWDOWN-WIND-TUNNEL SUPERSONIC EXHAUST JET HAVING ABOUT 475,000 POUNDS OF THRUST, William H. Mayes, Philip M. Edge, Jr., and James S. O'Brien, Jr., April 1961

TN D 525 A THREE-AXIS FIXED-SIMULATOR INVESTIGATION OF THE EFFECTS ON CONTROL PRECISION OF VARIOUS WAYS OF UTILIZING RATE SIGNALS, John W. McKee, January 1961

TN D 546 EXPERIENCE WITH A THREE-AXIS SIDE-LOCATED CONTROLLER DURING A STATIC AND CENTRIFUGE SIMULATION OF THE PILOTED LAUNCH OF A MANNED MULTISTAGE VEHICLE, William H. Andrews and Euclid C. Holleman, November 1960

TN D 554 INVESTIGATION OF THE STATIC LONGITUDINAL STABILITY CHARACTERISTICS OF A 0.067-SCALE MODEL OF A FOUR-STAGE CONFIGURATION OF THE SCOUT RESEARCH VEHICLE AT MACH NUMBERS OF 2.29, 2.96, 3.96, AND 4.65, L. S. Jernell and Norman Wong, September 1960

TN D 555 THEORY OF ARTIFICIAL STABILIZATION OF MISSILES AND SPACE VEHICLES WITH EXPOSITION OF FOUR CONTROL PRINCIPLES, R. F. Hoelker, June 1961

TN D 566 ROTATIONAL MAGNETODYNAMICS AND STEERING OF SPACE VEHICLES, R. S. Wilson, Jr., September 1961

TN D 611 FAR-FIELD NOISE CHARACTERISTICS OF SATURN STATIC TESTS, Wade D. Dorland, August 1961

TN D 616 EXPERIMENTAL INVESTIGATION OF SOME OF THE PARAMETERS RELATED TO THE STABILITY AND CONTROL OF AERIAL VEHICLES SUPPORTED BY DUCTED FANS, Lysle P. Parlett, November 1960

TN D 630 AN ANALYTICAL APPROACH TO THE DESIGN OF AN AUTOMATIC DISCONTINOUS CONTROL SYSTEM, Lawrence W. Taylor, Jr., and John W. Smith, April 1961

TN D 632 A LONGITUDINAL CONTROL FEEL SYSTEM FOR IN-FLIGHT RESEARCH ON RESPONSE FEEL, Stanley Faber and Harold L. Crane, January 1961

TN D 638 ROCKET-MODEL INVESTIGATION OF LATERAL STABILITY CHARACTERISTICS AND POWER EFFECTS OF A JET-ENGINE AIRPLANE CONFIGURATION WITH TAIL BOOM AT MACH NUMBERS FROM 1.15 TO 1.37, T. Bradley Curry, Jr., and Norman L. Crabill, January 1961

TN D 641 A THREE-DIMENSIONAL TRAJECTORY SIMULATION USING SIX DEGREES OF FREEDOM WITH ARBITRARY WIND, Robert L. James, Jr., APPENDIX B: DAMPING IN PITCH AND YAW FOR RADIAL BURNING SOLID-PROPELLANT ROCKETS, Norman L. Crabill, March 1961

TN D 646 LOW-SUBSONIC-SPEED STATIC STABILITY OF RIGHT-TRIANGULAR-PYRAMID AND HALF-CONE LIFTING REENTRY CONFIGURATIONS, George M. Ware, February 1961

TN D 651 INVESTIGATION OF THE STATIC STABILITY CHARACTERISTICS OF TWO STAGES OF A THREE-STAGE MISSILE AT A MACH NUMBER OF 4.00, Ausley B. Carraway, Frederick G. Edwards, and Jean C. Keating, March 1961

TN D 654 APPLICATION OF DESCRIBING-FUNCTION ANALYSIS TO THE STUDY OF AN ON-OFF REACTION-CONTROL SYSTEM, Edgar C. Lineberry, Jr., and Edwin C. Foudriat, January 1961

TN D 655 STATIC LONGITUDINAL AND LATERAL STABILITY CHARACTERISTICS OF A RIGHT TRIANGULAR PYRAMIDAL LIFTING REENTRY CONFIGURATION AT TRANSONIC SPEEDS, Walter B. Olstad, John P. Mugler, Jr., and Maurice S. Cahn, April 1961

TN D 659 AN ANALYTICAL TREATMENT OF AIRCRAFT PROPELLER PRECESSION INSTABILITY, Wilmer H. Reed III and Samuel R. Bland, January 1961

TN D 677 CRITICAL CONDITIONS FOR DROP AND JET SHATTERING, Gerald Morrell, February 1961

TN D 691 STUDY OF SYSTEMS USING INERTIA WHEELS FOR PRECISE ATTITUDE CONTROL OF A SATELLITE, John S. White and Q. Marion Hansen, April 1961

TN D 694 MEASURED TWO-DIMENSIONAL DAMPING EFFECTIVENESS OF FUEL-SLOSHING BAFFLES APPLIED TO RING BAFFLES IN CYLINDRICAL TANKS, Henry A. Cole, Jr., and Bruno J. Gambucci, February 1961

TN D 711 INVESTIGATION OF THE STATIC LONGITUDINAL AND LATERAL STABILITY CHARACTERISTICS OF A 0.10-SCALE MODEL OF A THREE-STAGE CONFIGURATION OF THE SCOUT RESEARCH VEHICLE AT MACH NUMBERS OF 2.29, 2.96, 3.96, AND 4.65, L. S. Jernell, March 1961

TN D 715 AN EXPERIMENTAL INVESTIGATION OF THE DAMPING OF LIQUID OSCILLATIONS IN CYLINDRICAL TANKS WITH VARIOUS BAFFLES, Milton A. Silveira, David G. Stephens, and H. Wayne Leonard, May 1961

TN D 719 INVESTIGATION OF THIRD ORDER CONTACTOR CONTROL SYSTEMS WITH ZEROS IN THEIR TRANSFER FUNCTIONS, I. Flugge-Lotz and T. Ishikawa, January 1961

TN D 735 HANDLING QUALITIES EXPERIENCE WITH SEVERAL VTOL RESEARCH AIRCRAFT, John P. Reeder, March 1961

TN D 736 NOISE CONSIDERATIONS IN THE DESIGN AND OPERATION OF V/STOL AIRCRAFT, Domenic J. Maglieri, David A. Hilton, and Harvey H. Hubbard, April 1961

TN D 746 FLIGHT CONTROLLABILITY LIMITS AND RELATED HUMAN TRANSFER FUNCTIONS AS DETERMINED FROM SIMULATOR AND FLIGHT TESTS, Lawrence W. Taylor, Jr., and Richard E. Day, May 1961

TN D 747 ANALOG SIMULATION OF A PILOT-CONTROLLED RENDEZVOUS, Roy F. Brissenden, Bert B. Burton, Edwin C. Foudriat, and James B. Whitten, April 1961

TN D 749 EXPERIMENTAL EVALUATION OF THE DECELERATION OF ALUMINUM CYLINDERS ROTATING IN A MAGNETIC FIELD AND COMMENTS ON MAGNETIC DAMPING OF A FLYWHEEL CONTROL, Donald G. Eide, April 1961

TN D 771 PROCEEDINGS OF MEETING ON PROBLEMS AND TECHNIQUES ASSOCIATED WITH THE DECONTAMINATION AND STERILIZATION OF SPACECRAFT JUNE 29, 1960, WASHINGTON, D. C., Jack Posner, Editor. APPENDIX: STERILIZATION OF INTERPLANETARY VEHICLES, Charles R. Phillips and Robert K. Hoffman, January 1961

TN D 778 A FLIGHT STUDY OF THE DYNAMIC STABILITY OF A TILTING ROTOR CONVERTIPLANE, Hervey C. Quigley and David G. Koenig, April 1961

TN D 779 FLIGHT INVESTIGATION USING VARIABLE STABILITY AIRPLANES OF MINIMUM STABILITY REQUIREMENTS FOR HIGH SPEED, HIGH ALTITUDE VEHICLES, Norman M. McFadden, Richard F. Vomaske, and Donovan R. Heinle, April 1961

TN D 780 A METHOD FOR OBTAINING THE NONLINEAR AERODYNAMIC STABILITY CHARACTERISTICS OF BODIES OF REVOLUTION FROM FREE FLIGHT TESTS, Donn B. Kirk, March 1961

TN D 792 ATTITUDE CONTROL REQUIREMENTS FOR HOVERING DETERMINED THROUGH THE USE OF A PILOTED FLIGHT SIMULATOR, Alan E. Faye, Jr., April 1961

TN D 804 INVESTIGATION AT HIGH SUBSONIC SPEEDS OF THE USE OF LOW AUXILIARY TAIL SURFACES HAVING DIHEDRAL TO IMPROVE THE LONGITUDINAL AND DIRECTIONAL STABILITY OF A T-TAIL MODEL AT HIGH LIFT, William C. Sleeman, Jr., April 1961

TN D 808 AN EXPERIMENTAL INVESTIGATION OF THE DAMPING OF LIQUID OSCILLATIONS IN AN OBLATE SPHEROIDAL TANK WITH AND WITHOUT BAFFLES, David G. Stephens, H. Wayne Leonard, and Milton A. Silveira, June 1961

TN D 810 TOLERABLE LIMITS OF OSCILLATORY ACCELERATIONS DUE TO ROLLING MOTIONS EXPERIENCED BY ONE PILOT DURING AUTOMATIC-INTERCEPTOR FLIGHT TESTS, Roy F. Brissenden, Donald C. Cheatham, and Robert A. Champine, April 1961

TN D 812 EFFECTS OF GYROSCOPIC CROSS COUPLING BETWEEN PITCH AND ROLL ON THE HANDLING QUALITIES OF VTOL AIRCRAFT, John F. Garren, Jr., April 1961

TN D 818 METHOD FOR CALCULATING INDUCED VELOCITIES AT THE BLADES OF A SLIGHTLY INCLINED PROPELLER WITH CONSTANT CIRCULATION, Harry H. Heyson, May 1961

TN D 825 OPTIMUM NONLINEAR CONTROL OF A SECOND ORDER NONLINEAR SYSTEM, Rufus Oldenburge, John C. Nicklas, and E. H. Gamble, April 1961

TN D 828 STUDY OF THE USE OF A TERMINAL CONTROL TECHNIQUE FOR REENTRY GUIDANCE OF A CAPSULE-TYPE VEHICLE, Edwin C. Foudriat, May 1961

TN D 852 A PRELIMINARY STUDY OF THE ACOUSTIC TRANSMISSION LOSS OF TWO FIBERGLAS NOSE-CONE SHAPES, Vern G. Rollin, June 1961

TN D 856 EXPERIMENTAL EVALUATIONS OF ANALYTICAL MODELS FOR THE INERTIAS AND NATURAL FREQUENCIES OF FUEL SLOSHING IN CIRCULAR CYLINDRICAL TANKS, Robert W. Warner and John T. Caldwell, May 1961

TN D 858 DESIGN AND FLIGHT TESTS OF AN ADAPTIVE CONTROL SYSTEM EMPLOYING NORMAL-ACCELERATION COMMAND, Walter E. McNeill, John D. McLean, Daniel M. Hegarty, and Donovan R. Heinle, April 1961

TN D 872 EFFECT OF IMPINGEMENT ANGLE ON DROP-SIZE DISTRIBUTION AND SPRAY PATTERN OF TWO IMPINGING WATER JETS, Marcus F. Heidmann and Hampton H. Foster, July 1961

TN D 874 GROUND AN IN-FLIGHT ACOUSTIC AND PERFORMANCE CHARACTERISTICS OF JET-AIRCRAFT EXHAUST NOISE SUPPRESSORS, Willard D. Coles, John A. Mihaloew, and William H. Swann, August 1961

TN D 892 LOW-SUBSONIC MEASUREMENTS OF THE STATIC STABILITY AND CONTROL AND OSCILLATORY STABILITY DERIVATIVES OF A PROPOSED REENTRY VEHICLE HAVING AN EXTENSIBLE HEAT SHIELD FOR HIGH-DRAG REENTRY, Joseph L. Johnson, Jr., and Peter C. Boisseau, August 1961

TN D 896 LOW-SPEED INVESTIGATION OF THE EFFECTS OF FREQUENCY AND AMPLITUDE OF OSCILLATION IN SIDESLIP ON THE LATERAL STABILITY DERIVATIVES OF A 60° DELTA WING, A 45°SWEPTBACK WING, AND AN UNSWEPT WING, Jacob H. Lichtenstein and James L. Williams, May 1961

TN D 904 AN INVESTIGATION OF THE NATURAL FREQUENCIES AND MODE SHAPES OF LIQUIDS IN OBLATE SPHEROIDAL TANKS, H. Wayne Leonard and William C. Walton, Jr., June 1961

TN D 905 STUDY OF AN ACTIVE CONTROL SYSTEM FOR A SPINNING BODY, J. J. Adams, June 1961

TN D 909 ANALYTICAL INVESTIGATION OF AN ADAPTIVE FLIGHT-CONTROL SYSTEM USING A SINUSOIDAL TEST SIGNAL, Jack E. Harris, June 1961

TN D 912 EFFECTS OF CONTROL-FEEL CONFIGURATION ON AIRPLANE LONGITUDINAL CONTROL RESPONSE, Harold L. Crane and Robert W. Sommer, October 1961

TN D 913 INVESTIGATION OF THE LOW-SUBSONIC STABILITY AND CONTROL CHARACTERISTICS OF A FREE-FLYING MODEL OF A THICK 70° DELTA REENTRY CONFIGURATION, John W. Paulson and Robert E. Shanks, October 1961

TN D 920 STABILITY AND CONTROL CHARACTERISTICS OF A SMALL-SCALE MODEL OF AN AERIAL VEHICLE SUPPORTED BY TWO DUCTED FANS, Lysle P. Parlett, July 1961

TN D 937 STABILITY AND CONTROL CHARACTERISTICS OF A MODEL OF AN AERIAL VEHICLE SUPPORTED BY FOUR DUCTED FANS, Lysle P. Parlett, August 1961

TN D 949 STATIC LONGITUDINAL CHARACTERISTICS AT HIGH SUBSONIC SPEEDS OF A COMPLETE AIRPLANE MODEL WITH A HIGHLY TAPERED WING HAVING THE 0.80 CHORD LINE UNSWEPT AND WITH SEVERAL TAIL CONFIGURATIONS, Kenneth W. Goodson, August 1961

TN D 950 STATIC LATERAL CHARACTERISTICS AT HIGH SUBSONIC SPEEDS OF A COMPLETE AIRPLANE MODEL WITH A HIGHLY TAPERED WING HAVING THE 0.80 CHORD LINE UNSWEPT AND WITH SEVERAL TAIL CONFIGURATIONS, Kenneth W. Goodson, August 1961

TN D 952 ANALYSIS OF EFFECTS OF INTERCEPTOR ROLL PERFORMANCE AND MANEUVERABILITY ON SUCCESS OF COLLISION-COURSE ATTACKS, William H. Phillips, August 1961

TN D 956 INCIPIENT- AND DEVELOPED-SPIN AND RECOVERY CHARACTERISTICS OF A MODERN HIGH-SPEED FIGHTER DESIGN WITH LOW ASPECT RATIO AS DETERMINED FROM DYNAMIC-MODEL TESTS, Henry A. Lee and Charles E. Libbey, December 1961

TN D 965 ANALYTICAL AND PRELIMINARY SIMULATION STUDY OF A PILOT'S ABILITY TO CONTROL THE TERMINAL PHASE OF A RENDEZVOUS WITH SIMPLE OPTICAL DEVICES AND A TIMER, Edgar C. Lineberry, Jr., Roy F. Brissenden, and Max C. Kurbjun, October 1961

TN D 973 EFFECTS OF GYROSCOPIC CROSS COUPLING BETWEEN PITCH AND YAW ON THE HANDLING QUALITIES OF VTOL AIRCRAFT, John F. Garren, Jr., November 1961

TN D 976 THE SMOKE-TRAIL METHOD FOR OBTAINING DETAILED MEASUREMENTS OF THE VERTICAL WIND PROFILE FOR APPLICATION TO MISSILE-DYNAMIC-RESPONSE PROBLEMS, Robert M. Henry, George W. Brandon, Harold B. Tolefson, and Wade E. Lanford, November 1961

TN D 979 GUIDANCE AND CONTROL DURING DIRECT-DESCENT PARABOLIC REENTRY, Edwin C. Foudriat and Rodney C. Wingrove, November 1961

TN D 986 DYNAMIC STABILITY AND CONTROL PROBLEMS OF PILOTED RENETRY FROM LUNAR MISSIONS, Martin T. Moul, Albert A. Schy, and James L. Williams, November 1961

TN D 993 STATIC LONGITUDINAL STABILITY OF A ROCKET VEHICLE HAVING A REAR-FACING STEP AHEAD OF THE STABILIZING FINS, Robert J. Keynton, November 1961

TN D 996 AN ANALYTICAL TREND STUDY OF PROPELLER WHIRL INSTABILITY, John L. Sewall, April 1962

TN D 997 IN-FLIGHT NOISE MEASUREMENTS FOR THREE PROJECT MERCURY VEHICLES, William H. Mayes, David A. Hilton, and Charles A. Hardesty, January 1962

TN D 1012 EQUATIONS OF MOTION AND DESIGN CRITERIA FOR THE DESPIN OF A VEHICLE BY THE RADIAL RELEASE OF WEIGHTS AND CABLES OF FINITE MASS, Donald G. Eide and Chester A. Vaughan, January 1962

TN D 1033 STATIC STABILITY AND CONTROL OF CANARD CONFIGURATIONS AT MACH NUMBERS FROM 0.70 TO 2.22 - TRIANGULAR WING AND CANARD WITH VERTICAL TAILS, Victor L. Peterson, June 1961

TN D 1036 TESTS OF AN ASYMMETRICAL BAFFLE FOR FUEL-SLOSHING SUPPRESSION, Henry A. Cole, Jr., and Bruno J. Gambucci, July 1961

TN D 1040 PREDICTED PERFORMANCE OF ON-OFF SYSTEMS FOR PRECISE SATELLITE ATTITUDE CONTROL, Stuart C. Brown, July 1961

TN D 1059 ANALYSIS OF A PILOT-AIRPLANE LATERAL INSTABILITY EXPERIENCED WITH THE X-15 AIRPLANE, Lawrence W. Taylor, Jr., November 1961

TN D 1067 THE EFFECT OF LATERAL- AND LONGITUDINAL-RANGE CONTROL ON ALLOWABLE ENTRY CONDITIONS FOR A POINT RETURN FROM SPACE, Alfred G. Boissevain, July 1961

TN D 1068 SATELLITE ATTITUDE CONTROL UTILIZING THE EARTH'S MAGNETIC FIELD, John S. White, Fred H. Shigemoto, and Kent Bourquin, August 1961

TN D 1073 STUDY OF A SATELLITE ATTITUDE CONTROL SYSTEM USING INTEGRATING GYROS AS TORQUE SOURCES, John S. White and Q. Marion Hansen, September 1961

TN D 1076 A DIGITAL COMMAND SYSTEM FOR SATELLITES, Frederick A. Kierner, February 1962

TN D 1086 SOUND PRESSURES AND CORRELATIONS OF NOISE ON THE FUSELAGE OF A JET AIRCRAFT IN FLIGHT, Russell D. Shattuck, August 1961

TN D 1105 SPACE DEBRIS HAZARD EVALUATION, Elmer H. Davison and Paul C. Winslow, Jr., December 1961

TN D 1106 ELEMENTS AND PARAMETERS OF THE OSCULATING ORBIT AND THEIR DERIVATIVES, Wilbur F. Dobson, Vearl N. Huff, and Arthur V. Zimmerman, January 1962

TN D 1137 PROJECT ECHO - ANTENNA STEERING SYSTEM, R. Klahn, J. A. Norton, and J. A. Githens, September 1961

TN D 1141 THE EFFECT OF LATERAL-DIRECTIONAL CONTROL COUPLING ON PILOT CONTROL OF AN AIRPLANE AS DETERMINED IN FLIGHT AND IN A FIXED-BASE FLIGHT SIMULATOR, Richard F. Vomaske, Melvin Sadoff, and Fred J. Drinkwater III, November 1961

TN D 1150 THE COORDINATE-TRANSFORMATION EQUATIONS FOR A PILOTED FLIGHT SIMULATOR WITH SEVERAL DEGREES OF FREEDOM, Joseph G. Douvillier, Jr., and Robert E. Coate, January 1962

TN D 1157 X-15 AIRPLANE STABILITY AUGMENTATION SYSTEM, Lawrence W. Taylor, Jr. and George B. Merrick, March 1962

TN D 1160 FLIGHT-DETERMINED AERODYNAMIC-NOISE ENVIRONMENT OF AN AIRPLANE NOSE CONE UP TO A MACH NUMBER OF 2, Norman J. McLeod, March 1962

TN D 1192 DETERMINATIONS OF LOCAL AND INSTANTANEOUS COMBUSTION CONDITIONS FROM ACOUSTIC MEASUREMENTS IN A ROCKET COMBUSTOR AND COMPARISON WITH OVERALL PERFORMANCE, Martin Hersch, March 1962

TN D 1201 A PRELIMINARY PILOTED SIMULATOR AND FLIGHT STUDY OF HEIGHT CONTROL REQUIREMENTS FOR VTOL AIRCRAFT, Ronald M. Gerdes and Richard F. Weick, February 1962

TN D 1202 WIND-TUNNEL INVESTIGATION OF THE STATIC AND DYNAMIC STABILITY CHARACTERISTICS OF A 10° SEMIVERTEX ANGLE BLUNTED CONE, William R. Wehrend, Jr., January 1962

TN D 1204 COMPARISON OF TWO MANEUVERS FOR LONGITUDINAL RANGE CONTROL DURING ATMOSPHERE ENTRY, Lionel L. Levy, Jr., and Elliott D. Katzen, January 1962

TN D 1211 AN INVESTIGATION OF THE EFFECTS OF THE TIME LAG DUE TO LONG TRANSMISSION DISTANCES UPON REMOTE CONTROL. PHASE I - TRACKING EXPERIMENTS, James L. Adams, December 1961

TN D 1220 STABILITY OF THREE-DIMENSIONAL COMPRESSIBLE BOUNDARY LAYERS, Eli Reshotko, June 1962

TN D 1223 A THEORETICAL INVESTIGATION OF THE EFFECT OF CROSS-CONTROL DERIVATIVES ON THE STABILITY CHARACTERISTICS OF AIRPLANES DESIGNED FOR FLIGHT AT HIGH MACH NUMBERS, Lawrence W. Brown, March 1962

TN D 1229 HUMAN PILOTS' DYNAMIC-RESPONSE CHARACTERISTICS MEASURED IN FLIGHT AND ON A NONMOVING SIMULATOR, Helmut A. Kuehnel, March 1962

TN D 1231 A RIGIDLY FORCED OSCILLATION SYSTEM FOR MEASURING DYNAMIC-STABILITY PARAMETERS IN TRANSONIC AND SUPERSONIC WIND TUNNELS, Albert L. Braslow, Harleth G. Wiley, and Cullen Q. Lee, March 1962

TN D 1233 EFFECTS OF COUPLING BETWEEN PITCH AND ROLL CONTROL INPUTS ON THE HANDLING QUALITIES OF VTOL AIRCRAFT, John F. Garren, Jr., March 1962

TN D 1263 EFFECTS OF FOREBODY LENGTH ON THE STABILITY AND CONTROL CHARACTERISTICS AT A MACH NUMBER OF 2.01 OF A CANARD AIRPLANE CONFIGURATION WITH A TRAPEZOIDAL ASPECT-RATIO-3 WING, M. Leroy Spearman and Cornelius Driver, April 1962

TN D 1271 A SIMPLE SOLAR ORIENTATION CONTROL SYSTEM FOR SPACE VEHICLES, Seymour Salmirs, S. Lawrence Kessler, and Otis J. Parker, September 1962

TN D 1277 STUDIES IN FAR-FIELD ACOUSTIC PROPAGATION, Richard N. Tedrick, Roy Peterson, T. Kleffman, Wade D. Dorland, R. Ewing, and D. Church, August 1962

TN D 1279 SOME OPERATIONAL ASPECTS OF USING A HIGH PERFORMANCE AIRPLANE AS A FIRST-STAGE BOOSTER FOR AIR-LAUNCHING SOLID-FUEL SOUNDING ROCKETS, Victor W. Horton and Wesley E. Messing, January 1963

TN D 1281 ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF FORCES AND FREQUENCIES RESULTING FROM LIQUID SLOSHING IN A SPHERICAL TANK, Andrew J. Stofan and Alfred L. Armstead, July 1962

TN D 1294 ACOUSTIC PHENOMENA OBSERVED ON ROCKET-BORNE HIGH ALTITUDE EXPLOSIONS, William Nordberg, June 1962

TN D 1299 FREE-FLIGHT MEASUREMENTS OF THE STATIC AND DYNAMIC STABILITY AND DRAG OF A 10° BLUNTED CONE AT MACH NUMBERS 3.5 AND 8.5, Peter F. Intrieri, May 1962

TN D 1302 MEASURED STEADY-STATE PERFORMANCE OF WATER VAPOR JETS FOR USE IN SPACE VEHICLE ATTITUDE CONTROL SYSTEMS, Bruce E. Tinling, May 1962

TN D 1311 EXPERIMENTAL DAMPING OF LIQUID OSCILLATIONS IN A SPHERICAL TANK BY POSITIVE-EXPULSION BAGS AND DIAPHRAGMS, Andrew J. Stofan and Albert J. Pavli, July 1962

TN D 1328 A FLIGHT DETERMINATION OF THE ATTITUDE CONTROL POWER AND DAMPING REQUIREMENTS FOR A VISUAL HOVERING TASK IN THE VARIABLE STABILITY AND CONTROL X-14A RESEARCH VEHICLE, L. Stewart Rolls and Fred J. Drinkwater, III, May 1962

TN D 1351 AN INVESTIGATION OF THE EFFECTS OF THE TIME LAG DUE TO LONG TRANSMISSION DISTANCE UPON REMOTE CONTROL. PHASE II - VEHICLE EXPERIMENTS. PHASE III - CONCLUSIONS, James L. Adams, April 1962

TN D 1352 EFFECT OF JET PLUMING ON THE STATIC STABILITY OF CONE-CYLINDER-FLARE CONFIGURATIONS AT A MACH NUMBER OF 9.65, William F. Hinson and Ralph A. Falanga, September 1962

TN D 1363 WIND-TUNNEL INVESTIGATION OF THE DRAG AND STATIC STABILITY CHARACTERISTICS OF FOUR HELICOPTER FUSELAGE MODELS, George E. Sweet and Julian L. Jenkins, Jr., July 1962

TN D 1365 LONGITUDINAL STABILITY AND CONTROL OF A TILT-WING VTOL AIRCRAFT MODEL WITH RIGID AND FLAPPING PROPELLER BLADES, Louis P. Tosti, July 1962

TN D 1367 INVESTIGATION OF THE DAMPING OF LIQUIDS IN RIGHT-CIRCULAR CYLINDRICAL TANKS, INCLUDING THE EFFECTS OF A TIME-VARIANT LIQUID DEPTH, David G. Stephens, H. Wayne Leonard and Tom W. Perry, Jr., August 1962

TN D 1375 FLIGHT-TEST INVESTIGATION OF AILERONS AS A SOURCE OF YAW CONTROL ON THE VZ-2 TILT-WING AIRCRAFT, Robert J. Pegg, July 1962

TN D 1379 STATIC LONGITUDINAL STABILITY AND PERFORMANCE OF SEVERAL BALLISTIC SPACECRAFT CONFIGURATIONS IN HELIUM AT A MACH NUMBER OF 24.5, Patrick J. Johnston and Curtis D. Snyder, August 1962

TN D 1389 FORCE-TEST INVESTIGATION OF THE STABILITY AND CONTROL CHARACTERISTICS OF A FOUR PROPELLER TILT-WING VTOL MODEL WITH A PROGRAMMED FLAP, William A. Newsom, Jr., September 1962

TN D 1390 FLIGHT INVESTIGATION OF THE LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS OF A FOUR-PROPELLER TILT-WING VTOL MODEL WITH A PROGRAMED FLAP, William A. Newsom, Jr., September 1962

TN D 1395 SIMULATOR STUDIES OF SIMPLE ATTITUDE CONTROL FOR SPIN-STABILIZED VEHICLES, H. D. Garner and H. J. E. Reid, Jr., September 1962

TN D 1402 OPERATIONAL EXPERIENCES AND CHARACTERISTICS OF THE X-15 FLIGHT CONTROL SYSTEM, Robert A. Tremant, December 1962

TN D 1420 A METHOD OF ACCURATELY REDUCING THE SPIN RATE OF A ROTATING SPACECRAFT, Henry J. Cornille, Jr., October 1962

TN D 1446 METHODS OF EXPRESSING MASS UNBALANCE, N. C. Schaller and J. M. Lewallen, May 1963

TN D 1482 LONGITUDINAL AERODYNAMIC CHARACTERISTICS AT LOW SUBSONIC SPEEDS OF A HIGHLY SWEPT DELTA WING UTILIZING NOSE DEFLECTION FOR CONTROL, Bernard Spencer, Jr., November 1962

TN D 1484 FIXED-BASE-SIMULATOR STUDY OF THE ABILITY OF A PILOT TO PERFORM SOFT LUNAR LANDING, M. J. Queijo, G. Kimball Miller, Jr. and Herman S. Fletcher, October 1962

TN D 1492 AN ANALYTICAL STUDY OF EFFECTS OF SOME AIRPLANE AND LANDING-GEAR FACTORS ON THE RESPONSE TO RUNWAY ROUGHNESS WITH APPLICATION TO SUPERSONIC TRANSPORTS, Norman S. Silsby, December 1962

TN D 1495 PRELIMINARY EVALUATION OF TWO JET-TRANSPORT SIMULATORS FOR THE INVESTIGATION OF LANDING-CONTACT CONDITIONS, Harold L. Crane, November 1962

TN D 1497 STATIC STABILITY INVESTIGATION OF PROPOSED PROJECT FIRE SPACE-VEHICLE AND REENTRY-PACKAGE CONFIGURATIONS AT MACH NUMBERS FROM 1.47 TO 4.63, Dennis E. Fuller and C. Donald Babb, November 1962

TN D 1498 A STUDY OF HUMAN PILOTS' ABILITY TO DETECT ANGULAR MOTION WITH APPLICATION TO CONTROL OF SPACE RENDEZVOUS, Roy F. Brissenden, December 1962

TN D 1506 STABILITY INVESTIGATION OF A BLUNTED CONE AND A BLUNTED OGIVE WITH A FLARED CYLINDER AFTERBODY AT MACH NUMBERS FROM 0.30 TO 2.85, Lucille C. Coltrane, October 1962

TN D 1507 PRESSURE DISTRIBUTION INDUCED ON A FLAT PLATE AT A FREE-STREAM MACH NUMBER OF 1.39 BY ROCKETS EXHAUSTING UPSTREAM AND DOWNSTREAM, Abraham Leiss, November 1962

TN D 1508 STATIC STABILITY TESTS IN THE LANGLEY 24-INCH HYPERSONIC ARC TUNNEL ON A BLUNTED CONE AT A MACH NUMBER OF 20, Edwin F. Harrison, December 1962

TN D 1511 LATERAL RANGE CONTROL BY BANKING DURING INITIAL PHASES OF SUPERCIRCULAR REENTRIES, Donald L. Baradell, November 1962

TN D 1514 A STUDY OF ABORT FROM A MANNED LUNAR LANDING AND RETURN TO RENDEZVOUS IN A 50-MILE ORBIT, Jack A. White, December 1962

TN D 1515 SIMULATOR STUDY OF AN ACTIVE CONTROL SYSTEM FOR A SPINNING BODY, James J. Adams, December 1962

TN D 1516 SPIN INVESTIGATION OF A 1/20-SCALE MODEL OF AN UNSWEPT-WING, TWIN-ENGINE, OBSERVATION AIRPLANE, Henry A. Lee, January 1963

TN D 1517 HOVERING CHARACTERISTICS OF A ROTOR HAVING AN AIRFOIL SECTION DESIGNED FOR A UTILITY TYPE OF HELICOPTER, James P. Shivers and William J. Monahan, December 1962

TN D 1518 LONGITUDINAL AERODYNAMIC CHARACTERISTICS AT MACH NUMBERS FROM 0.40 TO 1.10 OF A BLUNTED RIGHT-TRIANGULAR PYRAMIDAL LIFTING REENTRY CONFIGURATION EMPLOYING VARIABLE-SWEEP WING PANELS, Bernard Spencer, Jr., March 1963

TN D 1552 A STUDY OF A PILOT'S ABILITY TO CONTROL DURING SIMULATED STABILITY AUGMENTATION SYSTEM FAILURES, Melvin Sadoff, November 1962

TN D 1585 LATERAL CONTROL CHARACTERISTICS OF A POWERED MODEL OF A TWIN-PROPELLER DEFLECTED SLIPSTEAM STOL AIRPLANE CONFIGURATION, Richard J. Margason and Alexander D. Hammond, November 1964

TN D 1589 MODES OF CONTROL, C.A. Harvey, November 1962

TN D 1602 AN ANALYSIS OF THE DELTA-WING HYPERSONIC STABILITY AND CONTROL BEHAVIOR AT ANGLES OF ATTACK BETWEEN 30° AND 90°, David E. Fetterman and Luther Neal, Jr., March 1963

TN D 1608 AN ANALYTICAL STUDY OF A SIMPLE ATTITUDE CONTROL SYSTEM FOR A FINNED VEHICLE, Jack E. Harris, March 1963

TN D 1613 PILOT-CONTROLLED SIMULATION OF RENDEZVOUS BETWEEN A SPACECRAFT AND A COMMANDED MODULE HAVING LOW THRUST, Gary P. Beasley, March 1963

TN D 1614 EXPERIMENTAL INVESTIGATION OF THE DYNAMIC STABILITY OF A TOWED PARAWING GLIDER MODEL, Robert E. Shanks, March 1963

TN D 1617 A STUDY OF THE EFFECTS OF BANK ANGLE, BANKING DURATION, AND TRANJECTORY POSITION OF INITIAL BANKING ON THE LATERAL AND LONGITUDINAL RANGES OF A HYPERSONIC GLOBAL REENTRY VEHICLE, Gene W. Sparrow, March 1963

TN D 1638 LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF SEVERAL FIFTH-STAGE SCOUT REENTRY VEHICLES FROM MACH NUMBER 0.60 TO 24.4 INCLUDING SOME REYNOLDS NUMBER EFFECTS ON STABILITY AT HYPERSONIC SPEEDS, Patrick J. Johnston, May 1963

TN D 1647 HANDLING QUALITIES AND OPERATIONAL PROBLEMS OF A LARGE OUR-PROPELLER STOL TRANSPORT AIRPLANE, Hervey C. Quigley and Robert C. Innis, January 1963

TN D 1668 MATHEMATICAL ANALYSIS FOR THE ORIENTATION AND CONTROL OF THE ORBITING ASTRONOMICAL OBSERVATORY SATELLITE, Paul B. Davenport, January 1963

TN D 1771 SOME CONTROL PROBLEMS ASSOCIATED WITH EARTH-ORIENTED SATELLITES, Vernon K. Merrick, June 1963

TN D 1772 STUDY OF INERTIAL NAVIGATION ERRORS DURING REENTRY TO THE EARTH'S ATMOSPHERE, Q. Marion Hansen, John S. White, and Albert Y. K. Pang, May 1963

TN D 1773 SIMULATOR STUDY OF THE LATERAL-DIRECTIONAL HANDLING QUALITIES OF A LARGE FOUR-PROPELLERED STOL TRANSPORT AIRPLANE, Hervey C. Quigley and Herbert F. Lawson, Jr., May 1963

TN D 1782 A SIMPLIFIED METHOD FOR MEASURING HUMAN TRANSFER FUNCTIONS, James J. Adams, April 1963

TN D 1792 STATIC LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF AN ELASTIC CANARD-FUSELAGE CONFIGURATION AS MEASURED IN AIR AND IN FREON-12 AT MACH NUMBERS UP TO 0.92, E. Carson Yates, Jr., and Maynard C. Sandford, July 1963

TN D 1796 LONGITUDINAL STABILITY CHARACTERISTICS OF LOW-ASPECT-RATIO WINGS HAVING VARIATIONS IN LEADING- AND TRAILING-EDGE CONTOURS, William P. Henderson, October 1964

TN D 1801 MANEUVER ACCELERATIONS EXPERIENCED DURING ROUTINE OPERATIONS OF A COMMERCIAL TURBOJET TRANSPORT AIRPLANE, Paul A. Hunter and Mary W. Fetner, May 1963

TN D 1807 WIND-TUNNEL MEASUREMENT OF PROPELLER WHIRL-FLUTTER SPEEDS AND STATIC-STABILITY DERIVATIVES AND COMPARISONS WITH THEORY, Samuel R. Bland and Robert M. Bennett, August 1963

TN D 1816 COMPARISON OF STEADY-STATE AND SIX-DEGREE-OF-FREEDOM ANALYSES OF PITCH-ROLL RESONANCE CONDITIONS FOR A LONG SLENDER SOUNDING POCKET, Charles H. Whitlock, June 1963

TN D 1822 LOW-SUBSONIC MEASUREMENTS OF STATIC AND DYNAMIC STABILITY DERIVATIVES OF SIX FLAT-PLATE WINGS HAVING LEADING-EDGE SWEEP ANGLES OF 70° TO 84°, Robert E. Shanks, July 1963

TN D 1823 AERODYNAMIC CHARACTERISTICS IN PITCH AT A MACH NUMBER OF 2.01 OF SEVERAL WING-BODY COMBINATIONS WITH WEDGE-SHAPED BODIES LOCATED ABOVE AND BELOW A 54.5° SWEPT DELTA WING, Odell A. Morris, June 1963

TN C 1826 PRELIMINARY FLIGHT EVALUATION OF TWO UNPOWERED MANNED PARAGLIDERS, Garrison P. Layton, Jr. and Milton O. Thompson, April 1963

TN D 1827 FIXED-BASE-SIMULATOR EVALUATION OF A PILOT'S TERRAIN-FOLLOWING DISPLAY WITH VARIOUS MODES OF PRESENTING INFORMATION, Thomas E. Wempe, November 1964

TN D 1828 THEORETICAL INVESTIGATION OF THE SLIDEOUT DYNAMICS OF A VEHICLE EQUIPPED WITH A TRICYCLE SKID-TYPE LANDING-GEAR SYSTEM, Richard B. Noll and Robert L. Halasey, May 1963

TN D 1829 PERFORMANCE ANALYSIS OF HIGH-ENERGY CHEMICAL STAGES FOR INTERPLANETARY MISSIONS, Walter H. Stafford, Sam H. Harlin, and Carmen R. Catalfamo, January 1964

TN D 1832 A TECHNIQUE FOR PREDICTING FAR-FIELD ACOUSTIC ENVIRONMENTS DUE TO A MOVING ROCKET SOUND SOURCE, G. A. Wilhold, S. H. Guest, and J. H. Jones, August 1963

TN D 1833 LUNAR FLIGHT STUDY SERIES: VOLUME 5. TRAJECTORIES IN THE EARTH-MOON SPACE WITH SYMMETRICAL FREE RETURN PROPERTIES, Arthur J. Schwaniger, June 1963

TN D 1836 TECHNIQUES FOR PREDICTING LOCALIZED VIBRATORY ENVIRONMENTS OF ROCKET VEHICLES, Robert E. Barrett, October 1963

TN D 1837 A SIMPLIFIED TECHNIQUE FOR DETERMINING DEVIATION IN THE LUNAR TRANSFER ORBIT EPHEMERIS, Richard Reid, October 1964

TN D 1838 TRAJECTORY SIMULATION APPLICABLE TO STABILITY AND CONTROL STUDIES OF LARGE MULTI-ENGINE VEHICLES, Ronald J. Harris, August 1963

TN D 1839 METEOROID EFFECTS ON SPACE EXPLORATION, Maurice Dubin, October 1963

TN D 1855 THE EFFECT OF SOLAR RADIATION PRESSURE ON THE SPIN OF EXPLORER XII, J. V. Fedor, August 1963

TN D 1860 APPLICATION OF ACOUSTIC THEORY TO PREDICTION OF SONIC-BOOM GROUND PATTERNS FROM MANEUVERING AIRCRAFT, Donald L. Lansing, October 1964

TN D 1867 EFFECT OF SKEWED WING-TIP CONTROLS ON A HIGHLY SWEPT ARROW WING AT MACH NUMBER 2.03, Emma Jean Landrum, October 1964

TN D 1873 SOME EFFECTS OF SPECTRAL CONTENT AND DURATION ON PERCEIVED NOISE LEVEL, Karl D. Kryter and Karl S. Pearsons, Bolt Beranek and Newman Inc, April 1963

TN D 1888 A PRELIMINARY STUDY OF HANDLING QUALITIES REQUIREMENTS OF SUPERSONIC TRANSPORTS IN HIGH-SPEED CRUISING FLIGHT USING PILOTED SIMULATORS, Maurice D. White, Richard F. Vomaske, Walter E. McNeill, and George F. Cooper, May 1963

TN D 1895 AN APPLICATION OF TIME OPTIMAL CONTROL THEORY TO LAUNCH VEHICLE REGULATION, F. B. Smith, Jr., and J. A. Lovingood, May 1963

TN D 1897 EVALUATION OF A TECHNIQUE FOR DETERMINING TIME-INVARIANT AND TIME-VARIANT DYNAMIC CHARACTERISTICS OF HUMAN PILOTS, Jerome I. Elkind, Edward A. Starr, David M. Green, and D. Lucille Darley, May 1963

TN D 1902 ANALYSIS OF THE DYNAMIC TESTS OF THE STRETCH YO-YO DE-SPIN SYSTEM, William R. Mentzer, September 1963

TN D 1921 HANDLING QUALITIES AND TRAJECTORY REQUIREMENTS FOR TERMINAL LUNAR LANDING, AS DETERMINED FROM ANALOG SIMULATION, Gene J. Matranga, Harold P. Washington, Paul L. Chenoweth, and William R. Young, August 1963

TN D 1922 FLIGHT TEST OF A PITCH CONTROL FOR A SPINNING VEHICLE, H. D. Garner and H. J. E. Reid, Jr., July 1963

TN D 1923 STUDY OF A GUIDANCE SCHEME USING APPROXIMATE SOLUTIONS OF TRAJECTORY EQUATIONS TO CONTROL THE AERODYNAMIC SKIP FLIGHT OF A REENTRY VEHICLE, Robert S. Dunning, August 1962

TN D 1931 STATIC STABILITY CHARACTERISTICS OF MODELS OF THE BLUE SCOUT AND THE BLUE SCOUT, JR., RESEARCH VEHICLES AT MACH NUMBERS FROM 2.29 TO 3.75, Lloyd S. Jernell, July 1963

TN D 1932 FREE-FLIGHT INVESTIGATION OF THE DEPLOYMENT, DYNAMIC STABILITY, AND CONTROL CHARACTERISTICS OF A 1/12-SCALE DYNAMIC RADIO-CONTROLLED MODEL OF A LARGE BOOSTER AND PARAWING, Sanger M. Burk, Jr., August 1963

TN D 1934 INVESTIGATION OF THE LANDING CHARACTERISTICS OF A REENTRY VEHICLE HAVING A CANTED MULTIPLE-AIR-BAG LOAD-ALLEVIATION SYSTEM, Sandy M. Stubbs and John R. McGehee, August 1963

TN D 1941 MEASUREMENTS OF THE RESPONSE OF TWO LIGHT AIRPLANES TO SONIC BOOMS, Domenic J. Maglieri and Garland J. Morris, August 1963

TN D 1947 TRANSONIC INVESTIGATION OF THE STATIC LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF LOW-ASPECT-RATIO WING-BODY CONFIGURATIONS AT ANGLES OF ATTACK FROM 0° TO 90°, Charles D. Trescot, Jr., Lawrence E. Putnam, and Cuyler W. Brooks, Jr., June 1963

TN D 1951 CONTROL OF A LARGE LAUNCH VEHICLE WITH LIMITED THRUST VECTORING IN THE PRESENCE OF WINDS, Dennis F. Collins, Jr., and Homer G. Morgan, August 1963

TN D 1952 MEASURED VARIATION IN THE TRANSFER FUNCTION OF A HUMAN PILOT IN SINGLE-AXIS TASKS, James J. Adams and Hugh P. Bergeron, October 1963

TN D 1969 SIMULATOR STUDY OF A SATELLITE ATTITUDE CONTROL SYSTEM USING INERTIA WHEELS AND A MAGNET, James J. Adams, W. E. Howell, and Hugh P. Bergeron, October 1963

TN D 1991 AN EXPERIMENTAL INVESTIGATION OF THE VISCOUS DAMPING OF LIQUID SLOSHING IN SPHERICAL TANKS, Irving E. Sumner and Andrew J. Stofan, December 1963

TN D 1999 ACOUSTIC EFFICIENCY TRENDS FOR HIGH THRUST BOOSTERS, S. H. Guest, July 1964

TN D 2001 TOUCHDOWN DYNAMICS ANALYSIS OF SPACECRAFT FOR SOFT LUNAR LANDING, Robert E. Lavender, January 1964

TN D 2002 AN AERODYNAMIC ANALYSIS OF SATURN I BLOCK I FLIGHT TEST VEHICLES, Fernando S. Garcia, February 1964

TN D 2017 FLIGHT TEST AND ANALYSIS OF THE ROLLING MOTIONS OF A 79° CLIPPED DELTA CONFIGURATION WITH WING-TIP FINS AT SUPERSONIC SPEEDS, James L. Raper. APPENDIX: AN ANALYTICAL SOLUTION OF THE SIMPLIFIED THREE-DEGREE-OF-FREEDOM EQUATIONS OF MOTION, Percy J. Bobbitt, November 1963

TN D 2024 THE EFFECT OF RESIN COMPOSITION AND FILLERS ON THE PERFORMANCE OF A MOLDED CHARRING ABLATOR, Roger W. Peters and Kenneth L. Wadlin, December 1963

TN D 2025 THE NONLINEAR RESPONSE OF WINDOWS TO RANDOM NOISE, Henry S. Freynik, Jr., December 1963

TN D 2036 A FIXED-BASE VISUAL-SIMULATOR STUDY OF PILOT CONTROL OF ORBITAL DOCKING OF ATTITUDE-STABILIZED VEHICLES, Donald R. Riley and William T. Suit, January 1964

TN D 2049 FEASIBILITY STUDY OF A BANG-BANG PATH CONTROL FOR A REENTRY VEHICLE, Jack A. White, November 1963

TN D 2055 STUDY OF THE USE OF TERMINAL CONTROL TECHNIQUES FOR GUIDANCE DURING DIRECT AND SKIP ENTRIES FOR A CAPSULE-TYPE VEHICLE AT PARABOLIC VELOCITY, John W. Young, January 1964

TN D 2057 STATIC LONGITUDINAL CHARACTERISTICS OF THE PROJECT FIRE REENTRY STAGE AFTER REENTRY-PACKAGE SEPARATION AT MACH 28.3 IN HELIUM, Curtis D. Snyder, January 1964

TN D 2060 A PILOTED SIMULATOR STUDY OF THE LOSS OF ALTITUDE BY A JET TRANSPORT IN A GO-AROUND FROM AN INSTRUMENT-LANDING APPROACH, Walter E. McNeill, November 1963

TN D 2061 A METHOD FOR ANALYZING NONLINEAR CLOSED-LOOP CONTROL SYSTEMS WITH STATIONARY STOCHASTIC INPUTS, Wilfred J. Minkus, October 1963

TN D 2067 EFFECTS OF HIGH SUSTAINED ACCELERATION ON PILOTS' PERFORMANCE AND DYNAMIC RESPONSE, Melvin Sadoff, July 1964

TN D 2068 SIMULATOR STUDIES OF THE MANUAL CONTROL OF VEHICLE ATTITUDE USING AN ON-OFF REACTION CONTROL SYSTEM, Armando E. Lopez and Donald W. Smith, December 1963

TN D 2113 STUDY OF SENSORY DEPRIVATION, PAIN AND PERSONALITY RELATIONSHIPS FOR SPACE TRAVEL, J. Peters, F. B. Benjamin, W. M. Helvey, and G. A. Albright, September 1963

TN D 2134 THE USE OF A TWO-DEGREES-OF-FREEDOM GYROSCOPE AS A SATELLITE YAW SENSOR, Francis J. Moran, February 1964

TN D 2135 ON THE PITCHING AND YAWING MOTION OF A SPINNING SYMMETRIC MISSILE GOVERNED BY AN ARBITRARY NONLINEAR RESTORING MOMENT, Maurice L. Rasmussen and Donn B. Kirk, March 1964

TN D 2171 EXPERIMENTAL EVALUATION OF STEADY-STATE CONTROL PROPERTIES OF AN ELECTRON-BOMBARDMENT ION THRUSTOR, Shigeo Nakanishi, Eugene V. Pawlik, and Charles W. Baur, February 1964

TN D 2176 EVALUATION OF A GRAVITY-SIMULATION TECHNIQUE FOR STUDIES OF MAN'S SELF-LOCOMOTION IN LUNAR ENVIRONMENT, Donald E. Hewes and Amos A. Spady, Jr., March 1964

TN D 2177 MEASURED TRANSFER FUNCTIONS OF PILOTS DURING TWO-AXIS TASKS WITH MOTION, Hugh P. Bergeron and James J. Adams, March 1964

TN D 2178 A STUDY OF FACTORS AFFECTING THE ACCURACY OF POSITION FIX FOR LUNAR TRAJECTORIES, Margery E. Hannah and Alton P. Mayo, January 1964

TN D 2181 ANALYTICAL STUDY OF AIRCRAFT-DEVELOPED SPINS AND DETERMINATION OF MOMENTS REQUIRED FOR SATISFACTORY SPIN RECOVERY, Ernie L. Anglin and Stanley H. Scher, February 1964

TN D 2185 A BRIEF STUDY OF CLOSED-CIRCUIT TELEVISION FOR AIRCRAFT LANDING, John P. Reeder and Joseph J. Kolnick, February 1964

TN D 2188 SOME EXPERIMENTAL RESULTS FOR A DOPPLER TRACKING METHOD USING A SIMPLE CW BEACON, Allen B. Henning, March 1964

TN D 2190 SUPERSONIC LONGITUDINAL STABILITY CHARACTERISTICS OF THE TWO FINAL STAGES OF A FOUR-STAGE LAUNCH VEHICLE, Royce L. McKinney, March 1964

TN D 2191 DYNAMIC-MODEL INVESTIGATION OF A 1/20-SCALE GEMINI SPACECRAFT IN THE LANGLEY SPIN TUNNEL, Henry A. Lee, Peter J. Costigan, and James S. Bowman, Jr., May 1964

TN D 2198 EFFECTS OF MAGNETICALLY INDUCED EDDY-CURRENT TORQUES ON SPIN MOTIONS OF AN EARTH SATELLITE, G. Louis Smith, April 1964

TN D 2203 RESPONSE OF A JET TRAINER AIRCRAFT TO ROUGHNESS OF THREE RUNWAYS, Garland J. Morris, May 1964

TN D 2214 EXPERIMENTAL LATERAL VIBRATION CHARACTERISTICS OF A 1/5-SCALE MODEL OF SATURN SA-1 WITH AN EIGHT-CABLE SUSPENSION SYSTEM, John S. Mixson and John J. Catherine, November 1964

TN D 2216 ON FREQUENCY MEASUREMENTS AND RESOLUTION, Alan M. Demmerle, December 1964

TN D 2217 THE RESOLUTION OF FREQUENCY MEASUREMENTS IN PFM TELEMETRY, Alan M. Demmerle and Paul Heffner, December 1964

TN D 2218 HYDROMAGNETIC STABILITY OF STELLAR ATMOSPHERES, Satya P. Talwar, January 1965

TN D 2219 FLIGHT EVALUATION OF SOME EFFECTS OF THE PRESENT AIR TRAFFIC CONTROL SYSTEM ON OPERATION OF A SIMULATED SUPERSONIC TRANSPORT, Donald L. Hughes, Bruce G. Powers, and William H. Dana, November 1964

TN D 2225 A PARAMETRIC STUDY OF MASS-RATIO AND TRAJECTORY FACTORS IN FAST MANNED MARS MISSIONS, Duane W. Dugan, February 1965

TN D 2229 DESIGN AND EVALUATION OF A PREDICTOR FOR REMOTE CONTROL SYSTEMS OPERATING WITH SIGNAL TRANSMISSION DELAYS, John E. Arnold and Paul Braisted, December 1963

TN D 2231 A FLIGHT INVESTIGATION OF THE PERFORMANCE HANDLING QUALITIES, AND OPERATIONAL CHARACTERISTICS OF A DEFLECTED SLIPSTREAM STOL TRANSPORT AIRPLANE HAVING FOUR INTER-CONNECTED PROPELLERS, Hervey C. Quigley, Robert C. Innis, and Curt A. Holzhauser, March 1964

TN D 2237 THEORETICAL STUDY OF ORBITAL ELEMENT CONTROL WITH POTENTIAL APPLICATIONS TO MANNED SPACE MISSIONS, James C. Howard, April 1964

TN D 2243 EFFECTS OF AIRCRAFT RELATIVE DENSITY ON SPIN AND RECOVERY CHARACTERISTICS OF SOME CURRENT CONFIGURATIONS, William D. Grantham and Sue B. Grafton, March 1965

TN D 2251 A PILOTED SIMULATOR STUDY OF LONGITUDINAL HANDLING QUALITIES OF SUPERSONIC TRANSPORTS IN THE LANDING MANEUVER, Richard S. Bray, April 1964

TN D 2252 A FLIGHT STUDY OF MANUAL BLIND LANDING PERFORMANCE USING CLOSED CIRCUIT TELEVISION DISPLAYS, Bernard R. Kibort and Fred J. Drinkwater III, May 1964

TN D 2255 THE ADAPTIVE DYNAMIC RESPONSE CHARACTERISTICS OF THE HUMAN OPERATOR IN SIMPLE MANUAL CONTROL, Laurence R. Young, David M. Green, Jerome I. Elkind, and Jennifer A. Kelly, Bolt, Beranek and Newman, Inc., April 1964

TN D 2265 FLIGHT EVALUATION OF WIDE-ANGLE, OVER-LAPPING MONOCULARS FOR PROVIDING PILOT'S FIELD OF VISION, Paul L. Chenoweth and William H. Dana, April 1964

TN D 2284 ON THE USE OF A MAGNETOMETER TO DETERMINE THE ANGULAR MOTION OF A SPINNING BODY IN REGULAR PRECESSION, George R. Young and Jesse D. Timmons, May 1964

TN D 2285 FLIGHT TESTS OF A 0.13-SCALE MODEL OF A VECTORED-THRUST JET VTOL TRANSPORT AIRPLANE, Charles C. Smith, Jr., and Lysle P. Parlett, August 1964

TN D 2291 STALLING AND TUMBLING OF A RADIO-CONTROLLED PARAWING AIRPLANE MODEL, Charles E. Libbey and Joseph L. Johnson, Jr., July 1964

TN D 2292 EXPERIMENTAL INVESTIGATION OF THE DYNAMIC STABILITY OF A TOWED PARAWING GLIDER AIR CARGO DELIVERY SYSTEM, Robert E. Shanks, August 1964

TN D 2298 A TECHNIQUE FOR THRUST-VECTOR ORIENTATION DURING MANUAL CONTROL OF LUNAR LANDINGS FROM A SYNCHRONOUS ORBIT, L. Keith Barker and M. J. Queijo, June 1964

TN D 2332 CONTROL-SURFACE INTERACTION EFFECTS ON DELTA-WING WINDWARD PRESSURES AT A MACH NUMBER OF 6.83 AT HIGH ANGLES OF ATTACK, Luther Neal, Jr. and David E. Fetterman, June 1964

TN D 2336 PRELIMINARY ANALYSIS OF VARIATION OF PITCH MOTION OF A VEHICLE IN A SPACE ENVIRONMENT DUE TO FUEL SLOSHING IN A RECTANGULAR TANK, Donald G. Eide, June 1964

TN D 2343 THE CAPABILITY OF A PROPORTIONAL-TYPE LATERAL CONTROL SYSTEM IN PROVIDING AERODYNAMIC HEADING-ANGLE TRAJECTORY CONTROL DURING REENTRY, Gene W. Sparrow, July 1964

TN D 2361 GUIDANCE EQUATIONS FOR QUASI-OPTIMUM SPACE MANEUVERS, D. J. Jezewski, August 1964

TN D 2370 SONIC BOOMS FROM AIRCRAFT IN MANEUVERS, Domenic J. Maglieri and Donald L. Lansing, July 1964

TN D 2376 SUPERSONIC LATERAL-DIRECTIONAL STABILITY CHARACTERISTICS OF A 45° SWEPT WING-BODY-TAIL MODEL WITH VARIOUS BODY CROSS-SECTIONAL SHAPES, Dennis E. Fuller and James F. Campbell, August 1964

TN D 2378 EFFECTS OF TEMPERATURE ON NOISE OF BYPASS JETS AS MEASURED IN THE LANGLEY NOISE RESEARCH FACILITY, George T. Kantarges and Jimmy M. Cawthorn, August 1964

TN D 2394 MEASUREMENTS OF HUMAN TRANSFER FUNCTION WITH VARIOUS MODEL FORMS, James J. Adams and Hugh P. Bergeron, August 1964

TN D 2416 A SPRING-MASS REPRESENTATION OF A FREE-FREE NONUNIFORM BAR IN RESPONSE TO LONGITUDINAL FORCES, Harold P. Frisch, August 1964

TN D 2419 A TWIN-GYRO ATTITUDE CONTROL SYSTEM FOR SPACE VEHICLES, Jerry R. Havill and Jack W. Ratcliff, August 1964

TN D 2436 PILOT EVALUATION OF DYNAMIC STABILITY CHARACTERISTICS OF A SUPER-SONIC TRANSPORT IN CRUISING FLIGHT USING A FIXED-BASE SIMULATOR, Milton D. McLaughlin and James B. Whitten, September 1964

TN D 2443 FLIGHT INVESTIGATION OF STABILITY AND CONTROL CHARACTERISTICS OF A 1/9-SCALE MODEL OF A FOUR-PROPELLER TILT-WING V/STOL TRANSPORT, William A. Newsom, Jr., and Robert H. Kirby, September 1964

TN D 2447 CREW PERFORMANCE DURING REAL-TIME LUNAR MISSION SIMULATION, Howard G. Hatch, Jr., Joseph S. Algranti, Donald L. Mallick, Harold E. Ream, and Glen W. Stinnett, September 1964

TN D 2467 A STUDY OF THE PILOT'S ABILITY TO CONTROL AN APOLLO TYPE VEHICLE DURING ATMOSPHERE ENTRY, Rodney C. Wingrove, Glen W. Stinnett and Robert C. Innis, August 1964

TN D 2470 EXPERIMENTAL EVALUATION OF SIZE EFFECTS ON STEADY-STATE CONTROL PROPERTIES OF ELECTRON-BOMBARDMENT ION THRUSTOR, Eugene V. Pawlik and Shigeo Nakanishi, September 1964

TN D 2477 EFFECTS OF GROSS CHANGES IN STATIC DIRECTIONAL STABILITY ON V/STOL HANDLING CHARACTERISTICS BASED ON A FLIGHT INVESTIGATION, John F. Garren, Jr., James R. Kelly, and John P. Reeder, October 1964

TN D 2483 AN INVESTIGATION OF THE DYNAMIC STABILITY AND CONTROL CHARACTERISTICS FOR A TRANSPORT CRUISING AT A MACH NUMBER OF 3, Lawrence W. Brown, October 1964

TN D 2486 COMPARISON OF LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF CURVED AND STRAIGHT LEADING-EDGE DELTA WINGS AT MACH NUMBERS 3 AND 6, Dewey E. Wornom and Joseph Gera, September 1964

TN D 2517 INVESTIGATION OF THE DYNAMIC STABILITY AND CONTROLLABILITY OF A TOWED MODEL OF A MODIFIED HALF-CONE REENTRY VEHICLE, Robert E. Shanks, February 1965

TN D 2532 FLIGHT MEASUREMENTS OF STABILITY AND CONTROL DERIVATIVES OF THE X-15 RESEARCH AIRPLANE TO A MACH NUMBER OF 6.02 AND AN ANGLE OF ATTACK OF 25°, Roxanah B. Yancey, November 1964

TN D 2569 MEASURED HUMAN TRANSFER FUNCTIONS IN SIMULATED SINGLE-DEGREE-OF-FREEDOM NONLINEAR CONTROL SYSTEMS, Hugh P. Bergerson, Joseph K. Kincaid, and James J. Adams, January 1965

TN D 2576 SUPERSONIC INVESTIGATION OF A SPINNING AND NONSPINNING MODEL OF A CAJUN (OR APACHE) ROCKET VEHICLE WITH ROLL-CONTROL TABS, Ralph A. Falanga, January 1965

TN D 2596 APPLICATION OF A BANG-BANG CONTROL SYSTEM TO TWO SPINNING SPACE VEHICLES, Paul S. Rempfer and Jerrold H. Suddath, January 1965

TN D 2632 VISUAL ASPECTS OF A FULL-SIZE PILOT-CONTROLLED SIMULATION OF THE GEMINI-AGENDA DOCKING, Jack E. Pennington, Howard G. Hatch, Jr. Edward R. Long, and Jere B. Cobb, February 1965

TN D 2636 PRELIMINARY INVESTIGATION OF THE HANDLING QUALITIES OF A VEHICLE IN A SIMULATED LUNAR GRAVITATIONAL FIELD, Peter C. Boisseau, Robert O. Schade, Robert A. Champine, and Henry C. Elkins, February 1965

TN D 2645 A STUDY OF THE DYNAMIC MODEL TECHNIQUE IN THE ANALYSIS OF HUMAN TOLERANCE TO ACCELERATION; Prepared under contract no. NASr-37, by Stanley Aviation Corporation, Denver, Colo., March 1965

Applicable NACA Technical Reports

TR 301 FULL SCALE TESTS OF WOOD PROPELLERS ON A VE-7 AIRPLANE IN THE PROPELLER RESEARCH TUNNEL, Fred E. Weick, 1928

The results of propeller tests in the new propeller research tunnel showed a fair agreement with those of the flight and model tests.

The effect of the tail surfaces on the propeller characteristics was negligible but the wings reduced the maximum propulsive efficiency about 5%.

TR 302 FULL SCALE TESTS ON A THIN METAL PROPELLER AT VARIOUS TIP SPEEDS, Fred E. Weick, 1928

These tests indicate that the effect of high speed is less for thin than for thick section propellers. The effect of tip speed on the efficiency and performance coefficients of the propellers tested was negligible throughout the range of the tests (about 0.5 to 0.9 the velocity of sound in air), except as the thrust and power coefficients were effected by the slight change of pitch due to deflection.

TR 306 FULL-SCALE WIND-TUNNEL TESTS OF A SERIES OF METAL PROPELLERS ON A VE-7 AIRPLANE, Fred E. Weick, 1928

The efficiencies of this series of metal propellers were found to be from 4 to 7% higher than those of standard wood propellers operating under the same condition. The maximum efficiencies of the metal propellers reached 86% for the highest pitch setting.

TR 326 TESTS OF FIVE METAL MODEL PROPELLERS WITH VARIOUS PITCH DISTRIBUTIONS IN A FREE WIND STREAM AND IN COMBINATION WITH A MODEL VE-7 FUSELAGE, E. P. Lesley and Elliott G. Reid, 1929

The radial distribution of air velocity through the propeller plane varies from zero at the hub center to approximately free stream velocity at the blade tip.

The reduction of propeller efficiency is caused by the slip stream, but this can be minimized by giving the propeller a radial distribution of pitch similar to the radial distribution of velocity through the propeller plane. In other words, the propeller is designed so that all its blade sections attain their optimum angles of attack at the condition of maximum efficiency.

TR 339 FULL SCALE WIND TUNNEL TESTS WITH A SERIES OF PROPELLERS OF DIFFERENT DIAMETERS ON A SINGLE FUSELAGE, Fred E. Weick, 1930

There are four metal propellers varying in diameter (9 feet - No. 4412, 9.5 feet - No. 4413, 10 feet - No. 4414, 10.5 feet - No. 4102) which were used in the experiments.

C_T, C_p and η vs J for each of four propellers are shown. The difference in the aerodynamic coefficients found for various diameter propellers was quite small. Throughout the working range the smaller the propeller diameter is, the higher the thrust coefficient and power coefficient; but the maximum propulsive efficiency is increased slightly as the propeller diameter was increased. (1% of η for a 5% of change in diameter.)

TR 340 FULL SCALE WIND TUNNEL TESTS ON SEVERAL METAL PROPELLERS HAVING DIFFERENT BLADE FORMS, Fred E. Weick, 1930

Five different AL alloy propellers having 4 different blade forms (No. 3790 - d = 8'11", No. 4412 - d = 8'11", Reed R - d = 9', No. 4102 - d = 10'5", and No. 3603 - d = 10'5") were tested. Comparative curves of thrust coefficients, power coefficients, and efficiencies for 5 different propellers are shown.

The results show that:

1. The differences in propulsive efficiency due to the difference in blade form were small.

2. The blade form with the thinnest airfoil sections had the highest efficiency.

3. Propellers having the pitch reduced toward the hub had higher efficiencies than the one uniform pitch propeller.

TR 408 GENERAL FORMULAS AND CHARTS FOR THE CALCULATION OF AIRPLANE PERFORMANCE, W. Bailey Oswald, 1932

The general formulas for the determination of all major airplane performance characteristics are developed. A rigorous analysis is used throughout. The characteristics of performance are given in terms of the three fundamental parameters L_p, λ_s, and λ_t, or their engineering alternatives L_p, L_s, and L_t, where

$\lambda_p \propto L_p$ = parasite loading
$\lambda_s \propto L_s$ = effective span-loading
$\lambda_t \propto L_t$ = thrust horsepower loading

which may be combined into a parameter of fundamental importance

$$\Lambda' \propto \Lambda = \frac{L_s L_t^{4/3}}{L_p^{1/3}} \; ; \; \Lambda' = \frac{\lambda_s \lambda_t}{V_m} \left(1 - \frac{\lambda_s \lambda_t}{V_m}\right)^{1/3}$$

The significance of the fundamental parameter is that $\Lambda' = \frac{V_0}{V_m}$ (approximately) where V_m = design maximum velocity at sea level and V_0 = ideal minimum speed (minimum value for V for sea level horicontal flight of the ideal airplane). Λ' determined uniquely the "ideal speed ratio" of an airplane and for normal airplanes Λ' also has the the property of uniquely determining the speed ratios for maximum L/D and minimum power required.

Equations for the various performance characteristics of an airplane may be developed from the funadmental performance equation:

$$\frac{dh}{dt} = \frac{1}{\lambda_t} \left[(T_e T_v - \sigma R_v^3) + (\sigma R_v^3 - \frac{1}{\sigma R_v}) \frac{\lambda_s' \lambda_t}{V_m} \right] ;$$

$$R_v = V/V_m$$

$$T_a = \frac{\text{thp}_a \text{ at altitude}}{\text{thp}_a \text{ at S.L.}}$$

$$T_V = \frac{\text{thp}_a \text{ at velocity } V}{\text{thp}_a \text{ at } V_m}$$

and from the equation

$$\Lambda' = \frac{\lambda_s \lambda_t}{V_m} \left(1 - \frac{\lambda_s \lambda_t}{V_m}\right)^{1/3}$$

The general formulas for the more important performance characteristics are given and expressed in American engineering units; Maximum Velocity at S.L., Maximum Velocity at altitude, Maximum rate of climb at any altitude; speed for maximum climb, absolute ceiling; speed at absolute ceiling, service ceiling, minimum time to climb to any altitude.

One of the greatest advantages of the formulas and resulting charts is the explicit manner in which the dependence of each performance characteristic of the airplane upon its various parameters is shown. The particular parameter that need be changed and the amount of the change that will be necessary when a certain variation of performance is desired, consequently, the particular detail of the airplane that need be changed, is readily determined. A discussion of propeller efficiency is also given in this report.

Using the results of this investigation, a series of performance charts is drawn for airplanes which are equipped with unsupercharged engines and fixed-pitch metal propellers. Other charts (for supercharged engines and variable pitch props) can be constructed using the formulas presented here. A complete discussion of the method for using these charts is also presented.

The use of these charts is very rapid and they produce results of good accuracy, generally within 5% of flight test data. These same charts may be used to reduce flight data and obtain actual airplane parameters.

TR 654 GENERAL AIRPLANE PERFORMANCE, W. C. Rockefeller, 1937

This report combines the results and techniques of NACA TR-408 and NACA TN 571. The result is a set of performance prediction techniques, equations, and charts very similar in character to those of Oswald, but which may be used for aircraft which are powered by supercharged engines equipped with constant-speed propellers.

TR 684 STATIC THRUST AND POWER CHARACTERISTICS OF SIX FULL-SCALE PROPELLERS, Edwin P. Hartman and David Biermann, 1940

An investigation is made of the static thrust and power of six full scale propellers. Measurements were made outdoors to avoid the velocities induced in wind tunnel tests. The propeller blade sections were essentially Clark Y, RAF-6, but one blade had an NACA 4400 series on the inner half and NACA 2400-34 series on the outer half.

Propeller thrust and power coefficients are plotted as functions of tip Mach number. The propeller with the RAF-6 airfoil sections showed the greatest effect of compressibility while the blade with the NACA 4400 series and NACA 2400-34 series blade sections showed the least effect of compressibility. A propeller with a wide blade displayed much less compressibility effect than similar propeller with a blade of normal width.

It was found that the single-point method of calculating airfoil coefficients from wind tunnel propeller data was not particularly successful for the propellers tested, except when a spinner covered the hub and part of the long cylindrical blade shanks.

TR 691 FREE-SPINNING WIND-TUNNEL TESTS OF A LOW-WING MONOPLANE WITH SYSTEMATIC CHANGES IN WINGS AND TAILS. EFFECT OF AIRPLANE RELATIVE DENSITY, Oscar Seidman and A. I. Neihouse, 1940

These tests are continuation of an NACA investigation being made in the free spinning wind tunnel to determine the effects of independent variations in load distribution, wing and tail arrangement, and control disposition on the spin characteristics of airplanes. This set of tests was made to determine the effect of airplane relative density upon the spin of a representative single-engine monoplane. The term airplane relative density is defined as the ratio of the mass of an airplane to the mass of a volume of air, this volume being dependent upon the dimensions of the airplane but not necessarily equal to the volume of the airplane.

For each wing and tail combination with each value of the relative-density parameter, spin tests were made for four control settings:

a) Rudder 30° with the spin, elevators neutral
b) Rudder 30° with the spin, elevators 20° down
c) Rudder 30° with the spin, elevators 30° up
d) Rudder neutral, elevators neutral

The angle of attack α, the angle of sideslip β, the rate of descent γ, the spin coefficient $\Omega b/2V$ (where Ω is the angular velocity), and the turns for recovery are plotted in 12 charts grouped so as to permit ready comparison of the effects of relative density, tip shape, plan form, section, flaps and Army standard wing.

Effects of airplane relative density (wing loading or altitude of the spin):

1. In nearly every case, an increase in the relative density gave flatter spins and slower recoveries.

2. Except for the wing of NACA 6718 section, sideslip generally became more outward as the relative density was decreased.

3. At high values of the relative-density parameter, the effects of wing arrangement, tail arrangement, control position became very critical.

TR 700 PRELIMINARY INVESTIGATION OF THE FLYING QUALITIES OF AIRPLANES, H. A. Soule, 1940

An investigation of the flying qualities of airplanes is presented. The work consists of the determination of the qualities susceptible to measurement, the development of the instruments required to make the measurements, and the accumulation of data on the flying qualities of airplanes to serve as a basis for quantitative specifications. The work in connection with this investigation is divided into three phases. Two sets of instruments were used; one set consists of special NACA recording instruments and the other is a set of generally available commercial instruments, including those usually found on instrument panels.

TR 709 AN ANALYSIS OF THE STABILITY OF AN AIRPLANE WITH FREE CONTROLS, Robert T. Jones and Doris Cohen, (Superseded by TR 787 as far as Aileron Investigation is concerned), 1941

A theoretical investigation is made of the conditions essential to the stability of an airplane with free control surfaces. Stability charts are included to show the limiting values of the aerodynamic hinge moments and the weight hinge moments of the control surfaces for various positions of the c.g. of the airplane and for control systems with various moments of inertia. The effects of reducing the chord and of eliminating the floating tendency of the surface, of changing the wing loading, and of decreasing the radius of gyration of the airplane are indicated. An investigation has also been made of the nature of the motion of the airplane with controls free and of the modes of instability that may occur.

Stability with Elevator Free

The pitching moment due to angular velocity of the elevator about its hinge, $\partial M/\partial \dot{\delta}$; the pitching moment due to the aerodynamic inertia of the surfaces, $\partial M/\partial \dot{\omega}$, and the aerodynamic damping of the elevator, $\partial H/\partial \dot{\delta}$ are included in this analysis. The roots of the stability equation were found for several typical cases and apparently the motion is oscillatory and of two fairly distinct modes. The slower of the modes (although more rapid than those with controls fixed) involved coupling and reinforcing movements of the airplane. The damping is consequently light and instability will occur first in this slower mode.

Stability with Ailerons Free

The stability of an airplane with the ailerons free is examined by including in the equations the interaction between the rolling motions of the airplane and movements of the ailerons.

The stability charts give boundaries which are of value chiefly as indications of the effect of certain design factors, they are useful quantatively only as outside limits. The charts are however slightly conservative because they do not take into account the possibility of friction in the control system.

The indications of this study may be summarized as follows:

1. The percentage of hinge moment that can be compensated for with aerodynamic balance is limited by stability considerations.

2. Reduction of the floating moment C_{h_α}, if the reduction is

independent of aerodynamic balance, causes a shift of the divergence boundary.

3. Divergence is a more likely form of instability for rudder control and may be avoided by reducing the effectiveness of the aerodynamic balance.

4. C_{m_α} has little effect on longitudinal oscillatory stability, but C_{n_β} increases the likelihood of oscillatory instability in yaw.

5. An increase in the relative radius of gyration increases the range of stability.

6. The use of a narrow control surface is recommended as a means of increasing control free stability.

TR 711 ANALYSIS AND PREDICTION OF LONGITUDINAL STABILITY OF AIRPLANES, R. R. Gilruth and M. D. White, 1941

An analysis is made of the longitudinal stability characteristics of 15 airplanes as determined by flight. The 15 airplanes range from large four engine bombers to small single engine airplanes. It was found that the derivative $d\delta_e/d\alpha$ represents most nearly the stability characteristic appreciated by the pilot. Here δ_e is the elevator angle and α is the angle of attack. The derivative $d\delta_e/d\alpha$ expresses the ratio of static-restoring moments to elevator-control moments.

An expression, determined from the stability equation, for $d\delta_e/d\alpha$ is given and charts are presented for each of the factors which appear in the equation. With these charts it is possible to show the effects of wing position relative to the tail, fuselage size and location; engine nacelles and horizontal-tail arrangements on the longitudinal stability of the airplane.

A design value of $d\delta_e/d\alpha$ of 0.5 is suggested.

TR 712 PROPELLER ANALYSIS FROM EXPERIMENTAL DATA, George W. Stickle and John L. Crigler, 1941

The distribution of thrust and torque along the propeller radius is used to compare the actual performance of a propeller with the calculated performance. The energy losses in the wake of the propeller as obtained from experimental measurements are discussed. A method of determining these losses from the total thrust and torque of the complete propeller is given; the method permits an analysis of the effects of the propeller solidity on the axial and the rotational losses of the propeller to be made from the total thrust and torque. The data used in the analysis were obtained in the NACA 20 foot tunnel on a 4 foot diameter, two blade propeller operating in front of four body shapes (a free air body, a propeller hub body, a body of revolution, and a body of revolution with an NACA cowling), ranging from a small shaft to support the propeller to a conventional NACA cowling.

The loss in efficiency due to the rotational velocity is always small for a propeller of an optimum design, being only of the order of 1% for a low solidity propeller. The loss of efficiency from this source may become quite large at high blade angle settings for a propeller with improper load distribution.

Counter-rotating propellers are attractive from considerations of aerodynamic efficiency only when propellers of high solidity are used. Large gains in propeller efficiency with counter-rotating propellers may be expected only if propellers of poor torque distribution are used.

If high solidity propellers are selected because of limitations on propeller diameter, it may be useful to resort to counter-rotating propellers to eliminate the effect of the engine torque on the flying characteristics of the airplane. Only a small direct gain in propeller efficiency is normally to be expected.

The average angle of twist in the propeller slipstream is shown to be a unique function of the torque coefficient Q_c and charts are given to help estimate the angle. The increase in total slipstream along the radius behind the propeller is given as a function of the power coefficient $\frac{1}{\sqrt[3]{P_c}}$. This is of use in estimating the available pressure that can be obtained for air intakes behind the propeller.

Reference 1
Glauert, H.: Airplane Propellers. Vol. IV, Div. L of Aerodynamic Theory, W. F. Durand, Ed., Julius Springer (Berlin), 1935, pp. 169-360.

Reference 2
Stickle, George W.: Measurement of the Differential and Total Thrust and Torque of Six Full-Scale Adjustable Pitch Propellers. Report 421, NACA, 1932

TR 715 LATERAL CONTROL REQUIRED FOR SATISFACTORY FLYING QUALITIES BASED ON FLIGHT TESTS OF NUMEROUS AIRPLANES, R. R. Gilruth and W. N. Turner, 1941

An investigation was made of the aileron control characteristics of a total of 28 different aileron-wing combinations tested in flight. It was found that the parameter pb/2V, which expresses the helix angle described by the wing tip, was the measure of aileron effectiveness most appreciated by pilots. Here p is the rolling velocity of the airplane in radians per second, b is the wing span and V is the true airspeed.

The airplanes tested included bombers, transport airplanes, trainers and pursuit airplanes.

It was found a value of 0.07 for pb/2V represented a criterion of minimum satisfactory aileron effectiveness.

Using a previously derived expression for pb/2V, it was possible to show how pb/2V is related to:

(a) The rate of change of rolling moment coefficient with aileron angle.

(b) An aileron effectiveness factor which is the effective change in angle of attack of the wing-aileron section per unit aileron angle.

(c) The rate of change of rolling moment coefficient with helix angle pb/2V, and the angular difference between up and down aileron deflection.

It is therefore possible to calculate pb/2V for various configurations (using charts supplied in the report) and then to compare their aileron effectiveness on the basis of this parameter.

TR 725 EFFECT OF BODY NOSE SHAPE ON THE PROPULSIVE EFFICIENCY OF A PROPELLER, G. W. Stickle, John L. Crigler, and Irven Naiman, 1941

Three adjustable propellers of 10 foot diameter were operated in front of four body nose shapes, varying from a streamline nose that continued through the propeller plane in the form of a large spinner to a conventional open nose radial engine cowling. One propeller had airfoil sections close to the hub, the second had conventional round blade shanks, and the third differed from the second only in pitch distribution. The blade angle settings ranged from 20° to 55° at the 0.75 radius.

The effect of the body nose shape on propulsive efficiency may be divided into two parts: (1) the change in the body drag due to the propeller slipstream and (2) the change in propeller load distribution due to the change in velocity caused by the body. For the nose shapes tested in this report, the first effect is shown to be very small. The chief emphasis of the report is confined to the second effect.

The results showed that, in the design of the pitch distribution, proper consideration should be given to the velocity field produced by the presence of the body adjacent to the propeller.

The presence of a body behind the propeller produces its greatest effect on the inner sections of the propeller blades. When the inner sections are of conventional round shank design, the important effect is the change in the drag of these sections due to the reduced velocity in front of the body. For inner sections of an airfoil design, the main effect is the change of the load distribution of the propeller due to increasing the angle of attack by reduction of the forward velocity. The gain in efficiency realized by covering the propeller hub with a spinner is a function of the local velocity to which the hub is exposed; the possible gain increases as the power loading decreases.

TR 747 WIND-TUNNEL TESTS OF FOUR- AND SIX-BLADE SINGLE- AND DUAL-ROTATING TRACTOR PROPELLERS, David Biermann and Edwin P. Hartman, 1942

Tests of 10 foot diameter, four- and six-blade single rotating and dual rotating propellers were conducted in the NACA propeller research tunnel. The propellers were mounted at the front end of a streamline body incorporating spinners to house the hub portions. The effect of a symmetrical wing mounted in the slipstream was investigated. The blade angles investigated ranged from 20° to 65°.

The peak efficiencies of dual rotating four- and six-blade tractor propellers were found to be from 0 to 6 percent greater than that for single rotating propellers, depending upon the disk loading and the blade angle setting; the higher values, the greater the difference in efficiency up to the limiting test blade angle of 65°. But when the dual propellers operated in the presence of a wing, the gain was reduced about one-half. (The maximum efficiency of a single rotating propeller was increased by installing a wing in the slipstream.)

Other advantages of dual rotating propellers were found to include greater power absorption and greater efficiency at the low V/nD operating ranges of high pitch propellers.

TR 749 PROPELLER CHARTS FOR THE DETERMINATION OF THE ROTATIONAL SPEED FOR THE MAXIMUM RATIO OF THE PROPULSIVE EFFICIENCY TO THE SPECIFIC FUEL CONSUMPTION, David Biermann and Robert N. Conway, 1942

A set of propeller operating efficiency charts, based on a coefficient from which the propeller rotational speed has been eliminated, is presented. The report contains working charts for nine propeller body combinations and includes results obtained from tests of dual rotating propellers. These charts are to be used in the calculation of the range and the endurance of airplanes equipped with constant speed propellers. It is desired to determine, from the propeller engine operating characteristics, the propeller rotational speed that gives the maximum ratio of the propulsive efficiency to the specific fuel consumption.

The coefficient on which the charts are based may be written in the form of a thrust coefficient or a thrust power coefficient.

A method of using the charts is outlined and sample computation for a typical airplane is included.

TR 755 REQUIREMENTS FOR SATISFACTORY FLYING QUALITIES OF AIRPLANES, R. R. Gilruth, 1941

Three phases of work are required in order to obtain the information of flying qualities of an airplane:

1. The development of a test procedure and test equipment which would measure the characteristics on which flying qualities depend (is reported in reference 1).

2. The measurement of the flying qualities of a number of airplanes (is described in reference 1).

3. The analysis of available data to determine what measured characteristics were significant in defining satisfactory flying qualities, what characteristics it was reasonable to require of an airplane, and what influence the various design features had on the observed flying qualities.

The report presents the flying quality requirements as follows:

I. Requirements for longitudinal stability and control
   a. Characteristics of uncontrolled longitudinal motion
   b. Characteristics of elevator control in steady flight
   c. Characteristics of elevator control in accelerated flight
   d. Characteristics of elevator control in landing
   e. Characteristics of elevator control in take off
   f. Limits of trim change due to power and flaps
   g. Characteristics of longitudinal trimming device

II. Requirements for lateral stability and control
   a. Characteristics of uncontrolled lateral and directional motion
   b. Aileron control characteristics
   c. Yaw due to aileron
   d. Limit of rolling moment due to sideslip
   e. Rudder control characteristics
   f. Yawing moment due to sideslip
   g. Cross wind force characteristics
   h. Pitch moment due to sideslip
   i. Characteristics of rudder and aileron trimming devices

III. Stalling characteristics

Reference 1:
Soule, H. A.: Preliminary Investigation of the Flying Qualities of Airplanes. NACA Report 700, 1940.

TR 775 THE THEORY OF PROPELLERS. I - DETERMINATION OF THE CIRCULATION FUNCTION AND THE MASS COEFFICIENT FOR DUAL-ROTATING PROPELLERS, Theodore Theodorsen, 1944

Values of the circulation function have been obtained for dual rotating propellers. Numerical values are given for four-, eight-, and twelve-blade dual rotating propellers and for advance ratios from 2 to 6. In addition, the circulation function has been determined for single rotating propellers for the higher values of advance ratio. Mass coefficient, which is actually the mean value of circulation coefficient, expresses the effective area of the column of the medium acted upon by the propeller in terms of the propeller disk area. Values of the mass coefficient, which have been determined directly by special measurements and also by integration of the circulation function, are given for the four-, eight-, and twelve-blade dual rotating propellers.

The mass coefficient has also been determined for several cases of single rotating propellers, partly for the purpose of comparing such experimental values with theoretical results in the known range of low advance ratio and partly to extend the results to include a range of high advance ratios. The effect of stationary countervanes on the mass coefficient has also been determined for several cases of practical interest.

TR 776 THE THEORY OF PROPELLERS. II - METHOD FOR CALCULATING THE AXIAL INTERFERENCE VELOCITY, Theodore Theodorsen, 1944

This paper is the second in a series on the theory of propellers. Part 1 deals with a method for obtaining the circulation function for dual rotating propellers.

A method is given for calculating the axial interference velocity of a propeller. The method involves the use of certain weight function for which numerical values are given for two blade, three blade, and six blade propellers.

The results of these functions and their derivatives are shown.

TR 777 THE THEORY OF PROPELLERS. III - THE SLIPSTREAM CONTRACTION WITH NUMERICAL VALUES FOR TWO-BLADE AND FOUR-BLADE PROPELLERS, Theodore Theodorsen, 1944

This paper determines the relationship of the propeller diameter and the wake diameter, or the problem of the slipstream contraction. As the conditions of the ultimate wake are of concern both theoretically and practically, the magnitude of the slipstream contraction has been calculated. It will be noted that the contraction in a representative case is of the order of only 1% of the propeller diameter. Curves and tables are given for the contraction coefficient of two blade and four blade single rotating propellers at four specific values of the advance ratio. The contraction coefficient is defined as the contraction in the diameter of the wake helix in terms of the wake diameter at infinity. The contour lines of the wake helix are also shown at four values of the advance ratio in comparison with the contour lines for an infinite number of blades.

TR 778 THE THEORY OF PROPELLERS. IV - THRUST, ENERGY, AND EFFICIENCY FORMULAS FOR SINGLE- AND DUAL-ROTATING PROPELLERS WITH IDEAL CIRCULATION DISTRIBUTION, Theodore Theodorsen, 1944

Simple and exact expressions are given for the efficiency of single- and dual-rotating propellers with ideal circulation distribution as given by the Goldstein functions for single rotating propellers and by the new functions for dual rotating propellers from part 1 of this series. The efficiency is shown to depend primarily on a defined load factor and, to a very small extent, on an axial loss factor, given as:

$$\eta = f_1(\bar{w}, \frac{\epsilon}{k}) \quad \text{or} \quad \eta = f_2(\frac{C_s}{k}, \frac{\epsilon}{k})$$

where $k = \epsilon + \epsilon_t + \epsilon_r$

$\frac{\epsilon}{k}$ = axial loss in terms of the total loss

$\bar{w} = \frac{w}{V} = \frac{\text{angular velocity of propeller}}{\text{advance velocity of propeller}}$

C_s = specific loading factor

TR 797 APPLICATION OF SPRING TABS TO ELEVATOR CONTROLS, William H. Phillips, 1944

An analysis of the effects of spring tabs on elevator forces for airplanes of various sizes is presented. The main problems encountered in the design of a satisfactory elevator spring tab are to provide stick forces in the desired range, to maintain the force per g sufficiently constant throughout the speed range, to avoid undesirable "feel" of the control in ground handling or in flight at low speeds, and to prevent flutter. The report briefly outlines the theory of the geared spring tab, gives formulas for use in design, and indicates the practical possibilities and limitations of the device. An appendix is given on Equations for Elevator Forces with Geared Spring Tab.

The four criterion listed above are shown to restrict the design characteristics of a satisfactory ordinary elevator spring tab to a rather narrow range for any particular type of airplane. In order to illustrate the application of ordinary spring tabs to elevator controls of airplanes of various sizes, the stick force characteristics in maneuvers have been calculated for four airplanes. The problem of providing sufficient heaviness of the control stick for quick movements (with the resultant undesirable variation of force per g with center-of-gravity position) when a spring tab is used may present some difficulties on a small airplane. The lower limit on the size of the airplane that can be controlled is determined by the requirement for a definite centering tendency of the control stick. One of the chief objections to the use of spring tabs is the amount of weight required for mass balance to prevent flutter.

It is theoretically possible to provide a value of stick-force gradient in maneuvers that does not vary with speed, no matter what spring stiffness is used. If the geared spring tab is used in conjunction with an elevator that has zero variation of hinge moment with angle of attack, the force per g may be made independent of speed at any center of gravity location, however, the geared spring tab appears most suitable for application to large airplanes.

TR 823 EXPERIMENTAL VERIFICATION OF A SIMPLIFIED VEE-TAIL THEORY AND ANALYSIS OF AVAILABLE DATA ON COMPLETE MODELS WITH VEE-TAILS, Paul E. Purser and John P. Campbell, 1945

This report extends the theory concerning vee-tails found in NACA TN 815 to include control effectiveness and control forces as well as stability, summarizes the results of two complete model investigations, and reports tests of two isolated tail surfaces with various amounts of dihedral. A method for designing vee-tails is also given.

Considering an isolated vee-tail as a wing with a large amount of dihedral, the basic assumptions usually made for a wing with dihedral are used to derive fairly simple expressions for the stability, control, and control force parameters for vee-tails.

The analysis indicated that a vee-tail designed to provide values of stability and control parameters equal to those provided by a conventional tail would probably provide no reduction in area unless the conventional vertical tail is in a bad canopy wake or unless the vee-tail has a higher effective aspect ratio than the conventional vertical and horizontal tails.

The analysis also indicated that a possible reduction in control forces (or in amount of control balance required) can be made by use of a vee-tail, provided large deflections of the control surface do not cause a large decrease in the effectiveness and increase in the hinge moment coefficient per degree of deflection of the control surface. If large chord control surfaces must be used in order to keep the control deflections small, the control forces (or the amount of control balance required) on the vee-tail is likely to be equal or greater than those for the conventional tail assembly.

The analysis indicated that the vee-tail would give the following advantages over the conventional tail assembly:

1. Less drag because the vee-tail has fewer fuselage tail junctures.

2. Less tendency toward rudder lock.

3. Higher location of tail surfaces, which tends to reduce elevator deflection required for take-off and landing and to reduce possibilities of tail buffeting from the wing and canopy wakes in high speed flight.

4. Fewer tail surfaces to manufacture.

On the other hand, the analysis indicated the following disadvantages that a vee-tail might have when compared with conventional tails:

1. Possible interaction of elevator and other control surfaces.

2. Possible interaction of elevator and rudder trimming when tabs are at fairly large deflections.

3. More complicated operating mechanism.

4. Greater loads on tail and fuselage, which would tend to require increased weight.

The tests of the isolated vee-tail indicated that the simplified theory developed for vee-tails was valid for dihedral angles up to about 40^{o}.

For spins recovery, the vee-tail is probably at least as good as the conventional tail except possibly in cases in which simultaneous full deflection of both rudder and elevator is required for recovery from the spin.

TR 825 ANALYSIS OF WIND-TUNNEL STABILITY AND CONTROL TESTS IN TERMS OF FLYING QUALITIES OF FULL-SCALE AIRPLANES, Gerald G. Kayten, 1945

NACA flying qualities requirements are discussed in relation to wind-tunnel tests, and general procedures for the estimation of flying qualities are outlined.

The inclusion of a discussion of the particular dimensional values describing the airplanes flying qualities would eliminate the confusion often caused by mere presentation of wind tunnel test results, facilitate the practical application of tunnel data, and provide assurance that no flight difficulties will pass undetected because of failure to put the accumulated information to its proper use. A lack of understanding of the manner in which tunnel data should be applied has at times resulted in insufficient data concerning trim conditions and considerable unnecessary data for untrimmed conditions.

The purpose of this report is to outline a suggested form of presentation of the results of a stability and control investigation in terms of flying qualities as defined in NACA TR 755 and to systemize and review briefly the analytical work required for this type of presentation. No effort is made to specify definite test procedures.

This paper considers the following requirements for satisfactory flying qualities:

1. Requirements for Longitudinal Stability and Control
2. Requirements for Lateral Stability and Control
3. Stalling Characteristics

It is believed that wind tunnel tests of powered models can, if properly analyzed, be used to examine the flying qualities of airplanes and to determine the extent to which any particular airplane will satisfy these requirements for satisfactory stability, control and handling characteristics in flight. It is recommended that this type of testing, analysis and presentation of data be generally employed in wind tunnels engaged in testing airplane models for stability and control.

TR 837 STANDARD NOMENCLATURE FOR AIRSPEEDS WITH TABLES AND CHARTS FOR USE IN CALCULATION OF AIRSPEED, William S. Aiken, Jr., 1946

A standard set of symbols and definitions of various airspeed terms that were adopted by the NACA Subcommittee on Aircraft Structural Design and a compilation of the necessary equations and charts and tables for converting measured pressures and temperatures into airspeeds, determining Mach numbers and Reynolds numbers, and determining other quantities such as dynamic and impact pressures that are of interest are presented herein.

This report presents procedures for determining the following quantities:

1. Determination of True Airspeed from Calibrated Airspeed
2. Determination of True Airspeed from Impact Pressure
3. Determination of Dynamic Pressure and Equivalent Airspeed
4. Determination of the Reynolds Number

Also included is a section on the Standard Atmosphere along with a tentative extension of the Standard Atmosphere.

The following appendices are given:

Appendix A - Summary of Equations Relating Airspeed Quantities, 19 equations
Appendix B - Constants and Equations for Use in Computations of Standard Atmosphere

Tables of Impact Pressure in Pounds per square foot for Various Values of Calibrated Airspeed (mph) as well as Static Pressure (psf) for values of Pressure Altitude and Mach Number for Various Values of q/p are given along with Speed of Sound for Various Values of Free Temperature in ^{o}F and ^{o}C.

Tables on Properties of the Standard Atmosphere and charts used for various calculations involving airspeeds are given.

TR 862 AN INVESTIGATION OF A THERMAL ICE-PREVENTION SYSTEM FOR A TWIN-ENGINE TRANSPORT AIRPLANE, Alun R. Jones, 1946

The thermal system investigated was based upon the transfer of heat from the engine exhaust gas to air, which is then caused to flow along the inner surface of any portion of the airplane for which protection is desired.

The investigation consisted of four steps as follows:

1. The analysis of the heat requirements for ice prevention of the wings, empennage, and windshield.

2. The design, fabrication, and installation of the thermal system in the test airplane.

3. Performance tests of the system in clear air and in natural icing conditions at various altitudes and engine operating conditions.

4. The evaluation of the effects of the system on the airplane cruise performance and the structural integrity of the wings.

For the determination of the thermal performance of the system, venturi meters and thermocouples were installed to measure the heated air flow rates throughout the system and the resultant temperature rise of the surfaces to be protected.

There are three possible deleterious effects of the system on the wing structure as follows:

1. Reduction on the strength of the wing structural material at elevated temperatures.

2. Thermal stresses generated by temperature gradients in the wing.

3. Corrosion.

The operation of the wing leading edge thermal system produced thermal stresses which may be negligible for regions aft of the heated leading edge, but should be considered during design for the leading edge region. No corrosive effects were noted which could be attributed to the basic principle of employing free stream air as the heat transfer medium in an internal circulatory system.

The installation of an ice prevention system similar in thermal performance to that tested could be effected with a negligible loss (6 mph indicated airspeed at 10,000 feet) in the airplane cruise performance, provided the heat exchange installation was given consideration on the early stages of the nacelle design.

The surface temperature rises measured in the performance tests of the thermal system were greater than those predicted by the design analysis, indicating the analysis method is conservative but requires refinement.

There are many figures which illustratethe thermal ice prevention system for a twin engine transport airplane in this report.

TR 868 SUMMARY OF LATERAL-CONTROL RESEARCH, Langley Research Staff compiled by Thomas A. Toll, 1947

This paper discusses rather completely the problems associated with lateral control and presents the available information that is believed to be most useful in the aerodynamic design of lateral-control devices. This report covers work done thru 1945. In general this report considers the work done by the NACA and then selects the most important aspects of that work for presentation. Occasional reference is made to sources other than the NACA. The material presented seems extensive enough to serve as a guide in preliminary design of lateral control systems. Following is a brief outline of the essential contents of this report:

I. Criterions Used in Lateral-Control Specifications

Rolling Performance, Control Forces, Stick or Wheel Travel, Adverse Yaw, Lag in Response, Control-Free Stability

II. Factors Involved in the Lateral-Control Problem

(a) Lateral Maneuverability - Concept of Lateral Maneuverability, Control Force, Effects of Wing Twist, Effects of Control System Stretch, Effects of Adverse Yaw, Weathercock Stability, Dihedral, Effects of Aspect Ratio, Effects of Altitude, Effects of Radii of Gyration and Wing Loading.
(b) Control-Free Stability
(c) Flutter

III. Testing Procedures and Application of Experimental Results

(a) Flight Investigations - Procedure for Determining Rolling Performance, Procedure for Determining Adverse Yaw, Procedure for Determining Aileron Trim Changes With Speed
(b) Wind Tunnel Investigations - Two Dimensional Models, Finite Span Models

IV. Characteristics of Lateral Control Devices

(a) Conventional Flap-Type Ailerons - Plain Ailerons, Ailerons Having Exposed-Overhang Balances, Ailerons Having Sealed Internal Balances, Ailerons Having Linked Tabs, Comparisons of Various Balancing Devices, Application to Arrangements Involving Full-Span Flaps, Effects of Air Flow and Wing-Surface Conditions (Reynolds and Mach No., etc.)
(b) Spoiler Devices - Hinged-Flap Spoilers, Retractable-Arc Spoilers, Slot-Lip Ailerons, Plug-Type Spoiler Ailerons, Effects of Mach Number

V. Booster Mechanisms

(a) Aerodynamic Boosters - Equations for Control Force, Characteristics of Spring-Tab Ailerons, Special Spring-Tab Designs, Other Aerodynamic Boosters
(b) Mechanical Boosters

VI. Structural Aspects

(a) Integrity of Airplane
(b) Rolling Performance
(c) Control Forces

VII. Application of Equations and Design Charts, Illustrative Example

(a) Compute the Aileron Effectiveness Parameter $\Delta\alpha/\Delta\delta$
(b) Estimate the Aileron Hinge-Moment Parameters
(c) Estimate the Balance Requirements of the Linked Tab and of the Spring Tab

(d) Estimate the Required Span Ratios of the Spring Tab and of the Linked Tab
(e) Compute the Helix-Angle Reduction Factors Resulting from Wing Twist
(f) Estimate the Helix-Angle Reduction Factors Resulting from Adverse Yaw
(g) Compute the Required Aileron Span Ratio
(h) Compute the Required Wing Torsional Stiffness
(i) Calculate the Spring Stiffness and the Mechanical Linkage of the Aileron-Spring-Tab System

VIII. Status of Lateral-Control Research

(a) Conventional Flap-Type Ailerons, Rolling Performance, Hinge Moments
(b) Spoiler Devices
(c) Lateral Control with Swept Wings

Adequate work for lateral control design seems to be presented or at least referenced. Numerous graphs useable in preliminary design are presented.

TR 919 ACCURACY OF AIRSPEED MEASUREMENTS AND FLIGHT CALIBRATION PROCEDURES, Wilber B. Huston, 1948

The results of tests of a number of different pitot-static tubes are used to show the influence of the geometry of the head, angle of attack, Mach number, Reynolds number, turbulence, and drain holes on the development of total and static pressures.

The following areas are covered:

1. Flow field about an airfoil: the errors depend on location of static pressure head and on location of total pressure head.
2. Pressure lag measuring: discusses the errors which can be introduced by pressure lag, summarizes the methods for evaluating the lag constant, establishes criteria and methods for minimizing the errors due to lag, and outlines a method for correcting flight records for the effects of lag.
3. A brief discussion is given of the magnitude and types of errors introduced by the mechanical and elastic characteristics of the conventional airspeed indicator and altimeter.
4. The sources and magnitudes of errors and the evaluation of temperature data are discussed.

TR 924 APPLICATION OF THEODORSEN'S THEORY TO PROPELLER DESIGN, John L. Crigler, 1949

This analysis attempts to interrelate the conditions in the final wake of the propeller and to give the information necessary to design a propeller for any desired operating condition. A theoretical analysis is presented for obtaining by use of Theodorsen's propeller theory the load distribution along a propeller radius to give the optimum propeller efficiency for any design condition. The efficiencies realized by designing for the optimum load distribution are given in graphs, and the optimum efficiency for any design condition may be read directly without laborious calculations. Examples are included to illustrate the method for obtaining the optimum load distributions of both single rotating and dual rotating propellers.

A comparison of Theodorsen's propeller theory with the conventional vortex theory shows that the optimum load distribution along the blade for single rotating propellers obtained by the two theories is essentially identical and as a result the optimum efficiencies are the same for a given operating condition.

Theodorsen's theory has the advantage that the optimum efficiency for any design condition can be obtained quickly and accurately by the use of the mass coefficient.

TR 927 APPRECIATION AND PREDICTION OF FLYING QUALITIES, William H. Phillips, 1949

The material given in this report summarizes some of the results of research and the methods used in predicting the stability and control characteristics of an airplane. This material was based on lecture notes for a trailing course for research workers engaged in airplane stability and control investigation.

The contents in the report are as follows:

A. LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS IN STRAIGHT FLIGHT

1. Stability characteristics in straight flight
2. Effects of propeller operation and power on stability
    a. Moment of propeller normal force about center of gravity
    b. Moment of propeller axial force about center of gravity
    c. Increased angle of downwash
    d. Increased dynamic pressure at the tail
    e. Change in pitch moment of wing due to action of slipstream
3. Control characteristics in steady flight
    a. Hinge moment
    b. Elevator deflection

4. Determination of neutral points from flight tests

   a. Stick fixed neutral point

$$\frac{d\delta_e}{dC_L} = 0$$

   b. Stick free neutral point

$$\frac{\partial F/q}{\partial C_L} = 0$$

5. Effect of compressibility on trim and stability

   a. Effect of compressibility
   b. Dive recovery flaps

6. Effect of structure and control surface distortion on longitudinal stability

   a. Due to negative or positive internal pressure
   b. External aerodynamic loads

7. Longitudinal trim changes due to power and flaps

8. Landing and take off characteristics

B. LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS IN ACCELERATED FLIGHT

1. Relation between longitudinal stability in straight and in accelerated flight

2. Stick force in accelerated flight and rapid pull ups

3. Elevator deflection in accelerated flight

C. DISCUSSION OF TYPES OF CONTROL SURFACE BALANCE

1. Types of control surface balance (overhanging or inset hinge balance, unshielded chord balance, balancing tab, beveled trailing edge balance, sealed internal balance and other types of control surface balance)

2. Comparison of various balancing devices

D. DIRECTIONAL STABILITY AND CONTROL CHARACTERISTICS

1. Directional trim characteristics
2. Characteristics in steady sideslips

E. AILERON CONTROL CHARACTERISTICS

1. Aileron control and balance characteristics
2. Rolling effectiveness
3. Aileron balance, frise ailerons and spoilers
4. Yaw due to ailerons

F. STALLING CHARACTERISTICS

1. Stalling characteristics
2. Ground looping

G. CONTROL FREE STABILITY OR SHORT PERIOD OSCILLATIONS

1. Longitudinal motion
2. Lateral motion
3. Relation between rudder, aileron and elevator short period oscillations

H. WIND TUNNEL TESTS AND CALCULATION PROCEDURES FOR DETERMINATION OF FLYING QUALITIES

1. Simulation of power conditions
2. Wind tunnel tests for landing and take off characteristics
3. Neutral point
   a. Stick-fixed
   b. Stick-free

TR 941 PREDICTION OF THE EFFECTS OF PROPELLER OPERATION ON THE STATIC LONGITUDINAL STABILITY OF SINGLE-ENGINE TRACTOR MONOPLANES WITH FLAPS RETRACTED, Joseph Weil and William C. Sleeman, Jr., (Supersedes TN 1722), 1949

The effects of propeller operation on the static longitudinal stability of single engine tractor monoplanes are analyzed, and a simple method is presented for computing power on pitching moment curves for flap-retracted flight conditions. Correlation curves are presented from which the effects of power on the downwash over the tail and the stabilizer effectiveness can be readily predicted. The procedures developed enable prediction of power-on longitudinal stability characteristics that are generally in good agreement with experiment. The method of computing power-on pitching moments is based upon the assumption that power off pitching moment data are available for at least 2 stabilizer settings, and with the tail off.

The following individual component effects contributing to the over-all power-on static longitudinal stability are treated separately and approximate formulas are developed for estimating these effects:

Effect of power on the wing fuselage characteristics, effect of power on the tail contribution to stability and computation of power on lift and pitching moment coefficients.

Wind tunnel data on personal-type airplanes were not available for use in correlations and the applicability of the correlation curves to this type of design is dependent on a number of factors. An estimate of the variation of T_c with C_L for several typical single-engine personal type airplanes showed that the thrust coefficients for maximum rated power for these airplanes fell in the range of thrust coefficients for the medium power conditions on the fighter-type airplanes. The range of wing vertical positions relative to the slipstream and the ratio of the slipstream diameter to the wing span might be expected to be considerably different for military and personal-type airplanes, and these differences could have a significant bearing on the magnitude of the power effects. All models presented herein have a wing location that placed the wing well within the slipstream. Generally, the diameter of the propeller relative to the wing span is smaller for personal-type airplanes than for fighter-type airplanes.

In view of the fact that considerations other than aerodynamic determine the final geometry of a design and the rapidity with which the power effects of a specific configuration can be computed by the method of this report, each proposed design should be examined for power effects, and an optimum configuration (minimum power effects) should be attained by a process of rational modification to the original design.

TR 999 INVESTIGATION OF THE NACA 4-(3)(08)-03 AND NACA 4-(3)(08)-045 TWO-BLADE PROPELLERS AT FORWARD MACH NUMBERS TO 0.725 TO DETERMINE THE EFFECTS OF COMPRESSIBILITY AND SOLIDITY ON PERFORMANCE, John Stack, Eugene C. Draley, James B. Delano, and Lewis Feldman, 1950

This report consists of investigation of two blade propellers (NACA 4-(3)(08)-03 and NACA 4-(3)(08)-045) over an extensive range of Mach numbers (from 0.165 to 0.725) and blade angle (20° to 60°) to determine the effects of compressibility and solidity on performance. These propellers differed primarily only in blade solidity, one propeller having 50% more solidity than the other.

Serious losses in propeller efficiency occurred at tip Mach numbers in excess of 0.91. The effect of compressibility losses on maximum efficiency was dependent upon the blade angle and varied in magnitude from approximately 9 to 22 percent per 0.1 increase in tip Mach number above the critical value. The range of advance ratio for peak efficiency decreased markedly with increase of forward speed. Efficiency losses due to compressibility effects decreased with increase of blade width. Compressibility losses could be delayed to successively higher forward Mach numbers by decreasing the tip Mach number through the use of an increased blade angle. The range of power disk loading for high efficiency decreased with increase of forward speed as a consequence of compressibility effects.

At constant power coefficient, an increase of solidity improved the efficiency for climb and high speed conditions.

TR 1126 THE EFFECT OF BLADE-SECTION THICKNESS RATIOS ON THE AERODYNAMIC CHARACTERISTICS OF RELATED FULL-SCALE PROPELLERS AT MACH NUMBERS UP TO 0.65, Julian D. Maynard and Seymour Steinberg, 1953

The results of an investigation of two 10 foot diameter, two blade NACA propellers are presented for a range of blade angles from 20° to 55° at airspeeds up to 500 mph. These results are compared with those from previous investigations of five related NACA propellers in order to evaluate the effects of blade section thickness ratios on propeller aerodynamic characteristics. The design lift coefficient, thickness, and solidity per blade at the 0.7 radius station of seven propellers are presented. Effect of blade section thickness ratio on envelope efficiency, effect of thickness ratio on constant power propeller operation, and effect of thickness ratio and compressibility on propeller characteristics are discussed.

The envelope efficiencies of all the NACA propellers are high at the low Mach numbers where the adverse effects of compressibility are small. The higher envelope efficiencies are attained by the propellers having thinner blade sections. The highest efficiencies, about 93% at a helical tip Mach number of 0.9 and 84% at a helical tip Mach number of 1.1, reflect the importance of using thin, efficient airfoil sections throughout the blade. For propeller operation at constant rotational speed and power at helical tip Mach numbers below 0.8, a reduction in blade section thickness from 12 to 8% at the 0.7 radius station, or approximately one third all along the radius, results in gains in propeller efficiency up to 10%.

The maximum efficiency of a propeller operating at a helical tip Mach number of 1.1 may be increased approximately 20% by reducing the blade section thickness from 12 to 5% at the 0.7 radius station. At this same condition for propellers having blade section thiskness between 12 to 8% at the 0.7 radius station, the maximum efficiency increases approximately 3% for each decrease in thickness of 1% at this station. For blade section thickness between 8 and 5% at the 0.7 radius station, the rate of increase in propeller efficiency with reductions in blade section thickness is small, but further reduction in thickness may still improve the maximum efficiency of propellers operating at high forward speeds with helical tip Mach numbers as high as 1.1.

TR 1138 STUDY OF INADVERTENT SPEED INCREASES IN TRANSPORT OPERATION, Henry A. Pearson (Supersedes NACA TN 2638), 1953

This report investigates the problem of selecting satisfactory limits for airplane operating speeds that will insure against exceeding values of either Mach number or the dynamic pressure for which the airplane can be expected to remain controllable and structurally sound. This report presents an analysis for determining the margins required under several assumed conditions and is confined mainly to the physical aspects of the problem. Some of the conditions which may be considered as leading to inadvertent increases in airspeed are listed as follows:

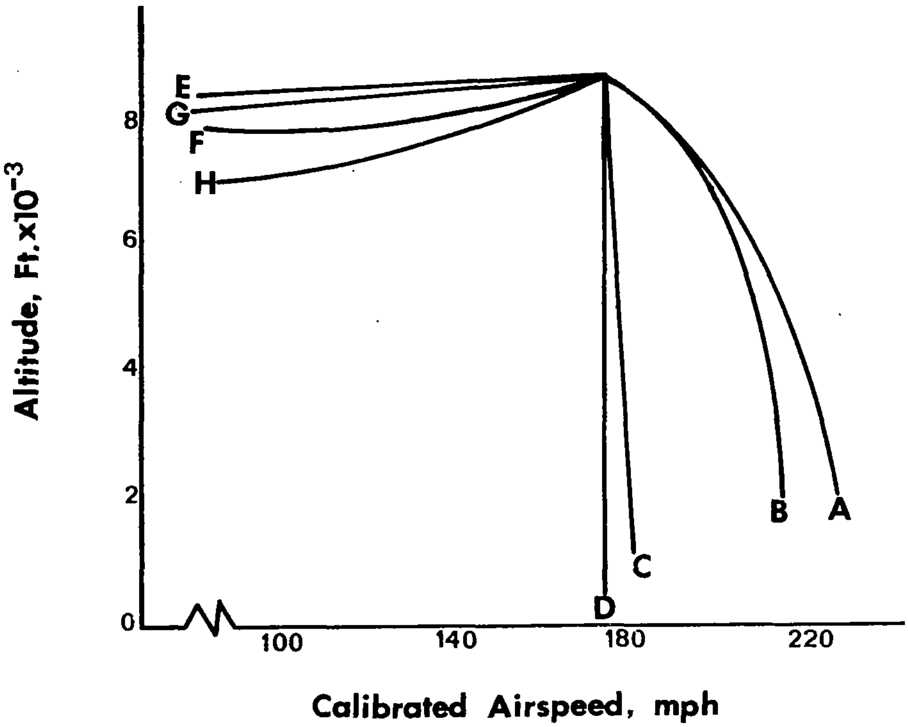
1. Avoidance of obstacles or sudden failure of automatic pilot or booster system.
2. Gusts.
3. Forward shift of passengers or payload.
4. Mach number margin required to permit maneuvering without reaching the buffeting boundary.
5. Traversing areas with temperature inversions.
6. Increase in speed and Mach number associated with carrying a planned descent from attitude.

A simple mathematical treatment is presented for each of these conditions. Calculations were made for various specific descent plans for three different airplanes and the results are presented in graphs. Descents were made for constant velocity, constant Mach number, constant rate of change of altitude, and constant flight-path angle.

The following trends were indicated by this investigation:

1. As the cruising speeds of transports increase, the percentage margins required to avoid inadvertent speed gains caused by gusts, autopilot failure, and so forth should decrease.

Some other trends encountered or expected to be encountered in the design of larger transport airplanes are discussed.



Descent Plan	With Thrust	With Thrust
γ = 0.0284 rad	A	E
γ = 0.0568 rad		F
dh/dt = 500 ft/min	B	G
dh/dt = 1000 ft/min		H
M = 0.272	C	C
q = 755 lb/sq ft	D	D

Velocity-altitude relations for various descent plans for a propeller driven airplane with non-pressurized cabin circa 1943.

TR 1169 MATRIX METHODS FOR DETERMINING THE LONGITUDINAL-STABILITY DERIVATIVES OF AN AIRPLANE FROM TRANSIENT FLIGHT DATA, James J. Donegan, 1954

Three matrix methods are presented for determining the longitudinal stability derivatives from transient flight data.

Method A, the most general method; requires four measurements in time history form and permits computation of all the longitudinal stability derivatives. Two must be incremental elevator deflection and incremental tail load; two other measurements can be chosen from a possible three, namely incremental load factor, pitching velocity, and angle of attack. This method is the most rigorous, and yields the most accurate answers.

Method B requires three measurements in time hisroty form and one supplemental assumption, namely $C_{m\dot{\alpha}} = \lambda_{m\dot{\theta}}$ where λ is constant. One of the measurements must be incremental elevator angle and the other two measurements can be chosen from a possible three, namely incremental load factor, pitching velocity and angle of attack. This method gives the most information for the least amount of work and gives results which are in good agreement with those of method A.

Method C requires two measurements in time history form and two supplementary assumptions, namely $C_{m\dot{\alpha}} = \lambda C_{m\dot{\theta}}$ and

$C_{m\delta} = \frac{x_t}{\bar{C}} C_{L\delta}$ where C_m and C_1 are the elevator effectiveness derivatives, x_t is the tail length and $\bar{C}$ is the meanaerodynamic chord.

One of the measurements must be incremental elevator angle and the other one may be chosen from incremental load factor, pitching velocity and angle of attack.

An inspection of the results obtained for the various methods shows the scatter which is typical of this type of analysis of flight data.

Reference 1:
Milliken, W. F., Jr.: Dynamic Stability and Control Research. Rep. CAL-39, Cornell Aero. Lab., Inc. (Presented at Third International Joint Conference of the R.A.S.-I.A.S., Brighton, England, September 3-14, 1951)

TR 1197 A STUDY OF THE CHARACTERISTICS OF HUMAN-PILOT CONTROL RESPONSE TO SIMULATED AIRCRAFT LATERAL MOTIONS, Donald C. Cheatham, (Supersedes NACA RM L52C17), 1954

The purposes of this study were to investigate experimentally and analytically the characteristics of pilot ability to control dynamically unstable yawing oscillations, to study pilot control response, and to determine whether and to what extent pilot control response can be represented in an analytical form.

The limit of the ability of a pilot to control simulated aircraft yawing oscillations that are made unstable by the introduction of a moment proportional to yawing velocity has been determined as a function of frequency, inherent damping, and control effectiveness. A comparison with previous work showed that the ability of pilots to control yawing oscillation was also a function of the characteristics of the destabilizing element in the system.

In the simulated rolling or yawing aircraft motions, the difference in response patterns was performed by different pilots.

The frequency data indicated a phase angle variation that is reflective of the response time of a human pilot. The studies also indicated that the control response of pilots may vary in accordance with the control requirements of different situations.

Calculation of pilot ability to control simulated aircraft yawing oscillations by using a control response expression that approximates the experimentally determined frequency response of the pilot gave results that compare qualitatively with experimental results.

TR 1204 APPLICATION OF SEVERAL METHODS FOR DETERMINING TRANSFER FUNCTIONS AND FREQUENCY RESPONSE OF AIRCRAFT FROM FLIGHT DATA, John M. Eggleston and Charles W. Matthews, 1954

This report discusses several methods of obtaining the transfer functions of aircraft from measured inputs and responses. The methods may be divided into 2 classes:

1. Methods that first determine the frequency response of the system.
2. Methods that determine the transfer function without the determination of the frequency response.

The methods are discussed with regard to the time required, the means for facilitating their use, and the limitations on their application.

<u>Sinusoidal-Response Method</u> (Oscillate control surface sinusoidally and measure aplitude and phase relationship between input and output curves)

1. Requires least computation time and most flight time.
2. Frequency-response parameters may be determined from these relations. (Several simplifications are discussed.)

$$\text{Frequency} = \frac{2}{\text{Period}}$$

$$\text{AR} = \frac{\text{Amplitude of Output}}{\text{Amplitude of Input}}$$

$$\text{Phase Angle} = 360\,\frac{\text{Lag}}{\text{Period}}$$

Fourier Analysis of Transient Response - Process indicated by the expression

$$\frac{Q_O}{Q_I}(jw) = \frac{\int_0^\infty q_O(t)e^{-jwt}dt}{\int_0^\infty q_I(t)e^{-jwt}dt} = \frac{\text{Fourier Integral of Output}}{\text{Fourier Integral of Input}}$$

Data points are given for AR and Φ (phase angle) for a number of discrete frequencies. Several methods which illustrate the various approaches to the Fourier transformation are considered.

Curve-Fitting Methods - The form of the transfer function is directly or indirectly assumed and the coefficients of the transfer function are determined by least-squares methods or a combination of least-squares and direct computation methods. The transfer function is obtained without first obtaining frequency-response data.

A comparison of these methods is made for data obtained for an airplane at one flight condition. It was found that in the methods which involve the analysis of transient responses over short periods of time a control input should be used that will afford (d) a close approach to the steady state condition and (b) response amplitudes and harmonic content large enough to give good instrument and reading accuracy yet small enough to keep the aircraft from departing from the flight condition for which response data are desired.

For the sinusoidal-response method, satisfactory data may be obtained with a human pilot generating an approximate sinusoidal control input. Special machines for accomplishing a Fourier analysis, such as the Fourier synthesizer, afford a means for significantly reducing calculation time as compared to a manual approach. The Donegan-Pearson and the Prony methods (curve fittings) can be used satisfactorily when reasonable confidence exists in the form of the analytical expression to be assumed. Unlike these two methods, Fourier analysis will detect all details of the frequency response which are within the accuracy of the frequency measurements and the calculation procedure. Fourier methods are more critical to the forms of the input than the Donegan-Pearson method and inputs should be chosen to avoid regions of low harmonic content in the frequency range of interest.

TR 1263 INVESTIGATION OF THE AERODYNAMIC CHARACTERISTICS OF A MODEL WING-PROPELLER COMBINATION AND OF THE WING AND PROPELLER SEPARATELY AT ANGLES OF ATTACK UP TO 90°, Richard E. Kuhn and John W. Draper, 1956

In an attempt to design an aircraft that would combine the take-off and landing characteristics of a helicopter with the high speed potential of a conventional fixed-wing aircraft, an investigation of the aerodynamic characteristics of a model wing-propeller combination, and the wing and propeller separately at angles of attack up to 90°, was conducted.

Increasing the thrust coefficient increased the angle of attack for maximum lift coefficient and greatly diminished the reduction of lift coefficient above the angle of attack for maximum lift.

The pitching moment was approximately doubled when the propeller was operated in the presence of the wing and corresponded to a downward movement of the effective center of thrust of approximately 20% of the propeller radius.

Calculations for a hypothetical airplane, with a wing loading of 40 pounds per square foot and the relationship of the total propeller disk area to wing area represented by this model, indicate that airplanes designed for a high speed range of 350 to 400 mph will have sufficient power available for vertical take-off.

TR 1295 AN ANALYSIS OF ONCE-PER-REVOLUTION OSCILLATING AERODYNAMIC THRUST LOADS ON SINGLE-ROTATION PROPELLERS ON TRACTOR AIRPLANES AT ZERO YAW, John L. McCloud III, Vernon L. Rogallo, and Paul F. Yaggy, 1956

An important consideration in the structural design of propellers is that which deals with vibratory stresses resulting from the blade bending flatwise one-cycle per propeller revolution (1·P stresses). To answer the following questions; an analysis of the methods employed to obtain 1·P blade stresses, 1·P loads, and flow field parameters was undertaken.

1. If the 1·P aerodynamic thrust load is known, can the 1·P stresses be computed?

2. If (1) can be accomplished, can the 1·P thrust loads be computed if the flow field characteristics are known?

3. If (1) and (2) can be accomplished, can the flow field characteristics be computed for any given airplane configuration?

Data obtained from a wind-tunnel investigation of a propeller operating in the nonuniform flow field can be found in TN 2192 and TN 2308.

This report presents an analysis, based on the 2 above references and TN's 2528, 2795, 2894, 2957 and 3675 of the problem of computing 1·P stresses for propellers operating in nonuniform flow fields.

A method utilizing strip analysis to compute the thrust load variation from known flow-field characteristics has been developed and is presented as an appendix.

A simplified procedure is shown for calculating the once-per-revolution oscillating aerodynamic thrust loads on propellers of tractor airplanes at zero yaw. This simplified procedure allows the rapid calculation of these 1·P thrust loads without the need for tedious experimental surveys of the flow field at the propeller plane. The only flow field information needed are the lipflow angles at the horizontal centerline of the propeller disk. The evaluations of the simplified procedure which are shown indicate that the 1·P thrust loads computed for the airplane configurations investigated are generally satisfactory.

TR 1304 FLIGHT INVESTIGATION OF THE EFFECTIVENESS OF AN AUTOMATIC AILERON TRIM CONTROL DEVICE FOR PERSONAL AIRPLANES, William H. Phillips, Helmut A. Kuehnel, and James B. Whitten, 1957

An investigation of the effectiveness of an automatic aileron trim control device to augment the apparent spiral stability of a personal airplane and thus prevent spiral divergence has led to:

1. The automatic aileron trim control will maintain the airplane in a safe attitude for an indefinite period of time over the speed range investigated (90 to 150 mph) without manually retrimming the plane.

2. During turbulent air operation, the automatic control helps the airplane hold a more constant heading with less pilot effort than is required for the basic airplane.

3. An automatic control such as that used in this investigation provides considerable pilot relief and adds to the safety of cross-country flight, particularly during instrument flight conditions.

4. The increased pilot control forces necessary to overpower the automatic control shows a need for voluntary disengaging of the device.

TR 1309 AERODYNAMIC CHARACTERISTICS AT HIGH SPEEDS OF RELATED FULL SCALE PROPELLERS HAVING DIFFERENT BLADE SECTION CAMBERS, Julian D. Maynard and Leland B. Salers, 1957

The purpose of this report is to determine the effect of blade section camber (design lift coefficient) and compressibility upon propeller performance.

The results show that:

1. Increasing the blade section camber is a very effective means of increasing the thrust and power coefficient of a propeller.

2. Blades with higher design lift coefficients (lower camber) have a lower maximum efficiency. They have a more extensive range of thrust coefficients for efficient operation, but are much more efficient than propellers with lower design lift coefficients for take off and climb condition of operation at low advance ratios.

3. The critical tip Mach number is lowered by an increase in blade section design camber, but the supercritical tip Mach number at which recovery of thrust occurs is lower for the high camber propeller than the low camber propeller.

TR 1332 SEAT DESIGN FOR CRASH WORTHINESS (Supersedes TN 3777), I. Irving Pinkel and Edmund G. Rosenberg, 1957

This paper is concerned principally with the answer to the question "What is the relation between the properties of a seat measured under static conditions and its ability to hold the passenger through a deceleration?"

Crash measurements showed:

1. Periods of high deceleration lastings several tenths of a second.
2. Longer time intervals with deceleration below 3 and 4 g's.

Interest in this report centers on the high-deceleration period where most seat failures occurred.

Seat flexibility with the passenger tightly coupled to the chair is considered. The passenger and the seat are considered as a spring-mass system. The point of maximum seat stress occurs when the seat distortion is greatest at the top of the passenger-deceleration curve.

A mathematical analysis shows that the relative magnitudes of the passenger and airplane decelerations depend on the ratio of the natural frequency of the seat to the frequency of the half-sine-wave deceleration pulse.

Two of the several factors defining the severity of a deceleration pulse are the airplane velocity change that occurs over the pulse and the peak deceleration attained.

The proposed approach to seat design is based on the equation:

$$E = \frac{1}{2}\frac{k^2X_d^2}{K}\left(\frac{X^2max}{X_d^2} - 1\right) = \frac{1}{2}\frac{F_d^2}{(2\pi f_n)^2 \frac{m}{32}}\left[\left(\frac{A_s}{A_{s,d}}\right)^2 - 1\right]$$

A = maximum magnitude of deceleration, g's
E = energy for seat destruction, ft-lb
k = elastic constant of seat

Little attempt is made to describe the passengers motion beyond the first deceleration peak he experiences, but some discussion is presented in the form of concluding remarks.

TR 1336 AN INVESTIGATION OF SINGLE AND DUAL ROTATION PROPELLERS AT POSITIVE AND NEGATIVE THRUST AND IN COMBINATION WITH AN NACA 1 SERIES D TYPE COWLING AT MACH NUMBERS UP TO 0.81, Robert M. Reynolds, Robert I. Sammond, and John H. Walder, 1957

This report summarizes RM's A54J22, A54G13, A53B06, A52D1a, A52I19a.

Propeller force characteristics (at positive thrusts with spinner combinations, at negative thrust, and at static thrust), local velocity distribution in the propeller plane, inlet pressure recoveries and static pressure distribution on the cowling surface are discussed.

The propeller with NACA 1-series can reach Mach numbers of about 0.7 without serious compressibility losses. For operation at Mach numbers greater than 0.8, higher efficiencies would be obtained at lower advanced ratio and blade angles. For operation of Mach number at subcritical Mach number, higher efficiencies were obtained at higher advanced ratios.

There were no significant effects of compressibility on the negative thrust characteristics of the dual rotation propellers up to a Mach number of about 0.6.

At a Mach number of 0.8 and at the design inlet velocity ratio, a ram recovery ratio of about 0.87 was obtained for the various propeller spinner combinations; as compared to recovery ratio of 0.96 with the propeller removed.

The maximum efficiencies obtained for the propellers operating in the presence of the cowlings were higher at all Mach numbers and blade angles than those for the isolated propeller spinner combinations, with the difference in efficiencies amounting to as much as 19% for the single rotating propeller at a Mach number of 0.8. Variation of cowling inlet velocity ratio and changes from ideal to planform-type propeller spinner junctures had no significant effects on the characteristics of the propellers.

Ram recovery ratios greater than 0.96 were obtained at inlet velocity ratios greater than about 0.4 and 0.51, for the single and dual rotation spinner cowling combination with the propeller removed. Decreasing the inlet velocity ratio below these values resulted in abrupt and rapid losses in pressure recovery.

Not Applicable NACA Technical Reports

TR 686 STABILITY OF CASTERING WHEELS FOR AIRCRAFT LANDING GEARS, Arthur Kantrowitz, 1940

TR 690 LONGITUDINAL STABILITY AND CONTROL WITH SPECIAL REFERENCE TO SLIPSTREAM EFFECTS, S. Katzoff, 1940

TR 692 EFFECTIVE GUST STRUCTURE AT LOW ALTITUDES AS DETERMINED FROM THE REACTIONS OF AN AIRPLANE, Philip Donely, 1940

TR 693 A THEORETICAL STUDY OF LATERAL STABILITY WITH AN AUTOMATIC PILOT, Frederick H. Imlay, 1940

TR 705 WIND-TUNNEL INVESTIGATION OF EFFECT OF INTERFERENCE ON LATERAL-STABILITY CHARACTERISTICS OF FOUR NACA 23012 WINGS, AN ELLIPTICAL AND A CIRCULAR FUSELAGE, AND VERTICAL FINS, Rufus O. House and Arthur R. Wallace, 1941

TR 721 DETERMINATION OF CONTROL-SURFACE CHARACTERISTICS FROM NACA PLAIN-FLAP AND TAB DATA, Milton B. Ames, Jr., and Richards I. Sears, 1941

TR 731 DETERMINATION OF OPTIMUM PLAN FORMS FOR CONTROL SURFACES, Robert T. Jones and Doris Cohen, 1942

TR 749 PROPELLER CHARTS FOR THE DETERMINATION OF THE ROTATIONAL SPEED FOR THE MAXIMUM RATIO OF THE PROPULSIVE EFFICIENCY TO THE SPECIFIC FUEL CONSUMPTION, David Biermann and Robert N. Conway, 1942

TR 753 METHODS USED IN THE NACA TANK FOR THE INVESTIGATION OF THE LONGITUDINAL-STABILITY CHARACTERISTICS OF MODELS OF FLYING BOATS, Roland E. Olson and Norman S. Land, 1943

TR 767 THE PROBLEM OF LONGITUDINAL STABILITY AND CONTROL AT HIGH SPEEDS, Manley J. Hood and H. Julian Allen, 1943

TR 769 THE EFFECT OF MASS DISTRIBUTION ON THE LATERAL STABILITY AND CONTROL CHARACTERISTICS OF AN AIRPLANE AS DETERMINED BY TESTS OF A MODEL IN THE FREE-FLIGHT TUNNEL, John P. Campbell and Charles L. Seacord, Jr., 1943

TR 774 EFFECT OF TILT OF THE PROPELLER AXIS ON THE LONGITUDINAL-STABILITY CHARACTERISTICS OF SINGLE-ENGINE AIRPLANES, Harry J. Goett and Noel K. Delany, 1944

TR 781 WIND-TUNNEL PROCEDURE FOR DETERMINATION OF CRITICAL STABILITY AND CONTROL CHARACTERISTICS OF AIRPLANES, Harry J. Goett, Roy P. Jackson, and Steven E. Belsley, 1944

TR 787 A THEORETICAL INVESTIGATION OF THE ROLLING OSCILLATIONS OF AN AIRPLANE WITH AILERONS FREE, Doris Cohen, 1944

TR 796 AN INTERIM REPORT ON THE STABILITY AND CONTROL OF TAILLESS AIRPLANES, Langley Stability Research Division--Compiled by Charles J. Donlan, 1944

TR 798 EFFECT OF HINGE-MOMENT PARAMETERS ON ELEVATOR STICK FORCES IN RAPID MANEUVERS, Robert T. Jones and Harry Greenberg, 1944

TR 801 A METHOD FOR STUDYING THE HUNTING OSCILLATIONS OF AN AIRPLANE WITH A SIMPLE TYPE OF AUTOMATIC CONTROL, Robert T. Jones, 1944

TR 816 COMPARISON OF WIND-TUNNEL AND FLIGHT MEASUREMENTS OF STABILITY AND CONTROL CHARACTERISTICS OF A DOUGLAS A-26 AIRPLANE, Gerald G. Kayton and William Koven, 1945

TR 831 AN ANALYSIS OF THE DISSIPATION OF HEAT IN CONDITIONS OF ICING FROM A SECTION OF THE WING OF THE C-46 AIRPLANE, J. K. Hardy, 1945

TR 856 THE NACA HIGH-SPEED MOTION-PICTURE CAMERA--OPTICAL COMPENSATION AT 40,000 PHOTOGRAPHS PER SECOND, Cearcy D. Miller, 1946

TR 882 FREQUENCY-RESPONSE METHOD FOR DETERMINATION OF DYNAMIC STABILITY CHARACTERISTICS OF AIRPLANES WITH AUTOMATIC CONTROLA, Harry Greenberg, 1947

TR 883 FLIGHT MEASUREMENTS OF THE LATERAL CONTROL CHARACTERISTICS OF NARROW-CHORD AILERONS ON THE TRAILING EDGE OF A FULL-SPAN SLOTTED FLAP, Richard H. Sawyer, 1947

TR 892 DAMPING IN PITCH AND ROLL OF TRIANGULAR WINGS AT SUPERSONIC SPEEDS, Clinton E. Brown and Mac C. Adams, 1948

TR 908 STABILITY DERIVATIVES OF TRIANGULAR WINGS AT SUPERSONIC SPEEDS, Herbert S. Ribner and Frank S. Malvestuto, Jr., 1948

TR 923 EFFECT OF AFTERBODY LENGTH AND KEEL ANGLE ON MINIMUM DEPTH OF STEP FOR LANDING STABILITY AND ON TAKE-OFF STABILITY OF A FLYING BOAT, Roland E. Olson and Norman S. Land, 1949

TR 925 STABILITY DERIVATIVES AT SUPERSONIC SPEEDS OF THIN RECTANGULAR WINGS WITH DIAGONALS AHEAD OF TIP MACH LINES, Sidney M. Harmon, 1949

TR 926 SOUND-LEVEL MEASUREMENTS OF A LIGHT AIRPLANE MODIFIED TO REDUCE NOISE REACHING THE GROUND, A. W. Vogeley, 1949

TR 943 A SIMPLIFIED METHOD FOR THE DETERMINATION AND ANALYSIS OF THE NEUTRAL-LATERAL-OSCILLATORY-STABILITY BOUNDARY, Leonard Sternfield and Ordway B. Gates, Jr., 1949

TR 965 THE LONGITUDINAL STABILITY OF ELASTIC SWEPT WINGS AT SUPERSONIC SPEED, C. W. Frick and R. S. Chubb, 1950

TR 968 INVESTIGATION AT LOW SPEEDS OF THE EFFECT OF ASPECT RATIO AND SWEEP ON ROLLING STABILITY DERIVATIVES OF UNTAPERED WINGS, Alex Goodman and Lewis R. Fisher, 1950

TR 971 THEORETICAL STABILITY DERIVATIVES OF THIN SWEPT-BACK WINGS TAPERED TO A POINT WITH SWEPTBACK OR SWEPTFORWARD TRAILING EDGES FOR A LIMITED RANGE OF SUPERSONIC SPEEDS, Frank S. Malvestuto, Jr., and Kenneth Margolis, 1950

TR 973 FLIGHT INVESTIGATION OF THE EFFECT OF VARIOUS VERTICAL-TAIL MODIFICATIONS ON THE DIRECTIONAL STABILITY AND CONTROL CHARACTERISTICS OF A PROPELLER-DRIVEN FIGHTER AIRPLANE, Harold I. Johnson, 1950

TR 984 METHOD FOR DETERMINING THE FREQUENCY-RESPONSE CHARACTERISTICS OF AN ELEMENT OR SYSTEM FROM THE SYSTEM TRANSIENT OUTPUT RESPONSE TO A KNOWN INPUT FUNCTION, Howard J. Curfman, Jr., and Robert A. Gardiner, 1950

TR 993 AN INTRODUCTION TO THE PHYSICAL ASPECTS OF HELICOPTER STABILITY, Alfred Gessow and Kenneth B. Amer, 1950

TR 996 FREE-SPACE OSCILLATING PRESSURES NEAR THE TIPS OF ROTATING PROPELLERS, Harvey H. Hubbard and Arthur A. Regier, 1950

TR 1012 INVESTIGATION OF THE NACA 4-(10)(08)-03 TWO-BLADE PROPELLERS AT FORWARD MACH NUMBERS TO 0.725 TO DETERMINE THE EFFECTS OF CAMBER AND COMPRESSIBILITY ON PERFORMANCE, James B. Delano, 1951

TR 1017 INVESTIGATION OF FREQUENCY-RESPONSE CHARACTERISTICS OF ENGINE SPEED FOR A TYPICAL TURBINE-PROPELLER ENGINE, Burt L. Taylor, III, and Frank L. Oppenheimer, 1951

TR 1018 A THEORETICAL ANALYSIS OF THE EFFECT OF TIME LAG IN AN AUTOMATIC STABILIZATION SYSTEM ON THE LATERAL OSCILLATORY STABILITY OF AN AIRPLANE, Leonard Sternfield and Ordway B. Gates, Jr., 1951

TR 1024 CALCULATION OF THE LATERAL CONTROL OF SWEPT AND UNSWEPT FLEXIBLE WINGS OF ARBITRARY STIFFNESS, Franklin W. Diederich, 1951

TR 1031 A STUDY OF THE USE OF EXPERIMENTAL STABILITY DERIVATIVES IN THE CALCULATION OF THE LATERAL DISTURBED MOTIONS OF A SWEPT-WING AIRPLANE AND COMPARISON WITH FLIGHT RESULTS, John D. Bird and Byron M. Jaquet, 1951

TR 1035 ANALYSIS OF MEANS OF IMPROVING THE UNCONTROLLED LATERAL MOTIONS OF PERSONAL AIRPLANES, Marion O. McKinney, Jr., 1951

TR 1042 SOME EFFECTS OF NONLINEAR VARIATION IN THE DIRECTIONAL-STABILITY AND DAMPING-IN-YAWING DERIVATIVES ON THE LATERAL STABILITY OF AN AIRPLANE, Leonard Sternfield, 1951

TR 1049 EXPERIMENTAL INVESTIGATION OF THE EFFECT OF VERTICAL-TAIL SIZE AND LENGTH AND OF FUSELAGE SHAPE AND LENGTH ON THE STATIC LATERAL STABILITY CHARACTERISTICS OF A MODEL WITH 45° SWEPTBACK WING AND TAIL SURFACES, M. J. Queijo and Walter D. Wolhart, 1951

TR 1052 A SUMMARY OF LATERAL-STABILITY DERIVATIVES CALCULATED FOR WING PLAN FORMS IN SUPERSONIC FLOW, Arthur L. Jones and Alberta Alksne, 1951

TR 1068 AUTOMATIC CONTROL SYSTEMS SATISFYING CERTAIN GENERAL CRITERIONS ON TRANSIENT BEHAVIOR, Aaron S. Bokesenbom and Richard Hood, 1952

TR 1076 EFFECTS ON LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS OF A BOEING B-29 AIRPLANE OF VARIATIONS IN STICK-FORCE AND CONTROL-RATE CHARACTERISTICS OBTAINED THROUGH USE OF A BOOSTER IN THE ELEVATOR-CONTROL SYSTEM, Charles W. Mathews, Donald B. Talmage, and James B. Whitten, 1952

TR 1079 SOUND FROM A TWO-BLADE PROPELLER AT SUPERSONIC TIP SPEEDS, Harvey H. Hubbard and Leslie W. Lassiter, 1952

TR 1080 A THEORETICAL ANALYSIS OF THE EFFECTS OF FUEL MOTION ON AIRPLANE DYNAMICS, Albert A. Schy, 1952

TR 1086 ANALYSIS OF THE EFFECTS OF WING INTERFERENCE ON THE TAIL CONTRIBUTIONS TO THE ROLLING DERIVATIVES, William H. Michael, Jr., 1952

TR 1088 THEORETICAL DAMPING IN ROLL AND ROLLING MOMENT DUE TO DIFFERENTIAL WING INCIDENCE FOR SLENDER CRUCIFORM WINGS AND WING-BODY COMBINATIONS, Gaynor J. Adams and Duane W. Dugan, 1952

TR 1091 EFFECT OF ASPECT RATIO ON THE LOW-SPEED LATERAL CONTROL CHARACTERISTICS OF UNTAPERED LOW-ASPECT-RATIO WINGS EQUIPPED WITH FLAP AND WITH RETRACTABLE AILERONS, Jack Fischel, Rodger L. Naeseth, John R. Hagerman, and William M. O'Hare, 1952

TR 1101 FLIGHT INVESTIGATION OF A MECHANICAL FEEL DEVICE IN AN IRREVERSIBLE ELEVATOR CONTROL SYSTEM OF A LARGE AIRPLANE, B. Porter Brown, Robert G. Chilton, and James B. Whitten, 1952

TR 1125 DYNAMICS OF MECHANICAL FEEDBACK-TYPE HYDRAULIC SERVOMOTORS UNDER INERTIA LOADS, Harold Gold, Edward W. Otto, and Victor L. Ransom, 1953

TR 1130 SOME EFFECTS OF FREQUENCY ON THE CONTRIBUTION OF A VERTICAL TAIL TO THE FREE AERODYNAMIC DAMPING OF A MODEL OSCILLATING IN YAW, John D. Bird, Lewis R. Fisher, and Sadie M. Hubbard, 1953

TR 1133 MECHANISM OF START AND DEVELOPMENT OF AIRCRAFT CRASH FIRES, I. Irving Pinkel, G. Merritt Preston, and Gerard J. Pesman, 1953

TR 1137 INITIAL RESULTS OF INSTRUMENT-FLYING TRIALS CONDUCTED IN A SINGLE-ROTOR HELICOPTER, Almer D. Crim, John P. Reeder, and James B. Whitten, 1953

TR 1139 CHARTS AND APPROXIMATE FORMULAS FOR THE ESTIMATION OF AEROELASTIC EFFECTS ON THE LATERAL CONTROL OF SWEPT AND UNSWEPT WINGS, Kenneth A. Foss and Franklin W. Diederich, 1953

TR 1151 THE EFFECTS ON DYNAMIC LATERAL STABILITY AND CONTROL OF LARGE ARTIFICIAL VARIATIONS IN THE ROTARY STABILITY DERIVATIVES; Robert O. Schade and James L. Hassell, Jr., 1953

TR 1156 EXPERIMENTS TO DETERMINE NEIGHBORHOOD REACTIONS TO LIGHT AIRPLANES WITH AND WITHOUT EXTERNAL NOISE REDUCTION, Fred S. Elwell, 1953

TR 1167 METHOD FOR CALCULATING THE ROLLING AND YAWING MOMENTS DUE TO ROLLING FOR UNSWEPT WINGS WITH OR WITHOUT FLAPS OR AILERONS BY USE OF NONLINEAR SECTION LIFT DATA, Albert P. Martina, 1954

TR 1181 STRUCTURAL RESPONSE TO DISCRETE AND CONTINUOUS GUSTS OF AN AIRPLANE HAVING WING-BENDING FLEXIBILITY AND A CORRELATION OF CALCULATED AND FLIGHT RESULTS, John C. Houbolt and Eldon E. Kordes, 1954

TR 1198 A THEORETICAL STUDY OF THE EFFECT OF FORWARD SPEED ON THE FREE-SPACE SOUND-PRESSURE FIELD AROUND PROPELLERS, I. E. Garrick and Charles E. Watkins, 1954

TR 1199 A STUDY OF THE PROBLEM OF DESIGNING AIRPLANES WITH SATISFACTORY INHERENT DAMPING OF THE DUTCH ROLL OSCILLATION, John P. Campbell and Marion O. McKinney, Jr., 1954

TR 1200 METHOD FOR STUDYING HELICOPTER LONGITUDINAL MANEUVER STABILITY, Kenneth B. Amer, 1954

TR 1203 WIND-TUNNEL INVESTIGATION AT LOW SPEED OF THE EFFECTS OF CHORDWISE WING FENCES AND HORIZONTAL-TAIL POSITION ON THE STATIC LONGITUDINAL STABILITY CHARACTERISTICS OF AN AIRPLANE MODEL WITH A 35° SWEPTBACK WING, M. J. Queijo, Byron M. Jaquet and Walter D. Wolhart, 1954

TR 1205 A WIND-TUNNEL INVESTIGATION OF THE EFFECTS OF THRUST-AXIS INCLINATION ON PROPELLER FIRST-ORDER VIBRATION, W. H. Gray, J. M. Hallissy, Jr., and A. R. Heath, Jr., 1954

TR 1207 STUDIES OF THE LATERAL-DIRECTIONAL FLYING QUALITIES OF A TANDEM HELICOPTER IN FORWARD FLIGHT, Kenneth B. Amer and Robert J. Tapscott, 1954

TR 1212 ANALOG STUDY OF INTERACTING AND NONINTERACTING MULTIPLE-LOOP CONTROL SYSTEMS FOR TURBOJET ENGINES, George J. Pack and W. E. Phillips, Jr., 1955

TR 1224 EFFECTS OF WING POSITION AND FUSELAGE SIZE ON THE LOW-SPEED STATIC AND ROLLING STABILITY CHARACTERISTICS OF A DELTA-WING MODEL, Alex Goodman and David F. Thomas, Jr., 1955

TR 1225 DETERMINATION OF LATERAL-STABILITY DERIVATIVES AND TRANSFER-FUNCTION COEFFICIENTS FROM FREQUENCY-RESPONSE DATA FOR LATERAL MOTIONS, James J. Donegan, Samuel W. Robinson, Jr., and Ordway B. Gates, Jr., 1955

TR 1234 ON THE KERNEL FUNCTION OF THE INTEGRAL EQUATION RELATING THE LIFT AND DOWNWASH DISTRIBUTIONS OF OSCILLATING FINITE WINGS IN SUBSONIC FLOW, Charles E. Watkins, Harry L. Runyan, and Donald S. Woolston, 1955

TR 1237 A FLIGHT EVALUATION OF THE LONGITUDINAL STABILITY CHARACTERISTICS ASSOCIATED WITH THE PITCH-UP OF A SWEPT-WING AIRPLANE IN MANEUVERING FLIGHT AT TRANSONIC SPEEDS, Seth B. Anderson and Richard S. Bray, 1955

TR 1241 THEORETICAL AND ANALOG STUDIES OF THE EFFECTS OF NONLINEAR STABILITY DERIVATIVES ON THE LONGITUDINAL MOTIONS OF AN AIRCRAFT IN RESPONSE TO STEP CONTROL DEFLECTIONS AND TO THE INFLUENCE OF PROPORTIONAL AUTOMATIC CONTROL, Howard J. Curfman, Jr., 1955

TR 1250 THE DYNAMIC-RESPONSE CHARACTERISTICS OF A 35° SWEPT-WING AIRPLANE AS DETERMINED FROM FLIGHT MEASUREMENTS, William C. Triplett, Stuart C. Brown, and G. Allan Smith, 1955

TR 1258 A WIND-TUNNEL TEST TECHNIQUE FOR MEASURING THE DYNAMIC ROTARY STABILITY DERIVATIVES AT SUBSONIC AND SUPERSONIC SPEEDS, Benjamin H. Beam, 1956

TR 1260 STUDIES OF THE SPEED STABILITY OF A TANDEM HELICOPTER IN FORWARD FLIGHT, Robert J. Tapscott and Kenneth B. Amer, 1956

TR 1265 A THEORY FOR STABILITY AND BUZZ PULSATION AMPLITUDE IN RAM JETS AND AN EXPERIMENTAL INVESTIGATION INCLUDING SCALE EFFECTS, Robert L. Trimpi, 1956

TR 1298 AN ANALYSIS OF THE EFFECTS OF AEROELASTICITY ON STATIC LONGITUDINAL STABILITY AND CONTROL OF A SWEPT-WING AIRPLANE, Richard B. Skoog, 1957

TR 1299 CORRELATION, EVALUATION, AND EXTENSION OF LINEARIZED THEORIES FOR TIRE MOTION AND WHEEL SHIMMY, Robert F. Smiley, 1957

TR 1324 COMPARISON OF SEVERAL METHODS FOR OBTAINING THE TIME RESPONSE OF LINEAR SYSTEMS TO EITHER A UNIT IMPULSE OR ARBITRARY INPUT FROM FREQUENCY-RESPONSE DATA, James J. Donegan and Carl R. Huss, 1957

TR 1326 FLIGHT AND ANALYTICAL METHODS FOR DETERMINING THE COUPLED VIBRATION RESPONSE OF TANDEM HELICOPTERS, John E. Yeates, Jr., George W. Brooks, and John C. Houbolt, 1957

TR 1330 EXPERIMENTAL AND PREDICTED LONGITUDINAL AND LATERAL-DIRECTIONAL RESPONSE CHARACTERISTICS OF A LARGE FLEXIBLE 35° SWEPT-WING AIRPLANE AT AN ALTITUDE OF 35,000 FEET, Henry A. Cole, Jr., Stuart C. Brown, and Euclid C. Holleman, 1957

TR 1337 DETERMINATION OF LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS FROM FREE-FLIGHT MODEL TESTS WITH RESULTS AT TRANSONIC SPEEDS FOR THREE AIRPLANE CONFIGURATIONS, Clarence L. Gillis and Jesse L. Mitchell, 1957

TR 1339 A SUMMARY AND ANALYSIS OF THE LOW-SPEED LONGITUDINAL CHARACTERISTICS OF SWEPT WINGS AT HIGH REYNOLDS NUMBER, G. Chester Furlong and James G. Mellugh, 1957

TR 1341 INFLUENCE OF HOT-WORKING CONDITIONS ON HIGH-TEMPERATURE PROPERTIES OF A HEAT-RESISTANT ALLOY, John F. Ewing and J. W. Freeman, 1957

TR 1344 A SIMPLIFIED METHOD FOR APPROXIMATING THE TRANSIENT MOTION IN ANGLES OF ATTACK AND SIDESLIP DURING A CONSTANT ROLLING MANEUVER, Leonard Sternfield, 1958

TR 1348 GROUND SIMULATOR STUDIES OF THE EFFECTS OF VALVE FRICTION, STICK FRICTION, FLEXIBILITY, AND BACKLASH ON POWER CONTROL SYSTEM QUALITY, B. Porter Brown, 1958

TR 1350 METHODS FOR OBTAINING DESIRED HELICOPTER STABILITY CHARACTERISTICS AND PROCEDURES FOR STABILITY PREDICTIONS, F. B. Gustafson and Robert J. Tapscott, 1958

TR 1357 EXPERIMENTAL DETERMINATION OF EFFECTS OF FREQUENCY AND AMPLITUDE ON THE LATERAL STABILITY DERIVATIVES FOR A DELTA, A SWEPT, AND AN UNSWEPT WING OSCILLATING IN YAW, Lewis R. Fisher, 1958

TR 1363 ORIGIN AND PREVENTION OF CRACH FIRES IN TURBOJET AIRCRAFT, I. Irving Pinkel, Solomon Weiss, G. Merritt Preston, and Gerard J. Pesman, 1958

TR 1364 MEASUREMENT OF STATIC PRESSURE ON AIRCRAFT, William Gracey, 1958

TR 1391 INVESTIGATION OF A NONLINEAR CONTROL SYSTEM, I. Flugge-Lotz, C. F. Taylor, and H. E. Lindberg, 1958

TR R 57 STATUS OF SPIN RESEARCH FOR RECENT AIRPLANE DESIGNS, A. I. Neihouse, Walter J. Klinar, and S. H. Scher, 1960

This report is primarily concerned with recent trends for tactical types but updates basic discussions of results in WR L-168, WR L-351, WR L-370, WR L-461, WR L-721, TN 776, TN 2134, TR 691, TN 1045.

TR R 228 ESTIMATION OF FLIGHT PERFORMANCE WITH CLOSED-FORM APPROXIMATIONS TO THE EQUATIONS OF MOTION, Charlie M. Jackson, January 1966

The author has presented an approximate method whereby the climb and acceleration performance of air-breathing aircraft may be determined. His equations are solved using finite-difference numerical techniques, and the results are presented in nomograph form as an appendix. The methods produce estimates which are suitable for preliminary sizing, air frame design, and propulsion system evaluation.

Not Applicable NASA Technical Reports

TR R 19 THEORETICAL ANALYSIS OF THE LONGITUDINAL BEHAVIOR OF AN AUTOMATICALLY CONTROLLED SUPERSONIC INTERCEPTOR DURING THE ATTACK PHASE, Ordway B. Gates, Jr., and C. H. Woodling, 1959

TR R 29 EFFECT OF FLOW INCIDENCE AND REYNOLDS NUMBER ON LOW-SPEED AERODYNAMIC CHARACTERISTICS OF SEVERAL NONCIRCULAR CYLINDERS WITH APPLICATIONS TO DIRECTIONAL STABILITY AND SPINNING, Edward C. Polhamus, 1959

TR R 35 GROUND REFLECTION OF JET NOISE, Walton L. Howes, 1959

TR R 41 NORMAL COMPONENT OF INDUCED VELOCITY FOR ENTIRE FIELD OF A UNIFORMLY LOADED LIFTING ROTOR WITH HIGHLY SWEPT WAKE AS DETERMINED BY ELECTROMAGNETIC ANALOG, Walter Castles, Jr., Howard L. Durham, Jr., and Jirair Kevorkian, 1959

TR R 49 SUMMARY AND ANALYSIS OF HORIZONTAL-TAIL CONTRIBUTION TO LONGITUDINAL STABILITY OF SWEPT-WING AIRPLANES AT LOW SPEEDS, Robert H. Neely and Roland F. Griner, 1959

TR R 51 ADSORPTION OF HALOGENATED FIRE EXTINGUISHING AGENTS ON POWDERS, Allen J. Barduhn, Bhailal S. Patel, Walter Meyer, and Bronislaw B. Smura, 1960

TR R 52 SIMILARITY OF FAR NOISE FIELDS OF JETS, Walton L. Howes, 1960

TR R 57 STATUS OF SPIN RESEARCH FOR RECENT AIRPLANE DESIGNS, Anshal I. Neihouse, Walter J. Klinar, and Stanley H. Scher, 1960

TR R 65 DETERMINATION OF LATERAL STABILITY CHARACTERISTICS FROM FREE-FLIGHT MODEL TESTS, WITH EXPERIMENTAL RESULTS ON THE EFFECTS OF WING VERTICAL POSITION AND DIHEDRAL AT TRANSONIC SPEEDS, Clarence L. Gillis, Jesse L. Mitchell, and Charles T. D'Aiutolo, 1960

TR R 69 CALCULATED RESPONSES OF A LARGE SWEPTWING AIRPLANE TO CONTINUOUS TURBULENCE WITH FLIGHT-TEST COMPARISONS, Floyd V. Bennett and Kermit G. Pratt, 1960

TR R 74 THE LATERAL RESPONSE OF AIRPLANES TO RANDOM ATMOSPHERIC TURBULENCE, John M. Eggleston and William H. Phillips, 1960

TR R 83 A THEORETICAL STUDY OF THE ANGULAR MOTIONS OF SPINNING BODIES IN SPACE, Jerrold H. Suddath, 1961

TR R 87 A STUDY OF THE POSITIONS AND VELOCITIES OF A SPACE STATION AND A FERRY VEHICLE DURING RENDEZVOUS AND RETURN, John M. Eggleston and Harold D. Beck, 1961

TR R 110 ANALYTICAL METHOD OF APPROXIMATING THE MOTION OF A SPINNING VEHICLE WITH VARIABLE MASS AND INERTIA PROPERTIES ACTED UPON BY SEVERAL DISTURBING PARAMETERS, James J. Buglia, George R. Young, Jesse D. Timmons, and Helen S. Brinkworth, 1961

TR R 115 METHOD FOR APPROXIMATING THE VACUUM MOTIONS OF SPINNING SYMMETRICAL BODIES WITH NONCONSTANT SPIN RATES, C. William Martz, 1961

TR R 126 ANALYSIS OF CLOSE LUNAR TRANSLATION TECHNIQUES, Joseph N. Sivo, Carl E. Campbell, and Vladimir Hamza, 1962

TR R 128 STUDY OF AN AUTOMATIC SYSTEM FOR CONTROL OF THE TERMINAL PHASE OF SATELLITE RENDEZVOUS, Edgar C. Lineberry, Jr., and Edwin C. Foudriat, 1962

TR R 129 A THEORETICAL STUDY OF THE TORQUES INDUCED BY A MAGNETIC FIELD ON ROTATING CYLINDERS AND SPINNING THIN-WALL CONES, CONE FRUSTUMS, AND GENERAL BODY OF REVOLUTION, G. Louis Smith, 1962

TR R 130 ANALYSIS OF THERMAL-PROTECTION SYSTEMS FOR SPACE-VEHICLE CRYOGENIC -PROPELLANT TANKS, George R. Smolak, Richard H. Knoll, and Lewis E. Wallner, 1962

TR R 137 USE OF AN INERTIA SPHERE TO DAMP THE ANGULAR MOTIONS OF SPINNING SPACE VEHICLES, Jerrold H. Suddath, 1962

TR R 138 THE PROPAGATION OF PLANE ACOUSTIC WAVES IN A RADIATING GAS, Barrett Stone Baldwin, Jr., 1962

TR R 145 AN INVESTIGATION OF THE VIBRATION CHARACTERISTICS OF PRESSURIZED THIN-WALLED CIRCULAR CYLINDERS PARTLY FILLED WITH LIQUID, John S. Mixson and Robert W. Herr, 1962

WR A 11 COMPUTATION OF HINGE-MOMENT CHARACTERISTICS OF HORIZONTAL TAILS FROM SECTION DATA, Robert M. Crane, April 1945

A method is presented by which two dimensional characteristics of airfoil with flaps could be corrected so that is it suitable for application to the problem of determining the hinge moment characteristics of finite span control surfaces. The method consists of correcting the two dimensional data for:

1. The effects of aerodynamic balance.
2. Effect of control surface chord.
3. Effect of trailing-edge angle.
4. The effect of three-dimensional flow.

To illustrate the use of the method and to check its accuracy, the method was used to estimate the hinge moment characteristics for 16 different horizontal tail surfaces mounted on complete airplane models for which the experimental hinge moment characteristics are known. A comparison of the experimental hinge moment characteristics with the hinge moment characteristics estimated by the method presented indicates that the method is capable of estimating the hinge moment characteristics to within the tolerance required in preliminary design.

WR A 15 MEASUREMENT OF FREE WATER IN CLOUD UNDER CONDITIONS OF ICING, J. K. Hardy, October 1944

Measurements have been made, in flight, of the concentration of free water present in clouds under conditions of icing. The physical conditions of icing are specified by the temperature of the air, the concentration of free water, and the size of droplet present in the cloud. The performance of a thermal system for protecting airplanes against ice can then be analyzed in terms of icing conditions to be encountered. The measurement of the concentration of free water is the subject of this report while the analysis of the performance of the thermal system of protection is contained in NACA ARR No. 4I11a. The method used in determining the free water in clouds is outlined in the report.

A table of results for several flights of a thermal system equipped C-46 is given showing the free water concentration at various times. This table can be used in conjunction with NACA ARR No. 4I11a. The tests of the C-46 in conditions of icing have shown that the severity of conditions is reduced substantially by the effect of kinetic heating.

The values for the concentration of free water given in this report are believed to be slightly greater than those actually encountered. The weakness of the method seems to be the uncertainty as to the static temperature of the air in the cloud.

WR A 17 AN ANALYTICAL INVESTIGATION OF THERMAL-ELECTRIC MEANS OF PREVENTING ICE FORMATIONS ON A PROPELLER BLADE, Richard Scherrer, August 1944

An analysis of thermal electric means of preventing ice formations on a propeller blade have been investigated and a theoretical basis for the continued development of thermal electric blade shoes is provided.

In flight tests with electrically heated propeller blade shoes, the power required for ice prevention is reported in references 1 and 2.

A method is presented that can be applied to the design of thermal electric blade shoes for any propeller or rotor, and an optimum heat distribution is determined for a propeller blade.

The method of analysis which follows is concerned with the determination of these various factors which are necessary to evaluate q_{bs} and q_{as} and effect a solution for the total power required and for the optimum heat distribution for the specific application. q_{bs} is dependent upon (1) the surface heat transfer coefficient, (2) the ambient air temperature, (3) the resultant velocity and effective angle of attack of the propeller blade section, (4) the water content of the air stream. q_{as} is dependent upon (1), (2), and (3), which is same as q_{bs}, and (4) the thermal conductivities of the propeller blade and blade show materials;

where

q_{bs} = the unit heat required to prevent or remove ice at each point on the blade shoe surface.

q_{as} = the unit heat loss at each point on the after surface of the propeller blade.

Reference 1
Orr, J. L.: Interim Report on Flight Tests of Thermal Electric Propeller De-Icing. Rep. No. MD-25, Nat. Research Council of Canada, November 7, 1942.

Reference 2
Scherrer, Richard and Lewis A. Rodert: Tests of Thermal Electric De-Icing Equipment for Propellers. NACA ARR 4a20, 1944.

WR A 20 AN INVESTIGATION OF THE CHARACTERISTICS OF ALCOHOL-DISTRIBUTION TUBES USED FOR ICE PROTECTION ON AIRCRAFT WINDSHIELDS, Richard Scherrer and Clair F. Young, February 1944

An investigation has been conducted with alcohol used in conjunction with a windshield wiper as a means of affording protection against ice formation on the windshields of aircraft when operating in inclement weather. Flight tests were under simulated icing conditions.

The optimum location and size of the alcohol distribution tube and orifices were determined for the specific installation investigated. A procedure by which economical and effective distribution can be obtained was developed and is presented.

WR A 47 TESTS OF THERMAL-ELECTRIC DE-ICING EQUIPMENT FOR PROPELLERS, Richard Scherrer and Lewis A. Rodert, January 1944

The purpose of the present tests was to develop a satisfactory blade shoe and hub-generator combination and to provide additional data on which future designs could be based. Observations were made of the effectiveness of three different blade shoes in order to determine the effect of two variables: the radial extent to the shoe and the chordwise heat distribution.

Three different blade shoes are as follows:

1. Shoe extending 50% of the blade radius and covering approximately 20% of the blade chord.

2. Shoe extending 90% of the blade radius and covering the leading edge 20% of the blade chord. A minimum average unit power input of 2.5 watts per square inch or blade shoe area would protect the propeller blades at the test conditions. It is a most satisfactory blade shoe of the three different blade shoes.

3. Shoe covering the leading edge and 7% of the blade chord. The unit heating supplied to it is twice that supplied to the remainder of the blade shoe area.

XB-24 and XB-17F were used in the tests. Flight tests were made in natural icing conditions.

A design output of 2000 watts for a satisfactory hub generator was determined.

WR L 30 THE USE OF GEARED SPRING TABS FOR ELEVATOR CONTROL, William H. Phillips, February 1945

See TR 797 which supercedes this report.

WR L 83 COMPARISON OF YAW CHARACTERISTICS OF A SINGLE-ENGINE AIRPLANE MODEL WITH SINGLE-ROTATING AND DUAL-ROTATING PROPELLERS, R. H. Neely, L. E. Fogarty and S. R. Alexander, April 1944

A dual rotating propeller, which for an ideal case has no resultant torque and produces a symmetrical slipstream, should eliminate the lateral control change due to power. A single rotating propeller, which has a large torque reaction and asymmetrical slipstream, causes a large lateral trim change which involves both aileron and rudder.

The purpose of this report is to determine the effects of a single rotating and a dual rotating propeller on stability and control characteristics in yaw with the vertical tail on and with the vertical tail off. Tests were made of a 0.32 scale model of a single engine, fighter type airplane in the NACA 19 foot pressure tunnel at Langley Field, Virginia. The blades were of the NACA 4-308-03 type.

The most important difference in the yaw characteristics of the airplane model with single rotating and dual rotating propellers was that, in the low speed and high thrust conditions, large rudder deflections and forces were required to trim at zero yaw with single rotation, and negligible deflections and forces were required to trim at zero yaw with dual rotation. For high thrust conditions with the rudder fixed, the model with single rotating propellers tended to be directionally unstable at large negative angles of yaw. With dual rotating propellers the model was stable throughout the trim range. For moderate angles of yaw, a greater degree of rudder-fixed stability was generally obtained with single rotation as opposed to dual rotation. The total range of angle of yaw maintained by maximum deflection of the rudder was greater with dual rotation. The rudder control forces per degree of yaw were two to three times as great for single rotation as for dual rotation in the high thrust conditions.

WR L 95 A METHOD FOR PREDICTING THE ELEVATOR DEFLECTION REQUIRED TO LAND, R. F. Goranson, September 1944

Flight measurements of elevator deflections used during landings were published in Reference 1; however, no analytical method for estimating the elevator deflection required to land was available at that time.

A method is presented for predicting from basic airplane characteristics the elevator deflection required to maintain optimum landing attitude. Charts for evaluating the components of the equation for the elevator deflection required to land, as well as a comparison of computed and measured values for 15 airplanes are included.

A comparison of results computed by this method with available experimental results indicated the following conclusions:

1. For preliminary design purposes, the elevator deflection required to land can be satisfactorily predicted from the basic airplane dimensions.

2. Because of variations in piloting technique, the computed deflection is considered as the minimum value required to maintain landing attitude.

3. The largest contribution to the elevator deflection required to land is the change in the downwash angle as the airplane approaches the ground.

A simplified method of obtaining the downwash angle near the ground and a limited analysis of the effect of flap type and deflection on the aerodynamic-center location and pitching moment coefficient are presented as appendices.

Reference 1:

Vensel, Joseph R.: Flight Measurements of the Elevator Deflections Used in Landings of Several Airplanes. NACA ARR, November 1941.

WR L 116 ESTIMATION OF STICK FIXED NEUTRAL POINTS OF AIRPLANES, Maurice D. White, March 1945

A method is given for calculating the stick fixed neutral point of an airplane with propeller windmilling, flaps neutral and landing gear retracted.

The neutral point of an airplane is defined as the center of gravity location at which the slope of the curve of airplane pitching moment coefficient with respect to the lift coefficient $\partial C_m/\partial C_L$ is zero. The airplane pitching moment curve slope is the resultant of the slopes contributed by the various parts of the airplane, as follows:

1. pitch moment slope due to wing
2. pitch moment slope due to fuselage and engine
3. pitch moment slope due to horizontal tail
4. pitch moment slope due to normal force on windmilling propeller and to downwash increment resulting from this normal force.

A procedure for determining the contribution to the neutral point of the various parts of the airplane is illustrated and the values of $\partial C_m/\partial C_L$ for the various parts of the airplane are plotted against center of gravity location. Estimated values of $\partial C_m/\partial C_L$ and the resultant neutral point are presented.

Comparison of the neutral points predicted by this method with the neutral points obtained in flight tests indicated good agreement at low lift coefficients, and indicated that at higher lift coefficients the neutral point generally remains the same or moves back; thus, the neutral point predicted by the present method will be conservative throughout the flight range for the flight condition.

The methods presented, in conjunction with the results given in NACA CB L4H01 "Effect of Power on the Stick-Fixed Neutral Points of Several Single Engine Monoplanes as Determined in Flight," should be useful in estimating the stick-fixed neutral points of new designs for all flight conditions.

Reference 1: Gilruth, R. R., and White, M. D.: Analysis and Prediction of Longitudinal Stability of Airplanes, NACA Rep. 711, 1941.

Reference 2: White, M. D.: Effect of Power on the Stick Fixed Neutral Points of Several Single Engine Monoplanes as Determined in Flight. NACA CB L4H01, 1944.

WR L 144 CHARTS FOR DETERMINING PROPELLER EFFICIENCY, John L. Crigler and Herbert W. Talkin, September 1944

A method of estimating propeller efficiency for a given operating condition is described. The efficiency is determined for any design condition by evaluating separately the induced losses (axial- and rotational-energy losses) and the profile drag losses. The estimated efficiency is compared with experimental results for a wide range of operating conditions and found to be in agreement near peak efficiency.

The maximum gain in efficiency to be realized with dual rotating propellers over single rotating propellers is evaluated for a wide range of operating conditions.

By this method, a large reduction in the time and effort required for propeller analysis is effected as compared with the strip-theory method.

The change in efficiency to be expected from body interference is discussed. Two examples illustrating the use of the method are given in an appendix.

The performance for operation at values of the advance ratio ($\frac{V}{nD}$) equal to or less than 2.5 may be accurately predicted. The approximate performance of conventional round-shank propellers may be predicted to values of the advance diameter ratio much higher than 2.5. The upper limit of possible performance for other types of propellers is shown for values of the advance diameter ratio up to 6.0.

WR L 161 THE EFFECT OF THE LIFT COEFFICIENT ON PROPELLER FLUTTER, Theodore Theodorsen and Authur A. Regier, July 1945

This report was written in connection with a study on the design of wind-tunnel propellers. Such propellers do not operate in a fully stalled condition, and so require only a small margin of safety against flutter. This is as opposed to airplane propellers which may operate in or near the stall occasionally. There are two basic types of flutter.

1. Classical-oscillating instability in potential flow.

2. Stall flutter which involves flow separation.

Stall flutter speed is much lower than that for classical flutter, and occurs at higher angles of attack. It is shown that blades need not be set at a particular angle of attack to induce flutter, but that the blades will twist to the critical position and flutter will occur. This may be alleviated through the use of proper camber by increasing the stall flutter speed to the classical flutter speed.

WR L 168 A MASS DISTRIBUTION CRITERION FOR PREDICTING THE EFFECT OF CONTROL MANIPULATION ON THE RECOVERY FROM A SPIN, A. I. Neihouse, August 1942

This report is a summary of spin-tunnel tests of 65 airplane models. Two classes of aircraft for spin recovery are generated: (1) loaded mainly along fuselage (e.g. single engine light planes) (2) heavily loaded along wings (multi-engine or singles with wing tanks, armament, retractable gear, etc.)

For the 1st class, recovery is best effected by rudder reversal. The elevator is left "up" until recovery commences and then should be moved to the slightly "down" position. If the elevator is moved first, the rudder may become useless because of shielding. The ailerons are to be left with the spin because reversal somehow hinders recovery.

For the second group, elevator reversal is most important. The ailerons should be set against spin, as they can retard recovery greatly when left with spin. Rudder reversal is of some help to recovery.

WR L 177 CLIMB AND HIGH SPEED TESTS OF A CURTISS NO. 714-1C2-12 FOUR-BLADE PROPELLER ON THE REPUBLIC P-47C AIRPLANE, A. W. Vogeley, December 1944

Flight tests of several propellers on the Republic P-47c airplane for the purpose of determining climb and high speed characteristics, were made of a Curtiss 714-1C2-12 four propeller blade.

horizontal tail. The tail-area requirements, control forces required in the critical landing condition, static margin, control-force gradients in a dive recovery, and elevator-free stability are investigated. The analysis includes a comparison for the various tails of the effect of a partial-wing stall on the control-force gradient in a dive recovery. The effect of an increase in the tail aspect ratio is also investigated.

For the adjustable-stabilizer tail, the maximum angular travel of the stabilizer was limited by the condition that, with the wing flaps fully deflected at 120 percent of the minimum speed, the negative angle of attack of the tail was about 2.5° below its negative stalling angle. It was further specified that with the stabilizer fully deflected, the airplane could be trimmed at all times in a normal landing maneuver by use of the elevator.

The maximum negative deflection of the all-movable tail was so determined that the negative stalling angle for the tail could be obtained in a three-point landing at a minimum speed.

Force coefficients and stability derivatives were calculated.

Results

1. For a specified range of permissible center-of-gravity positions, the all-movable and adjustable-stabilizer tails permit reductions in tail area of approximately 40 percent, as compared with the fixed-stabilizer tail.

2. A specified static margin can be maintained with large reductions in horizontal-tail area by adjustments in the center-of-gravity or wing positions, which are feasible in the preliminary stages of design.

3. For the adjustable-stabilizer tail, the required value for the rate of change of hinge-moment coefficients with elevator deflection can be obtained with appreciably smaller control balance than would be required with the fixed-stabilizer tail.

4. The control forces required to effect a three-point landing at minimum speed will be approximately the same with the fixed-stabilizer and all-movable horizontal tails.

5. The increase in control-force gradient in a dive recovery, which results from a partial-wing stall, will be significantly smaller with the all-movable and adjustable-stabilizer tails than with the conventional fixed-stabilizer tail.

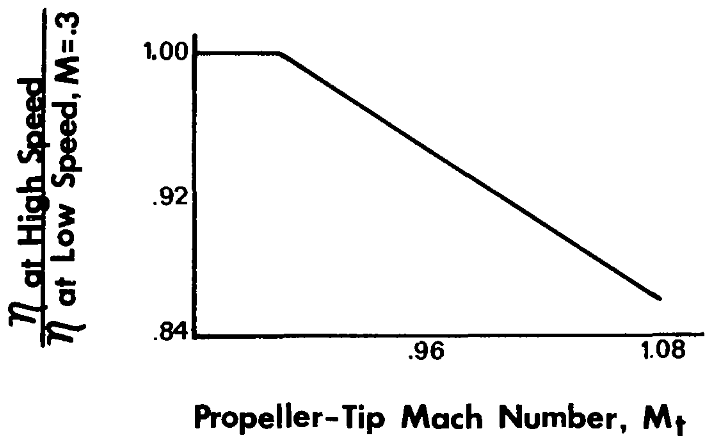
6. In the case of the fixed-stabilizer tail, an increase in aspect ratio from 4.24 to 5.82 for a specified range of permissible c.g. positions permits a reduction in tail area that varies from approximately 10 to 12.5 percent.

Climb tests were made under the following conditions:

(1) Military power - airspeed at 165 miles per hour, and from sea level to 23,000 feet.

(2) Normal power - airspeed at 160 to 165 miles per hour, and from sea level to 30,000 feet.

The loss in efficiency, when power was increased from normal to military, was found to be from 6 to 8% in climbs at an indicated airspeed of 165 miles per hour. This loss was attributed primarily to reduction in section lift-drag ratios resulting from increased operating lift coefficients. In high speed flight at military power, losses in efficiency due to compressibility started at an airplane Mach number less than 0.4 and increased steadily to 10 or 11% at an airplane Mach number of 0.7. These losses were encountered when the propeller tip Mach number exceeded 0.88 and the propeller efficiency decreased at a rate of about 7% for each increase of 0.1 in tip Mach number thereafter. At an airplane Mach number of 0.7 and constant porpeller rotational speed, the propeller efficiency decreased with a decrease in power below military power. The loss in efficiency due to compressibility was relatively independent of power. By suitably increasing the solidity and reducing the rotational speed, an improvement in the propeller efficiency in both climb and high speed operation may be possible. Flight data obtained from climb tests and from high speed tests of Curtiss 714-1C2-12 four blade propeller are presented in Table I and Table II. Effect of propeller tip Mach number on propeller efficiency at constant rotational speed is shown below.



WR L 195 COMPARISON OF FIXED STABILIZER, ADJUSTABLE STABILIZER AND ALL MOVABLE HORIZONTAL TAILS, Sidney M. Harmon, October 1945

An analysis is presented to compare longitudinal stability and control characteristics obtained with a conventional fixed-stabilizer, an adjustable-stabilizer, and an all-movable

WR L 210 FLIGHT MEASUREMENTS TO DETERMINE EFFECT OF A SPRING-LOADED TAB ON LONGITUDINAL STABILITY OF AN AIRPLANE, Paul A. Hunter and John P. Reeder, February 1946

In conjunction with a program of research on the general problem of stability of airplanes in the climbing condition, tests have been made of a spring tab installed on the elevator of a low wing airplane. The tab was arranged to deflect upward with decrease in speed, which caused an increase in the pull force required to trim at low speeds and increased the stick free static longitudinal stability of the airplane. The data obtained in these flights are compared with data obtained for the same airplane with the production tab locked.

The following conclusions were reached:

1. It was found that the spring tab would increase the stick free stability in all flight conditions, would reduce the danger of inadvertent stalling because of the pull force required to stall the airplane with power on, would reduce the effect of center of gravity position on stick free stability, and would have little effect on the elevator stick forces in accelerated flight.

2. The spring tab may be used to provide almost any desired variation of elevator stick force with speed by adjusting the tab hinge moment characteristics and the variation of spring moment with tab deflection.

3. The spring tab would provide stick force stability without requiring a pull force to hold the stick back while taxying, as would be required by the bungee and the bobweight.

A device similar to the spring tab may be used on the rudder or ailerons to eliminate undesirable trim force variations with speed.

WR L 217 FORMULAS FOR PROPELLERS IN YAW AND CHARTS OF THE SIDE-FORCE DERIVATIVE, Herbert S. Ribner, May 1943

General formulas are given for the rate of change of side force coefficient with angle of yaw and or the rate of change of pitching moment coefficient with angle of yaw. A series of charts gives the rate of change of side force coefficient with angle of yaw as a function of the advance diameter ratio V/nD; the blade angle and solidity are parameters. The charts cover both single and dual rotation, blades of from two to six blades. The blade angles range from 15° or 20° to 60°. The propellers were Hamilton Standard 3155-6 and the NACA 10-3062-045.

Study of these equations indicates that they are consistent with the following physical interpretation:

In developing side force, the propeller acts like a fin of which the area is the projected side area of the propeller, the effective aspect ratio is of the order of 8, and the effective dynamic pressure is roughly that at the propeller disk as augmented by the inflow. The variation of the inflow velocity, for a fixed pitch propeller, accounts for most of the variation of side force with advance diameter ratio.

WR L 219 PROPELLERS IN YAW, Herbert S. Ribner, December 1943

This analysis shows that the fin analogy may be extended to the form of the side force expression and that the effective fin area may be taken as the projected side area of the propeller. The effective aspect ratio is of the order of 8 and the appropriate dynamic pressure is roughly that at the propeller disk as augmented by the inflow. The variation of the inflow velocity, for a fixed pitch propeller, accounts for most of the variation of side force with advance diameter ratio V/nD.

The following conclusions have been reached:

1. A dual rotating propeller in yaw develops up to one third more side force than a single rotating propeller.

2. A yawed single rotating propeller experiences a pitching moment in addition to the side force.

3. The pitching moment is of the order of the moment produced by a force equal to the side force, acting at the end of a lever arm equal to the propeller radius.

4. This cross-coupling between pitch and yaw is small, but not negligible.

WR L 248 FLIGHT MEASUREMENTS OF THE ELEVATOR DEFLECTIONS USED IN LANDINGS OF SEVERAL AIRPLANES, Joseph R. Vensel, November 1941

The purpose of this report is to present flight test data on the elevator deflections used in landing for a number of airplanes.

Physical characteristics of the airplanes for which data were available are given. These data include flap setting, elevator deflection just before ground contact, vertical velocity just before contact, normal acceleration an instant before contact, the maximum normal acceleration at contact, attitude of the thrust axis at contact, elevator deflection required to produce an unaccelerated stall at altitude, the indicated air speed to stall at altitude, and pilot's remarks on the landing.

The elevator deflections used in landings of some airplanes are considerably larger than the elevator deflection required to stall at altitude because of ground interference on trim. The maximum value of the difference in the elevator angle required to stall at altitudes and to make a three point landing of the airplanes investigated was 14.4° under the same flight and loading conditions.

WR L 251 SOME NOTES ON THE DETERMINATION OF THE STICK-FREE NEUTRAL POINT FROM WIND-TUNNEL DATA, Marvin Schuldenfrei, February 1944

Two graphical methods for determining the stick-free neutral point, which are extensions of the methods commonly used to determine the stick-fixed neutral point, are presented. A mathematical formula for computing the stick-free neutral point is given. These methods may be used to determine the increase in tail size necessary to shift the neutral point (with stick free or fixed) to any desired location on an airplane having inadequate longitudinal stability. A method for determining the stick fixed neutral point may be found in NACA RB 3120. It is shown that the neutral point with the stick free may be determined by modification of the data from conventional tests with elevator fixed according to the factor given in the following equation:

$$\frac{\left(\frac{\partial C_{L_t}}{\partial \alpha_t}\right)_{\text{elevator free}}}{\left(\frac{\partial C_{L_t}}{\partial \alpha_t}\right)_{\text{elevator } \alpha_t \text{ fixed}}} = -1 \frac{\left[\left(\frac{\partial C_{L_t}}{\partial \delta_e}\right)_{\alpha_e \text{ fixed}}\right]\left[\left(\frac{\partial C_h}{\partial \alpha_t}\right)_{\text{elevator \& tab fixed}}\right]}{\left[\left(\frac{\partial C_{L_t}}{\partial \alpha_t}\right)_{\text{elevator fixed}}\right]\left[\left(\frac{\partial C_h}{\partial \delta_e}\right)_{\alpha \text{ \& tab fixed}}\right]}$$

WR L 286 REPRESENTATIVE OPERATING CHARTS OF PROPELLERS TESTED IN THE NACA 20-FOOT PROPELLER-RESEARCH TUNNEL, W. H. Gray and Nicholas Mastrocola, September 1943

Extensive tests of full scale propellers were made in the 20 foot porpeller research tunnel, and the results were presented in the form of charts showing thrust coefficient, power coefficient, and efficiency; each plotted separately against V/nD.

The power coefficients of all dual rotating propellers in this report represent the sum of the power coefficients of the front and rear propellers and are for the test conditions in which blade angles of the front and rear propellers were set to absorb approximately equal power at peak efficiency only.

The propeller blades used were Bureau of Aeronautics 5868-9; and Hamilton Standard 3155-6 and 3155-6-1.5 and 3156-6-1.5.

WR L 296 TAPERED WINGS, TIP STALLING, AND PRELIMINARY RESULTS FROM TESTS OF THE STALL-CONTROL FLAP, Eastman N. Jacobs, November 1937

The general problem of stalling of airplanes is considered. The increased difficulties associated with efficient wings, particularly with highly tapered wings and high lift devices, are discussed and various means are considered of avoiding these difficulties with a minimum aerodynamic loss.

The following devices have been discussed in the report: stall control flap, movable tip slots, spoiler device, and sharp leading edge. The stall control flap used together with the slotted sections may remain the most efficient means of avoiding the tip stall of highly tapered wings.

Preliminary data are presented for the stall control flap and the application of these section data to wing design is briefly covered, mainly by means of an example.

WR L 316 WIND-TUNNEL TESTS OF SINGLE- AND DUAL-ROTATING TRACTOR PROPELLERS AT LOW BLADE ANGLES AND OF TWO- AND THREE-BLADE TRACTOR PROPELLERS AT BLADE ANGLES UP TO 65°, W. H. Gray, February 1943

Tests were conducted in the propeller research tunnel to determine the characteristics of two- and three-blade tractor propellers at blade angles from 20 to 65 degrees.

Propeller blades were of Hamilton Standard 3155-6 and 3156-6 configuration. Tests were made at low speeds, and the effect of compressibility was not measured.

The results were presented in the form of charts showing thrust coefficient, power coefficient, and efficiency, plotted separately against V/nD.

Reference 1
Biermann, David, and Edwin P. Hartman: The Effect of Compressibility on Eight Full Scale Propellers Operating in the Take Off and Climbing Range. NACA Rep. 639, 1938.

WR L 344 SOME NOTES ON THE DETERMINATION OF THE STICK-FIXED NEUTRAL POINT FROM WIND-TUNNEL DATA, Marvin Schuldenfrei, September 1943

Two methods are presented for determining the horizontal location of the stick fixed neutral point from wind tunnel data. One method involves the solution of a mathematical equation, and the other method is a graphical solution for the mathematical equation. A method is also included for determining the vertical variation of the neutral point. The combined horizontal and vertical variation of the neutral point completely describes the stick fixed longitudinal stability of airplanes that have large allowable center of gravity shifts.

The neutral point location may be determined from wind-tunnel data taken at different lift coefficients made with the elevator in a neutral position. An equation which relates the neutral point to the airplane center of gravity is:

$$X_o = X - \frac{\left(\frac{C_{m_1}}{C_L}\right)\left(\frac{dC_m}{dC_L}\right)_2 - \left(\frac{C_{m_2}}{C_L}\right)\left(\frac{dC_m}{dC_L}\right)_1}{\left[\left(\frac{dC_m}{dC_L}\right)_2 - \left(\frac{dC_m}{dC_L}\right)_1\right] + \left(\frac{C_{m_1}}{C_L} - \frac{C_{m_2}}{C_L}\right)} \qquad (7)$$

Where:

X_o = location of neutral point

C_{m_1} = untrimmed pitching moment coefficient at C_{L_1}

C_{m_2} = untrimmed pitching moment coefficient at C_{L_2}

$(dC_m/dC_L)_1$ = slope of stabilizer curve 1 at C_{L_1}

$(dC_m/dC_L)_2$ = slope of stabilizer curve 2 at C_{L_2}

X = center of gravity location for which data are given.

Through the use of figures in the report, it is possible to determine the neutral point by graphical construction techniques:

$$\frac{\Delta X}{Y} = \frac{\frac{dC_D}{dC_L} - \frac{2\alpha}{57.3} + \frac{\alpha_{\ell o}}{57.3} - K\left(\frac{C_D}{C_L} - \frac{\alpha}{57.3}\right)}{1 - K} \qquad (15)$$

Where:

ΔX = horizontal change in neutral point $\frac{\Delta X}{Y} = f\left(\frac{dC_D}{dC_L}\right)$

Y = vertical center of gravity shift

α = angle of attack at given C_L

$\alpha_{\ell o}$ = angle of attack for zero lift

$K = \frac{C_L}{C_L - C_{L_p}}$

When the power effect is small, $C_{L_p} = -\infty$ and $K \rightarrow 0$

$$\therefore \frac{\Delta X}{Y} = \frac{dC_D}{dC_L} - \frac{2\alpha}{57.3} + \frac{\alpha_{\ell o}}{57.3}$$

WR L 346 APPLICATION OF BALANCING TABS TO AILERONS, Richard I. Sears, June 1942

An analysis has been made to determine the characteristics required of a balancing tab system for ailerons.

A series of calculations has been made to determine balancing tab systems of various chord tabs and ailerons that will give, for a particular airplane, zero rate of change of aileron hinge moment with aileron deflection and will produce the same maximum rate of roll as a plain, unbalanced aileron of same span.

A balancing tab is a feasible and convenient means of reducing aileron hinge moments form zero to any desired magnitude. Because the over all lift effectiveness is less for an aileron balancing tab combination than for a plain aileron, the chord, the span, and the maximum deflection must be greater for the balanced aileron than for the plain aileron to produce a given maximum rate of roll. In the range investigated, balancing tabs of a given ratio of tab chord to aileron chord were more effective in reducing the hinge moments of large chord aileron than of small chord ailerons.

WT L 351 THE EFFECT OF SPANWISE MASS DISTRIBUTION UPON THE SPIN CHARACTERISTICS OF AIRPLANES AS DETERMINED BY MODEL TESTS CONDUCTED IN THE FREE-SPINNING WIND TUNNEL, Robert W. Kamm, August 1942

The object of this investigation was to establish the importance of spanwise loading in determining the differences between the spins of the two types of aircraft considered. The variation of spin angle of attack and of the relative effectiveness of the rudder and elevator as spin recovery devices were investigated. Six models, 5 single engine and 1 multi-engine were tested. A wide range of aerodynamic characteristics, such as wing and tail arrangement, and tail-damping power factors were represented. Changes in the inertia yawing moment parameter were obtained by adding ballast weights to the wings of the models. In this way, a model characteristics of a single engine type could be transformed into one of the multi-engine variety and the variation of spinning characteristics with loading were studied. Complete measurements were made of only the steady spin characteristics of the models. Steady spin parameters converted to corresponding full scale values are presented in a series of 6 charts.

The results of this series of tests lead to the following general conclusions:

1. The difference in the proportions of the loading carried in the wings for single-engine and multi-engine airplanes as expressed by the inertia yawing-moment parameter, does not appear to be the factor controlling the angle of attack of an airplane in a spin.

2. The difference in spanwise loading appears to bear a consistent relation to the relative effectiveness of the ailerons and elevator on the recovery characteristics.

WR L 359 WIND-TUNNEL TESTS OF SINGLE- AND DUAL-ROTATING PUSHER PROPELLERS HAVING FROM THREE TO EIGHT BLADES, David Biermann and W. H. Gray, February 1942

Tests of 10-foot-diameter, single and dual rotating pusher propellers having from three to eight blades were conducted in the 20 foot propeller research tunnel as a continuation of previous investigations of tractor propellers.

The general effects of dual rotation on other propeller characteristics were substantially the same for the pusher position as previously noted for the tractor position.

Single rotating pusher propellers were found to be from 0 to 10% less efficient than corresponding tractor propeller; but dual rotating pusher propellers had about the same efficiency as the corresponding tractor propellers. The peak efficiency of dual rotating pusher propellers was found to be from 1 to 16% higher than that for single rotating propellers. Dual rotating propellers were found to be substantially more efficient for the take off and climbing conditions of flight than the single rotating propellers, particularly for operation at high power coefficients. The peak blade efficiency was found to decrease with increased number of blades for single rotating pusher propellers but not for the dual rotating propellers. Efficiency for take off and climbing conditions increased substantially with increases in number of blades for constant power input, with a slight loss at the higher speed conditions. Dual rotating propellers were found to absorb substantially more power at peak efficiency than single rotating propellers of the same solidity; the effect was even more pronounced for take off and climb conditions.

The power absorbed per blade at peak efficiency decreased slightly with increased number of blades, more so for single rotation than for dual rotation. A large increase in the length of the spinner resulted in several percent increases in the net efficiency of a single rotating propeller but the gain was negligible for a dual rotating propeller.

WR L 362 COMPARISON OF CALCULATED AND EXPERIMENTAL PROPELLER CHARACTERISTICS FOR FOUR-, SIX-, AND EIGHT-BLADE SINGLE-ROTATING PROPELLERS, John L. Crigler, February 1944

The calculated performance of four-, six-, and eight-blade single rotating propellers has been compared with experimental results for blade angles ranging from 25° to 65° at 0.75 radius.

The method of calculation is based on the propeller theory as used by Lock and the correction factors for finite numbers of blades was obtained from Goldstein. The calculated propeller performance was found to be in good agreement with the experimental results over the complete range of blade angles investigated. The method of calculation is presented in detail and a sample computation is included. It is concluded from the comparison that the performance of a propeller can be accurately calculated if the velocity distribution in the plane of the propeller, the propeller airfoil section characteristics, and the propeller plan form are known. Hamilton Standard 3155-6 propeller blades were used in the investigation.

Reference 5
Lock, C. N. H. and D. Yeatman: Tables for Use in an Improved Method of Airscrew Strip Theory Calculation. RM No. 1674, British A.C.R., 1935.

WR L 369 CRITICAL SPEEDS AND PROFILE DRAG OF THE INBOARD SECTIONS OF A CONVENTIONAL PROPELLER, Arvo A. Luoma, September 1941

The purpose of this investigation was to determine the critical speeds and the profile drag coefficients of the shank and hub sections of a propeller (Pittsburgh screw and bolt drawing no. 614 Cc 15) used on a liquid cooled engine pursuit airplane.

The profile drags at five sections were obtained by the momentum method and the use of Jone's equations modified to include compressibility effects. Section critical speeds were obtained from maximum negative pressure measurements. Section normal force coefficients were determined for two blades sections from complete pressure distribution measurements.

Serious adverse compressibility effects can be expected on the shank and hub sections at speeds of the order of 400 mph with subsequent detrimental effects on propulsive efficiency.

WR L 370 TESTS OF INVERTED SPINS IN THE NACA FREE-SPINNING TUNNELS, George F. MacDougall, Jr., December 1943

Results are given for inverted-spin tests of 44 airplane models in the NACA 15-foot and 20-foot free-spinning tunnels. A detailed analysis of the data is not made; however, several well-defined trends are pointed out. Special emphasis is given to the effects of aileron deflection on the recovery from the spin. A wide range of mass distribution was covered since both single engine and multi-engine designs were tested. The models representing the airplanes of a normal-loading condition with flaps neutral and landing gears retracted where possible. Spin tunnel results are not always in complete agreement with full scale tests but recovery predictions have been satisfactory about 80% of the time.

Effects of Control Position

Moving the stick rearward, that is, moving the elevator down with respect to the ground, tended to prevent the inverted spin. Setting the controls together--that is, stick right for a spin made with right rudder pedal forward (setting the ailerons against the rotation of the inverted model)--generally prevented the inverted spin. Crossing the controls had the opposite effect, because spins could then be obtained with all models.

Relation between Mass Distribution and Effect of Aileron Deflection on Spinning

Although the models tested in inverted spins covered a wide range of mass distribution, there was no point at which the effect of aileron deflection reversed, as was the case with erect spins. For all models, setting the controls together was beneficial and crossing them had an adverse effect.

WR L 384 WIND-TUNNEL TESTS OF EIGHT-BLADE SINGLE- AND DUAL-ROTATING PROPELLERS IN THE TRACTOR POSITION, David Biermann and W. H. Gray, November 1941

Tests of 10-foot diameter, eight blade single- and dual-rotating propellers were conducted in the 20 foot propeller research tunnel as a continuation of a previous investigation of four- and six-blade propellers (reference 1). The effect of a symmetrical wing mounted in the slipstream was investigated. Blade angle settings ranged from 20° to 65°.

Thrust, power, and propulsive efficiency were plotted against V/nD. The general characteristics of eight blade single and dual rotating propellers indicate that the principal effect of the increased solidity was increased total power absorption with little loss in blade efficiency.

The results indicated that dual rotation resulted in gains of 1 to 8% in efficiency over single rotation for eight blade propellers, but the presence of a wing reduced this gain by about one-half. Also indicated was a greater power absorption over the entire flight range, and higher efficiency or thrust for the range of take off and climb for the dual propellers.

Reference 1
Biermann, David and Edwin P. Hartman: Wind Tunnel Tests of Four- and Six-Blade, Single- and Dual-Rotating Tractor Propellers. NACA Rep. 747, 1942.

WR L 385 WIND-TUNNEL TESTS OF SINGLE- AND DUAL-ROTATING TRACTOR PROPELLERS OF LARGE BLADE WIDTH, David Biermann, W. H. Gray and Julian D. Maynard, September 1942

Tests of 10 foot diameter, single- and dual-rotating tractor propellers having from two to eight blades were conducted in the NACA 20-foot propeller research tunnel of the LMAL. This test program differed from the previous investigations of tractor propellers only in the respect that the blades used were 50% wider than those previously employed.

Various comparisons and design charts are presented. The basic propeller characteristics (C_T, η, C_S, and C_P plotted against V/nD; η plotted against C_S for 2 blades and for single- or dual-rotating propellers) are presented.

The effects of dual rotation and changes in solidity were, in general, the same as the effects found in previous investigations of standard blades. The decrease of peak efficiency with increased solidity was very low. Increasing the solidity four times decreased the maximum efficiency by only 6% for single rotation. The percentage change was even less for dual rotation.

Reference 1
Biermann, David and Edwin P. Hartman: Wind Tunnel Tests of Four and Six Blade Single- and Dual-Rotating Tractor Propellers. NACA Rep. 747, 1942.

Reference 2
Biermann, David and W. H. Gray: Wind Tunnel Tests of Eight Blade Single- and Dual-Rotating Propellers in the Tractor Position. NACA ARR, November 1941.

WR L 404 THE CHARACTERISTICS OF TWO MODEL SIX-BLADE COUNTERROTATING PUSHER PROPELLERS OF CONVENTIONAL IMPROVED AERODYNAMIC DESIGN, James G. McHugh and Edward Pepper, June 1942

The aerodynamic characteristics of models of two counterrotating six-blade propellers are compared from the results of tests made in the NACA 19-foot pressure tunnel.

The two propellers differ in plan form, thickness ratio, diameter, section shape, and pitch distribution. One of the propellers, similar to the full scale Curtiss propeller 512, embodies the modified Clark Y airfoil sections; and is representative of a type in use on military and commercial aircraft. The other propeller (4-308-045) embodies NACA 16 series airfoil sections, and is designed for minimum induced losses.

Previous investigations have shown that the rotational losses of high pitch propellers may be materially reduced by the use of counter-rotating propellers.

At low values of airspeed (at which this investigation was conducted) the maximum values of propulsive efficiency obtained with propeller 4-308-045 were greater than those obtained with propeller 512 by an amount that varied from one half of 1% at a V/nD of 1.5 to 4% at a V/nD of 3.4. The greater efficiency of propeller 4-308-045 is attributed to the fact that it is designed to produce minimum aerodynamic losses whereas the design of propeller 512 was dictated largely from considerations of structural reliability. Propeller 4-308-045, because of greater blade area, absorbs more power than propeller 512.

WR L 425 FULL-SCALE TUNNEL INVESTIGATION OF THE CONTROL AND STABILITY OF A TWIN-ENGINE MONOPLANE WITH PROPELLERS OPERATING, Harold H. Sweberg, November 1942

As part of a general investigation directed toward predicting the effects of propeller operation on the stability of various types of aircraft with various power-plant arrangements, extensive tests have been conducted in the NACA full-scale tunnel of a typical twin-engine tractor monoplane model. The results of the force tests of the model with and without the horizontal tail are given in this paper. Some comparisons of the experimental results with the existing theory of the Phenomena involved are given.

Effect of Propeller Operation on Wing-Fuselage Combination

Agreement between experimental lift coefficients with propeller operating and theoretical predictions is good for the flaps-retracted condition; but with flaps deflected, satisfactory agreement is found only at low angles of attack. Since the thrust axis for this aircraft is slightly above the c.g., the thrust causes a small increment of diving moment for the flaps retracted condition while the effect of the slipstream on the wing-pitching moment coefficient maybe considered negligible for this airplane. Flap deflection caused a large increment of diving moment with propeller operation increasing this diving moment.

Forces and Air Flow at Tail

Elevator effectiveness either decreased or increased slightly with angle of attack as the horizontal tail advanced into or receded from the wake (for propellers removed). Flap deflection resulted in only a slight increase of rudder effectiveness. Experimental values for elevator hinge moment coefficients for isolated and attached tail are in satisfactory agreement but are lower than the theoretical values computed from thin-airfoil theory. For propellers operating at constant thrust coefficient the elevator effectiveness increases with angle of attack. When propellers are operating, there exists an increment of downwash associated with the vertical component of the propeller forces. A further increment of downwash at the tail may exist as a result of the rotation imparted to the airstream by the propeller. As a result of the increased downwash at the tail due to the thrust, the effect of propeller operation is to increase the downward force on the tail.

WR L 430 A THEORETICAL INVESTIGATION OF LONGITUDINAL STABILITY OF AIRPLANES WITH FREE CONTROLS INCLUDING EFFECT OF FRICTION IN CONTROL SYSTEM, Harry Greenberg and Leonard Sternfield, February 1944

The purpose of this report is to make a theoretical analysis of the control-free longitudinal stability of an airplane, which takes into account a trend toward positive floating tendency (tendency to float against the relative wind) in control-surface design. Parameters considered included restoring tendency, floating tendency, mass unbalance (bobweight control), moment of inertia, viscous and solid friction; and for the airplane, density and c.g. position. The method of analysis of dynamic stability is based on the classical theory of Bryan and Bairstow extended to include movements of the controls and their couplings with the airplane motions. Some discussion is given of the effect of the various parameters on the elevator forces for trim and for accleration. The Evaluation of Stability Derivatives is given as an appendix. The study of the effects of different parameters on the control-free stability was made by a series of computations for an average airplane.

Static Stability and Relation to Control Forces

The formulas developed indicate that the stick force gradients Fu and Fn (level flight and maneuvers) are dependent on the airplane and elevator parameters. The gradients are independent of speed when power and compressibility effects are neglected. The stick force in a steady pull-up is proportional to the normal acceleration provided the control deflection is not so great that the basic assumption of linearity is violated. Stick force gradients on an airplane of given tail size and c.g. position may be increased by making the floating tendency $C_{n_{\alpha_t}}$ more positive or by mass-unbalancing the elevator control system to depress the elevator. Another method of increasing the stick-force-gradients in level flight consists of applying a constant hinge moment to the elevator by means of a spring or bungee.

Dynamic Stability

The addition of viscous friction to the control system will prevent dynamic instability provided the airplane c.g. is forward of a critical position which is behind the aerodynamic center. The dynamic stability with frictionless controls depends chiefly on the restoring tendency C_{h_δ} and on the mass balance of the elevator control system. The presence of solid friction in the control system may cause short-period steady oscillations under the conditions for which viscous friction is destabilizing.

WR L 446 THE EFFECT OF PITCH ON FORCE AND MOMENT CHARACTERISTICS OF FULL-SCALE PROPELLERS OF FIVE SOLIDITIES, Jack F. Runckel, June 1942

Varying the angle of pitch of a propeller, besides changing the efficiency, thrust, and power, introduced vertical and side forces as well as pitching, yawing, and rolling moments; of these effects, efficiency, vertical forces, and yawing moment have an important effect on performance and stability.

Pitching the propeller had little effect, in general, on the efficiency until the angle of pitch was greater than 5°; beyond this value of the angle of pitch, the loss became appreciable, depending upon the blade angle and the number of blades. The loss in efficiency due to pitch increased with propeller solidity and blade angle. This loss amounted to as much as 0.12 for a six blade propeller operating at 45° blade angle and 15° angle of pitch. The loss was about the same for dual rotation as for single rotation. The side forces and the pitching moments as found in these tests were small and except for an airplane of low stability, these forces and moments could probably be neglected. The vertical force increased with the angle of pitch throughout the entire range of V/nD, while the yawing moment increased with pitch only in the lower part of the V/nD range.

The yawing moment, rolling moment, and side force nearly vanished with dual rotation; but the vertical force increased.

Higher solidity increased the vertical force and generally increased the yawing moment. The forces and moments measured generally increased as the blade angle increased.

WR L 461 INFLUENCE OF LOADING CONDITION ON PILOTING TECHNIQUE FOR SPIN RECOVERY FOR PURSUIT AIRPLANES, H. A. Soule and Oscar Seidman, June 1942

Information relative to the influence on spins and spin recovery of the wing loading and load distribution of pursuit type airplanes is discussed for the guidance of pilots. High wing loadings and rearward center-of-gravity locations make for more difficult spin recoveries. The high wing loadings also result in high rates of descent and large control forces for recovery. The position of the ailerons may have a considerable effect on both the steady spin and the recovery. The optimum position of the aileron depends on the relative weight carried in the fuselage and along the wings and may change with the expenditure of load in flight. Unless conditions for a particular airplane are completely understood, therefore, care should be taken to maintain the ailerons neutral.

Only upright spins have been considered as these spins represent the type most commonly encountered.

Effect of Wing Loading

As the wing loading is increased the spins tend to flatten, the rate of descent increases, and the recovery slows. For fully loaded pursuit airplanes, rates of descent of 200 mph at 10,000 feet should not be unusual. At this rate the altitude loss per turn is about 650 feet. It is of interest to note that an increase in altitude increases the difference between the densities of the airplane and the air and has much the same effect on the spin as an increase in wing loading.

The high speeds on the flight path appear to be directly responsible for the high control forces because the control force varies as the square of the speed. The trim tab should be of considerable aid in lightening the control forces for recovery.

Effect of Distribution of Load

Many tests have indicated that the effectiveness of each of the airplane controls in spin recoveries is dependent upon the distribution of load. When loads are carried mainly in the fuselage the rudder is the predominant control during spin recovery. When considerable weight is carried in the wing, the rudder becomes less effective and the elevator more effective, while the optimum position for the ailerons is reversed.

WR L 464 WIND-TUNNEL INVESTIGATION OF CONTROL-SURFACE CHARACTERISTICS V - THE USE OF A BEVELED TRAILING EDGE TO REDUCE THE HINGE MOMENT OF A CONTROL SURFACE, Robert T. Jones and Milton B. Ames, Jr., March 1942

Wind-tunnel tests have been made to investigate the possibility of reducing the hinge moments of a control surface by beveling the trailing edge.

In these tests, a moderate bevel on a 30% chord flap produced a 50% reduction in the hinge moment caused by a given flap deflection. This balancing effect extended over a wide angular range and showed a smooth variation with angle of attack and with flap deflection. The profile-drag coefficient showed an increase of 0.0004.

Overbalance and reversal of the floating tendency over a small angular range were obtained when rather blunt bevels were tested. The effect of trailing-edge shape is expected to be even more pronounced as the chord of the flap is reduced, indicating the necessity for careful construction of narrow flaps.

WR L 483 THE SELECTION OF PROPELLERS FOR HIGH THRUST AT LOW AIRSPEED, David Biermann and Robert N. Conway, October 1941

An analysis was made of several methods for improving the thrust of propellers operating at low airspeeds. The analysis consisted of determining the improvements in thrust or efficiency which could be obtained by the following:

Increased number of blades
Increased blade width
Increased diameter
Dual rotation
Two-speed gearing

The analysis indicated that all of the above methods were very effective in increasing the efficiency of highly loaded propellers operating at low airspeeds, particularly the last one (gearing).

Conclusions:

Increasing the number of blades from three to six was found to result in substantial improvements in the low speed thrust, particularly for the higher power loadings. Eight-blade propellers were found to produce only a slightly higher thrust than six-bladed propellers. Increased solidities resulted in small reductions in the efficiencies at higher speeds.

Increasing the solidity by means of increasing the blade width was found to have the same results as increasing the number of blades, within the scope of the analysis.

Increasing the blade area by means of increasing the diameter had about the same effect on the low speed thrust as increasing the solidity, for equal tip speeds.

Dual rotation resulted in a small improvement in the efficiency over the entire operating range, particularly for the more highly loaded propellers.

Two speed gearing was found to be very effective in increasing low speed thrust, particularly so for low solidity propellers operating under highly loaded conditions.

A combination of six-blade, dual-rotation, two-speed gearing was found to provide a means for approximating closely the ideal efficiency of highly loaded propellers.

WR L 503 FLIGHT INVESTIGATION OF A STALL-WARNING INDICATOR FOR OPERATION UNDER ICING CONDITIONS, Alun R. Jones and John A. Zalovcik, July 1942

1. The loss in total pressure at the trailing-edge rake, when referred to freestream total pressure, was too greatly influenced by the ice formations to serve as a basis for warning of the approach of the stall.

2. The change in local velocity at the trailing edge was sufficient and consistent enough to serve as stall warning, but the effect of the deflected flaps on the local velocity would require the indicator setting to be a function of flap position.

3. The difference between the total pressure at the trailing edge and either the free-stream static pressure or the static pressure of the swiveling airspeed head changed sufficiently to serve as a basis for stall warning in all the conditions tested. The variation of total pressure loss, however, was too small to justify the practical application of this loss as a basis for stall warning indication; further development would be desirable to produce a large pressure change at the warning device when the total pressure in the boundary layer reached the critical value.

4. For the cruising condition, the degree of section stall warning varied with increasing wing loading from 10 mph with normal wing loading to 16 mph with the wing loading corresponding to a normal acceleration of 1.5g produced by banking the airplane.

WR L 504 EFFECT OF WING LEADING-EDGE SLOTS ON THE SPIN AND RECOVERY CHARACTERISTICS OF AIRPLANES, Anshal I. Neihouse and Marvin Pitkin, April 1943

An investigation has been made in the NACA 15-foot free-spinning tunnel to determine the effect of wing leading-edge slots on spin and recovery characteristics. Results obtained from these tests establish a criterion from which the adverse or favorable effects of slots may be predicted from a nondimensional mass-distribution parameter.

Five airplane models of widely different types, all having slots, were tested with the slots both open and closed. The mass distributions were varied to cover a wide range of loadings from a single-engine mass distribution with mass distributed chiefly along the fuselage to a multi-engine mass distribution with mass distributed chiefly along the wings. The effects of the slots on the steady-spin and recovery characteristics were determined.

Recovery is attemped by full and rapid reversal of the rudder. The turns for recovery are taken as the number of turns made by the model from the time the rudder is reversed until the spin rotation ceases.

Results

1. Leading-edge slots, either partial or full span, may seriously affect the recovery from the spin. The effect may be either adverse or favorable depending on the mass distribution of the airplane.

2. The adverse or favorable slot effect may be generally predicted from design data by use of a nondimensional mass-distribution parameter.

3. For single-engine designs with mass distributed heavily along the wings and for multi-engine designs, open slots have an adverse effect on spin recoveries. For single-engine designs heavily loaded along the fuselage, open slots generally improve spin recoveries when the elevator is neutral or down; there is only little effect when the elevator is full up.

4. Open slots tend to depress the inboard wing in a spin regardless of mass distribution. For mass distributions for which open slots have an adverse effect on recovery, the spin is flatter and and the rate of descent lower with slots open than with slots closed. For mass distributions for which open slots are favorable to recovery, there is only little effect upon the steady spin when the slots are opened.

WR L 529 STATIC CHARACTERISTICS OF HAMILTON STANDARD PROPELLERS HAVING CLARK Y AND NACA 16-SERIES BLADE SECTIONS, Blake W. Corson, Jr., and Nicholas Mastrocola, August 1941

The purpose of this investigation was to determine the relative merits of the Clark Y propeller sections and the NACA 16 series sections at various propeller tip speeds. The propellers are compared on the basis of a static thrust power figure of merit. As a further analysis, use is made of Deiggs' Simplified Propeller Calculations, Reference 2, for reducing the propeller characteristics to quasi airfoil characteristics. The airfoil polars so obtained are then reconverted into the propeller envelope efficiency as a function of the advance ratio. A comparison of the efficiencies computed from static data indicates that a propeller having 16 series sections may give about three percent higher efficiency than a Clark Y propeller of similar blade form, when the blade sections operate at tip speed ratios of about M = 0.9 or M = 1.0. The propeller with Clark Y blade sections appears to be superior to that with the 16 series sections for take off and climb. Redesign of the 16 series propeller with greater blade area and for higher tip speeds might produce a propeller with much better take off characteristics with little sacrifice of efficiency at high speed.

Reference 1
Gray, W. H.: Wind Tunnel Tests of Two Hamilton Standard Propellers Embodying Clark Y and NACA 16 Series Blade Sections. NACA MR, August 20, 1941.

Reference 2
Driggs, Ivan H.: Simplified Propeller Calculations. Jour. Aero. Sci., Vol. 5, No. 9, July 1938, pp. 337-344.

WR L 530 WIND-TUNNEL TESTS OF TWO HAMILTON STANDARD PROPELLERS EMBODYING CLARK Y AND NACA 16-SERIES BLADE SECTIONS, W. H. Gray, August 1941

Tests of two 10-foot Hamilton Standard propellers were made in the propeller research tunnel to determine the relative merits of the Clark Y and NACA 16 series sections and to determine the thrust available at negative angles. The propellers were of identical plan form. Tests covered a range of blade angles from -25° to 65°, and were all made at tip speeds of from 0 to 280 feet per second. Characteristics curves for 6259A-18 (NACA 16 throughout) and characteristics curves for 6267A-18 (Clark Y throughout) are shown.

The results indicated comparatively little difference between propellers at peak efficiency for the low Mach numbers experienced in the tunnel tests. The NACA 16 series sections displayed earlier stalling characteristics than the Clark Y section.

WR L 546 THE EFFECT OF ALTITUDE ON BOMBER PERFORMANCE, Paul R. Hill and John L. Crigler, October 1943

This study considers the effect of operating altitude upon performance. The chief emphasis in this report is placed on range performance. Charts are presented which give range as a function of wing loading, power loading, and design altitude. Performance selection charts are then presented which show the high speed, the rate of climb at design altitude, the take-off run at sea level, and the range. The charts are presented for airplanes with design altitudes of 10,000, 20,000, 30,000 and 40,000 ft.

Range computations are made by the use of the Brequet range equation, and are made for maximum L/D and constant power for various operational and design altitudes. The effects of altitude on specific fuel consumption, weight changes due to addition of altitude equipment, parasite drag, propeller efficiency for optimum propeller designs, disposable load, and cooling power are considered for operation at L/D_{max} as well as constant power.

The following factors are considered individually in an appendix; power plants, cooling power, propellers, drag, span factor, aspect ratio, load factor, wing thickness weights and calculation of performance.

WR L 568 STATIC CHARACTERISTICS OF CURTISS PROPELLERS HAVING DIFFERENT BLADE SECTIONS, Blake W. Corson, Jr., and Nicholas Mastrocola, August 1941

The purpose of this investigation was to determine the relative merits of Curtiss propellers having Clark Y, double cambered Clark Y, and NACA 16 series propeller sections under various loading and at various tip speeds. The propellers are compared on the basis of a static thrust figure of merit. As a further analysis, use is made of Driggs Simplified Calculations, Reference 2, for reducing the propeller characteristics of quasi-airfoil characteristics. The airfoil polars so obtained were reconverted into the propeller envelope efficiency as a function of the advance ratio, for two of the propellers.

The propeller with Clark Y blade sections yields slightly higher efficiency in take off and climb than the modified 16 series sections. The propeller with modified 16 series sections may yield efficiencies higher by 2 or 3% than a similar propeller with Clark Y sections at high speeds for same airplane. The double cambered Clark Y gives only slightly lower efficiency than the modified 16 series section for high speed and slightly higher efficiencies for take off. Redesign of the 16 series propeller with greater blade area and for higher tip speeds might produce a propeller with much better take off characteristics with little sacrifice of efficiency at high speed.

Reference 1
Gray, W. H.: Wind Tunnel Tests of Four Curtiss Propellers Embodying Different Blade Sections. NACA MR, August 21, 1941.

Reference 2
Driggs, Ivan H.: Simplified Propeller Calculations. Jour. Aero. Sci., Vol. 5, No. 9, July 1938, pp. 337-344.

Reference 3
Hartman, Edwin P. and David Biermann: Static Thrust and Power Characteristics of Six Full Scale Propellers. NACA Rep. 684, 1940.

WR L 569 WIND-TUNNEL TESTS OF FOUR CURTISS PROPELLERS EMBODYING DIFFERENT BLADE SECTIONS, W. H. Gray, August 1941

This report covers the wind tunnel tests to check flight and static thrust tests results which (reference 1) indicated that the Clark Y section was 10 to 15% superior to the modified NACA 16-series propeller for the take off condition; but that the modified NACA 16 series propeller was from 0 to 3% more efficient at high speed.

The purpose of these tests was to determine the relative merits of the Clark Y and a modified NACA 16 series section for the various flight conditions.

The blades had sections with both single- and double-cambered Clark Y, modified NACA 16 series, and a combination of Clark Y and modified NACA 16 series. The tests covered a range of blade angles from 20° to 70° and were all made at tip speeds below 280 feet per second.

The results of the NACA 16-series point out that lower drag qualities at high speeds permit the use of larger blade areas, operation at higher speeds, or the employment of sections designed for higher values of C_L; all of which will increase the take off thrust.

Reference 1
Anon.: Comparison of Flight Test on Propellers Using Clark Y, NACA 16 and Combination Clark Y and NACA 16 Profiles. Rep. C-1123, Curtiss Propeller Div., Curtiss Wright Corp., November 11, 1940.

Reference 3
Corson, Black, Jr., and Nicholas Mastrocola: Static Characteristics of Curtiss Propellers Having Different Blade Sections. NACA MR., August 27, 1941.

WR L 582 TESTS OF FOUR FULL-SCALE PROPELLERS TO DETERMINE THE EFFECT OF TRAILING-EDGE EXTENSIONS ON PROPELLER AERODYNAMIC CHARACTERISTICS, Julian D. Maynard and Albert J. Evans, September 1942

This report is to determine experimentally the effect of trailing edge extensions on the aerodynamic characteristics of four propellers.

Propeller blades:

Blade Design No.	Type of Extension	Length of Extension, Percent Chord	Angle of Extension at 0.7 Radius (deg)
109374	None	-	-
109376	Straight	40	6.5°
109378	Cambered	20	-
109376 Modified	Straight	20	6.5°

The blade angles we e varied from 20 to 55 at three quarter radius, and the airspeed was varied from 60 to 460 mph.

A theoretical analysis has been made in reference 1, and the method of reference 1 is applied in reference 2 to the calculation of propeller characteristics.

Extension of the trailing edge of a propeller blade greatly increases the power absorption qualities of the propeller with little loss in efficiency. Based on equal power absorption and constant rotational speed, the efficiency of the propellers with trailing edge extensions was about the same or perhaps greater than the efficiency of the propeller without an extension for a cruising or a high speed condition of operation at a high power coefficient.

Straight type trailing edge extension of 20 and 40% increased the power coefficient for maximum efficiency by an amount almost equal to the percent extension at an advance ratio of 1.0. At values of advance ratio greater than 1.0 the increase in power coefficient becomes smaller; and at values less than 1.0, or in the take off range, the percent increase in power coefficient is greater than the percent extension. A 20% cambered extension increased the power coefficient for maximum efficiency considerably, more than a 20% straight extension over the range of advance from 1.0 to 2.5. The propeller with the 20% cambered extension was from 1 to 3% less efficient than the propeller with the 20% straight type of extension over this range of advance ratio.

Reference 1
Theodorsen, Theodore and George W. Stickle: Effect of a Trailing Edge Extension on the Characteristics of a Propeller Section. NACA ACR L4I21, 1944.

Reference 2
Crigler, John L: The Effect of Trailing Edge Extension Flaps on Propeller Characteristics. NACA ACR L5A11, 1945.

WR L 605 MEASUREMENT OF FLYING QUALITIES OF A DOUGLAS A-26B AIRPLANE (AAF NO. 41-39120) I - LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS, H. L. Crane, S. A. Sjoberg and H. H. Hoover, December 1944

Flight tests have been made to determine the longitudinal stability and control characteristics of a Douglas A-26B airplane and are presented in this report which is one of a series of reports concerning the flying qualities of this airplane. The A-26B is a three-place, twin engine, midwing airplane, having double-slotted flaps and a retractable tricycle landing gear. The airplane was all metal with the exception of fabric covered control surfaces. The airplane weight varied from 27,000 to 31,000 pounds during the tests. The results of the tests are evaluated in terms of the specifications of AFF Specification No. C-1815 August 31, 1943.

The conclusions reached regarding the longitudinal stability and control characteristics of the A-26B airplane may be summarized as follows:

1. Abruptly deflecting and releasing the elevator produced no oscillation of the elevator or airplane.

2. With the c.g. at 32% MAC the airplane had satisfactory stick-fixed stability except with flaps full down and power on.

3. Stick-free stability was unsatisfactory with c.g. at 30% MAC with flaps full down and power on or in the climbing condition where neutral stability existed for maximum rate of climb.

4. At the forward c.g. limit the control-force gradient was 102 pounds per g.

5. The trim changes due to power and flaps were not excessive except when the airplane was trimmed for power-off flap-down flight and full power was applied and the flaps were retracted.

WR L 606 MEASUREMENT OF FLYING QUALITIES OF A DOUGLAS A-26B AIRPLANE (AAF NO. 41-39120) II - LATERAL AND DIRECTIONAL STABILITY AND CONTROL CHARACTERISTICS, S. A. Sjoberg, H. L. Crane and H. H. Hoover, January 1945

This report presents the results of the tests of lateral and directional stability and control of the Douglas A-26B airplane.

1. The control-free lateral and directional oscillations of the airplane were satisfactorily damped.

2. The sideslip due to full aileron deflection at 120% stalling speed was about 1/2 of the permissible limit.

3. Effective dihedral became marginal at large angles of sideslip (stick-free).

4. Side force due to sideslip was always in the right direction.

5. Rudder control was satisfactory in all respects.

6. Variation of rudder and aileron force with speed was small.

7. The response to abrupt aileron deflection was small.

WR L 607 MEASUREMENT OF FLYING QUALITIES OF A DOUGLAS A-26B AIRPLANE (AAF NO. 41-39120) III - STALLING CHARACTERISTICS, S. A. Sjoberg, H. L. Crane and H. H. Hoover, January 1945

The results of tests made to determine the stalling characteristics, the variation of maximum normal force coefficient with flap position, and a calibration of the service airspeed installation for a Douglas A-26B airplane are reported.

1. This airplane had good stalling characteristics in all conditions tested in both straight and turning flight.

2. The average maximum normal-force coefficients obtained with engines idling were 1.32 with flaps up and 1.94 with flaps full down.

WR L 634 CHARACTERISTICS OF SEVERAL SINGLE- AND DUAL-ROTATING PROPELLERS IN NEGATIVE THRUST, W. H. Gray and Jean Gilman, Jr., March 1945

Thrust and power characteristics of several single- and dual-rotating propellers differing in blade width and number of blades are presented for the region of negative-thrust operation from -45° to 145° blade angle. The tests reported are an extension of previous single- and dual-rotating propeller tests utilizing blades of Hamilton Standard 3155-6 (Clark Y section) design. Negative thrust has a number of potential uses; among which are reduction of landing run, reduction of terminal velocity in diving flight, tactical maneuvering of fighters, maneuvering of multiengine seaplanes on water, and mooring lighter-than-air ships. Tests were made using single-rotating propellers having three and four blades and dual-rotating propellers having four, six, and eight blades.

Results

1. For similar propeller blade designs, characteristics may be predicted in the negative-thrust range to a limited degree of accuracy for any activity factor, provided the propeller characteristics are known for one value of activity factor.

2. Adequate negative thrusts may be possible at extremely high positive as well as negative blade angles.

3. At low values of J (J is the advance ratio = V/nD.), single rotation propellers produced higher negative-thrust coefficients than dual rotation, but values of J higher than about 1.5, dual rotation gave higher coefficients.

WR L 664 EFFECTS OF TRAILING-EDGE MODIFICATIONS ON PITCHING-MOMENT CHARACTERISTICS OF AIRFOILS, Paul E. Purser and Harold S. Johnson, September 1944

The available data on the effects of trailing-edge modifications on the pitching-moment characteristics of airfoils have been collected and briefly analyzed. With the control-surface gap sealed, the location of the airfoil aerodynamic center moved forward as the included angle between the upper and lower surfaces of the airfoil at the trailing edge was increased and as the airfoil thickness at 0.9 chord was increased. The variation of pitching-moment coefficient with control-surface deflection, at constant lift coefficient with gap sealed, decreased as the trailing-edge angle was increased but the effect of the airfoil thickness near the trailing-edge could not be determined because of insufficient data.

The addition of roughness to the airfoil leading edge appeared to intensify the tendency of trailing-edge modifications to move the aerodynamic center. Changes in Reynolds number within the test range did not appear to change the effects of trailing-edge modifications on the pitching-moment characteristics. No attempt was made to determine the effects of unsealed control-surface gaps on the pitching-moment characteristics because of the inconsistency of the data.

WR L 671 EFFECT OF AIRPLANE DESIGN EFFICIENCY AND ENGINE ECONOMY ON RANGE, Maurice J. Brevoort, George W. Stickle, and Paul R. Hill, December 1942

The parameters affecting the performance of an airplane may be divided into two groups:

Primary - altitude, power, gross weight, wing area
Secondary (efficiency) - engine economy, aerodynamic efficiency, structural efficiency

This report examines the effect of magnified variations of the secondary or efficiency parameters to determine their influence upon performance. The effect of efficiency parameters on performance is computed for two bombers, that is, for two sets of primary or dimensional parameters. An appendix presents the usual selection charts with values of the efficiency parameters used in this report.

The analysis shows that the efficiency parameters are comparatively ineffective insofar as performance is concerned.

WR L 673 GENERALIZED PERFORMANCE SELECTION CHARTS FOR SINGLE-ENGINE PURSUIT AIRPLANES, H. Reese Ivey, George W. Stickle, and Maurice J. Brevoort, February 1943

The NACA has carried out an investigation of the effect of wing loading, power loading, and aspect ratio on the performance of pursuit airplanes. The study is based on data combined from specifications, wind-tunnel and flight tests of various modern fighter airplanes, and the results are presented on graphs that show the performance that may be obtained by airplanes having an aerodynamic cleanness that is approximately the best found as of February 1943. The charts are prepared for airplanes powered by one 2000-horsepower radial air-cooled engine, but are placed on cordinates that allow their use for airplanes of different power for the determination of trends. The performance characteristics that are related to the parameters considered are: speed, rate of climb, take-off distance, rate of roll, radius of turn, and time of turn. The main purpose of this report is to show the trends of performance in a convenient graphical form that may be used without laborious computations. The following appendices are presented:

Airplane Characteristics (includes assumptions made in developing the Charts)

Performance Calculations
Discussion of the Limitations and Coordinates of Charts

The general conclusions reached are:

1. Increased power loading adversely effects take-off distance, rate of climb, minimum radius of steady turn, and time to turn.
2. Increased wing loading adversely effects take-off distance, minimum radius of steady turns and accelerated turns, and time to turn.
3. The maximum speed increases with wing loading and decreases with power loading in the normal range of values used for pursuit airplanes.
4. At high forward speed where the ailerons deflection is determined by the stick force, the rate of roll decreases with forward velocity and wing area. For this condition the rate of roll is unaffected by aspect ratio. At low forward speeds where the pilot can give the ailerons full deflection, the rate of roll increases with forward speed and decreases with wing span. In this case low aspect ratio is advantageous.

WR L 706 CHARTS SHOWING STABILITY AND CONTROL CHARACTERISTICS OF AIRPLANES IN FLIGHT, Stability and Control Section of Flight Research Division, December 1944

Conferences were held to acquaint the flight organizations of the aircraft industry with the flight test method employed by the NACA and to standarize the techniques insofar as possible as they are employed by the various manufacturers and agencies in determining the flying qualities of airplanes. To facilitate the discussion a series of charts was presented which portrayed typical good and undesirable airplane characteristics as determined in flight. Copies of the charts are presented in this report.

WR L 710 DETERMINATION OF THE STABILITY AND CONTROL CHARACTERISTICS OF AIRPLANES FROM TESTS OF POWERED MODELS, Isidore G. Recant and Robert S. Swanson, July 1942

A technique of testing wind-tunnel powered models has been developed as a result of experience gained in the investigation of the static longitudinal and lateral-stability and control characteristics of several powered models in the NACA 7-by-10 foot wind tunnel. The report has been divided into 3 parts. Part I presents a discussion of the conditions to be investigated along with a tentative minimum program of the tests considered necessary to specify satisfactorily the static stability and control characteristics. A suggested operating procedure is presented in Part II and in Part III the results of some tests on a typical powered model as well as a discussion of the effects of power on stability are given.

A summary of the tests, believed to be the smallest number consistent with a satisfactory determination of the static-stability characteristics, required for a routine investigation of the static-stability and control characteristics of a model is presented in the form of two tables listing different flap conditions, landing gear conditions, stabilizer deflections, elevator deflections, elevator-tab deflections, and power conditions as well as angle of attack, rudder deflection, rudder tab deflection, and aileron deflection. Tests are conducted at the following power conditions: full power, windmilling, and half power. The basic conditions of flight; take-off, climbing, gliding, straight and level, landing, and the stalled or spinning conditions are investigated with the various representative power conditions. The criterions necessary for properly simulating the various power conditions and the general methods used to estimate the numerical values of the airplane criteria and the methods necessary to reproduce these criteria for the model tests are given in the report. A method for determining the full scale propeller characteristics as well as a discussion of model propeller characterisitics are presented.

As to the effects of power upon stability, the following general statements are made:

1. On single-engine, low-wing models, power decreased the longitudinal stability and the effective dihedral.

2. The directional stability and the rudder and elevator effectiveness were usually increased by power.

3. Power-off tests of models may give results that are misleading with regard to the static stability of the full-scale airplane; whereas, power-on tests give results that are in close agreement with flight tests. About 40 or 50 graphs are presented showing the effect of propeller operation.

WR L 721 MULTIENGINE AIRPLANE SPIN CHARACTERISTICS AS INDICATED BY MODEL TESTS IN THE FREE-SPINNING WIND-TUNNEL, Oscar Seidman and Robert W. Kamm, July 1942

The multi-engine airplanes have steep spins with high rates of descent and high load factors. Movement of the elevators down and ailerons against the spin is especially effective for recovery. The rudder may be relatively less effective. For spins of single-engine airplanes loaded along the fuselage, the rudder is usually the most effective control and the ailerons should be moved with the spin to aid recovery. The difference in characteristics of the spins appears to be associated with the difference in mass distribution.

WR L 750 STATIC-THRUST AND TORQUE CHARACTERISTICS OF SINGLE- AND DUAL-ROTATING TRACTOR PROPELLERS, Jean Gilman, Jr., June 1944

A program of outdoor tests was carried out to determine the static-thrust and torque characteristics of single- and dual-rotating propellers for use in aircraft propeller design and in take-off performance estimation. The propellers used for the tests were 10 feet in diameter and were made up of blades of Hamilton Standard design, drawing numbers 3155-6-1.5. The characteristics were investigated over a considerable range of solidity for both single- and dual-rotating propellers. Blade-angle settings ranged from 10° to 40° in 50° increments. The propeller characteristics are presented as functions of the blade-angle setting at the three-quarters radius and, for comparison, as a function of the power coefficient. Design charts showing the variation of thrust with total activity factor are included. The program covered tests of two-, three-, four-, six-, and eight-blade single-rotating and four-, six-, and eight-blade dual-rotating propellers of standard blade width. In addition, three- and four-blade single-rotating and six- and eight-blade dual-rotating propellers of 50 percent increase in thickness and blade width were included. The blade-angle range was from 10° to 40°. The Reynolds number was of the order of 900,000 for the standard-width blade.

Dual-rotating propellers exhibited a substantial gain in static thrust and power absorption over the corresponding single-rotating propellers. On the basis of equal power absorption, the six-blade dual-rotating propeller was found to be capable of producing approximately the same static thrust as the eight-blade single-rotating propeller, both propellers having standard-width blades. At equal solidity or total activity factor, wide-blade single-rotating propellers produced a higher static thrust for a given power coefficient than did the equivalent propellers with standard-width blades. The agreement of C_T/C_P as obtained from static-test and extrapolated results of wind-tunnel tests, while generally fair, was found in one case to vary as much as 19 percent.

WR L 753 AERODYNAMIC PROBLEMS IN THE DESIGN OF EFFICIENT PROPELLERS, Edwin P. Hartman and Lewis Feldman, August 1942

This paper deals primarily with the phases of design that tend to improve the high speed efficiency of a propeller. It is divided into three parts: Part 1 deals with the development of the blade loading that gives a minimum induced energy loss, profile drag assumed to be zero; Part 2 considers the various effects of profile drag and presents a method for determining the optimum planform and the optimum sections for a propeller when profile drag is not neglected; and Part 3 deals with a sample computation of propeller design.

The effect of profile drag on the optimum planform is shown and a fairly simple method for obtaining the blade shape for minimum total energy loss is presented. A method for choosing the lift coefficient, the blade width, and the blade thickness ratio that will produce a minimu profile drag is also given, although its usefulness is impaired by the limited supply of experimental data available.

The results of the computations show that profile drag has a large effect on the optimum planform.

WR L 761 EFFECT OF PROPELLER OPERATION ON THE PITCHING MOMENTS OF SINGLE-ENGINE MONOPLANES, Harry J. Goett and H. R. Pass, May 1941

Investigation of the effects of propeller operation on pitching moment, especially the effect of propeller forces, field of flow in the slipstream, and increments of lift on wing and tail are considered. Two single-engine monoplanes without flaps were flight tested. The procedure is applicable only to single-engine monoplanes.

The location of the thrust line relative to the center of gravity is the most important single factor for determining the effect of propeller operation on pitching moments. The direct effect of propeller forces on pitching moment of the airplane can be calculated with satisfactory accuracy by methods given, and the effect of slipstream on pitching moment of wing - fuselage combination may be neglected. The slipsteam increases the velocity of the air at the tail but also increases downwash. Wing downwash and the downwash in the slipstream of an inclined propeller. are approximately additive at the tail.

WR W 5 WIND-TUNNEL PROCEDURE FOR DETERMINATION OF CRITICAL STABILITY AND CONTROL CHARACTERISTICS OF AIRPLANES, Harry J. Goett, Roy P. Jackson and Steven E. Belsley, April 1944

This report outlines the flight conditions that are usually critical in determining the design of components of an airplane which affect its stability and control characteristics. The wind-tunnel tests necessary to determine the pertinent data for these conditions are indicated, and the methods of computation used to translate these data into characteristics which define the flying qualities of the airplane are illustrated. The purposes of this report are threefold:

1. To outline the critical conditions for each component of the airplane.

2. To indicate wind-tunnel tests necessary to determine pertinent data.

3. To illustrate the methods of computation used to translate these data into characteristics which define the flying qualities of an airplane.

An outline for a preliminary series of wind-tunnel tests designed to obtain data from which any initial readjustments of airplane components, necessary to assure satisfactory characteristics in light of flying qualities requirements, can be determined is given in tables for both single engine and twin engine aircraft. The method of translating the wind-tunnel results into the terms of the flying qualities specification is outlined in figures presenting a typical set of results. The choice of critical conditions and the tables have been made after a detailed study of the characteristics of 3 typical single engine airplanes and 3 twin-engine airplanes with right-hand propellers. In each case it was found that if the 10 major points as outlined were satisfied the other characteristics called for in the flying qualities specifications would be met. It is believed that this conclusion will be similar for other conventional airplanes.

Ten major variables in airplane design can be determined using this method.

1. Horizontal tail size
2. Elevator size
3. Elevator balance
4. Minimum dihedral
5. Maximum dihedral
6. Aileron size
7. Aileron balance
8. Vertical tail size
9. Rudder size
10. Rudder balance

Methods used to reduce the data to flying qualities characteristics are outlined with the use of figures that are intend d to be detailed so as to require no further explanation.

WR W 45 DE-ICING OF AN AIRCRAFT-ENGINE INDUCTION SYSTEM, Henry A. Essex, August 1943

De-icing of an induction system with de-icing fluid was investigated for the following system:

i) simulated air scoop
ii) Holley 1375-F carburetor
iii) carburetor adaptor
iv) Wright R-1820, G200 supercharger rear section.

Results: (General)

1. No improvement in de-icing effectiveness was gained by stopping the ingestion of free water into the induction system at the start of the de-icing process. However, the possibility of re-icing was eliminated.

2. De-icing fluid should be injected as closely upstream as possible to the region to be de-iced in order to reduce fluid evaporation and dilution by water on the walls of the induction system and in the air stream.

3. Manipulation of the carburetor throttles during the first few seconds of fluid de-icing resulted in faster removal of large ice deposits.

4. De-icing fluid, to be most effective, should have a low vapor pressure, a low latent heat of vaporization, and a large freezing point depression.

5. Heated air, when properly applied, was fully as effective in restoring air flow and operable fuel air ratio as any of the fluid de-icing systems tested.

WR W 59 PROTECTION OF NONMETALLIC AIRCRAFT FROM LIGHTNING. I - GENERAL ANALYSIS, High Voltage Laboratory, September 1943

It is the purpose of this report to attempt in a preliminary way to give a logical and consistent analysis of the problem of providing adequate protection to the personnel, contents, and structure of non-metallic aircraft against the effects of electric shock, mechanical damage, and fire which are almost certain to occur if an unprotected aircraft is struck by lightning. Lightning conductors in non-metallic aircraft should perform the four following functions:

1. Intercept and direct stroke approaching the aircraft.

2. Guide a discharge away from any part of the craft where its blasting or igniting effects would cause damage (confined air space, within wooden skin or structural members).

3. Minimize electromagnetic induction which might circulate an appreciable fraction of the discharge through the bodies of personnel or thru nearby circuits that might be damaged.

4. Shield the contents of the aircraft electrostatically to minimize tendency to side flash.

Interception of Stroke

Some part of the lightning conductor should be exposed at any point where lightning may strike the plane (metallic skin for metallic airplanes performs this purpose except at windows and antennas). Strokes are likely to strike projecting extremities (wing tip, nose, or tail) however.

Guiding of Stroke

If the tip of the lightning discharge streamer strikes a conductor leading in the general direction of the electric field the lightning current will flow in the conductor and be guided by it unless:

1. The conductor is bent to such an extent that the inductive voltage $L\,dI/dt$ in any portion of the conductor is greater than the sparking voltage between the ends of that portion, in which case a spark will occur thru an insulating medium (the air).

2. The discharge current encounters an insulating material. If it encounters plywood:

   a. The discharge may continue as an arc thru the air causing blast effect and scorching.
   b. The discharge may puncture the insulator and pass inside the structure (wing or control element) to the nearest conductor. If explosive vapors (as from spilled gasoline) are present they may explode.
   c. The discharge may pass along the grain of the plywood due to the presence of residual moisture. Shattering may well occur.

Note: A strip 1 cm wide of conducting paint with resistance of 2500 ohms per cm is sufficient to keep the discharge in the air outside the plywood panel.

Electromagnetic Induction Effects

Because of the very high rates of increase (and of decrease) found to be present in the current in a lightning discharge, the effect of even a small inductance in the circuit is much more important than that of considerable resistance. The current may well increase by 10,000 amperes in a millionth of a second. Sufficient insulation can possibly be provided to resist puncture by induced voltage and prevent any diversion of current through the personnel. In the case of sparking from the lightning discharge current to some other circuit, if the induced voltage is to be kept below the minimum value which will produce a jump spark --namely, about 300 volts--the value of the mutual inductance should not exceed 3×10^{-8} henries for the worst case likely to arise.

Side Flash

If side flash should occur in an aircraft the following hazards would exist:

1. Igniting any gasoline vapor which might have accumulated.

2. Uncomfortable and perhaps serious electric shock to personnel.

There will exist momentarily between any conducting body, such as the pilot, gasoline tank, or other internal object, and the lightning conductor system a difference of potential

$$\Delta V = \frac{V_o C_{pg}}{C_{pc} + C_{pg}} \quad \text{(see text for definition of symbols)}$$

that can lead to side flash. If the distance between the internal object and the lightning conductor is too short, the voltage difference ΔV will produce a "side flash" spark between them.

WR W 97 ICING TESTS OF AIRCRAFT-ENGINE INDUCTION SYSTEMS, Leo B. Kimball, January 1943

Icing tests have been conducted on an aircraft engine induction system consisting of a R-1820, G-200 blower section, Holley 1375-F carburetor and adapter, and specially built air scoop. The object of this report is to determine the effect of a number of possible factors on icing of engine induction system.

Two sets of major and minor factors which influence the occurrence of ice can be grouped as follows:

Major icing factors:
1. Carburetor-air temperature
2. Moisture content of air

Minor icing factors (negligible effect)
1. Rate of air flow
2. Throttle opening
3. Droplet size
4. Fuel-air ratio
5. Altitude
6. Metal temperatures of engine blower section
7. Fuel temperature

Ice did not form in the induction system tested under any conditions at a carburetor air temperature of 80°F or above. When there was no free moisture present and the relative humidity of intake air was 100% or less, ice formed in the induction system at such a slight rate that neither the rate of air flow nor the mixture ratio was seriously affected.

With constant rain density, the rate of icing was increased in proportion to increase in rate of air flow. The final concluded that induction system air scoops should be designed to prevent as much water as possible from entering the carburetor. Ice which forms in an engine induction system can be classified under three general types: (1) atmospheric impact ice, (2) throttling ice, and (3) refrigeration ice (fuel ice).

WR W 100 WORKING CHARTS FOR THE COMPUTATION OF PROPELLER THRUST THROUGHOUT THE TAKE-OFF RANGE, Gerald L. Desmond and Robert F. Freitag, July 1943

Full scale propellers with 3135 blade design have been used to construct a set of propeller thrust charts which may be used to calculate take-off performance. The 3135 blade design propeller has been used because the NACA has tested this blade in a wide variety of assemblies; ranging from three blades to eight blades for both single and dual rotating propellers.

By use of these charts, the thrust of modern single and dual rotating propellers may be easily and rapidly calculated through the take off range.

The thrust formula is reduced to

$$T = \frac{K_T \, bhp}{ND}$$

where

T = thrust in pounds
bhp = brake horsepower
N = propeller revolutions per minute
D = propeller diameter, feet
K_T = modified thrust coefficient

Not Applicable NACA Wartime Reports

WR A 2 TESTS OF AN ATTACK-TYPE AIRPLANE IN THE AMES 40- BY 80-FOOT WIND TUNNEL TO IMPROVE THE HIGH-SPEED MANEUVERING CONTROL-FORCE CHARACTERISTICS, Gerald M. McCormack, November 1945

WR A 3 TESTS OF A THERMAL ICE-PREVENTION SYSTEM FOR A WING LEADING-EDGE LANDING-LIGHT INSTALLATION, Wesley H. Hillendahl, December 1945

WR A 4 A FLIGHT INVESTIGATION OF THE ICE-PREVENTION REQUIREMENTS OF THE UNITED STATES NAVAL K-TYPE AIRSHIP, Wesley H. Hillendahl, October 1945

WR A 7 FLIGHT TESTS OF THERMAL ICE PREVENTION EQUIPMENT IN THE XB-24F AIRPLANE, Carr B. Neel and Alun R. Jones, October 1943

WR A 8 KINETIC TEMPERATURE OF WET SURFACES A METHOD OF CALCULATING THE AMOUNT OF ALCOHOL REQUIRED TO PREVENT ICE, AND THE DERIVATION OF THE PSYCHROMETRIC EQUATION, J. K. Hardy, September 1945

WR A 9 AN INVESTIGATION OF A THERMAL ICE-PREVENTION SYSTEM FOR A C-46 CARGO AIRPLANE. V - EFFECT OF THERMAL SYSTEM ON AIRPLANE CRUISE PERFORMANCE, James Selna, May 1945

WR A 10 ANALYSIS OF A THERMAL ICE-PREVENTION SYSTEM FOR WING LEADING-EDGE LANDING-LIGHT INSTALLATIONS, Wesley H. Hillendahl, January 1944

WR A 14 TUNNEL-WALL CORRECTIONS TO ROLLING AND YAWING MOMENTS DUE TO AILERON DEFLECTION IN CLOSED RECTANGULAR WIND TUNNELS, Donald J. Graham, January 1945

WR A 16 AN INVESTIGATION OF A THERMAL ICE-PREVENTION SYSTEM FOR A C-46 CARGO AIRPLANE. III - DESCRIPTION OF THERMAL ICE-PREVENTION EQUIPMENT FOR WINGS, EMPENNAGE, AND WINDSHIELD, Alun R. Jones and Ray J. Spies, Jr., February 1945

WR A 19 AN EXPERIMENTAL INVESTIGATION OF THE EFFECT OF PROPELLERS USED AS AERODYNAMIC BRAKES ON STABILITY AND CONTROL, V. I. Stevens, G. B. McCullough, and F. H. Hanson, July 1945

WR A 21 AN ADDITIONAL INVESTIGATION OF THE HIGH-SPEED LATERAL-CONTROL CHARACTERISTICS OF SPOILERS, E. V. Laitone and J. L. Summers, June 1945

WR A 22 AN INVESTIGATION OF A THERMAL ICE-PREVENTION SYSTEM FOR A C-46 CARGO AIRPLANE. IV - RESULTS OF FLIGHT TESTS IN DRY-AIR AND NATURAL-ICING CONDITIONS, James Selna, Carr B. Neel, Jr., and E. Lewis Zeiller, February 1945

WR A 23 FLIGHT TESTS OF THE THERMAL ICE-PREVENTION EQUIPMENT ON THE B-17F AIRPLANE, Bonne C. Look, February 1944

WR A 25 AN INVESTIGATION OF A THERMAL ICE-PREVENTION SYSTEM FOR A C-46 CARGO AIRPLANE. II - THE DESIGN, CONSTRUCTION, AND PRELIMINARY TESTS OF THE EXHAUST-AIR HEAT EXCHANGER, Richard Jackson, February 1945

WR A 28 MEASUREMENTS IN FLIGHT OF THE STABILITY, LATERAL-CONTROL, AND STALLING CHARACTERISTICS OF AN AIRPLANE EQUIPPED WITH FULL-SPAN ZAP FLAPS AND SPOILER-TYPE AILERONS, J. R. Spahr and Don R. Christophersen, December 1943

WR A 30 EFFECT ON THE PERFORMANCE OF A TURBOSUPERCHARGED ENGINE OF AN EXHAUST-GAS-TO-AIR HEAT EXCHANGER FOR THERMAL ICE PREVENTION, Bonne C. Look, August 1945

WR A 31 WIND-TUNNEL INVESTIGATION OF THE EFFECT OF JET-MOTOR OPERATION ON STABILITY, W. F. Davis and S. H. Brown, July 1944

WR A 32 MEASUREMENTS IN FLIGHT OF THE LATERAL-CONTROL CHARACTERISTICS OF AN AIRPLANE EQUIPPED WITH FULL-SPAN ZAP FLAPS AND SIMPLE CIRCULAR-ARC-TYPE AILERONS, J. Richard Spahr and Don R. Christophersen, September 1944

WR A 33 AN INVESTIGATION OF A THERMAL ICE-PREVENTION SYSTEM FOR A C-46 CARGO AIRPLANE. VI - DRY-AIR PERFORMANCE OF THERMAL SYSTEM AT SEVERAL TWIN- AND SINGLE-ENGINE OPERATING CONDITIONS AT VARIOUS ALTITUDES, James Selna and Harold L. Kees, May 1945

WR A 34 PRELIMINARY INVESTIGATION AND DESIGN OF AN AIR-HEATED WING FOR LOCKHEED 12A AIRPLANE, Lewis A. Robert and Richard Jackson, April 1942

WR A 35 DEVELOPMENT OF THERMAL ICE-PREVENTION EQUIPMENT FOR THE B-24D AIRPLANE, Alun R. Jones and Lewis A. Robert, February 1943

WR A 37 A COMPARISON OF TWO FLIGHT-TEST PROCEDURES FOR THE DETERMINATION OF AILERON CONTROL CAPABILITIES OF AN AIRPLANE, Richard B. Skoog, July 1945

WR A 39 A DESCRIPTION OF THE Ju 88 AIRPLANE ANTI-ICING EQUIPMENT, Lewis A. Rodert and Richard Jackson, September 1942

WR A 40 A METHOD FOR DETERMINING THE RATE OF HEAT TRANSFER FROM A WING OR STREAMLINE BODY, Charles W. Frick, Jr., and George B. McCullough, December 1942

WR A 43 A COMPARISON OF THE EFFECTS OF FOUR-BLADE DUAL- AND SINGLE-ROTATION PROPELLERS ON THE STABILITY AND CONTROL CHARACTERISTICS OF A HIGH-POWERED SINGLE-ENGINE AIRPLANE, Charles W. Harper and Bradford H. Wick, June 1944

WR A 45 A FLIGHT INVESTIGATION OF THE THERMAL PROPERTIES OF AN EXHAUST HEATED WING DE-ICING SYSTEM ON A LOCKHEED 12-A AIRPLANE, Lewis A. Rodert and Lawrence A. Clousing, June 1941

WR A 48 AN INVESTIGATION OF A THERMAL ICE-PREVENTION SYSTEM FOR A C-46 CARGO AIRPLANE. VII - EFFECT OF THE THERMAL SYSTEM ON THE WING-STRUCTURE STRESSES AS ESTABLISHED IN FLIGHT, Alun R. Jones and Bernard A. Schlaff, September 1945

WR A 49 FLIGHT TESTS OF THERMAL ICE-PREVENTION EQUIPMENT ON A LOCKHEED 12A AIRPLANE, Richard Scherrer, November 1943

WR A 51 DEVELOPMENT OF THERMAL ICE-PREVENTION EQUIPMENT FOR THE B-17F AIRPLANE, Alun R. Jones and Lewis A. Rodert, August 1943

WR A 52 AN INVESTIGATION OF A THERMAL ICE-PREVENTION SYSTEM FOR A C-46 CARGO AIRPLANE. I - ANALYSIS OF THE THERMAL DESIGN FOR WINGS, EMPENNAGE, AND WINDSHIELD, Carr B. Neel, Jr., February 1945

WR A 53 PRELIMINARY REPORT ON FLIGHT TESTS OF AN AIRPLANE HAVING EXHAUST-HEATED WINGS, L. A. Rodert, W. H. McAvoy, and L. A. Clousing, April 1941

WR A 56 THERMODYNAMIC DESIGN OF DOUBLE-PANEL, AIR-HEATED WINDSHIELDS FOR ICE PREVENTION, Jerome L. Kushnick, June 1943

WR A 58 OBSERVATIONS OF THE IMPROVEMENT IN VISION BROUGHT ABOUT BY THE APPLICATION OF A RAIN-REPELLENT LACQUER ON AN AIRPLANE WINDSHIELD, William H. McAvoy and Lawrence A. Clousing, May 1942

WR A 59 EFFECT OF TILT OF THE PROPELLER AXIS ON THE LONGITUDINAL-STABILITY CHARACTERISTICS OF SINGLE-ENGINE AIRPLANES, Harry J. Goett and Noel K. Delany, November 1944

WR A 60 COMPRESSIBILITY EFFECTS ON THE LONGITUDINAL STABILITY AND CONTROL OF A PURSUIT-TYPE AIRPLANE AS MEASURED IN FLIGHT, W. N. Turner, P. J. Steffen, and L. A. Clousing, October 1945

WR A 68 FLIGHT MEASUREMENTS OF THE LATERAL CONTROL CHARACTERISTICS OF AN AIRPLANE EQUIPPED WITH A COMBINATION AILERON-SPOILER CONTROL SYSTEM, Lawrence A. Clousing and William H. McAvoy, September 1942

WR A 71 CORRELATION OF WIND-TUNNEL PREDICTIONS WITH FLIGHT TESTS OF A TWIN-ENGINE PATROL AIRPLANE. II - LATERAL- AND DIRECTIONAL-STABILITY AND CONTROL CHARACTERISTICS, Noel K. Delany and William M. Kauffman, August 1945

WR A 73 THE EFFECT OF AMPHIBIOUS FLOATS ON THE POWER-OFF STABILITY AND CONTROL CHARACTERISTICS OF A TWIN-ENGINE CARGO AIRPLANE, Steven E. Belsley and Roy P. Jackson, January 1943

WR A 74 THE EFFECT OF THE SKIS ON THE POWER-OFF STABILITY CHARACTERISTICS OF A TWIN-ENGINE CARGO AIRPLANE, Park Y. Wong, June 1945

WR A 77 INVESTIGATION OF THE LONGITUDINAL STABILITY AT HIGH SPEEDS OF A 1/5-SCALE MODEL OF A TAILLESS PURSUIT AIRPLANE, E. V. Laitone, March 1943

WR A 78 FLYING QUALITIES OF A HIGH-SPEED BOMBER WITH A DUAL PUSHER PROPELLER AFT OF THE EMPENNAGE AS ESTIMATED FROM WIND-TUNNEL TESTS OF A 1/8-SCALE POWERED MODEL, J. A. Weiberg and A. W. Schnurbusch, November 1944

WR A 79 FLIGHT MEASUREMENTS OF THE EFFECT OF VARIOUS AMOUNTS OF AILERON DROOP ON THE LOW-SPEED LATERAL-CONTROL CHARACTERISTICS OF AN OBSERVATION AIRPLANE, William N. Turner and Betty Adams, August 1943

WR A 84 LONGITUDINAL CHARACTERISTICS AND AILERON EFFECTIVENESS OF A MID-WING AIRPLANE FROM HIGH-SPEED WIND-TUNNEL TESTS, C. F. Hall and R. L. Mannes, September 1944

WR A 86 CORRELATION OF WIND-TUNNEL PREDICTIONS WITH FLIGHT TESTS OF A TWIN-ENGINE PATROL AIRPLANE. I - LONGITUDINAL-STABILITY AND CONTROL CHARACTERISTICS, Noel K. Delany and William M. Kauffman, April 1945

WR E 12 FLUID DE-ICING TESTS ON A CHANDLER-EVANS 1900 CPB-3 CARBURETOR MOUNTED ON A PRATT AND WHITNEY R-1830-C4 INTERMEDIATE REAR ENGINE SECTION, Herman B. Galvin and Henry A. Essex, October 1944

WR E 15 A LABORATORY INVESTIGATION OF ICING AND HEATED-AIR DE-ICING OF A CHANDLER-EVANS 1900 CPB-3 CARBURETOR-MOUNTED ON A PRATT AND WHITNEY R-1830-C4 INTERMEDIATE REAR ENGINE SECTION, Henry A. Essex and Herman B. Galvin, October 1944

WR E 18 A LABORATORY INVESTIGATION OF THE ICING CHARACTERISTICS OF THE BENDIX-STROMBERG CARBURETOR MODEL PD-12F5 WITH THE PRATT AND WHITNEY F-1830-C4 INTERMEDIATE REAR ENGINE SECTION, Herman B. Galvin and Henry A. Essex, October 1944

WR L 4 TESTS OF A LINKED DIFFERENTIAL FLAP SYSTEM DESIGNED TO MINIMIZE THE REDUCTION IN EFFECTIVE DIHEDRAL CAUSED BY POWER, Marvin Pitkin and Robert O. Schade, August 1945

WR L 8 INVESTIGATION OF EFFECT OF SIDESLIP ON LATERAL STABILITY CHARACTERISTICS. II - RECTANGULAR MIDWING ON CIRCULAR FUSELAGE WITH VARIATIONS IN VERTICAL-TAIL AREA AND FUSELAGE LENGTH WITH AND WITHOUT HORIZONTAL TAIL SURFACE, Thomas A. Hollingworth, April 1945

WR L 12 INVESTIGATION OF EFFECT OF SIDESLIP ON LATERAL STABILITY CHARACTERISTICS. I - CIRCULAR FUSELAGE WITH VARIATIONS IN VERTICAL-TAIL AREA AND TAIL LENGTH WITH AND WITHOUT HORIZONTAL TAIL SURFACE, Leo F. Fehlner and Robert MacLachlan, May 1944

WR L 15 STABILITY AND CONTROL CHARACTERISTICS OF A FIGHTER AIRPLANE IN INVERTED FLIGHT ATTITUDE AS DETERMINED BY MODEL TESTS, John W. Paulson and Charles V. Bennett, August 1945

WR L 17 INVESTIGATION OF EFFECT OF SIDESLIP ON LATERAL STABILITY CHARACTERISTICS. III - RECTANGULAR LOW WING ON CIRCULAR FUSELAGE WITH VARIATIONS IN VERTICAL-TAIL AREA AND FUSELAGE LENGTH WITH AND WITHOUT HORIZONTAL TAIL SURFACE, Thomas A. Hollingworth, April 1945

WR L 22 SPIN-TUNNEL TESTS OF AIRPLANE MODELS WITH EXTREME VARIATIONS IN MASS DISTRIBUTION ALONG THE THREE BODY AXES, Robert W. Kamm, March 1945

WR L 24 EFFECT OF POWER ON THE STICK-FIXED NEUTRAL POINTS OF SEVERAL SINGLE-ENGINE MONOPLANES AS DETERMINED IN FLIGHT, Maurice D. White, August 1944

WR L 25 NOTES ON THE PROPELLER AND SLIPSTREAM IN RELATION TO STABILITY, Herbert S. Ribner, October 1944

WR L 28 STABILITY OF A BODY STABILIZED BY FINS AND SUSPENDED FROM AN AIRPLANE, W. H. Phillips, April 1944

WR L 40 FLIGHT TESTS OF TWO AIRPLANES HAVING MODERATELY HIGH EFFECTIVE DIHEDRAL AND DIFFERENT DIRECTIONAL STABILITY AND CONTROL CHARACTERISTICS, S. A. Sjoberg, October 1945

WR L 42 EFFECT OF WING MODIFICATIONS ON THE LONGITUDINAL STABILITY OF A TAILLESS ALL-WING AIRPLANE MODEL, Charles L. Seacord, Jr., and Herman O. Ankenbruck, September 1945

WR L 45 DETERMINATION OF THE EFFECT OF HORIZONTAL-TAIL FLEXIBILITY ON LONGITUDINAL CONTROL CHARACTERISTICS, S. M. Harmon, February 1945

WR L 50 DETERMINATION OF THE STABILITY AND CONTROL CHARACTERISTICS OF A TAILLESS ALL WING AIRPLANE MODEL WITH SWEEPBACK IN THE LANGLEY FREE FLIGHT TUNNEL, J. P. Campbell and C. L. Seacord, Jr., February 1945

WR L 54 EXPERIMENTAL DETERMINATION OF THE EFFECT OF NEGATIVE DIHEDRAL ON LATERAL STABILITY AND CONTROL CHARACTERISTICS AT HIGH LIFT COEFFICIENTS, Marion O. McKinney, Jr., January 1946

WR L 55 THE EFFECTS OF STATIC MARGIN AND ROTATIONAL DAMPING IN PITCH ON THE LONGITUDINAL STABILITY CHARACTERISTICS OF AN AIRPLANE AS DETERMINED BY TESTS OF A MODEL IN THE NACA FREE-FLIGHT TUNNEL, John P. Campbell and John W. Paulson, June 1944

WR L 65 AN AUTOMATICALLY VARIABLE CONTROL LINKAGE AND ITS EFFECT ON THE LATERAL-CONTROL CHARACTERISTICS OF A HIGH-SPEED FIGHTER AIRPLANE, Harry E. Murray and Clarence L. Gillis, May 1944

WR L 85 USE OF VARIABLE-RATIO GEARED TABS TO IMPROVED STICK-FORCE CHARACTERISTICS IN TURNING FLIGHT, Harold F. Kleckner, October 1945

WR L 87 A COMPARISON OF DATA OBTAINED BY TWO FLIGHT TECHNIQUES FOR DETERMINING THE SIDESLIP CHARACTERISTICS OF A FIGHTER AIRPLANE, Harold I. Johnson, August 1945

WR L 89 PRELIMINARY FLIGHT RESEARCH ON AN ALL MOVABLE HORIZONTAL TAIL AS A LONGITUDINAL CONTROL FOR FLIGHT AT HIGH MACH NUMBERS, H. F. Kleckner, March 1945

WR L 92 EFFECT OF LATERAL SHIFT OF CENTER OF GRAVITY ON RUDDER DEFLECTION REQUIRED FOR TRIM, W. H. Phillips, H. L. Crane, and P. A. Hunter, November 1944

WR L 96 SPINNING OF LARGE AIRPLANES, O. Seidman, October 1944

WR L 99 COMPARISON OF WIND-TUNNEL AND FLIGHT MEASUREMENTS OF STABILITY AND CONTROL CHARACTERISTICS OF A DOUGLAS A-26 AIRPLANE, Gerald G. Kayten and William Koven, March 1946

WR L 100 MAXIMUM RATES OF CONTROL MOTION OBTAINED FROM GROUND TESTS, De E. Beeler, May 1944

WR L 101 STATIC-THRUST TEST OF SIX ROTOR-BLADE DESIGNS ON A HELICOPTER IN THE LANGLEY FULL-SCALE TUNNEL, R. C. Dingeldein and R. F. Schaefer, September 1945

WR L 102 AN APPROXIMATE DETERMINATION OF THE POWER REQUIRED TO MOVE CONTROL SURFACES AS RELATED TO CONTROL-BOOSTER DESIGN, Harold I. Johnson, September 1945

WR L 103 THE EFFECT OF LATERAL AREA ON THE LATERAL STABILITY AND CONTROL CHARACTERISTICS OF AN AIRPLANE AS DETERMINED BY TESTS OF A MODEL IN THE LANGLEY FREE-FLIGHT TUNNEL, Hubert M. Drake, February 1946

WR L 109 LANGLEY FULL-SCALE TUNNEL INVESTIGATION OF THE FACTORS AFFECTING THE DIRECTIONAL STABILITY AND TRIM CHARACTERISTICS OF A FIGHTER-

TYPE AIRPLANE, Harold H. Sweberg, Eugene R. Guryansky, and Roy H. Lange, November 1945

WR L 112 A METHOD FOR STUDYING THE HUNTING OSCILLATIONS OF AN AIRPLANE WITH A SIMPLE TYPE OF AUTOMATIC CONTROL, Robert T. Jones, May 1944

WR L 125 PREDICTION OF MOTIONS OF AN AIRPLANE RESULTING FROM ABRUPT MOVEMENT OF LATERAL OR DIRECTIONAL CONTROLS, Chester H. Wolowicz, May 1945

WR L 142 AN ANALYTICAL INVESTIGATION OF THE EFFECTS OF ELEVATOR-FABRIC DISTORTION ON THE LONGITUDINAL STABILITY AND CONTROL OF AN AIRPLANE, Charles W. Mathews, May 1944

WR L 148 WIND-TUNNEL INVESTIGATION OF EFFECTS OF A PUSHER PROPELLER ON LIFT, PROFILE DRAG, PRESSURE DISTRIBUTION, AND BOUNDARY-LAYER TRANSITION OF A FLAPPED WING, Carl A. Sandahl, April 1945

WR L 149 FLIGHT TESTS OF THE LATERAL CONTROL CHARACTERISTICS OF AN F6F-3 AIRPLANE EQUIPPED WITH SPRING-TAB AILERONS, Walter C. Williams, April 1945

WR L 184 EXPERIMENTAL VERIFICATION OF THE RUDDER-FREE STABILITY THEORY FOR AN AIRPLANE MODEL EQUIPPED WITH RUDDERS HAVING NEGATIVE FLOATING TENDENCY AND NEGLIGIBLE FRICTION, Marion O. McKinney, Jr., and Bernard Maggin, November 1944

WR L 191 THE INFLUENCE OF VERTICAL-TAIL DESIGN AND DIRECTION OF PROPELLER ROTATION ON TRIM CHARACTERISTICS OF A TWIN-ENGINE-AIRPLANE MODEL WITH ONE ENGINE INOPERATIVE, Marvin Pitkin, John N. Draper, and Charles V. Bennett, February 1945

WR L 194 A FLIGHT INVESTIGATION OF NACA AILERON MODIFICATIONS FOR THE IMPROVEMENT OF THE LATERAL CONTROL CHARACTERISTICS OF A HIGH-SPEED FIGHTER AIRPLANE, Walter C. Williams, December 1945

WR L 199 DETERMINATION OF THE STABILITY AND CONTROL CHARACTERISTICS OF A STRAIGHT WING TAILLESS FIGHTER AIRPLANE MODEL IN THE LANGLEY FREE FLIGHT TUNNEL, C. L. Seacord, Jr., and H. O. Ankenbruck, February 1946

WR L 202 AN INTERIM REPORT ON THE STABILITY AND CONTROL OF TAILLESS AIRPLANES, Stability Research Division, October 1944

WR L 213 FIELD OF FLOW ABOUT A JET AND EFFECT OF JETS ON STABILITY OF JET-PROPELLED AIRPLANES, H. S. Ribner, April 1946

WR L 214 WIND-TUNNEL TESTS OF A DUAL-ROTATING PROPELLER HAVING ONE COMPONENT LOCKED OR WINDMILLING, W. A. Bartlett, Jr., January 1945

WR L 220 THE EFFECT ON STABILITY AND CONTROL OF A PUSHER PROPELLER BEHIND CONVENTIONAL TAIL SURFACES AS DETERMINED BY TESTS OF A POWERED MODEL IN THE FREE-FLIGHT TUNNEL, John P. Campbell and Thomas A. Hollingworth, January 1943

WR L 222 FREE-SPINNING-TUNNEL TESTS OF A MODEL OF A CANARD AIRPLANE, P. W. Pepoon, May 1943

WR L 235 EFFECT OF POWERED PROPELLERS ON THE AERODYNAMIC CHARACTERISTICS AND THE PORPOISING STABILITY OF A DYNAMIC MODEL OF A LONG-RANGE FLYING BOAT, N. S. Land, May 1943

WR L 236 THE LANDING STABILITY OF A POWERED DYNAMIC MODEL OF A FLYING BOAT WITH A 30°V-STEP AND WITH TWO DEPTHS OF TRANSVERSE STEP, J. B. Parkinson and N. S. Land, February 1944

WR L 263 EFFECT OF SPRING AND GRAVITY MOMENTS IN THE CONTROL SYSTEM ON THE LONGITUDINAL STABILITY OF THE BREWSTER XSBA-1 AIRPLANE, William H. Phillips, April 1942

WR L 267 DETERMINATION OF TOWLINE TENSION AND STABILITY OF SPIN-RECOVERY PARACHUTES, J. H. Wood, March 1946

WR L 295 WIND-TUNNEL TESTS OF A TWIN-ENGINE MODEL TO DETERMINE THE EFFECT OF DIRECTION OF PROPELLER ROTATION ON THE STATIC-STABILITY CHARACTERISTICS, Francis M. Rogallo and Robert S. Swanson, January 1943

WR L 302 A THEORETICAL ANALYSIS OF THE EFFECT OF AILERON INERTIA AND HINGE MOMENT ON THE MAXIMUM ROLLING ACCELERATION OF AIRPLANES IN ABRUPT AILERON ROLLS, F. J. Bailey, Jr., and William J. O'Sullivan, February 1942

WR L 309 SOME THEORETICAL CONSIDERATIONS OF LONGITUDINAL STABILITY IN POWER-ON FLIGHT WITH SPECIAL REFERENCE TO WIND-TUNNEL TESTING, Charles J. Donlan, November 1942

WR L 322 ANALYSIS OF WIND-TUNNEL STABILITY AND CONTROL TESTS IN TERMS OF FLYING QUALITIES OF FULL-SCALE AIRPLANES, Gerald G. Kayten, October 1943

WR L 336 PROPOSAL FOR A PROPELLER SIDE-FORCE FACTOR, Herbert S. Ribner, December 1943

WR L 343 THE EFFECT OF COWLING SHAPE ON THE STABILITY CHARACTERISTICS OF AN AIRPLANE, C. J. Donlan and W. Letko, September 1942

WR L 347 A STUDY OF THE EFFECTS OF VERTICAL TAIL AREA AND DIHEDRAL ON THE LATERAL MANEUVERABILITY OF AN AIRPLANE, Leo F. Fehlner, October 1941

WR L 349 METHODS AND CHARTS FOR COMPUTING STABILITY DERIVATIVES OF A V-BOTTOM PLANING SURFACE, J. M. Benson and A. Freihofner, December 1943

WR L 354 FREE-FLIGHT-TUNNEL INVESTIGATION OF THE EFFECT OF MODE OF PROPELLER ROTATION UPON THE LATERAL-STABILITY CHARACTERISTICS OF A TWIN-ENGINE AIRPLANE MODEL WITH SINGLE VERTICAL TAILS OF DIFFERENT SIZE, Marvin Pitkin, October 1943

WR L 361 A THEORETICAL INVESTIGATION OF THE ROLLING OSCILLATIONS OF AN AIRPLANE WITH AILERONS FREE, Doris Cohen, January 1944

WR L 372 THEORETICAL ANALYSIS OF THE LATERAL STABILITY OF A GLIDER TOWED BY TWIN PARALLEL TOWLINGS, Marvin Pitkin and Marion O. McKinney, Jr., November 1943

WR L 379 CHARACTERISTICS OF PLAIN AND BALANCED ELEVATORS ON A TYPICAL PURSUIT FUSELAGE AT ATTITUDES SIMULATING NORMAL-FLIGHT AND SPIN CONDITIONS, R. I. Sears and H. P. Hoggard, Jr., March 1942

WR L 387 EXPERIMENTAL DETERMINATION OF THE YAWING MOMENT DUE TO YAWING CONTRIBUTED BY THE WING, FUSELAGE, AND VERTICAL TAIL OF A MIDWING AIRPLANE MODEL, John P. Campbell and Ward O. Mathews, June 1943

WR L 388 THE EFFECT OF MASS DISTRIBUTION ON THE LATERAL STABILITY AND CONTROL CHARACTERISTICS OF AN AIRPLANE AS DETERMINED BY TESTS OF A MODEL IN THE FREE-FLIGHT TUNNEL, John P. Campbell and Charles L. Seacord, Jr., August 1943

WR L 391 CHARACTERISTICS OF BEVELED-TRAILING-EDGE ELEVATORS ON A TYPICAL PURSUIT FUSELAGE AT ATTITUDES SIMULATING NORMAL FLIGHT AND SPIN CONDITIONS, Clarence L. Gillis, December 1942

WR L 392 CALCULATED EFFECTS OF FULL-SPAN SLOTTED AND FOWLER FLAPS ON LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS FOR A TYPICAL FIGHTER-TYPE AIRPLANE WITH VARIOUS TAIL MODIFICATIONS, R. Fabian Goranson, July 1942

WR L 394 A THEORETICAL INVESTIGATION OF THE LATERAL OSCILLATIONS OF AN AIRPLANE WITH FREE RUDDER WITH SPECIAL REFERENCE TO THE EFFECT OF FRICTION, Harry Greenberg and Leonard Sternfield, March 1943

WR L 395 DETERMINATION OF THE DAMPING MOMENT IN YAWING FOR TAPERED WINGS WITH PARTIAL-SPAN FLAPS, Sidney M. Harmon, August 1943

WR L 400 TESTS OF A DYNAMIC MODEL IN NACA TANK NO. 1 TO DETERMINE THE EFFECT OF LENGTH OF AFTERBODY, ANGLE OF AFTERBODY KEEL, GROSS LOAD, AND A POINTED STEP ON LANDING AND PLANING STABILITY, N. S. Land and L. J. Lina, March 1943

WR L 403 EFFECT OF CHANGES IN ASPECT RATIO, SIDE AREA, FLIGHT-PATH ANGLE, AND NORMAL ACCELERATION ON LATERAL STABILITY, M. J. Bamber, December 1942

WR L 409 THE LONGITUDINAL STABILITY OF FLYING BOATS AS DETERMINED BY TESTS OF MODELS IN THE NACA TANK I - METHODS USED FOR THE INVESTIGATION OF LONGITUDINAL-STABILITY CHARACTERISTICS, R. E. Olson and N. S. Land, November 1942

WR L 411 WIND-TUNNEL STUDY OF THE EFFECTS OF PROPELLER OPERATION AND FLAP DEFLECTION ON THE PITCHING MOMENTS AND ELEVATOR HINGE MOMENTS OF A SINGLE-ENGINE PURSUIT-TYPE AIRPLANE, H. R. Pass, July 1942

WR L 422 ELEVATOR STICK FORCES IN SPINS AS COMPUTED FROM WIND-TUNNEL MEASUREMENTS, Oscar Seidman and J. W. Klinar, October 1942

WR L 430 A THEORETICAL INVESTIGATION OF LONGITUDINAL STABILITY OF AIRPLANES WITH FREE CONTROLS INCLUDING EFFECT OF FRICTION IN CONTROL SYSTEM (Superseded by TR 791), Harry Greenberg and Leonard Sternfield, February 1944

WR L 444 A FLIGHT INVESTIGATION OF SHORT-PERIOD LONGITUDINAL OSCILLATIONS OF AN AIRPLANE WITH FREE ELEVATOR, William H. Phillips, May 1942

WR L 455 TESTS OF PROPELLER-SPEED COOLER BLOWERS, Abe Silverstein, July 1942

WR L 459 WIND-TUNNEL INVESTIGATION OF EFFECT OF YAW ON LATERAL-STABILITY CHARACTERISTICS. V - SYMMETRICALLY TAPERED WING WITH A CIRCULAR FUSELAGE HAVING A HORIZONTAL AND A VERTICAL TAIL, Arthur R. Wallace and Thomas R. Turner, June 1943

WR L 465 A STUDY OF THE EFFECT OF ADVERSE YAWING MOMENT ON LATERAL MANEUVERABILITY AT A HIGH LIFT COEFFICIENT, Leo F. Fehlner, September 1942

WR L 468 THE LONGITUDINAL STABILITY OF FLYING BOATS AS DETERMINED BY TESTS OF MODELS IN THE NACA TANK II - EFFECT OF VARIATIONS IN FORM OF HULL ON LONGITUDINAL STABILITY, S. Truscott and R. E. Olson, November 1942

WR L 479 THE PORPOISING CHARACTERISTICS OF A PLANING SURFACE REPRESENTING THE FOREBODY OF A FLYING-BOAT HULL, J. M. Benson, May 1942

WR L 487 FREE-FLIGHT-TUNNEL INVESTIGATION OF THE EFFECT OF THE FUSELAGE LENGTH AND THE ASPECT RATIO AND SIZE OF THE VERTICAL TAIL ON LATERAL STABILITY AND CONTROL, Joseph A. Shortal and John W. Draper, April 1943

WR L 514 EFFECTS OF COMPRESSIBILITY ON MAXIMUM LIFT COEFFICIENTS FOR SIX PROPELLER AIRFOILS, H. E. Cleary, January 1945

WR L 518 HYDRODYNAMIC-STABILITY TESTS OF A MODEL OF A FLYING BOAT AND OF A PLANING SURFACE HAVING A SMALL DOWNWARD PROJECTION (HOOK) ON THE PLANING BOTTOM NEAR THE STEP, J. M. Benson, January 1943

WR L 520 WIND-TUNNEL INVESTIGATION OF EFFECT OF YAW ON LATERAL-STABILITY CHARACTERISTICS. IV - SYMMETRICALLY TAPERED WING WITH A CIRCULAR FUSELAGE HAVING A WEDGE-SHAPED REAR AND A VERTICAL TAIL, I. G. Recant and Authur R. Wallace, March 1942

WR L 522 EFFECT OF WING LOADING AND ALTITUDE ON LATERAL STABILITY AND CONTROL CHARACTERISTICS OF AN AIRPLANE AS DETERMINED BY TESTS OF A MODEL IN THE FREE-FLIGHT TUNNEL, John P. Campbell and Charles L. Seacord, Jr., April 1943

WR L 525 DETERMINATION OF THE EFFECT OF WING FLEXIBILITY ON LATERAL MANEUVERABILITY AND A COMPARISON OF CALCULATED ROLLING EFFECTIVENESS WITH FLIGHT RESULTS, Sidney M. Harmon, May 1943

WR L 538 LONGITUDINAL TRIM TESTS OF A 0.059-SCALE MODEL OF THE CURTISS-WRIGHT XP-55 AIRPLANE, J. F. MacDougall, Jr., and L. E. Schneiter, April 1944

WR L 541 ESTIMATION OF THE PERFORMANCE AND LONGITUDINAL STABILITY AND CONTROL OF A LIFTING-BODY TYPE OF CARGO AIRPLANE FROM TESTS OF SIMPLIFIED MODELS, D. Feigenbaum, June 1945

WR L 559 A FLIGHT INVESTIGATION OF THE STABILITY OF A TOWED BODY, W. H. Phillips, October 1942

WR L 564 TESTS OF A 0.30-SCALE SEMISPAN MODEL OF THE DOUGLAS XTB2D-1 AIRPLANE WING AND FUSELAGE COMBINATION IN THE NACA 19-FOOT PRESSURE TUNNEL. II - ROLL-FLAP POSITIONING AND LATERAL-CONTROL INVESTIGATION, S. H. Spooner, C. D. Ashworth, and R. T. Russell, September 1944

WR L 567 SPRAY CHARACTERISTICS AND TAKE-OFF AND LANDING STABILITY OF SEVERAL MODIFICATIONS OF A 1/8-SIZE MODEL OF THE PBN-1 FLYING BOAT - NACA MODEL 192, D. R. Woodward and H. Zeck, April 1945

WR L 572 TESTS OF 0.14-SCALE MODELS OF THE CONTROL SURFACES OF ARMY PROJECT MX-511 IN ATTITUDES SIMULATING SPINS, H. Page Hoggard, Jr., and John R. Hagerman, April 1945

WR L 575 CALCULATION OF THE AILERON AND ELEVATOR STICK FORCES AND RUDDER PEDAL FORCES FOR THE BELL XP-83 AIRPLANE (PROJECT MX-511) IN SPINS, Ralph W. Stone, Jr., and Leslie E. Schneiter, September 1945

WR L 577 CONTROL-MOTION STUDIES OF THE PBM-3 FLYING BOAT IN ABRUPT PULL-UPS, H. A. Pearson and L. K. Smull, November 1942

WR L 589 SOME NOTES ON THE EFFECTS OF JET-EXIT DESIGN ON STATIC LONGITUDINAL STABILITY, C. L. Gillis and J. Weil, June 1944

WR L 593 MEASUREMENT OF FLYING QUALITIES OF A DEHAVILLAND MOSQUITO F-8 AIRPLANE (AAF NO. 43-335960). I - LATERAL AND DIRECTIONAL STABILITY AND CONTROL CHARACTERISTICS, H. L. Crane, D. B. Talmage, and W. E. Gray, Jr., November 1944

WR L 595 FLIGHT TESTS OF THE SIKORSKY HNS-1 (ARMY YR-4B) HELICOPTER 1 - EXPERIMENTAL DATA ON LEVEL-FLIGHT PERFORMANCE WITH ORIGINAL ROTOR BLADES, F. B. Gustafson, July 1944

WR L 596 FLIGHT TESTS OF THE SIKORSKY HNS-1 (ARMY YR-4B) HELICOPTER II - HOVERING AND VERTICAL-FLIGHT PERFORMANCE WITH THE ORIGINAL AND AN ALTERNATE SET OF MAIN-ROTOR BLADES, INCLUDING A COMPARISON WITH HOVERING PERFORMANCE THEORY, F. B. Gustafson and A. Gessor, July 1944

WR L 597 LATERAL-CONTROL CHARACTERISTICS OF NORTH AMERICAN XP-51 AIRPLANE (A.C. NO 41-38) WITH BEVELED TRAILING-EDGE AILERONS IN HIGH-SPEED FLIGHT, H. H. Hoover and M. D. White, November 1942

WR L 600 ESTIMATES OF THE VERTICAL-TAIL LOADS OF A BELL-P-63A-1 AIRPLANE (AAF NO. 42-68889) IN ACCELERATED ROLLING MANEUVERS BASED ON FLIGHT TESTS WITH TWO VERTICAL-TAIL ARRANGEMENTS, Harold I. Johnson, November 1944

WR L 601 RESUME OF NACA STABILITY AND CONTROL TESTS OF THE BELL P-63 SERIES AIRPLANE, Harold I. Johnson, October 1944

WR L 608 COMPARISON OF PREDICTED AND ACTUAL CONTROL-FIXED STABILITY AND CONTROL CHARACTERISTICS OF A DOUGLAS A-26B AIRPLANE, Harold L. Crane and Sigurd A. Sjoberg, April 1945

WR L 610 THE EFFECT OF DEAD RISE UPON THE LOW-ANGLE TYPE OF PORPOISING, J. M. Benson and L. J. Lina, October 1942

WR L 611 FLIGHT MEASUREMENTS OF THE EFFECT ON ELEVATOR STICK FORCES OF STABILIZER INCIDENCE AND ELEVATOR RIB SPACING ON THE P-63A-1-BE SERIES AIRPLANE, Harold I. Johnson and Robert G. Mungall, October 1945

WR L 614 MEASUREMENT OF FLYING QUALITIES OF A DEHAVILLAND MOSQUITO F-8 AIRPLANE (AAF NO. 43-334960). II - LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS, H. L. Crane, D. B. Talmage, and W. E. Grey, Jr., June 1945

WR L 626 LANGLEY-FULL-SCALE-TUNNEL STABILITY AND CONTROL TESTS OF THE BELL YP-59A AIRPLANE, G. W. Brewser, January 1945

WR L 631 HIGH-SPEED PHOTOGRAPHS OF A YR-4B PRODUCTION ROTOR BLADE FOR SIMULATED FLIGHT CONDITIONS IN THE LANGLEY FULL-SCALE TUNNEL, R. C. Dingeldein and R. F. Schaefer, March 1945

WR L 636 FLIGHT TESTS OF MODIFICATIONS TO IMPROVE THE AILERON CONTROL CHARACTERISTICS OF A NORTH AMERICAN XP-51 AIRPLANE (A.C. NO. 41-38), M. D. White and Herbert H. Hoover, June 1942

WR L 638 THE PROPELLER AND COOLING-AIR-FLOW CHARACTERISTICS OF A TWIN-ENGINE AIRPLANE MODEL EQUIPPED WITH NACA D_S-TYPE COWLINGS AND WITH PROPELLERS OF NACA 16-SERIES AIRFOIL SECTIONS, James G. McHugh and Edward Pepper, September 1944

WR L 642 STABILITY AND CONTROL TESTS OF A 3/4-SCALE MODEL OF THE XP-69 AIRPLANE IN THE NACA FULL-SCALE TUNNEL, Harold H. Sweberg, January 1943

WR L 643 AIRFOIL SECTION DATA FROM TESTS OF 10 PRACTICAL-CONSTRUCTION SECTIONS OF HELICOPTER ROTOR BLADES SUBMITTED BY THE SIKORSKY AIRCRAFT DIVISION, UNITED AIRCRAFT CORPORATION, N. Tetervin, September 1944

WR L 649 MEASUREMENT OF INDIVIDUAL AILERON HINGE MOMENTS AND AILERON CONTROL CHARACTERISTICS OF A P-40F AIRPLANE, R. Fabian Goranson, January 1945

WR L 650 SPIN TESTS OF A 0.059-SCALE MODEL OF THE CURTISS-WRIGHT XP-55 AIRPLANE, George F. MacDougall, Jr., and Leslie E. Schneiter, August 1945

WR L 667 WIND TUNNEL TESTS OF THE 1/8-SCALE POWERED MODEL OF THE CURTISS XBTC-2 AIRPLANE. I - PRELIMINARY INVESTIGATION OF LONGITUDINAL STABILITY, Joseph Weil and Evalyn G. Wells, June 1944

WR L 684 THE EFFECT OF AFTERBODY LENGTH OF THE HYDRODYNAMIC STABILITY OF A DYNAMIC MODEL OF A FLYING BOAT - LANGLEY TANK MODEL 134, N. S. Land, October 1945

WR L 692 A PRELIMINARY THEORETICAL STUDY OF HELICOPTER-BLADE FLUTTER INVOLVING DEPENDENCE UPON CONING ANGLE AND PITCH SETTING, R. P. Coleman, July 1946

WR L 709 POWER-ON LONGITUDINAL-STABILITY AND CONTROL TESTS OF THE 1/8-SCALE MODEL OF THE BREWSTER F2A AIRPLANE EQUIPPED WITH FULL-SPAN SLOTTED FLAPS AND A NEW HORIZONTAL TAIL, John G. Lowry and Thomas Toll, March 1942

WR L 715 FLIGHT MEASUREMENTS OF THE FLYING QUALITIES OF AN F6F-3 AIRPLANE (BUAER NO. 04776). I - LONGITUDINAL STABILITY AND CONTROL, Walter C. Williams and John P. Reeder, February 1945

WR L 716 FLIGHT MEASUREMENTS OF THE FLYING QUALITIES OF AN F6F-2 AIRPLANE (BAUER NO. 04776). II - LATERAL AND DIRECTIONAL STABILITY AND CONTROL, Walter C. Williams and John P. Reeder, February 1945

WR L 719 FLIGHT INVESTIGATION OF MODIFICATIONS TO IMPROVE THE ELEVATOR CONTROL-FORCE CHARACTERISTICS OF THE CURTISS SB2C-1C AIRPLANE IN MANEUVERS, M. D. White and J. P. Reeder, April 1945

WR L 730 FLIGHT INVESTIGATION TO IMPROVE THE DYNAMIC LONGITUDINAL STABILITY AND CONTROL-FEEL CHARACTERISTICS OF THE P-63A-1 AIRPLANE (AAF NO. 42-68889) WITH CLOSELY BALANCED EXPERIMENTAL ELEVATORS, Harold I. Johnson, July 1946

WR L 734 STABILITY AND CONTROL FORCE TESTS OF FOUR AND SIX-UNIT WING DESIGNS OF LOW ASPECT RATIO AND 20° TRIANGULAR PLAN FORM, J. W. Paulson, J. L. Johnson, and E. P. Varney, May 1946

WR L 737 COMPARISON OF FREE-SPINNING WIND-TUNNEL RESULTS WITH CORRESPONDING FULL-SCALE SPIN RESULTS, Oscar Seidman and A. I. Neihouse, December 1938

WR L 738 FREE-SPINNING, LONGITUDINAL-TRIM, AND TUMBLING TESTS OF 1/17.8-SCALE MODELS OF THE CORNELIUS XFG-1 GLIDER, Ralph W. Stone, Jr., and Lee T. Daughtridge, Jr., January 1946

WR L 739 SPIN-TUNNEL TESTS OF A 1/57.33-SCALE MODEL OF THE NORTHROP XB-35 AIRPLANE, R. W. Kamm and P. W. Pepoon, April 1944

WR L 756 PRELIMINARY TESTS TO DETERMINE THE DYNAMIC STABILITY CHARACTERISTICS OF VARIOUS HYDROFOIL SYSTEMS FOR SEAPLANES AND SURFACE BOATS, J. M. Benson and D. A. King, November 1943

WR L 780 ANALYTICAL INVESTIGATION OF THE STABILITY OF AN F8F DROPPING MODEL WITH AUTOMATIC STABILIZATION, Doris Cohen, December 1945

WR L 783 FREE-SPINNING-TUNNEL TESTS OF A 1/23.75-SCALE MODEL OF THE DOUGLAS DC-3 AIRPLANE, Oscar Seidman and George F. MacDougall, Jr., June 1942

WR L 785 WIND-TUNNEL TESTS OF THE 0.15-SCALE POWERED MODEL OF THE FLEETWINGS XBTK-1 AIRPLANE LONGITUDINAL STABILITY AND CONTROL, Joseph Weil and Rebecca I. Boykin, May 1945

WR L 786 WIND-TUNNEL TESTS OF THE 0.15-SCALE POWERED MODEL OF THE FLEETWINGS XBTK-1 AIRPLANE LATERAL STABILITY AND CONTROL, Kenneth W. Goodson and H. Norman Silvers, July 1945

WR L 787 WIND-TUNNEL TESTS OF THE 1/8-SCALE POWERED MODEL OF THE CURTISS XBTC-2 AIRPLANE. II - PRELIMINARY INVESTIGATION OF LATERAL STABILITY AND CONTROL, Arthur R. Wallace, August 1944

WR W 3 THE PROBLEM OF LONGITUDINAL STABILITY AND CONTROL AT HIGH SPEEDS, Manley J. Hood and H. Julian Allen, November 1943

WR W 6 CALCULATED AND MEASURED TURNING PERFORMANCE OF A NAVY F2A-3 AIRPLANE AS AFFECTED BY THE USE OF FLAPS, L. A. Clousing, B. L. Gadeberg, W. M. Kauffman, September 1943

WR W 16 AN INVESTIGATION OF AIRCRAFT HEATERS. X - MEASURED AND PREDICTED PERFORMANCE OF A FLUTED-TYPE EXHAUST GAS AND AIR HEAT EXCHANGER, L. M. K. Boelter, H. G. Dennison, A. G. Guibert, and E. H. Morrin, March 1943

WR W 17 AN INVESTIGATION OF AIRCRAFT HEATERS. XII - PERFORMANCE OF A FORMED-PLATE CROSSFLOW EXHAUST GAS AND AIR HEAT EXCHANGER, L. M. K. Boelter, H. G. Dennison, A. G. Guibert, and E. H. Morrin, May 1943

WR W 18 AN INVESTIGATION OF AIRCRAFT HEATERS. XIII - PERFORMANCE OF CORRUGATED AND NONCORRUGATED FLUTED TYPE EXHAUST GAS-AIR HEAT EXCHANGERS, L. M. K. Boelter, A. G. Guibert, M. A. Miller, and E. H. Morrin, August 1943

WR W 20 AN INVESTIGATION OF AIRCRAFT HEATERS. IX - MEASURED AND PREDICTED PERFORMANCE OF TWO EXHAUST GAS-AIR HEAT EXCHANGERS AND AN APPARATUS FOR EVALUATING EXHAUST GAS-AIR HEAT EXCHANGERS, L. M. K. Boelter, M. A. Miller, W. H. Sharp, E. H. Morrin, H. W. Iversen, and W. E. Mason, March 1943

WR W 25 AN INVESTIGATION OF AIRCRAFT HEATERS. XIX - PERFORMANCE OF TWO FINNED-TYPE CROSSFLOW EXHAUST GAS AND AIR HEAT EXCHANGERS, L. M. K. Boelter, A. G. Guibert, J. M. Rademacher, L. J. B. Sloggy, August 1944

WR W 26 AN INVESTIGATION OF AIRCRAFT HEATERS. XXII - MEASURED AND PREDICTED PERFORMANCE OF A FLUTED-TYPE EXHAUST GAS AND AIR HEAT EXCHANGER, L. M. K. Boelter, A. G. Guibert, J. M. Rademacher, and F. E. Romie, April 1945

WR W 27 AN INVESTIGATION OF AIRCRAFT HEATERS. XXI - MEASURED AND PREDICTED PERFORMANCE OF A FLATTENED-TUBE TYPE CROSSFLOW EXHAUST GAS AND AIR HEAT EXCHANGER, L. M. K. Boelter, A. G. Guibert, J. M. Rademacher, F. E. Romie, V. D. Sanders, L. J. B. Sloggy, April 1945

WR W 28 AN INVESTIGATION OF AIRCRAFT HEATERS. XX - MEASURED AND PREDICTED PERFORMANCE OF A FINNED-TYPE CAST-ALUMINUM CROSSFLOW EXHAUST GAS AND AIR HEAT EXCHANGER, L. M. K. Boelter, A. G. Guibert, J. M. Rademacher, F. E. Romie, and V. D. Sanders, April 1945

WR W 29 AN INVESTIGATION OF AIRCRAFT HEATERS. XXIII - MEASURED AND PREDICTED PERFORMANCE OF A FLAT-PLATE TYPE EXHAUST GAS AND AIR HEAT EXCHANGER, L. M. K. Boelter, A. G. Guibert, J. M. Rademacher, and V. D. Sanders, April 1945

WR W 42 AN INSTRUMENT FOR THE DETERMINATION OF RAIN DENSITIES IN FLIGHT, John R. Bemis and Henry G. Houghton, Jr., May 1943

WR W 49 RESPONSE OF HELICOPTER ROTORS TO PERIODIC FORCES, Bartram Kelley, March 1945

WR W 57 A METHOD FOR STUDYING THE LONGITUDINAL DYNAMIC STABILITY OF FLYING-BOAT HULL MODELS AT HIGH-PLANING SPEEDS AND DURING LANDING, F. W. S. Locke, Jr., and W. C. Hugli, Jr., April 1945

WR W 58 TANK TESTS ON THE RESISTANCE AND PORPOISING CHARACTERISTICS OF THREE-FLYING-BOAT HULL MODELS EQUIPPED WITH PLANING FLAPS, F. W. S. Locke, Jr., and Jean A. Barklie, November 1945

WR W 60 PROTECTION OF NONMETALLIC AIRCRAFT FROM LIGHTNING. II - LIGHTNING CONDUCTOR MATERIALS, High Voltage Laboratory, October 1943

WR W 62 PROTECTION OF NONMETALLIC AIRCRAFT FROM LIGHTNING. III - ELECTRICAL EFFECTS IN GLIDER TOWLINES. High Voltage Laboratory, National Bureau of Standards, March 1944

WR W 65 PORPOISING A COMPARISON OF THEORY WITH EXPERIMENT, Kenneth S. M. Davidson with F. W. S. Locke, Jr., and Anthony Suarez, July 1943

WR W 67 SOME SYSTEMATIC MODEL EXPERIMENTS ON THE PORPOISING CHARACTERISTICS OF FLYING-BOAT HULLS, Kenneth S. M. Davidson and F. W. S. Locke, Jr., July 1943

WR W 68 SOME ANALYSES OF SYSTEMATIC EXPERIMENTS ON THE RESISTANCE AND PORPOISING CHARACTERISTICS OF FLYING-BOAT HULLS, Kenneth S. M. Davidson and F. W. S. Locke, Jr., September 1943

WR W 85 PROTECTION OF NONMETALLIC AIRCRAFT FROM LIGHTNING. IV - ELECTROCUTION HAZARDS FROM INDUCTIVE VOLTAGES. High Voltage Laboratory, National Bureau of Standards, March 1945

WR W 96 GENERAL PORPOISING TESTS OF FLYING-BOAT-HULL MODELS, F. W. S. Locke, Jr., September 1943

WR W 98 AN INVESTIGATION OF AIRCRAFT HEATERS. III - MEASURED AND PREDICTED PERFORMANCE OF DOUBLE TUBE HEAT EXCHANGERS, R. C. Martinelli, E. B. Weinberg, E. H. Morrin, and L. M. K. Boelter, October 1942

WR W 101 NOTES ON MAXIMUM AIRPLANE ANGULAR VELOCITIES, H. M. Conway, May 1943

WR W 104 AN ANALYSIS OF THE SKIPPING CHARACTERISTICS OF SOME FULL-SIZE FLYING BOATS, F. W. S. Locke, Jr., January 1946

Not Applicable NACA Research Memoranda

RM A7L16 — A WIND-TUNNEL INVESTIGATION AT LOW SPEED OF VARIOUS LATERAL CONTROLS ON A 45° SWEPT-BACK WING, Edward J. Hopkins, April 1948

RM A7L31 — A FLIGHT INVESTIGATION AND ANALYSIS OF THE LATERAL-OSCILLATION CHARACTERISTICS OF AN AIRPLANE, Carl J. Stough and William M. Kauffman, June 1948

RM A9C09 — A REVIEW OF INSTRUMENTS DEVELOPED FOR THE MEASUREMENT OF THE METEOROLOGICAL FACTORS CONDUCIVE TO AIRCRAFT ICING, Alun R. Jones and William Lewis, April 1949

RM A52J06 — CORRELATION OF PREDICTED AND EXPERIMENTAL LATERAL OSCILLATION CHARACTERISTICS FOR SEVERAL AIRPLANES, Donovan R. Heinle and Walter E. McNeill, December 1952

RM A52L04 — EXPERIMENTAL INVESTIGATION OF AERODYNAMICALLY BALANCED TRAILING-EDGE CONTROL SURFACES ON AN ASPECT RATIO 2 TRIANGULAR WING AT SUBSONIC AND SUPERSONIC SPEEDS, John W. Boyd and Frank A. Pfyl, February 1953

RM A53H10 — A FLIGHT STUDY OF THE EFFECTS ON TRACKING PERFORMANCE OF CHANGES IN THE LATERAL-OSCILLATION CHARACTERISTICS OF A FIGHTER AIRPLANE, Walter E. McNeill, Fred J. Drinkwater, III, and Rudolph D. Van Dyke, Jr., October 1953

RM A53H18 — A METHOD FOR ESTIMATING THE ROLLING MOMENTS CAUSED BY WING-TAIL INTERFERENCE FOR MISSILES AT SUPERSONIC SPEEDS, Sherman Edwards and Katsumi Hikido, November 1953

RM A54D05 — WIND-TUNNEL INVESTIGATION AT SUBSONIC AND SUPERSONIC SPEEDS OF A FIGHTER MODEL EMPLOYING A LOW-ASPECT-RATIO UNSWEPT WING AND A HORIZONTAL TAIL MOUNTED WELL ABOVE THE WING PLANE - LONGITUDINAL STABILITY AND CONTROL, Willard G. Smith, November 1954

RM A54F01 — BIBLIOGRAPHY OF NACA REPORTS RELATED TO AIRCRAFT CONTROL AND GUIDANCE SYSTEMS, JANUARY 1949 - APRIL 1954, Roy J. Niewald and Jack D. Brewer, July 1954

RM A54H26b — WIND-TUNNEL INVESTIGATION AT SUBSONIC AND SUPERSONIC SPEEDS OF A FIGHTER MODEL EMPLOYING A LOW-ASPECT-RATIO UNSWEPT WING AND A HORIZONTAL TAIL MOUNTED WELL ABOVE THE WING PLANE - LATERAL AND DIRECTIONAL STABILITY, Benton E. Wetzel, April 1955

RM A54I23 — A HEATED-WIRE LIQUID-WATER-CONTENT INSTRUMENT AND RESULTS OF INITIAL FLIGHT TESTS IN ICING CONDITIONS, Carr B. Neel, January 1955

RM A54J14 A FLIGHT AND ANALOG COMPUTER STUDY OF SOME STABILIZATION AND COMMAND NETWORKS FOR AN AUTOMATICALLY CONTROLLED INTERCEPTOR DURING THE FINAL ATTACK PHASE, Howard L. Turner, William C. Triplett and John S. White, March 1955

RM A54K16 TRACKING PERFORMANCE OF A SWEPT-WING FIGHTER WITH A DISTRUBED-RETICLE LEAD-COMPUTING SIGHT, Burnett L. Gadeberg and George A. Rathert, Jr., February 1955

RM A55C24 LIFT, DRAG, AND STATIC LONGITUDINAL STABILITY CHARACTERISTICS OF FOUR AIRPLANE-LIKE CONFIGURATIONS AT MACH NUMBERS FROM 3.00 TO 6.28, Stanford E. Neice, Thomas J. Wong and Charles A. Hermach, April 1955

RM A55C30 THE EFFECT OF WING HEIGHT ON THE LONGITUDINAL CHARACTERISTICS AT HIGH SUBSONIC SPEEDS OF A WING-FUSELAGE-TAIL COMBINATION HAVING A WING WITH 40° OF SWEEPBACK AND NACA FOUR-DIGIT THICKNESS DISTRIBUTION, Jerald K. Dickson and Fred B. Sutton, May 1955

RM A55C30a THE EFFECT OF WING FENCES ON THE LONGITUDINAL CHARACTERISTICS AT MACH NUMBERS UP TO 0.92 OF A WING-FUSELAGE-TAIL COMBINATION HAVING A 40° SWEPTBACK WITH WITH NACA 64A THICKNESS DISTRIBUTION, Jerald K. Dickson and Fred B. Sutton, May 1955

RM A55D12 CONTROLS FOR SUPERSONIC MISSILES, George E. Kaattari, William A. Hill, Jr. and Jack N. Nielsen, May 1955

RM A55D12a THE EFFECTS OF POWERED CONTROLS AND FIRE-CONTROL SYSTEMS ON TRACKING ACCURACY, George A. Rathert, Jr., Marvin Abramovitz and Burnett L. Gadeberg, May 1955

RM A55F20 AN AIR-BORNE TARGET SIMULATOR FOR USE IN OPTICAL-SIGHT TRACKING STUDIES, Brian F. Doolin, G. Allan Smith, and Fred J. Drinkwater, III, September 1955

RM A56A06 A PRELIMINARY INVESTIGATION OF THE STATIC STABILITY CHARACTERISTICS OF FOUR AIRPLANE-LIKE CONFIGURATIONS AT MACH NUMBERS FROM 3.00 TO 6.28, Thomas J. Wong and Hermilo R. Gloria, March 1956

RM A56E22 WIND-TUNNEL INVESTIGATION AT MACH NUMBERS FROM 0.8 TO 1.4 OF STATIC LONGITUDINAL AND LATERAL-DIRECTIONAL CHARACTERISTICS OF AN UNSWEPT-WING AIRPLANE MODEL, James L. Summers, Stuart L. Treon, and Lawrence A. Graham, December 1956

RM A56F07 SIMULATOR STUDY OF SOME LONGITUDINAL STABILITY AND CONTROL PROBLEMS OF PILOTED AIRCRAFT IN FLIGHTS TO EXTREME ALTITUDE AND HIGH SPEED, Howard F. Matthews and Robert B. Merrick, September 1956

RM A56I04 THE STATIC AND DYNAMIC-ROTARY STABILITY DERIVATIVES AT SUBSONIC SPEEDS OF AN AIRPLANE MODEL WITH AN UNSWEPT WING AND A HIGH HORIZONTAL TAIL, Donald A. Buell, Verlin D. Reed, and Armando E. Lopez, December 1956

RM A56I10 APPLICATION OF A WINDSHIELD-DISPLAY SYSTEM TO THE LOW-ALTUTUDE BOMBING PROBLEM, Robert M. Barnett, William M. Kauffman, and Elmer C. Fulcher, January 1957

RM A56K07 A SIMPLIFIED METHOD FOR ASSESSING THE EFFECT OF STEADY ROLLING ON ANGLE OF ATTACK AND SIDESLIP, Stanley F. Schmidt, Norman R. Bergrun, Robert B. Merrick, and Howard F. Matthews, January 1957

RM A56K19 THE INFLUENCE OF IMPERFECT RADAR SPACE STABILIZATION ON THE FINAL ATTACK PHASE OF AN AUTOMATIC INTERCEPTOR SYSTEM, William C. Triplett, John D. McLean and John S. White, March 1957

RM A57A24 WIND-TUNNEL TESTS OF STATIC LONGITUDINAL CHARACTERISTICS AT LOW SPEED OF SWEPT-WING AIRPLANE WITH SLOTTED FLAPS, AREA-SUCTION FLAPS, AND WING LEADING-EDGE DEVICES, Ralph L. Maki and Harry A. James, April 1957

RM A57C19 AN AIR-BORNE TARGET SIMULATOR FOR USE WITH SCOPE-PRESENTATION TYPE FIRE-CONTROL SYSTEMS, John V. Foster, Elmer C. Fulcher, and Donovan R. Heinle, May 1957

RM A57D09 FLIGHT TESTS OF AN AUTOMATIC INTERCEPTOR SYSTEM WITH A TRACKING RADAR MODIFIED TO MINIMIZE THE INTERACTION BETWEEN ANTENNA AND INTERCEPTOR MOTIONS, William C. Triplett and Francis W. K. Hom, May 1957

RM A57J01 TRACKING PERFORMANCE OF SWEPT-WING FIGHTER WITH DIRECTOR-TYPE RADAR FIRE-CONTROL SYSTEM AND SCOPE PRESENTATION, Howard L. Turner, George A. Rathert, Jr. and Donovan R. Heinle, January 1958

RM A57J15 STATIC STABILITY AND CONTROL OF CANARD CONFIGURATIONS AT MACH NUMBERS FROM 0.70 TO 2.22 LONGITUDINAL CHARACTERISTICS OF TRI-ANGULAR WING AND CANARD, John W. Boyd and Victor L. Peterson, January 1958

RM A57K07 AN ANALYTICAL EVALUATION OF THE EFFECTS OF AN AERODYNAMIC MODIFICATION AND OF STABILITY AUGMENTERS ON THE PITCH-UP BEHAVIOR AND PROBABLE PILOT OPINION OF TWO CURRENT FIGHTER AIRPLANES, Melvin Sadoff and John D. Stewart, April 1958

RM A57K14 STATIC STABILITY AND CONTROL OF CANARD CONFIGURATIONS AT MACH NUMBERS FROM 0.70 TO 2.22 - TRIANGULAR WING AND CANARD ON AN EXTENDED BODY, John W. Boyd and Victor L. Peterson, February 1958

RM A57K26 STATIC STABILITY AND CONTROL OF CANARD CONFIGURATIONS AT MACH NUMBERS FROM 0.70 TO 2.22 - LONGITUDINAL CHARACTERISTICS OF A TRIANGULAR WING AND UNSWEPT CANARD, Victor L. Peterson and Gene P. Menees, February 1958

RM A57K27 STATIC STABILITY AND CONTROL OF CANARD CONFIGURATIONS AT MACH NUMBERS FROM 0.70 TO 2.22 - LONGITUDINAL CHARACTERISTICS OF AN UNSWEPT WING AND CANARD, Victor L. Peterson and John W. Boyd, February 1958

RM A57L10 A FLIGHT STUDY OF LONGITUDINAL-CONTROL-SYSTEM DYNAMIC CHARACTERISTICS BY THE USE OF A VARIABLE-CONTROL-SYSTEM AIRPLANE, Norman M. McFadden, Frank A. Pauli, and Donovan R. Heinle, March 1958

RM A57L11a THE EFFECTS OF A MODIFIED ROLL-COMMAND SYSTEM ON THE FLIGHT-PATH STABILITY AND TRACKING ACCURACY OF AN AUTOMATIC INTERCEPTOR, William C. Triplett, March 1958

RM A57L18 STATIC STABILITY AND CONTROL OF CANARD CONFIGURATIONS AT MACH NUMBERS FROM 0.70 TO 2.22 - LATERAL-DIRECTIONAL CHARACTERISTICS OF A TRIANGULAR WING AND CANARD, Victor L. Peterson and Gene P. Menees, March 1958

RM A58A14 WIND-TUNNEL DATA ON THE LONGITUDINAL AND LATERAL-DIRECTIONAL ROTARY DERIVATIVES OF A STRAIGHT-WING, RESEARCH AIRPLANE CONFIGURATION AT MACH NUMBERS FROM 2.5 TO 3.5, Benjamin H. Beam and Kenneth C. Endicott, March 1958

RM A58C03 TRANSONIC INVESTIGATION OF YAWED WINGS OF ASPECT RATIOS 3 AND 6 WITH A SEARS-HAACK BODY AND WITH SYMMETRICAL AND ASYMMETRICAL BODIES INDENTED FOR A MACH NUMBER OF 1.20, George H. Holdaway and Elaine W. Hatfield, June 1958

RM A58C05 STATIC STABILITY AND CONTROL CHARACTERISTICS OF TRIANGULAR WING AND CANARD CONFIGURATION AT MACH NUMBERS FROM 2.58 TO 3.53, C. Ernest Hedstrom,James R. Blackaby, and Victor L. Peterson, May 1958

RM A58C21 STATIC LOGITUDINAL CHARACTERISTICS OF TWISTED AND CAMBERED 45° SWEPTBACK WING AT MACH NUMBERS UP TO 0.96, Robert I. Sammonds and Robert M. Reynolds, August 1958

RM A58D21 FLIGHT INVESTIGATION OF A FULL-SCALE AIRCRAFT EJECTOR WITH VARIOUS SPACING RATIOS AND CORRELATION WITH SMALL-SCALE TESTS, C. Dewey Havill and Rodney C. Wingrove, August 1958

RM A58D24 EFFECTS OF CANARDS ON AIRPLANE PERFORMANCE AND STABILITY, Charles F. Hall and John W. Boyd, July 1958

RM A58E02 WIND-TUNNEL INVESTIGATION AT MACH NUMBERS FROM 0.6 TO 1.4 OF SEVERAL EJECTED PILOT-SEAT MODELS, James L. Summers, September 1958

RM A58F09 THE STATIC AND DYNAMIC-ROTARY STABILITY DERIVATIVES AT SUBSONIC SPEEDS OF A MODEL OF THE X-15 RESEARCH AIRPLANE, Armando E. Lopez and Bruce E. Tinling, September 1958

RM E9C17 AN ELECTRIC THRUST METER SUITABLE FOR FLIGHT INVESTIGATION OF PROPELLERS, Porter J. Perkins, Jr. and Morton B. Millenson, May 1949

RM E53J30 EFFECT OF ICE FORMATION ON SECTION DRAG OF SWEPT NACA 63A-009 AIRFOIL WITH PARTIAL-SPAN LANDING-EDGE SLAT FOR VARIOUS MODES OF THERMAL ICE PROTECTION, Uwe H. von Glahn and Vernon H. Gray, March 1954

RM E55B11 FULL-SCALE PERFORMANCE STUDY OF PROTOTYPE CRASH-FIRE PROTECTION SYSTEM FOR RECIPROCATING-ENGINE-POWERED AIRPLANES, Dugald O. Black and Jacob C. Moser, November 1955

RM E55E17a PRELIMINARY DATA ON RAIN DEFLECTION FROM AIRCRAFT WINDSHIELDS BY MEANS OF HIGH-VELOCITY JET-AIR BLAST, Robert S. Ruggeri, July 1955

RM E55F28a STATISTICAL SURVEY OF ICING DATA MEASURED ON SCHEDULED AIRLINE FLIGHTS OVER UNITED STATES AND CANADA FROM NOVEMBER 1951 TO JUNE 1952, Porter J. Perkins, September 1955

RM E55K07 PRELIMINARY FLIGHT SURVEY OF AERODYNAMIC NOISE ON AIRPLANE WING, Harold R. Mull and Joseph S. Algranti, March 1956

RM E56E11 USE OF TRUNCATED FLAPPED AIRFOILS FOR IMPINGEMENT AND ICING TESTS OF FULL-SCALE LEADING-EDGE SECTIONS, Uwe H. von Glahn, July 1956

RM E57B05 THE INTERRELATED EFFECTS OF ENGINE ROTOR MOMENTUM AND FLIGHT REGIME ON THE DYNAMIC STABILITY OF HIGH-PERFORMANCE AIRCRAFT, Warren J. North, April 1957

RM H54J26a FLIGHT MEASUREMENTS OF DYNAMIC LONGITUDINAL STABILITY AND FREQUENCY-RESPONSE CHARACTERISTICS OF XF-92A DELTA-WING AIRPLANE, Euclid C. Holleman and William C. Triplett, January 1955

RM H54J27 LONGITUDINAL STABILITY CHARACTERISTICS IN MANEUVERING FLIGHT OF THE CONVAIR XF-92A DELTA-WING AIRPLANE INCLUDING THE EFFECTS OF WING FENCES, Thomas R. Sisk and Duane O. Muhleman, January 1955

RM H55G25 BEHAVIOR OF THE BELL X-1A RESEARCH AIRPLANE DURING EXPLORATORY FLIGHTS AT MACH NUMBERS NEAR 2.0 AND AT EXTREME ALTITUDES, Hubert M. Drake and Wendell H. Stillwell, September 1955

RM H55H03 FLIGHT EXPERIENCE WITH A DELTA-WING AIRPLANE HAVING VIOLENT LATERAL-LONGITUDINAL COUPLING IN AILERON ROLLS, Thomas R. Sisk and William H. Andrews, October 1955

RM H55L28a FLIGHT INVESTIGATION OF THE EFFECT OF VERTICAL-TAIL SIZE ON THE ROLLING BEHAVIOR OF A SWEPT-WING AIRPLANE HAVING LATERAL-LONGITUDINAL COUPLING, Thomas W. Finch, James R. Peele and Richard E. Day, April 1956

RM H56C20 TIME-VECTOR DETERMINED LATERAL DERIVATIVES OF A SWEPT-WING FIGHTER-TYPE AIRPLANE WITH THREE DIFFERENT VERTICAL TAILS AT MACH NUMBERS BETWEEN 0.70 AND 1.48, Chester H. Wolowicz, June 1956

RM H56C29 FLIGHT DETERMINATION OF THE LATERAL HANDLING QUALITIES OF THE BELL X-5 RESEARCH AIRPLANE AT 58.7° SWEEPBACK, Thomas W. Finch and Joseph A. Walker, May 1956

RM H56F08 CORRELATION OF FLIGHT AND ANALOG INVESTIGATIONS OF ROLL COUPLING, Joseph Weil and Richard E. Day, September 1956

RM H56G11 FLIGHT EVALUATION OF THE LATERAL STABILITY AND CONTROL CHARACTERISTICS OF THE CONVAIR YF-102 AIRPLANE, Thomas R. Sisk, William H. Andrews, and Robert W. Darville, January 1957

RM H56H03 DYNAMIC LONGITUDINAL STABILITY CHARACTERISTICS OF A SWEPT-WING FIGHTER-TYPE AIRPLANE AT MACH NUMBERS BETWEEN 0.36 AND 1.45, Chester H. Wolowicz, April 1957

RM H56I17 LONGITUDINAL STABILITY CHARACTERISTICS OF CONVAIR YF-102 AIRPLANE DETERMINED FROM FLIGHT TESTS, William H. Andrews, Thomas R. Sisk, and Robert W. Darville, December 1956

RM H57A16 FLIGHT-DETERMINED STATIC LATERAL STABILITY AND CONTROL CHARACTERISTICS OF A SWEPT-WING FIGHTER AIRPLANE TO A MACH NUMBER OF 1.39, Gene J. Matranga and James R. Peele, March 1957

RM H57G09 EFFECTS OF JET EXHAUSTS ON FLIGHT-DETERMINED LONGITUDINAL AND LATERAL DYNAMIC STABILITY CHARACTERISTICS OF THE DOUGLAS D-558-II RESEARCH AIRPLANE, Chester H. Wolowicz and Herman A. Rediess, August 1957

RM H57H12 EFFECTS OF WING-MOUNTED EXTERNAL STORES ON THE LONGITUDINAL AND LATERAL HANDLING QUALITIES OF THE DOUGLAS D-558-II RESEARCH AIRPLANE, Jack Fischel, Robert W. Darville and Donald Reisert, October 1957

RM H58A03a FLIGHT EVALUATION OF THE EFFECTS OF LEADING-EDGE-SLAT SPAN ON THE STABILITY AND CONTROL CHARACTERISTICS OF A SWEPT WING FIGHTER-TYPE AIRPLANE DURING ACCELERATED LONGITUDINAL MANEUVERS AT TRANSONIC SPEEDS, Gene J. Matranga and Katharine H. Armistead, March 1958

RM H58D22 SIMULATOR INVESTIGATION OF COMMAND REACTION CONTROLS, Euclid C. Holleman and Wendell H. Stillwell, July 1958

RM H58G18a SIMULATOR STUDIES OF JET REACTION CONTROLS FOR USE AT HIGH ALTITUDE, Wendell H. Stillwell and Hubert M. Drake, September 1958

RM L6J21 PRELIMINARY INVESTIGATION OF TWO FULL-SCALE PROPELLERS TO DETERMINE THE EFFECT OF SWEPT-BACK TIPS ON PROPELLER AERODYNAMIC CHARACTERISTICS, Albert J. Evans and E. Bernard Klunker, May 1947

RM L7H05 FACTORS AFFECTING THE DESIGN OF QUIET PROPELLERS, Arthur A. Regier and Harvey H. Hubbard, September 1947

RM L8C16 THE EFFECTS OF FULL SLOSHING ON THE LATERAL STABILITY OF A FREE-FLYING AIRPLANE MODEL, Charles C. Smith, Jr., June 1948

RM L8F07 A COMPARISON OF FLIGHT MEASUREMENTS WITH CALCULATIONS OF THE LOSS IN ROLLING EFFECTIVENESS DUE TO WING TWIST, T. V. Cooney and Bertram C. Wollner, August 1948

RM L8H23 EXPERIMENTAL DETERMINATION OF THE LATERAL STABILITY OF A GLIDER TOWED BY A SINGLE TOWLINE AND CORRELATION WITH AN APPROXIMATE THEORY, Bernard Maggin and Robert E. Shanks, November 1948

RM L8K19a AN INVESTIGATION OF THE SPIN AND RECOVERY CHARACTERISTICS OF A 1/25-SCALE MODEL OF THE DOUGLES D-558-II AIRPLANE, Stanley H. Scher and Lawrence J. Gale, January 1949

RM L8K30 LATERAL AND DIRECTIONAL STABILITY AND CONTROL CHARACTERISTICS OF A C-54D AIRPLANE, Donald B. Talmage and John P. Reeder, March 1949

RM L9E25a SOME TESTS OF THE LONGITUDINAL STABILITY AND CONTROL OF AN H-13B HELICOPTER IN FORWARD FLIGHT, John P. Reeder and Chester R. Haig, Jr., August 1949

RM L9K28 AN INVESTIGATION OF THE SPIN, RECOVERY, AND TUMBLING CHARACTERISTICS OF A 1/20-SCALE MODEL OF THE NORTHROP X-4 AIRPLANE, Lawrence J. Gale, Ira P. Jones, Jr., and Jack H. Wilson, January 1950

RM L50B09 WING-FLOW MEASUREMENTS OF LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS OF A SUPERSONIC AIRPLANE CONFIGURATION HAVING A 42.8° SWEPTBACK CIRCULAR-ARC WING WITH ASPECT RATIO 4.0, TAPER RATIO 0.50, AND SWEPTBACK TAIL SURFACES, Harold L. Crane and James J. Adams, April 1950

RM L50I06a DETERMINATION OF LONGITUDINAL STABILITY OF THE BELL X-1 AIRPLANE FROM TRANSIENT RESPONSES AT MACH NUMBERS UP TO 1.12 AT LIFT COEFFICIENTS OF 0.3 AND 0.6, Ellwyn E. Angle and Euclid C. Holleman, November 1950

RM L50K17 PRELIMINARY INVESTIGATION OF A FIN-ACTUATED JET-VANE CONTROL SYSTEM FOR STABILIZATION OF ROCKET-POWERED MODELS, Andrew R. Wineman, January 1951

RM L50K30 THE ORIGIN OF AERODYNAMIC INSTABILITY OF SUPERSONIC INLETS AT SUBCRITICAL CONDITIONS, Antonio Ferri and Louis M. Nucci, January 1951

RM L51I28 ROCKET-MODEL INVESTIGATION OF ROLLING EFFECTIVENESS ON FIGHTER-TYPE WING-CONTROL CONFIGURATION AT MACH NUMBERS FROM 0.6 TO 1.5, H. Kurt Strass and Edward T. Marley, February 1952

RM L52E06b MISCELLANEOUS DIRECTIONAL-STABILITY DATA FOR SEVERAL AIRPLANE-LIKE CONFIGURATIONS FROM ROCKET-MODEL TESTS AT TRANSONIC SPEEDS, Paul E. Purser and Jesse L. Mitchell, September 1952

RM L52F06 LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS OF A CANARD MISSILE CONFIGURATION FOR MACH NUMBERS FROM 1.1 TO 1.93 AS DETERMINED FROM FREE-FLIGHT AND WIND-TUNNEL INVESTIGATIONS, Howard J. Curfman, Jr. and Carl E. Grigsby, August 1952

RM L52K14b FLIGHT INVESTIGATION OF A SUPERSONIC CANARD MISSILE EQUIPPED WITH AN AUXILIARY DAMPING-IN-PITCH CONTROL SYSTEM, Martin T. Moul, February 1953

RM L52K20 SUMMARY OF PITCH-DAMPING DERIVATIVES OF COMPLETE AIRPLANE AND MISSILE CONFIGURATIONS AS MEASURED IN FLIGHT AT TRANSONIC AND SUPERSONIC SPEEDS, Clarence L. Gillis and Rowe Chapman, Jr., January 1953

RM L53B09 EFFECTS OF SPAN AND SPANWISE AND CHORDWISE LOCATION ON THE CONTROL EFFECTIVENESS OF SPOILERS ON A 50° SWEPTBACK WING AT MACH NUMBERS OF 1.41 AND 1.96, William H. Kindell, April 1953

RM L53D22 PRELIMINARY RESULTS FROM A LIMITED INVESTIGATION OF THE USE OF CONTROLS DURING SERVICE OPERATIONAL TRAINING WITH FIGHTER AIRPLANES, John P. Mayer, Carl R. Huss and Harold A. Hamer, June 1953

RM L53G24a MODEL DITCHING INVESTIGATIONS OF 3 AIRPLANES EQUIPPED WITH HYDRO-SKIS, Lloyd J. Fisher, September 1953

RM L53I10a A COMBINED AERODYNAMIC AND GUIDANCE APPROACH FOR A SIMPLE HOMING SYSTEM, Robert A. Gardiner, November 1953

RM L53I16 MEASUREMENT AND CALCULATION OF BLADE TORSIONAL DEFLECTION OF THREE SUPERSONIC-TYPE PROPELLERS, Arthur E. Allis and Willard E. Foss, Jr., May 1954

RM L53I18 PRELIMINARY INVESTIGATION OF THE EFFECTS OF SEVERAL SEEKER-NOSE CONFIGURATIONS ON THE LONGITUDINAL CHARACTERISTICS OF A CANARD-TYPE MISSILE AT A MACH NUMBER OF 1.60, A. Warner Robins, October 1953

RM L53I21a INVESTIGATIONS TOWARD SIMPLIFICATION OF MISSILE CONTROL SYSTEMS, Howard J. Curfman, Jr., H. Kurt Strass and Harold L. Crane, November 1953

RM L53I21b LONGITUDINAL CHARACTERISTICS OF WINGS, Thomas A. Toll, October 1953

RM L53I22a SEVERAL FACTORS AFFECTING ROLL CONTROL SYSTEMS OF INTERCEPTORS, Leonard Sternfield, November 1953

RM L53I23c RECENT DESIGN STUDIES DIRECTED TOWARD ELIMINATION OF PITCH-UP, Joseph Weil and W. H. Gray, November 1953

RM L54D09a EFFECTS OF FENCES, LEADING-EDGE CHORD-EXTENSIONS, BOUNDARY-LAYER RAMPS, AND TRAILING-EDGE FLAPS ON THE LONGITUDINAL STABILITY OF A TWISTED AND CAMBERED 60° SWEPTBACK-WING - INDENTED-BODY CONFIGURATION AT TRANSONIC SPEEDS, Thomas L. Fischetti, June 1954

RM L54E03 AN INVESTIGATION OF THE EFFECTS OF JET EXHAUST AND REYNOLDS NUMBER UPON THE FLOW OVER THE VERTICAL STABILIZER AND RUDDER OF THE DOUGLAS D-558-II RESEARCH AIRPLANE AT MACH NUMBERS OF 1.62, 1.93, AND 2.41, Carl E. Grigsby, June 1954

RM L54G08 STATIC LONGITUDINAL AND LATERAL STABILITY AND CONTROL CHARACTERISTICS OF A MODEL OF A 35° SWEPT-WING AIRPLANE AT A MACH NUMBER OF 1.41, Edward B. Palazzo and M. Leroy Spearman, May 1955

RM L54H04 ANALYTICAL STUDY OF THE EFFECT OF CENTER-OF-GRAVITY POSITION ON THE RESPONSE TO LONGITUDINAL CONTROL IN LANDING APPROACHES OF A SWEPT-WING AIRPLANE OF LOW ASPECT RATIO HAVING NO HORIZONTAL TAIL, Ralph W. Stone, Jr., October 1954

RM L54H17 FREE-FLIGHT MEASUREMENTS OF THE ROLLING EFFECTIVENESS AND OPERATING CHARACTERISTICS OF A BELLOWS-ACTUATED SPLIT-FLAP AILERON ON A 60° DELTA WING AT MACH NUMBERS BETWEEN 0.8 AND 1.8, Eugene D. Schult, October 1954

RM L54H31 A SUMMARY OF THE LOW-LIFT DRAG AND LONGITUDINAL TRIM CHARACTERISTICS OF TWO VERSIONS OF AN INTERCEPTOR-TYPE AIRPLANE AS DETERMINED FROM FLIGHT TESTS OF ROCKET-POWERED MODELS AT MACH NUMBERS BETWEEN 0.75 AND 1.78, Willard S. Blanchard, Jr., November 1954

RM L54I01 LONGITUDINAL STABILITY CHARACTERISTICS AT TRANSONIC SPEEDS OF A CANARD CONFIGURATION HAVING A 45° SWEPTBACK WING OF ASPECT RATIO 6.0 AND NACA 65A009 AIRFOIL SECTION, A. James Vitale and John C. McFall, Jr., November 1954

RM L54I10 LOW-AMPLITUDE DAMPING-IN-PITCH CHARACTERISTICS OF FOUR TAILLESS SWEPT WING-BODY COMBINATIONS AT MACH NUMBERS FROM 0.85 TO 1.30 AS OBTAINED WITH ROCKET-POWERED MODELS, Charles T. D'Aiutolo, November 1954

RM L54I20 EXPERIMENTAL INVESTIGATION AT HIGH SUBSONIC SPEEDS OF THE ROLLING STABILITY DERIVATIVES OF A COMPLETE MODEL WITH AN ASPECT-RATIO-2.52 WING HAVING AN UNSWEPT 72-PERCENT-CHORD LINE AND A HIGH HORIZONTAL TAIL, William C. Sleeman, Jr. and James W. Wiggins, May 1955

RM L54K08 THEORETICAL ANALYSIS OF THE LONGITUDINAL BEHAVIOR OF AN AUTOMATICALLY CONTROLLED SUPERSONIC INTERCEPTOR DURING THE ATTACK PHASE, Ordway B. Gates, Jr. and C. H. Woodling, January 1955

RM L54L30 EFFECTS OF AN ALL-MOVABLE WING-TIP CONTROL ON THE LONGITUDINAL STABILITY OF A 60° SWEPTBACK-WING - INDENTED-BODY CONFIGURATION EQUIPPED WITH FENCES AT TRANSONIC SPEEDS, Thomas L. Fischetti and Donald L. Loving, April 1955

RM L55A21 STATIC LONGITUDINAL AND LATERAL STABILITY DATA FROM AN EXPLORATORY INVESTIGATION AT MACH NUMBER 4.06 OF AN AIRPLANE CONFIGURATION HAVING A WING OF TRAPEZOIDAL PLAN FORM, Robert W. Dunning and Edward F. Ulmann, February 1955

RM L55A21a STATIC LATERAL STABILITY DATA FROM AN EXPLORATORY INVESTIGATION AT A MACH NUMBER OF 6.86 OF AN AIRPLANE CONFIGURATION HAVING A WING OF TRAPEZOIDAL PLAN FORM, Herbert W. Ridyard, David E. Fetterman, Jr. and Jim A. Penland, February 1955

RM L55B28 EXPLORATORY INVESTIGATION AT MACH NUMBER 4.06 OF AN AIRPLANE CONFIGURATION HAVING A WING OF TRAPEZOIDAL PLAN FORM. LONGITUDINAL AND LATERAL CONTROL CHARACTERISTICS, Robert W. Dunning and Edward F. Ulmann, April 1955

RM L55C04 STATIC LONGITUDINAL AND LATERAL STABILITY AND CONTROL DATA FROM AN EXPLORATORY INVESTIGATION AT A MACH NUMBER OF 6.86 OF AN AIRPLANE CONFIGURATION HAVING A WING OF TRAPEZOIDAL PLAN FORM, David E. Fetterman, Jr., Jim A. Penland and Herbert W. Ridyard, April 1955

RM L55C22 AN EVALUATION OF A ROLLERON-ROLL-RATE STABILIZATION SYSTEM FOR A CANARD MISSILE CONFIGURATION AT MACH NUMBERS FROM 0.9 TO 2.3, Martin L. Nason, Clarence A. Brown, Jr., and Rupert S. Rock, September 1955

RM L55D08 EXPLORATORY INVESTIGATION AT MACH NUMBER 4.06 OF AN AIRPLANE CONFIGURATION HAVING A WING OF TRAPEZOIDAL PLAN FORM. EFFECTS OF VARIOUS TAIL ARRANGEMENTS ON WING-ON AND WING-OFF STATIC LONGITUDINAL AND LATERAL STABILITY CHARACTERISTICS, Robert W. Dunning and Edward F. Ulmann, April 1955

RM L55D21 VELOCITY DISTRIBUTION MEASURED IN SLIPSTREAM OF 8-BLADE AND 6-BLADE DUAL-ROTATING PROPELLERS AT ZERO ADVANCE, Leland B. Salters, Jr., June 1955

RM L55E13c STUDY OF RESPONSE OF PANELS TO RANDOM ACOUSTIC EXCITATION, Robert W. Hess, Leslie W. Lassiter, and Harvey H. Hubbard, July 1955

RM L55E19 A STUDY OF SERVICE-IMPOSED MANEUVERS OF FOUR JET FIGHTER AIRPLANES IN RELATION TO THEIR HANDLING QUALITIES AND CALCULATED DYNAMIC CHARACTERISTICS, John P. Mayer and Harold A. Hamer, August 1955

RM L55F08 LATERAL STABILITY AND CONTROL MEASUREMENTS OF FIGHTER-TYPE AIRPLANE WITH LOW-ASPECT-RATIO UNSWEPT WING AND TEE-TAIL, Donald D. Arabian and James W. Schmeer, June 1956

RM L55F17 STATIC LONGITUDINAL AND LATERAL STABILITY AND CONTROL CHARACTERISTICS OF AN AIRPLANE CONFIGURATION HAVING A WING OF TRAPEZOIDAL PLAN FORM WITH VARIOUS TAIL AIRFOIL SECTIONS AND TAIL ARRANGEMENTS AT A MACH NUMBER OF 6.86, Jim A. Penland, David E. Fetterman, Jr. and Herbert W. Ridyard, August 1955

RM L55F21 WIND-TUNNEL INVESTIGATION AT LOW SPEED OF SIDESLIPPING, ROLLING, YAWING, AND PITCHING CHARACTERISTICS FOR A MODEL OF A 45° SWEPT-WING FIGHTER-TYPE AIRPLANE, Byron M. Jaquet and H. S. Fletcher, September 1955

RM L55G06 SIMULATOR STUDIES OF A SIMPLE HOMING SYSTEM, Anthony L. Passera and H. Douglas Garner, October 1955

RM L55G18 THEORETICAL ANALYSIS OF THE LONGITUDINAL BEHAVIOR OF AN AUTOMATICALLY CONTROLLED SUPERSONIC INTERCEPTOR DURING THE ATTACK PHASE AGAINST MANEUVERING AND NONMANEUVERING TARGETS, C(arroll) H. Woodling and Ordway B. Gates, Jr., October 1955

RM L55G29 FLIGHT INVESTIGATION AT SUPERSONIC MACH NUMBERS OF AN AUTOMATIC ACCELERATION CONTROL MISSILE IN WHICH RATE DAMPING IS OBTAINED FROM A LINEAR ACCELEROMETER PLACED AHEAD OF THE MISSILE CENTER OF GRAVITY, Ernest C. Seaberg, Royce H. Sproull, and H. I. E. Reid, Jr., November 1955

RM L55I19 WIND-TUNNEL INVESTIGATION OF THE DAMPING IN ROLL OF THE BELL X-1A RESEARCH AIRPLANE AND ITS COMPONENTS AT SUPERSONIC SPEEDS, Russell W. McDearmon and Frank L. Clark, January 1956

RM L55I20 EFFECT OF LARGE NEGATIVE DIHEDRAL OF THE HORIZONTAL TAIL ON LONGITUDINAL AND LATERAL STABILITY CHARACTERISTICS OF A SWEPT-WING CONFIGURATION AT TRANSONIC SPEEDS, Donald D. Arabian, January 1956

RM L55I23 WIND-TUNNEL INVESTIGATION OF STATIC LONGITUDINAL AND LATERAL STABILITY OF BELL X-1A AT SUPERSONIC SPEEDS, Arthur Henderson, Jr., October 1955

RM L55I26 LATERAL-CONTROL INVESTIGATION AT TRANSONIC SPEEDS OF DIFFERENTIALLY DEFLECTED HORIZONTAL-TAIL SURFACES FOR A CONFIGURATION HAVING A 6-PERCENT-THICK 45° SWEPT-BACK WING, Chris C. Critzos, November 1955

RM L55L15a SOME EFFECTS OF AIRCRAFT CONFIGURATION ON STATIC LONGITUDINAL AND DIRECTIONAL STABILITY CHARACTERISTICS AT SUPERSONIC MACH NUMBERS BELOW 3, M. Leroy Spearman and Arthur Henderson, Jr., February 1956

RM L55L16a THE USE OF THE HORIZONTAL TAIL FOR ROLL CONTROL, John P. Campbell, February 1956

RM L55L19 TRANSONIC WIND-TUNNEL MEASUREMENTS OF STATIC LATERAL AND DIRECTIONAL STABILITY AND VERTICAL-TAIL LOADS FOR MODEL WITH 45° SWEPT-BACK WING, Joseph M. Hallissy, Jr., May 1956

RM L55L19a FLOW-FIELD EFFECTS ON STATIC STABILITY AND CONTROL AT HIGH SUPERSONIC MACH NUMBERS, Edward F. Ulmann and Herbert W. Ridyard, March 1956

RM L55L22a RECENT CONTROL STUDIES, John G. Lowry, February 1956

RM L55L26 LONGITUDINAL CHARACTERISTICS OF UNSWEPT-WING FIGHTER TYPE MODEL WITH EXTERNAL STORES AT MACH NUMBER OF 1.82 AND SOME EFFECTS OF HORIZONTAL-TAIL AND YAW-DAMPER-VANE DEFLECTION ON SIDESLIP DERIVATIVES, Ross B. Robinson, August 1956

RM L56A18 A TRANSONIC INVESTIGATION OF THE STATIC LONGITUDINAL-STABILITY CHARACTERISTICS OF A 45° SWEPTBACK WING-FUSELAGE COMBINATION WITH AND WITHOUT HORIZONTAL TAIL, Chris C. Critzos, May 1956

RM L56B15 WIND-TUNNEL INVESTIGATION OF THE DAMPING IN ROLL OF THE BELL X-1E RESEARCH AIRPLANE AND ITS COMPONENTS AT SUPERSONIC SPEEDS, Russell W. McDearmon and Frank L. Clark, April 1956

RM L56C23b WIND-TUNNEL INVESTIGATION OF THE STATIC LONGITUDINAL AND LATERAL STABILITY OF A 1/62-SCALE MODEL OF THE X-1E AT SUPERSONIC SPEEDS, Arthur Henderson, Jr., May 1956

RM L56C27 STATIC-THRUST CHARACTERISTICS OF NACA 8.75-(5)(05)-037 DUAL-ROTATION PROPELLER, Harry T. Norton, Jr., July 1956

RM L56D04 STATIC LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS OF A MODEL OF A 45° SWEPT-WING FIGHTER AIRPLANE AT MACH NUMBERS OF 1.41, 1.61, AND 2.01, Cornelius Driver and Gerald V. Foster, July 1956

RM L56D05 STATIC LATERAL STABILITY AND CONTROL CHARACTERISTICS OF A MODEL OF A 45° SWEPT-WING FIGHTER AIRPLANE WITH VARIOUS VERTICAL TAILS AT MACH NUMBERS OF 1.41, 1.61, AND 2.01, M. Leroy Spearman and Ross B. Robinson, June 1956

RM L56D10 LONGITUDINAL STABILITY CHARACTERISTICS OF A SIMPLE INFRARED HOMING MISSILE CONFIGURATION AT MACH NUMBERS OF 0.7 TO 1.4, Clarence A. Brown, Jr., June 1956

RM L56D23 A FLIGHT AND ANALYTICAL STUDY OF METHODS FOR REDUCING AUTOMATIC-INTERCEPTOR TRACKING ERRORS CAUSED BY TARGET MANEUVERS, Charles W. Mathews, Donald C. Cheatham, and Howard C. Kyle, September 1956

RM L56E11 FREE-FLIGHT INVESTIGATION AT TRANSONIC SPEEDS OF STABILITY CHARACTERISTICS OF TAILLESS MISSILE CONFIGURATION HAVING 45° SWEPTBACK WING OF ASPECT RATIO 4, Richard G. Arbic, August 1956

RM L56E21 FLIGHT INVESTIGATION OF FACTORS AFFECTING PILOTS' ABILITY TO UTILIZE A RADARSCOPE DISPLAY OF STEERING INFORMATION, Stanley Faber, Donald C. Cheatham, and Robert A. Champine, November 1956

RM L56E23 STATIC LATERAL AND DIRECTIONAL STABILITY AND EFFECTIVE SIDEWASH CHARACTERISTICS OF A MODEL OF A 35° SWEPT-WING AIRPLANE AT A MACH NUMBER OF 1.61, M. Leory Spearman, August 1956

RM L56E29 INVESTIGATION AT HIGH SUBSONIC SPEEDS OF THE STATIC LATERAL AND DIRECTIONAL STABILITY AND TAIL-LOADS CHARACTERISTICS OF A MODEL HAVING A HIGHLY TAPERED SWEPT WING OF ASPECT RATIO 3 AND TWO HORIZONTAL-TAIL POSITIONS, Albert G. Few, Jr., September 1956

RM L56E30 EXPLORATORY INVESTIGATION AT MACH NUMBER OF 5.20 OF LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF FLAT-BOTTOM BODIES, Roy H. Lange, July 1956

RM L56F06 A FLIGHT INVESTIGATION OF THE HANDLING CHARACTERISTICS OF A FIGHTER AIRPLANE CONTROLLED THROUGH A RATE TYPE OF AUTOMATIC CONTROL SYSTEM, Walter R. Russell, S. A. Sjoberg and William L. Alford, September 1956

RM L56F12a FLIGHT AND ANALYTICAL STUDY OF ROLL REQUIREMENTS OF A FIGHTER AIRPLANE, James J. Adams, August 1956

RM L56F15a EFFECTS OF EXTERNAL STORES ON THE STATIC LONGITUDINAL AND LATERAL AERODYNAMIC CHARACTERISTICS OF A MODEL OF A 45° SWEPT-WING FIGHTER AIRPLANE AT MACH NUMBERS OF 1.61 AND 2.01, Gerald V. Foster and Cornelius Driver, August 1956

RM L56F19 WIND-TUNNEL INVESTIGATION AT LOW SPEED OF EFFECTS OF SIDESLIP ON STATIC LONGITUDINAL TRIM AND STATIC LATERAL STABILITY CHARACTERISTICS OF THREE FIGHTER-TYPE AIRPLANE MODELS, Byron M. Jaquet and H. S. Fletcher, September 1956

RM L56G10 MODEL DITCHING INVESTIGATION OF JET TRANSPORT AIRPLANE WITH VARIOUS ENGINE INSTALLATIONS, William C. Thompson, August 1956

RM L56G27 EXPERIMENTAL AND THEORETICAL STUDIES OF INTERFERENCE EFFECTS ON THE DAMPING IN ROLL OF THE BELL X-1A RESEARCH AIRPLANE AT SUPERSONIC SPEEDS (INCLUDING CANOPY SHAPE EFFECTS), Russell W. McDearmon and William B. Boatright, October 1956

RM L56H06 LONGITUDINAL AND LATERAL STABILITY CHARACTERISTICS OF A LOW-ASPECT-RATIO UNSWEPT-WING AIRPLANE MODEL AT MACH NUMBERS OF 1.82 AND 2.01, M. Leroy Spearman and Cornelius Driver, January 1957

RM L56H13 STATIC STABILITY CHARACTERISTICS OF A CAMBERED-DELTA-WING MODEL AT HIGH SUBSONIC SPEEDS, William C. Moseley, Jr., October 1956

RM L56H24 COMBINED EFFECTS OF WING TAPER RATIO AND LOW HORIZONTAL-TAIL POSITION ON LONGITUDINAL STABILITY OF A 45° SWEPTBACK WING-BODY COMBINATION AT TRANSONIC SPEEDS, Stanley H. Spooner, October 1956

RM L56I12 SEMIGRAPHICAL METHOD FOR DETERMINATION OF ROLLING CHARACTERISTICS OF ROLLERON-EQUIPPED MISSILES, Martin L. Nason, November 1956

RM L56I20 LIMITED INVESTIGATION OF EFFECTS OF DIFFERENTIAL HORIZONTAL-TAIL DEFLECTION ON LATERAL CONTROL CHARACTERISTICS OF TWO SWEPT-WING AIRPLANE MODELS AT MACH NUMBERS FROM 1.4 TO 2.0, M. Leroy Spearman, December 1956

RM L56I21 LOW-SPEED MEASUREMENT OF TAIL CONTRIBUTION TO ROLLING STABILITY DERIVATIVES AND AIR-FLOW ANGULARITY AT THE TAIL FOR AN X-TAIL MODEL IN STEADY ROLL INCLUDING SOME EFFECTS OF WING-TIP STORES, Donald R. Riely, November 1956

RM L56J25 INVESTIGATION AT HIGH SUBSONIC SPEEDS OF THE EFFECTS OF VARIOUS HORIZONTAL FUSELAGE FOREBODY FINS ON THE DIRECTIONAL AND LONGITUDINAL STABILITY OF A COMPLETE MODEL HAVING A 45° SWEPTBACK WING, William C. Sleeman, Jr., January 1957

RM L56J31a WIND-TUNNEL INVESTIGATION OF EFFECTS OF VENTRAL FINS AT TWO POSITIONS ON LATERAL-STABILITY DERIVATIVES OF 45° SWEPT HIGH-WING MODEL OSCILLATING IN YAW, Byron M. Jaquet, December 1956

RM L56L06 EXPLORATORY INVESTIGATION OF THE EFFECT OF WING SLOTS AND LEADING-EDGE SLATS ON THE LONGITUDINAL STABILITY CHARACTERISTICS OF A 45° SWEPTBACK WING-FUSELAGE CONFIGURATION, Chris C. Critzos, February 1957

RM L56L17 SOME DATA ON BODY AND JET REACTION CONTROLS, Allen B. Henning, Andrew R. Wineman, and Robert W. Rainey, March 1957

RM L56L18 FREE-FLIGHT EXPERIENCE OF THE LATERAL STABILITY CHARACTERISTICS AT LOW LIFT OF A 45° SWEPT-WING ROCKET-PROPELLED MODEL EQUIPPED WITH A NONLINEAR YAW-RATE DAMPER SYSTEM AT MACH NUMBERS FROM 0.76 TO 1.73, Charles T. D'Aiutolo, William W. Willoughby, and Lucille C. Coltrane, February 1957

RM L56L19 LONGITUDINAL AND LATERAL STABILITY AND CONTROL CHARACTERISTICS OF TWO CANARD AIRPLANE CONFIGURATIONS AT MACH NUMBERS OF 1.41 AND 2.01, Cornelius Driver, April 1957

RM L56L28a FLIGHT INVESTIGATION OF A SMALL SIDE-LOCATED CONTROL STICK USED WITH ELECTRONIC CONTROL SYSTEMS IN A FIGHTER AIRPLANE, S. A. Sjoberg, Walter R. Russell, and William L. Alford, March 1957

RM L57A04 SOME CHARACTERISTICS OF ROLL CONTROLS HAVING POSSIBLE APPLICATION TO FIN-STABILIZED AMMUNITION, Eugene D. Schult, March 1957

RM L57A08 LOW-SPEED INVESTIGATION OF STATIC LONGITUDINAL AND LATERAL STABILITY CHARACTERISTICS OF AN AIRPLANE CONFIGURATION WITH A HIGHLY TAPERED WING AND WITH SEVERAL BODY AND TAIL ARRANGEMENTS, Paul G. Fournier, May 1957

RM L57A31a STABILITY OF TWO ROCKET-PROPELLED MODELS HAVING ASPECT-RATIO-5 UNSWEPT TAILS ON A LONG BODY FOR THE MACH NUMBER RANGE OF 1.7 TO 2.4, Reginald R. Lundstrom, March 1957

RM L57B26 INVESTIGATION OF STATIC LONGITUDINAL STABILITY CHARACTERISTICS AT TRANSONIC SPEEDS OF 30° SWEPTBACK WING IN WING-BODY CONFIGURATION WITH AND WITHOUT HORIZONTAL TAIL, Conrad M. Willis, April 1957

RM L57C13 FREE-FLIGHT INVESTIGATION TO DETERMINE SOME EFFECTS OF TAIL DAMPING AND WING-TAIL INTERFERENCE ON THE ROLLING EFFECTIVENESS OF AILERONS AND A SPOILER ON A MODIFIED-DELTA WING AT MACH NUMBERS FROM 0.6 TO 1.5, Roland D. English, May 1957

RM L57C15 A WIND-TUNNEL INVESTIGATION OF THE LOW-AMPLITUDE DAMPING IN YAW AND DIRECTIONAL STABILITY OF A FUSELAGE-TAIL CONFIGURATION AT MACH NUMBERS UP TO 1.10, William E. Palmer, May 1957

RM L57C20 RESULTS OF AN INVESTIGATION AT HIGH SUBSONIC SPEEDS TO DETERMINE LATERAL-CONTROL AND HINGE-MOMENT CHARACTERISTICS OF A SPOILER-SLOT-DEFLECTOR CONFIGURATION ON A 35° SWEPTBACK WING, Alexander D. Hammond and Albert E. Brown, June 1957

RM L57C21 FREE-FLIGHT PERFORMANCE OF A ROTATING-VANE-SPOILER ROLL CONTROL SYSTEM WITH LOW ACTUATING FORCES, Eugene D. Schult, May 1957

RM L57D09 INVESTIGATION OF THE LOW-SPEED STABILITY AND CONTROL CHARACTERISTICS OF A 1/7-SCALE MODEL OF THE NORTH AMERICAN X-15 AIRPLANE, Peter C. Boisseau, June 1957

RM L57D15 STATIC LONGITUDINAL AND LATERAL STABILITY PARAMETERS OF 3 FLARED-SKIRT TWO-STAGE MISSILE CONFIGURATIONS AT MACH NUMBER OF 6.86, Jim A. Penland and C. Maria Carroll, June 1957

RM L57F14 THE USE OF CONES AS STABILIZING AND CONTROL SURFACES AT HYPERSONIC SPEEDS, Eugene S. Love, August 1957

RM L57F18 BRIEF ANALOG INVESTIGATION OF INERTIA COUPLING IN ROLLING MANEUVERS OF AIRPLANE CONFIGURATION USING VARIABLE-INCIDENCE WING AS LONGITUDINAL CONTROL, Clarence L. Gillis, August 1957

RM L57G10a EXPERIMENTAL DETERMINATION OF DAMPING IN PITCH OF SWEPT AND DELTA WINGS AT SUPERSONIC MACH NUMBERS, John A. Moore, September 1957

RM L57G22 WIND-TUNNEL INVESTIGATION OF STATIC LATERAL AND LONGITUDINAL STABILITY CHARACTERISTICS OF A 1/62-SCALE MODEL OF THE X-1E AIRPLANE AT COMBINED ANGLES OF ATTACK AND SIDESLIP AT SUPERSONIC SPEEDS, Arthur Henderson, Jr., September 1957

RM L57G23 ANALOG COMPUTER STUDY OF SOME FILTERING, COMMAND-COMPUTER, AND AUTOMATIC-PILOT PROBLEMS CONNECTED WITH THE ATTACK PHASE OF THE AUTOMATICALLY CONTROLLED SUPERSONIC INTERCEPTOR, Windsor L. Sherman, October 1957

RM L57G25 LATERAL STABILITY INVESTIGATION AT MACH NUMBERS FROM 0.8 TO 1.7 OF TWO ROCKET-BOOSTED MODELS OF AN AIRPLANE CONFIGURATION WITH A 45° SWEPT WING AND A LOW HORIZONTAL TAIL, John C. McFall, Jr., Jesse L. Mitchell, and A. James Vitale, September 1957

RM L57I13 STATIC LATERAL CHARACTERISTICS AT HIGH SUBSONIC SPEEDS OF A COMPLETE AIRPLANE MODEL WITH A HIGHLY TAPERED WING HAVING THE 0.80 CHORD LINE UNSWEPT AND WITH SEVERAL TAIL CONFIGURATIONS, Kenneth W. Goodson, October 1957

RM L57I18 ANALOG-COMPUTER INVESTIGATION OF EFFECTS OF FRICTION AND PRELOAD ON THE DYNAMIC LONGITUDINAL CHARACTERISTICS OF A PILOT-AIRPLANE COMBINATION, Harold L. Crane, November 1957

RM L57I24 INVESTIGATION AT HIGH SUBSONIC SPEEDS OF THE USE OF LOW AUXILIARY TAIL SURFACES HAVING DIHEDRAL TO IMPROVE THE LONGITUDINAL AND DIRECTIONAL STABILITY OF A T-TAIL MODEL AT HIGH LIFT, William C. Sleeman, Jr., December 1957

RM L57J08 INVESTIGATION AT HIGH SUBSONIC SPEEDS OF THE STATIC LONGITUDINAL AND LATERAL STABILITY CHARACTERISTICS OF TWO CANARD AIRPLANE CONFIGURATIONS, William C. Sleeman, Jr., December 1957

RM L57J15 STATIC STABILITY AND CONTROL OF CANARD CONFIGURATIONS AT MACH NUMBERS FROM 0.70 TO 2.22 - LONGITUDINAL CHARACTERISTICS OF A TRIANGULAR WING AND CANARD, John W. Boyd and Victor L. Peterson, January 1958

RM L57J25a INVESTIGATION OF THE AERODYNAMIC CHARACTERISTICS IN PITCH AND SIDESLIP OF A 45° SWEPT-WING AIRPLANE CONFIGURATION WITH VARIOUS VERTICAL LOCATIONS OF THE WING AND HORIZONTAL TAIL. STATIC LATERAL AND DIRECTIONAL STABILITY: MACH NUMBERS OF 1.41 AND 2.01, M. Leroy Spearman and Ross B. Robinson, December 1957

RM L57J28 FREE-FLIGHT ROLL PERFORMANCE OF A STEADY-FLOW JET-SPOILER CONTROL ON AN 80° DELTA-WING MISSILE BETWEEN MACH NUMBERS OF 0.6 AND 1.8, Eugene D. Schult, January 1958

RM L57J28a INVESTIGATION OF THE STATIC LATERAL STABILITY AND AILERON CHARACTERISTICS OF A 0.067-SCALE MODEL OF THE BELL X-2 AIRPLANE AT MACH NUMBERS OF 2.29, 2.78, 3.22, AND 3.71, Roger H. Fournier and H. Norman Silvers, March 1958

RM L57K05 LONGITUDINAL STABILITY INVESTIGATION OF A VERTICAL-TAKE-OFF-AND-LANDING AIRPLANE CONFIGURATION WITH SIMULATED JET INTAKE AND EXHAUST AT MACH NUMBERS OF 1.61 AND 2.01, Douglas R. Lord, January 1958

RM L57L05 LIMITED INVESTIGATION OF NOISE SUPPRESSION BY INJECTION OF WATER INTO EXHAUST OF AFTERBURNING JET ENGINE, Max C. Kurbjun, February 1958

RM L57L11 TRANSONIC WIND-TUNNEL INVESTIGATION OF EFFECT OF HORIZONTAL TAIL ON LONGITUDINAL STABILITY OF TWO 60° SWEPTBACK-WING-BODY CONFIGURATIONS WITH ASPECT RATIO OF 2.67 AND 4.00, Josephy D. Brooks, February 1958

RM L57L17 EXPERIMENTAL DETERMINATION OF THE EFFECTS OF FREQUENCY AND AMPLITUDE OF OSCILLATION ON THE ROLL-STABILITY DERIVATIVES FOR A 60° DELTA-WING AIRPLANE MODEL, Lewis R. Fisher, February 1958

RM L57L17a EFFECTS OF CANARD SURFACE SIZE ON STABILITY AND CONTROL CHARACTERISTICS OF TWO CANARD AIRPLANE CONFIGURATIONS AT MACH NUMBERS OF 1.41 AND 2.01, M. Leroy Spearman and Cornelius Driver, March 1958

RM L57L18a INVESTIGATION AT MACH NOS. 1.94 AND 2.41 OF JET EFFECTS UPON LONGITUDINAL AND DIRECTIONAL STABILITY OF GENERAL AIRCRAFT CONFIGURATION EMPLOYING WING-TIP-MOUNTED NACELLES, Frank L. Clark and Clyde L. W. Edwards, March 1958

RM L58A03 SECTION THRUST COEFFICIENTS FOR A FULL-SCALE, THREE-BLADE, SUPERSONIC-TYPE PROPELLER OPERATING AT LOW AND NEGATIVE BLADE ANGLES, Leland B. Salters, Jr. and Martha C. Lewis, March 1958

RM L58A20 LONGITUDINAL AND LATERAL STABILITY AND CONTROL CHARACTERISTICS AT MACH NUMBER 2.01 OF A 60° DELTA-WING AIRPLANE CONFIGURATION EQUIPPED WITH A CANARD CONTROL AND WITH WING TRAILING-EDGE FLAP CONTROLS, M. Leroy Spearman and Cornelius Driver, March 1958

RM L58A28 DYNAMIC DIRECTIONAL STABILITY DERIVATIVES FOR 45° SWEPT-WING-VERTICAL-TAIL AIRPLANE MODEL AT TRANSONIC SPEEDS AND ANGLES OF ATTACK, WITH DESCRIPTION OF MECHANISM AND INSTRUMENTATION EMPLOYED, Albert L. Braslow, Harleth G. Wiley, and Cullen O. Lee, April 1960

RM L58B14 GROUND SIMULATOR STUDIES OF A SMALL SIDE-LOCATED CONTROLLER IN A POWER CONTROL SYSTEM, Arthur Assadourian, April 1958

RM L58C11 WIND-TUNNEL INVESTIGATION AT A MACH NUMBER OF 2.01 OF FOREBODY STRAKES FOR IMPROVING DIRECTIONAL STABILITY OF SUPERSONIC AIRCRAFT, Cornelius Driver, May 1958

RM L58E06 EFFECTS OF WING SWEEP, HORIZONTAL-TAIL CONFIGURATION, AND A VENTRAL FIN ON STATIC STABILITY CHARACTERISTICS OF A MODEL WITH A WING OF ASPECT RATIO 3 AT MACH NUMBERS FROM 2.29 TO 4.65, Byron M. Jaquet and Roger H. Fournier, July 1958

RM L58E08 EXPERIMENTAL INVESTIGATION OF EFFECTS OF WING PLAN FORM AND DIHEDRAL ANGLE ON SIDESLIP DERIVATIVES OF SWEPTBACK-WING-BODY COMBINATIONS AT SUPERSONIC SPEEDS, William B. Boatright, July 1958

RM L58E20 LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS AT MACH NUMBERS OF 1.41 AND 2.01 OF A 67° SWEPT-WING AIRPLANE CONFIGURATION WITH CANARD CONTROL SURFACES, M. Leroy Spearman and Ross B. Robinson, July 1958

RM L58E27 ANALYSIS OF EFFECTS OF INTERCEPTOR ROLL PERFORMANCE AND MANEUVERABILITY ON SUCCESS OF COLLISION-COURSE ATTACKS, William H. Phillips, August 1958

RM L58E29 WIND-TUNNEL INVESTIGATION OF THE EFFECT OF SWEEP AND TAPER RATIO ON EFFECTIVENESS OF SPOILER-SLOT-DEFLECTOR CONTROLS ON ASPECT-RATIO-4 WINGS AT TRANSONIC SPEEDS, Alexander D. Hammond and Linwood W. McKinney, August 1958

RM L58F02 WIND-TUNNEL INVESTIGATION OF THE LOW-SPEED STABILITY AND PERFORMANCE CHARACTERISTICS OF A JET-POWERED LOW-ASPECT-RATIO VERTICAL-TAKE-OFF-AND-LANDING CONFIGURATION WITH ENGINES BURIED IN TILT-TABLE WINGS, William I. Scallion and Clarence D. Cone, Jr., August 1958

RM L58F06 AN EXPERIMENTAL INVESTIGATION OF TWO INTERNAL-COMPRESSION AIR-INLET DESIGNS WHICH USE FLUID BOUNDARIES AS A MEANS OF SUPERSONIC COMPRESSION, Robert R. Howell and Charles D. Trescot, Jr., August 1958

RM L58H07 FREE-SPINNING TUNNEL INVESTIGATION OF 1/28-SCLAE MODEL OF NORTH AMERICAN FJ-4 AIRPLANE WITH EXTERNAL FUEL TANKS, TED NO NACA AD 3112, Frederick M. Healy, August 1958

TM 925 EFFECT OF WING LOADING, ASPECT RATIO, AND SPAN LOADING ON FLIGHT PERFORMANCE, B. Gothert, January 1940

An investigation is made of the possible improvements to be obtained in maximum cruising, and climbing speeds through increasing the wing loading. The object of this investigation is to establish for which airplanes an increase in the wing loading is of particular advantage and up to what values this increase may be carried while still maintaining high speed and cruising flight with sufficient climb performance. In this investigation, the limits on wing loading increases due to take-off and landing characteristics and changes in maneuverability are taken into account. These wing loading increases are primarily obtained by wing area reductions at constant aspect ratio although the effect of increasing the wing loading at a constant span is briefly considered. A detailed presentation of the change in weight of airplane due to change in wing dimensions is given as an appendix.

Relationships are given which show the variation of airspeed and climb performance as a function of wing loading. It is shown that the maximum speed, on one hand, and the rate of climb, ceiling and take-off on the other, impose entirely different requirements on the wing size and shape and that a compromise solution is necessary. The general results appeared to show that increased wing loading is advantageous only when accompanied by a simultaneous increase in aspect ratio.

TM 1016 PROPELLER BLADE STRESSES CAUSED BY PERIODIC DISPLACEMENT OF THE PROPELLER SHAFT, J. Meyer, June 1942

This report deals with different vibration stresses of the propeller and their removal by an elastic coupling of propeller and engine. A method is described for protecting the propeller from unstable oscillations and from the thus excited alternating gyroscopic moments. The respective vibration equations are set down and the amount of elasticity required is deduced.

TM 1051 THE COUPLING OF FLEXURAL PROPELLER VIBRATIONS WITH THE TORSIONAL CRANKSHAFT VIBRATIONS, J. Meyer, December 1943

Propeller failures are found to be caused by fatigue stresses due to the flexural vibrations of the propeller blade.

For a homogeneous prismatic rod assumed equivalent to the propeller blade, the mathematical solution for the coupling of the flexural with the torsional vibrations of an elastic system consisting of a single mass or of several masses is presented, and valid conclusions are received for the propeller. Extensive tests confirmed the theoretical results.

The most important conclusion derived was the coincidence of a harmonic vibration with the torsional vibration. By spreading the two frequencies apart as can be done by a change in the elasticity of the torsionally vibrating system, the harmonics in question can be rendered harmless.

The torsional vibration of the system cannot be eliminated by similar combinations. This can be done only by employing a damper or an elastic hub. The maximum vibration moment in the blade root --barring a few exceptions--always acts in the direction of the chord.

TM 1219 THE INFLUENCE OF THE APPLICATION OF POWER DURING SPIN RECOVERY OF MULTIENGINE AIRPLANES, P. Hohler, June 1949

The effect of the application of power is investigated in this report in order to give the pilot, in addition to the control measures, an expedient for spin recovery of multi-engine airplanes. A series of spins were performed with a twin engine airplane in this connection. Due to the gyroscopic moment of the propeller the effect of application of power will be different for right and left spins. If both propellers are assumed to be rotating clockwise a noseheavy gyroscopic moment arises for right spins; a tail heavy one for left spins. The thrust of the inner engine produces a moment that has a retarding effect on the spinning rotation whereas the thrust of the outer engine produces a moment that excites the rotation.

Not Applicable NACA Technical Memoranda

TM 938 THE SHOCK-ABSORBING SYSTEM OF THE AIRPLANE LANDING GEAR, P. Callerio, March 1940

TM 941 SOME DATA ON THE STATIC LONGITUDINAL STABILITY AND CONTROL OF AIRPLANES (DESIGN OF CONTROL SURFACES), A. Martinov and E. Kolosov, May 1940

TM 966 COMPARISON OF AUTOMATIC CONTROL SYSTEMS, W. Oppelt, February 1941

TM 966 (SUPPLEMENT) SUPPLEMENT TO COMPARISON OF AUTOMATIC CONTROL SYSTEMS, W. Oppelt, August 1941

TM 1027 THE FORMATION OF ICE ON AIRCRAFT, W. Bleeker, August 1942

TM 1028 THE ICING OF AIRCRAFT, M. Robitzsch, September 1942

TM 1040 PIEZOELECTRIC INSTRUMENTS OF HIGH NATURAL FREQUENCY VIBRATION CHARACTERISTICS AND PROTECTION AGAINST INTERFERENCE BY MASS FORCES, W. Gohlke, February 1943

TM 1052 DETERMINATION OF THE MASS MOMENTS AND RADII OF INERTIA OF THE SECTIONS OF A TAPERED WING AND THE CENTER-OF-GRAVITY LINE ALONG THE WING SPAN, V. V. Savelyev, December 1943

TM 1091 THE EFFECT ON THE SPERRY DIRECTIONAL GYRO IN TURNING, R. R. Del Turco, August 1946

TM 1099 AIRSCREW GYROSCOPIC MOMENTS, G. Bock, September 1946

TM 1136 ON THE VORTEX SOUND FROM ROTATING RODS, E. Y. Yudin, March 1947

TM 1195 ON THE SOUND FIELD OF A ROTATING PROPELLER, L. Gutin, October 1948

TM 1197 INVESTIGATION ON THE STABILITY, OSCILLATION, AND STRESS CONDITIONS OF AIRPLANES WITH TAB CONTROL FIRST PARTIAL REPORT - DERIVATION OF THE EQUATIONS OF MOTION AND THEIR GENERAL SOLUTIONS, B. Filzek, September 1949

TM 1201 ROTATION IN FREE FALL OF RECTANGULAR WINGS OF ELONGATED SHAPE, P. Dupleich, April 1949

TM 1210 DEVELOPMENT OF SPOILER CONTROLS FOR REMOTE CONTROL OF FLYING MISSILES, G. Ernst and M. Kramer, March 1949

TM 1221 EXPERIMENTAL FLIGHTS FOR TESTING OF A REACTOR AS AN EXPEDIENT FOR THE TERMINATION OF DANGEROUS SPINS, P. Hohler and I. V. Koppen, July 1949

TM 1222 INVESTIGATION OF THE MODEL ME 210 IN THE SPIN WIND TUNNEL OF THE DVL FOURTH PARTIAL REPORT - MODEL WITH LONG FUSELAGE AND WITH A VEE TAIL, A. Huffschmid, April 1950

TM 1237 ON THE MOTIONS OF AN OSCILLATING SYSTEM UNDER THE INFLUENCE OF FLIP-FLOP CONTROLS, I. Flugge-Lotz and K. Klotter, November 1949

TM 1242 THEORY OF CHARACTERISTICS, W. Tollmien, September 1949

TM 1248 INVESTIGATIONS OF LATERAL STABILITY OF A GLIDE BOMB USING AUTOMATIC CONTROL HAVING NO TIME LAG, E. W. Sponder, August 1950

TM 1254 SYSTEMATIC MODEL RESEARCHES ON THE STABILITY LIMITS OF THE DVL SERIES OF FLOAT DESIGNS, W. Sottorf, December 1949

TM 1264 CALCULATION OF THE LATERAL-DYNAMIC STABILITY OF AIRCRAFT, A. Raikh, February 1952

TM 1273 RESONANCE SOUND ABSORBER WITH YIELDING WALL, S. N. Rzhevkin, May 1951

TM 1307 LATERAL CONTROL BY SPOILERS AT THE DVL, M. Kramer, Th. Zobel, and C. G. Esche, August 1951

TM 1323 INFLUENCE OF STATIC LONGITUDINAL STABILITY ON THE BEHAVIOR OF AIRPLANES IN GUSTS, H. Hoene, November 1951

TM 1337 ANALYTICAL STUDY OF SHIMMY OF AIRPLANE WHEELS, Christian Bourcier de Carbon, September 1952

TM 1348 ON THE REPRESENTATION OF THE STABILITY REGION IN OSCILLATING PROBLEMS WITH THE AID OF HURWITZ DETERMINANTS, E. Sponder, August 1952

TM 1365 PAPERS ON SHIMMY AND ROLLING BEHAVIOR OF LANDING GEARS PRESENTED AT STUTTGART CONFERENCE OCTOBER 16 AND 17, 1941, August 1954

TM 1376 EXPERIMENTS ON TAIL-WHEEL SHIMMY, O. Dietz and R. Harling, October 1954

TM 1378 DETERMINATION OF THE ELASTIC CONSTANTS OF AIRPLANE TIRES, Boeckh, November 1954

TM 1380 CONTRIBUTION TO THE THEORY ON TAIL-WHEEL SHIMMY, M. Melzer, December 1954

TM 1388 GENERAL SOLUTIONS OF OPTIMUM PROBLEMS IN NONSTATIONARY FLIGHT, Angelo Miele, October 1955

TM 1391 REDUCTION OF THE SHIMMY TENDENCY OF TAIL AND NOSE-WHEEL LANDING GEARS BY INSTALLATION OF SPECIALLY DESIGNED TIRES, H. Schrode, July 1955

TM 1404 INVESTIGATION OF APERIODIC TIME PROCESSES WITH AUTOCORRELATION AND FOURIER ANALYSIS, Marie Luise Exner, March 1958

TM 1406 ON THE USE OF THE HARMONIC LINEARIZATION METHOD IN THE AUTOMATIC CONTROL THEORY, E. P. Popov, January 1957

Not Applicable NASA Technical Translations

TT F 17 WIND-TUNNEL STUDY OF THE RESPONSE IN LIFT OF A ROTOR TO AN INCREASE IN COLLECTIVE PITCH IN THE CASE OF VERTICAL FLIGHT NEAR THE AUTOROTATIVE REGIME, Jean Rebont, Jacques Valensi, and Jean Soulez-Lariviere, April 1960

TT F 18 RESPONSE OF ROTOR LIFT TO AN INCREASE IN COLLECTIVE PITCH IN THE CASE OF DESCENDING FLIGHT, THE REGIME OF THE ROTOR BEING NEAR AUTOROTATION, Jean Rebont, Jean Soulez-Lariviere, and Jacques Valensi, April 1960

TT F 43 A VIBRATION ABSORBER FOR TWO-BLADED HELICOPTERS, Th. Laufer, November 1960

TT F 55 RESPONSE OF A HELICOPTER ROTOR TO AN INCREASE IN COLLECTIVE PITCH FOR THE CASE OF VERTICAL FLIGHT, Jean Rebont, Jacques Valensi, and Jean Soulez-Lariviere, January 1961

Not Applicable NASA Technical Memoranda

TM X 5 WIND-TUNNEL INVESTIGATION OF THE STATIC STABILITY OF A 1/56-SCALE MODEL OF THE X-1E AIRPLANE AT MACH NUMBERS OF 2.37, 2.98, AND 3.01, Fred M. Smith, August 1959

TM X 26 DESIGN GUIDE FOR PITCH-UP EVALUATION AND INVESTIGATION AT HIGH SUBSONIC SPEEDS OF POSSIBLE LIMITATIONS DUE TO WING-ASPECT-RATIO VARIATIONS, Kenneth P. Spreemann, August 1959

TM X 30 THE STABILIZING EFFECTIVENESS OF CONICAL FLARES ON BODIES WITH CONICAL NOSES, Donn B. Kirk and Gary T. Chapman, September 1959

TM X 39 DYNAMIC LONGITUDINAL AND DIRECTIONAL STABILITY DERIVATIVES FOR A 45° SWEPTBACK-WING AIRPLANE MODEL AT TRANSONIC SPEEDS, Ralph P. Bielat and Harleth G. Wiley, August 1959

TM X 44 EFFECTS OF WING VERTICAL LOCATION ON STABILITY AND CONTROL CHARACTERISTICS AT MACH NUMBER OF 2.01 OF CANARD AIRPLANE CONFIGURATION WITH TRAPEZOIDAL ASPECT-RATIO-3 WING, Gerald V. Foster, September 1959

TM X 47 STATIC STABILITY AND CONTROL CHARACTERISTICS OF AIRPLANE MODEL WITH TAIL SURFACES OUTBOARD OF WING TIPS AT MACH NUMBER OF 2.01, Cornelius Driver and M. Leroy Spearman, September 1959

TM X 72 LOW-SPEED STATIC LONGITUDINAL AND LATERAL STABILITY CHARACTERISTICS OF A VARIABLE-INCIDENCE DELTA-WING CANARD MODEL WITH HIGH-LIFT CANARD SURFACES, Clarence D. Cone, Jr., September 1959

TM X 92 EFFECTS OF WING-CRANK, LEADING-EDGE CHORD EXTENSIONS AND HORIZONTAL-TAIL FLIGHT ON THE LONGITUDINAL STABILITY OF SWEPT-WING MODELS AT MACH NUMBERS FROM 0.6 TO 1.4, Roy M. Wakefield, October 1959

TM X 120 LOW-SPEED STATIC LONGITUDINAL AND LATERAL CHARACTERISTICS OF DELTA-WING MODEL WITH FIXED AND FREE-FLOATING CANARD SURFACES, William I. Scallion and Michael D. Cannon, October 1959

TM X 121 SUPERSONIC JET TESTS OF MISSILE STABILIZERS, Louis F. Vosteen and Richard Rosecrans, December 1959

TM X 124 INVESTIGATION OF STATIC LONGITUDINAL STABILITY AND ROLL CHARACTERISTICS OF 3-STAGE MISSILE CONFIGURATION AT MACH NUMBERS FROM 1.77 TO 2.87, Donald T. Gregory and Ausley B. Carraway, October 1959

TM X 141 STATIC STABILITY CHARACTERISTICS OF THREE THICK WING MODELS WITH PARABOLIC PLAN FORMS AT A MACH NUMBER OF 3.11, M. J. Queijo, October 1959

TM X 144 LOW-SPEED MEASUREMENTS OF OSCILLATORY LATERAL STABILITY DERIVATIVES OF A 1/7-SCALE MODEL OF THE NORTH AMERICAN X-15 AIRPLANE, John W. Paulson and James L. Hassell, Jr., November 1959

TM X 167 STATIC STABILITY CHARACTERISTICS OF A SERIES OF HYPERSONIC BOOST-GLIDE CONFIGURATIONS AT MACH NUMBERS OF 1.41 AND 2.01, Gerald V. Foster, November 1959

TM X 178 EXPLORATORY INVESTIGATION AT MACH NUMBER OF 2.01 OF THE LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS OF A WINGED REENTRY CONFIGURATION, Gerald V. Foster, December 1959

TM X 179 WIND-TUNNEL INVESTIGATION AT HIGH SUBSONIC SPEED OF THE STATIC LONGITUDINAL STABILITY CHARACTERISTICS OF A WINGED REENTRY VEHICLE HAVING A LARGE NEGATIVELY DEFLECTED FLAP-TYPE CONTROL SURFACE, Paul G. Fournier, December 1959

TM X 199 STABILITY INVESTIGATION OF A BLUNTED CONE AND A BLUNTED OGIVE WITH A FLARED CYLINDER AFTERBODY AT MACH NUMBERS FROM 0.30 TO 2.85, Lucille C. Coltrane, November 1959

TM X 210 INVESTIGATION OF THE SUBSONIC STABILITY AND CONTROL CHARACTERISTICS OF A 1/7-SCALE MODEL OF THE NORTH AMERICAN X-15 AIRPLANE WITH AND WITHOUT FUSELAGE FOREBODY STRAKES, James L. Hassell, Jr., and Donald E. Hewes, February 1960

TM X 222 STATIC LONGITUDINAL STABILITY CHARACTERISTICS OF BLUNTED GLIDER REENTRY CONFIGURATION HAVING 79.5° SWEEP-BACK AND 45° DIHEDRAL AT MACH NUMBER OF 6.2 AND ANGLES OF ATTACK UP TO 20°, Edward E. Mayo, October 1959

TM X 227 LOW-SUBSONIC-SPEED STATIC LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS OF A WINGED REENTRY-VEHICLE CONFIGURATION HAVING WINGTIP PANELS THAT FOLD UP FOR HIGH-DRAG REENTRY, George M. Ware, February 1960

TM X 240 HYPERSONIC LONGITUDINAL TRIM, STABILITY, AND CONTROL CHARACTERISTICS OF DELTA-WING CONFIGURATION AT HIGH ANGLES OF ATTACK, William H. Close, April 1960

TM X 248 AN ANALYSIS OF THE STABILITY OF SPINNING DISKS DURING ATMOSPHERIC REENTRY, John D. Bird and Charles P. Llewellyn, March 1960

TM X 272 STATIC LONGITUDINAL AND LATERAL STABILITY CHARACTERISTICS AT MACH NUMBER OF 3.11 OF SQUARE AND CIRCULAR PLAN-FORM REENTRY VEHICLES, WITH SOME EFFECTS OF CONTROLS AND LEADING-EDGE EXTENSIONS, Byron M. Jaquet, May 1960

TM X 294 ANALYTICAL INVESTIGATION AND PREDICTION OF SPIN AND RECOVERY CHARACTERISTICS OF NORTH AMERICAN X-15 AIRPLANE, William D. Grantham and Stanley H. Scher, October 1960

TM X 305 INVESTIGATION OF STATIC LONGITUDINAL STABILITY CHARACTERISTICS OF AIR-TO-SURFACE CANARD MISSILE CONFIGURATION IN TRANSONIC MACH NUMBER RANGE, Gerald L. Hunt, October 1960

TM X 317 WIND-TUNNEL INVESTIGATION AT MACH NUMBERS FROM 0.40 TO 1.20 OF STATIC AERODYNAMIC AND CONTROL CHARACTERISTICS OF MODEL OF NON-LIFTING REENTRY CAPSULE IN COMBINATION WITH ROCKET BOOSTER, Albin O. Pearson, September 1960

TM X 361 WIND-TUNNEL INVESTIGATION OF STATIC AND DYNAMIC-ROTARY STABILITY DERIVATIVES OF FLAT-TOP WING-BODY MODEL AT MACH NUMBERS OF 2.5, 3.0 AND 3.5, Bedford A. Lampkin and Kenneth C. Endicott, April 1960

TM X 395 A HOMING MISSILE CONTROL SYSTEM TO REDUCE THE EFFECTS OF RADOME DIFFRACTION, Gerald L. Smith, October 1960

TM X 425 FREE-FLIGHT INVESTIGATION AT SUPERSONIC SPEEDS OF STABILITY AND DRAG OF 79° CLIPPED DELTA BOOST-GLIDE CONFIGURATION INCLUDING ANALOG STUDY OF COUPLED MOTIONS DURING FLIGHT, Sherwood Hoffman and William S. Blanchard, Jr., January 1961

TM X 431 STATIC STABILITY AND CONTROL CHARACTERISTICS AT LOW-SUBSONIC SPEEDS OF LENTICULAR REENTRY CONFIGURATION, George M. Ware, December 1960

TM X 665 INVESTIGATION OF LOW-SUBSONIC STABILITY AND CONTROL CHARACTERISTICS OF 0.34-SCALE FREE-FLYING MODIFIED HALF-CONE REENTRY VEHICLE, James L. Hassell, Jr., and George M. Ware, January 1962

NASA-Langley, 1970 — 2 CR-1486