TWENTY-EIGHTH ANNUAL REPORT

OF THE

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

1942

INCLUDING TECHNICAL REPORTS
NOS. 727 to 751

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TECHNICAL REPORTS

LETTER OF TRANSMITTAL

To the CONGRESS OF THE UNITED STATES:

In compliance with the provisions of the act of March 3, 1915, establishing the National Advisory Committee for Aeronautics, I transmit herewith the Twenty-eighth Annual Report of the Committee covering the fiscal year 1942.

FRANKLIN D. ROOSEVELT.

THE WHITE HOUSE,
March 30, 1943.

LETTER OF SUBMITTAL

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS,
Washington, D. C., March 26, 1943.

The PRESIDENT,
The White House, Washington, D. C.

DEAR MR. PRESIDENT: In compliance with the provisions of the act of Congress approved March 3, 1915 (U. S. C. title 50, sec. 153), I have the honor to submit herewith the Twenty-eighth Annual Report of the National Advisory Committee for Aeronautics, covering the fiscal year 1942.

During the past year the fighting forces of the United Nations have taken the offensive with substantial support from their air forces. The effectiveness of the air forces is in direct proportion to the energy and the resources which have been devoted to the technical development of their aircraft. Only by constant research can we be assured of providing airplanes of superior performance.

The Committee's research facilities and scientific staff have been greatly expanded and strengthened during the past 4 years with generous appropriations by the Congress. In our first year of war, day and night shifts have been working on urgent research projects in our three large laboratories in Virginia, Ohio, and California. With these facilities the Committee has been able to meet the important research requirements of the military services.

The general manner in which this research has been organized and conducted during 1942 is described in this report. In the interest of military security, technical matter has been omitted.

Respectfully submitted,

JEROME C. HUNSAKER, *Chairman.*

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

HEADQUARTERS, 1500 NEW HAMPSHIRE AVENUE NW., WASHINGTON, D. C.

Created by act of Congress approved March 3, 1915, for the supervision and direction of the scientific study of the problems of flight (U. S. Code, title 50, sec. 151). Its membership was increased to 15 by act approved March 2, 1929. The members are appointed by the President, and serve as such without compensation.

TECHNICAL COMMITTEES

AERODYNAMICS
POWER PLANTS FOR AIRCRAFT
AIRCRAFT MATERIALS

AIRCRAFT STRUCTURES
INVENTIONS & DESIGNS
OPERATING PROBLEMS

Coordination of Research Needs of Military and Civil Aviation

Preparation of Research Programs

Allocation of Problems

Prevention of Duplication

Consideration of Inventions

LANGLEY MEMORIAL AERONAUTICAL LABORATORY

LANGLEY FIELD, VA

AMES AERONAUTICAL LABORATORY

MOFFETT FIELD, CALIF

AIRCRAFT ENGINE RESEARCH LABORATORY

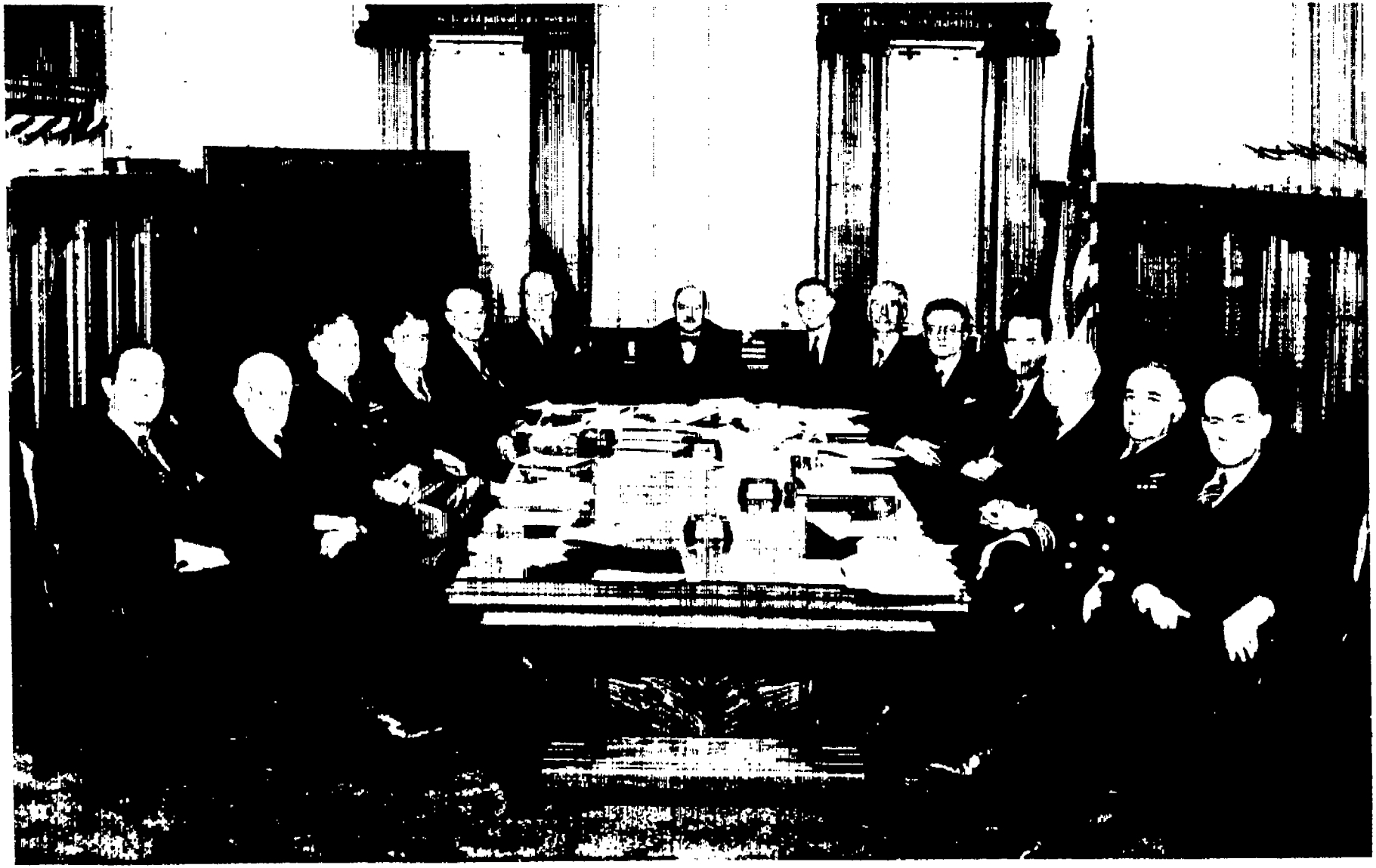
CLEVELAND AIRPORT, CLEVELAND, OHIO

Conduct, under unified control, for all agencies, of scientific research on the fundamental problems of flight.

OFFICE OF AERONAUTICAL INTELLIGENCE

WASHINGTON, D. C.

Collection, classification, compilation, and dissemination of scientific and technical information on aeronautics



NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

MEETING, WASHINGTON, D. C., DECEMBER 17, 1942

Left to right: Burden, Durand, Chidlaw (representing Arnold and Echols), Bush, Orville Wright, Lewis, Hunsaker, Victory, Abbot, T. P. Wright, Warner, Briggs, Kraus, Reichelderfer (Admiral McCain and Dr. Mead not present).

TWENTY-EIGHTH ANNUAL REPORT

OF THE

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

WASHINGTON, D. C., *February 25, 1943.*

To the Congress of the United States:

In accordance with the act of Congress approved March 3, 1915 (U. S. C., title 50, sec. 151), which established the National Advisory Committee for Aeronautics, the Committee submits herewith this Twenty-eighth Annual Report, for the fiscal year 1942. Since the requirements for military secrecy prevent mention of specific projects, the report has been edited to present only a general picture of the Committee's activity.

Tactical significance of NACA work.—The events of the past year, during which the United Nations have assumed the offensive with the aid of vastly increased air power, have indicated more clearly than ever the necessity for continuous technical development of aircraft. The need for new and improved types of combat airplanes has been strikingly demonstrated by experience gained in the operation of our aircraft in all corners of the globe. The military necessity for meeting the best aircraft developed by the enemy and for building new types for the kind of warfare anticipated by the High Command has confronted American aeronautical engineers.

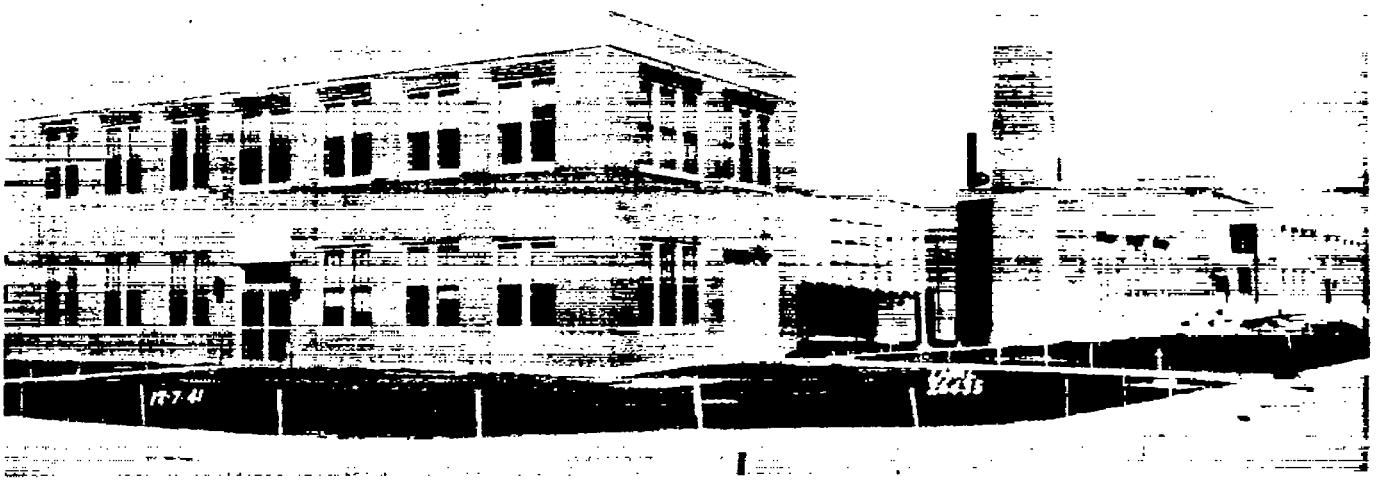
In contact with the enemy in all parts of the world, new problems must be met by our flyers and, in turn, new requirements are imposed on our manufacturers. In some cases the new requirements cannot be met without extensive research and experimentation. Sometimes, improvements to correct defects in, or to increase the performance of, existing airplanes or equipment can quickly be found. At other times, a military requirement demands the search for an entirely new solution, unknown to the present art.

More rarely, the discovery that enemy aircraft are in some features superior to American aircraft, demands urgent efforts to make up the deficiency. Research problems arise through the expressed needs of the armed services for improved performance, or in some cases out of the Committee's own experience and foresight, or again, as the result of unanticipated problems created by the enemy on the fighting fronts. All of these conditions, the Committee's staff must be prepared to meet. It may be accepted that the maintenance of supremacy in the air will be essential to final victory and the Committee feels that the contributions of its researches to the improved performance and effectiveness of American military aircraft are vital to the success of the national aircraft program. The Committee's activities are inseparably interwoven, not only with future designs of aircraft but likewise with aircraft in the production stage. For example, at the request of either the Army or the Navy, there are an average of 45 representatives of aircraft indu tries daily at the Langley Field laboratories. These men stay for a few days or a few weeks, consulting and advising, and waiting for solutions to their urgent problems. Solutions are promptly relayed to factories, and find immediate incorporation in types of aircraft already in production, or whose production has been held up awaiting answers from the Committee's laboratories.

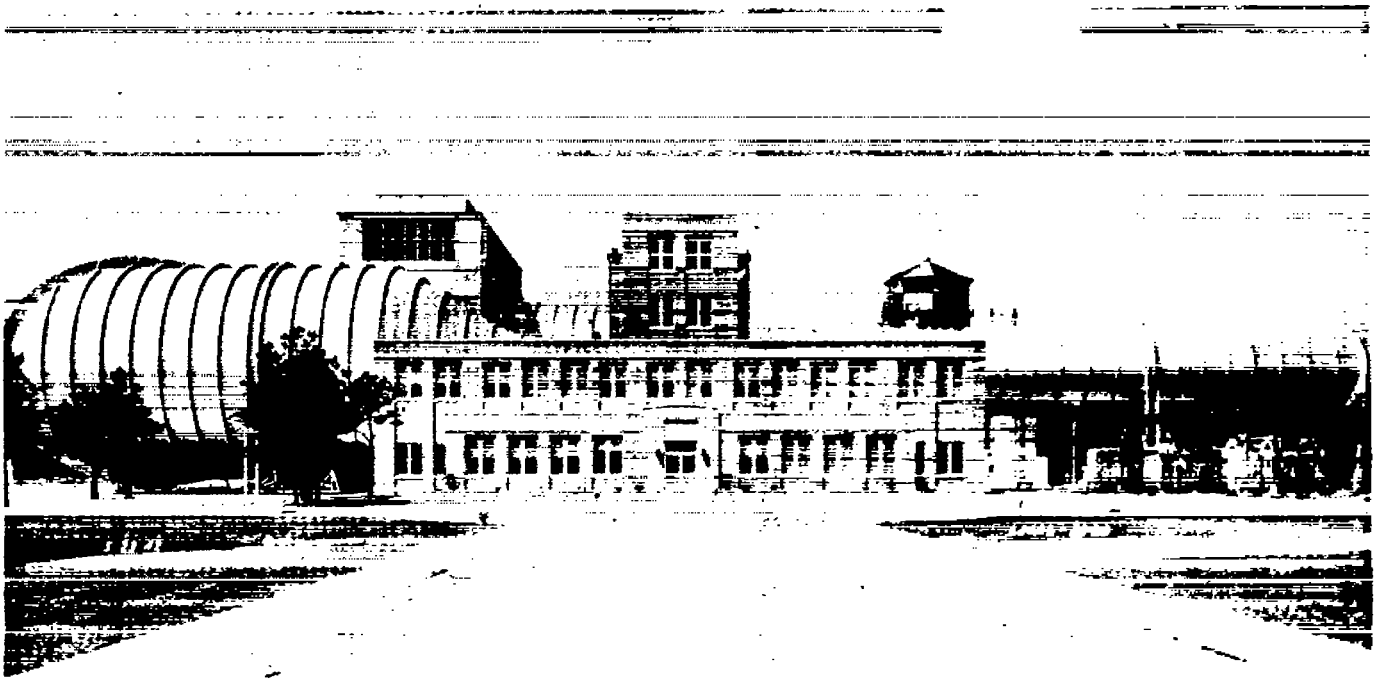
That American aircraft in actual combat have proved to be the equal or better in almost every respect than those which they oppose, depends in no small measure on the Committee's researches. As the result of continuing research, airplanes of still greater effectiveness are constantly being developed.

Expansion of research activity.—It is most fortunate that the need for a great increase in aircraft research and development activity was recognized by the Congress several years ago, and that at the time of Pearl Harbor the Committee was so well prepared to handle its vital and expanding war assignments.

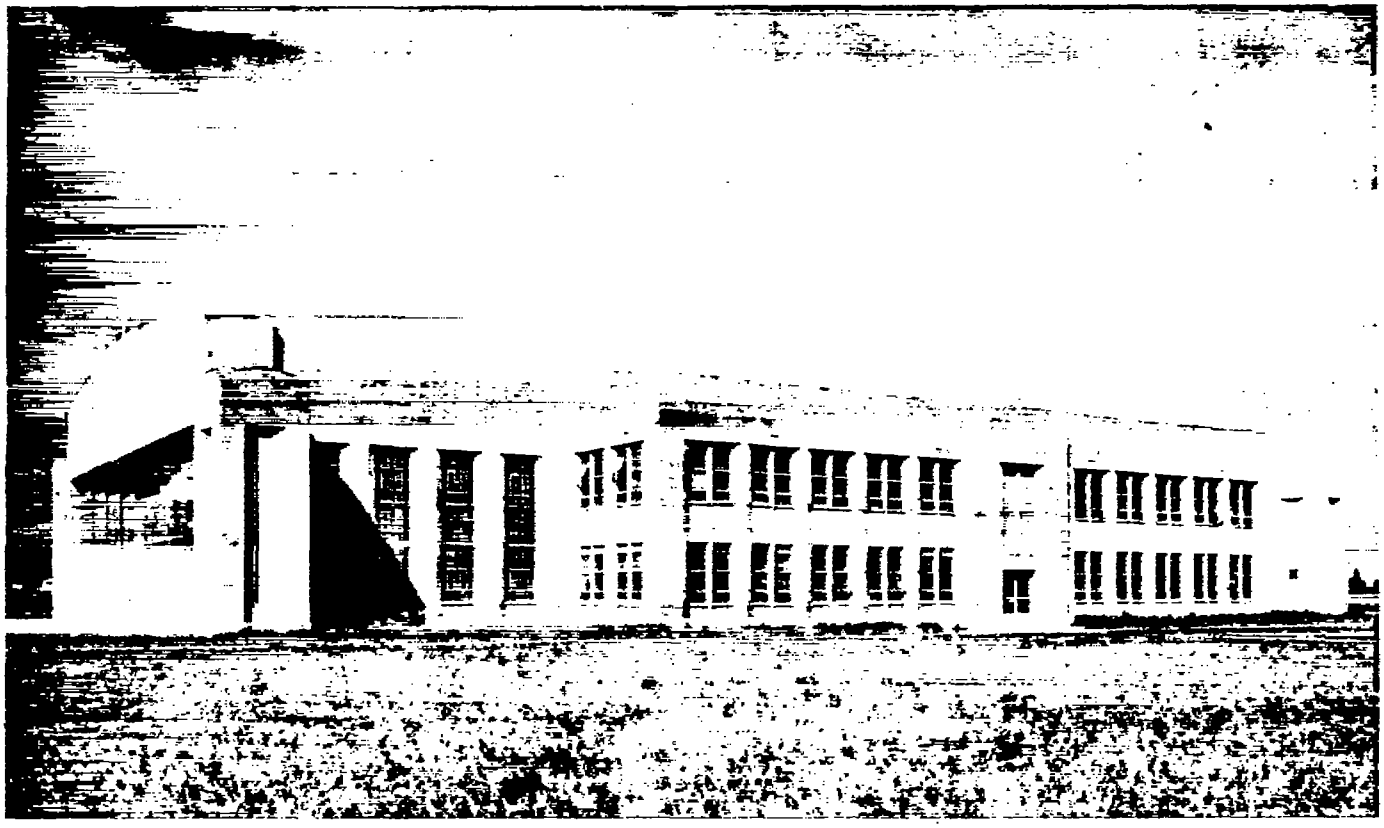
Beginning in 1937, the growing importance of the airplane to the national defense and to the Nation's domestic economy, led the Committee to recommend, and the Congress to approve, a marked expansion in scientific research facilities. That year marked the beginning of a construction program which has been supported by appropriations for new construction amounting to $38,507,425, and an expansion of staff from 446 to 4,410 estimated for 1944.



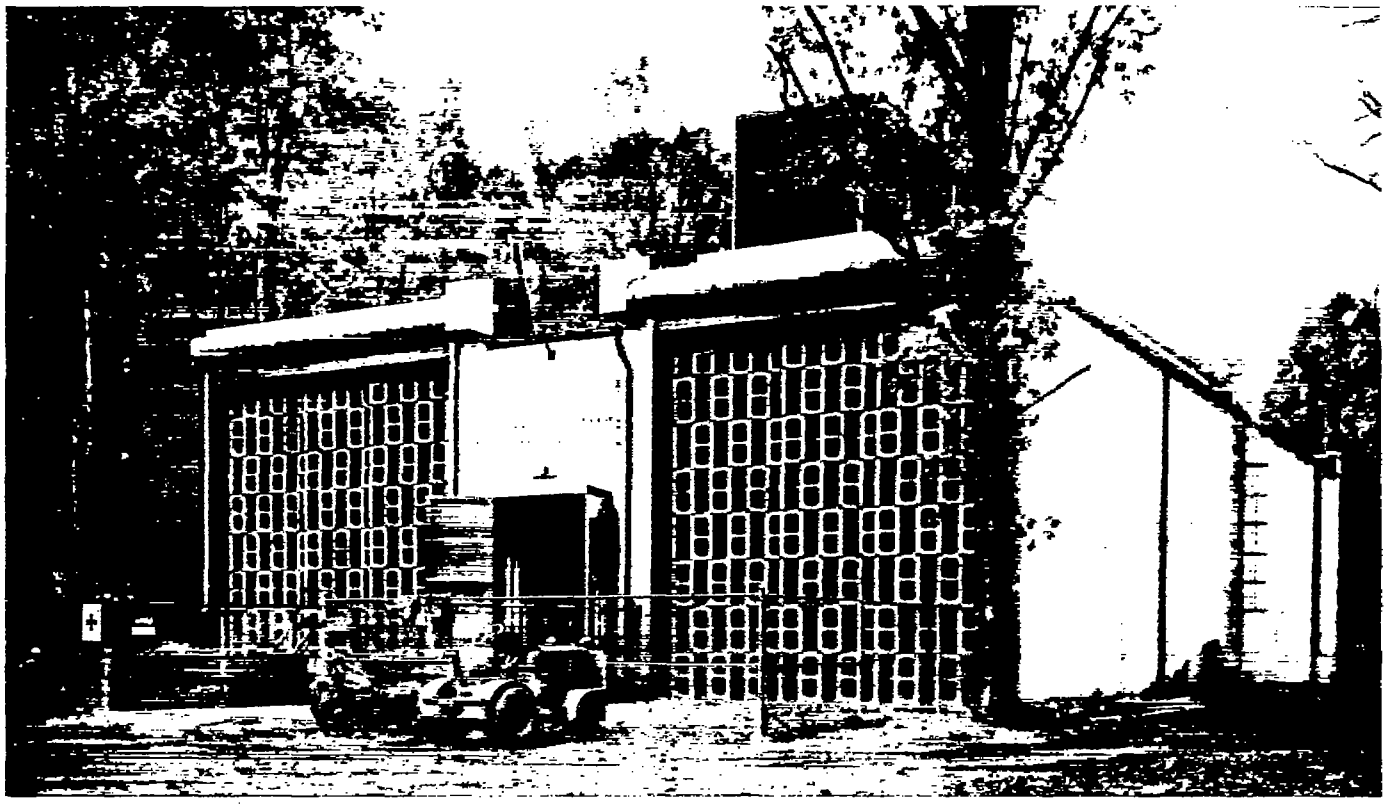
NEW FACILITIES.—A group of three new buildings at the Langley Memorial Aeronautical Laboratory, at Langley Field, Va. (Left to right) Stability Wind Tunnel, Central Heating Plant, and Power Generating Plant. The Power Plant supplies electric power for the drive motors of all large wind tunnels at Langley Field.



NEW WIND TUNNEL.—High-speed wind tunnel recently placed in operation at the Langley Memorial Aeronautical Laboratory, at Langley Field, Va.



FLIGHT RESEARCH LABORATORY.—At the Ames Aeronautical Laboratory at Moffett Field, Calif. Experimental airplanes are specially rigged in this hangar for flight research. Engineers of flight research section utilize office space.



ENGINE PROPELLER TEST HOUSE.—First research facility placed in operation at the new NACA Aircraft Engine Research Laboratory at Cleveland, Ohio.

RESEARCH BEGINS AT NEW LABORATORY.—A group of NACA officials are pictured at the opening of research at the new Aircraft Engine Research Laboratory at Cleveland, Ohio. Research was begun months ahead of schedule in May 1942.

The Langley Memorial Aeronautical Laboratory at Langley Field, Va., and the Ames Aeronautical Laboratory at Moffett Field, Calif., started in 1939, are working on a three-shift basis as far as practicable, and are wholly engaged on problems referred to the Committee by the Army and Navy. The new Aircraft Engine Research Laboratory at Cleveland, Ohio, is nearing completion and is already busily engaged on engine problems. It will operate on a two- and three-shift basis as soon as conditions permit.

During the past year, the following additional research facilities have been placed in operation:

At Langley Field, Va., a new towing basin for studying flying-boat hulls and high-speed surface craft; an impact basin for investigating the loads encountered in the landing of flying boats; a new fabrication and finishing shop for the construction of models and apparatus for research investigations; and a combined office and warehouse building to serve the various research laboratories.

At Cleveland, Ohio, the engine-propeller test house, fuels and lubricants laboratory, technical service building, flight research laboratory, utilities building, heating plant, two electric substations, and an administration building. The engine research building is nearly completed and is in partial operation. Still under construction are the altitude wind tunnel, the icing wind tunnel, and the exhauster and refrigerating buildings for these wind tunnels.

At the Moffett Field Laboratory, there are under construction a full-scale wind tunnel with operating section 80 feet wide by 40 feet high, a high-speed two-dimensional, low-turbulence, variable-density wind tunnel, and an administration building.

In addition, research contracts have been placed with 24 university laboratories for research on 54 special problems. In this way the Committee has provided for the conduct of research on many problems without increasing unnecessarily its facilities or personnel, and has made effective use of existing private facilities without duplication of effort.

COMMITTEE ORGANIZATION

The National Advisory Committee for Aeronautics was established by act of Congress approved March 3, 1915, and the membership increased from 12 to 15 by act approved March 2, 1929 (U. S. C., title 50, sec. 151). Its membership is appointed by the President and consists of two representatives each of the War and Navy Deparments from the offices in charge of military and naval aeronautics, two representatives of the Civil Aeronautics Authority (Civil Aeronautics Act of 1938), one representative each of the Smithsonian Institution, the United States Weather Bureau, and the National Bureau of Standards, together with six additional persons who are "acquainted with the needs of aeronautical science, either civil or military, or skilled in aeronautical

engineering or its allied sciences." These latter six serve for terms of 5 years. All the members serve as such without compensation. During the past year, the following changes occurred in the membership of the main Committee:

Maj. Gen. George H. Brett, United States Army, was relieved on January 23, 1942, because of his transfer to foreign duty, and Maj. Gen. O. P. Echols, commanding general of the Matériel Command, Army Air Forces, was appointed to succeed General Brett.

Brig. Gen. Donald H. Connolly, Administrator of the Civil Aeronautics Administration, resigned on January 15, 1942, because of his call to active duty in the Army Air Forces.

To succeed Brigadier General Connolly, the President, on May 14, 1942, appointed Dr. Edward Warner, member of the Civil Aeronautics Board, as one of the two official representatives on the Committee from the Civil Aeronautics Authority. Dr. Warner had been serving on the Committee as one of the six members appointed from private life.

On May 14, 1942, the President appointed Dr. Theodore P. Wright, of the Aircraft Division of the War Production Board, to succeed Dr. Edward Warner as a member from private life, for the balance of Dr. Warner's term, expiring December 1, 1946.

Hon. Robert H. Hinckley resigned on July 1, 1942, because of his resignation as Assistant Secretary of Commerce.

Hon. William A. M. Burden, Special Assistant to the Secretary of Commerce, was appointed by the President, on August 8, 1942, a member of the Committee to succeed Mr. Hinckley.

Rear Admiral John H. Towers, United States Navy, Chief of the Bureau of Aeronautics, resigned on September 28, 1942, because of his transfer to duty away from Washington.

On October 6, 1942, the President appointed, as Admiral Towers' successor, the newly appointed Chief of the Bureau of Aeronautics, Rear Admiral John S. McCain, United States Navy.

In accordance with the regulations governing the organization of the Committee, as approved by the President, the Chairman and Vice Chairman are elected annually, as are also the Chairman and Vice Chairman of the Executive Committee. On October 22, 1942, Dr. Jerome C. Hunsaker was reelected Chairman and Dr. Lyman J. Briggs was elected Vice Chairman of the main Committee succeeding Dr. George J. Mead. Dr. Hunsaker was also reelected Chairman of the Executive Committee and Dr. Charles G. Abbot was reelected Vice Chairman of the Executive Committee.

TECHNICAL COMMITTEES

In order to obtain the most competent advice on the many highly specialized problems of aeronautics with which the main Committee is concerned, a number of subcommittees are appointed for the purpose of making recommendations to the main Committee regarding programs of research to be conducted in their respective fields. These technical subcommittees comprise representatives of the various Governmental organizations concerned, as well as individuals from the aviation industry, and from private life. They constitute the best-informed experts in the Nation in their particular fields. Their discussions are extremely valuable in providing for the effective exchange of information and ideas and in advising on research programs.

The main Committee has principal technical committees which cover the following fields: Aerodynamics, Power Plants, Aircraft Materials, Aircraft Structures, and Operating Problems. Under these principal technical committees are a number of technical subcommittees which cover specific problems in these broad fields. The organization and scope of activity of each of these groups which, incidentally, also serve without compensation, are given in the succeeding pages.

COMMITTE ON AERODYNAMICS

In addition to supervising activities of five subcommittees dealing with the subjects of seaplanes, vibration and flutter, propellers, dual-rotation propellers, and rotating wing aircraft, the Committee on Aerodynamics studies general problems such as the cowling and cooling of the engine, compressibility phenomena encountered at high air speeds, stability, control, design of airfoil sections and control surfaces, and range, capacity, and ceiling of aircraft. These problems have become more numerous and difficult as well as of more vital importance as improvements in airplane design have increased the speed and altitude of operation. The membership of this committee during the past year was:

Dr. Theodore P. Wright, Aircraft Branch, War Production Board, Chairman.

Dr. Hugh L. Dryden, National Bureau of Standards, Vice Chairman.

John L. Atwood, North American Aviation, Inc.

Don R. Berlin, General Motors Corporation.

Col. Howard Z. Bogert, United States Army, Army Air Forces.

Brig. Gen. Franklin O. Carroll, United States Army, Army Air Forces.

Capt. Walter S. Diehl, United States Navy, Navy Department.

John Easton, Civil Aeronautics Administration.

Harold D. Hoekstra, Civil Aeronautics Administration.

Eastman N. Jacobs, National Advisory Committee for Aeronautics.

Clarence L. Johnson, Lockheed Aircraft Corporation.

Prof. Otto Koppen, Massachusetts Institute of Technology.

John G. Lee, United Aircraft Corporation.

Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).

Dr. Clark B. Millikan, California Institute of Technology.

Capt. J. E. Ostrander, United States Navy, Navy Department.

Dr. William Bailey Oswald, Douglas Aircraft Co., Inc.

H. J. E. Reid, National Advisory Committee for Aeronautics.
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).
Igor Sikorsky, United Aircraft Corporation.
Dr. Edward Warner, Civil Aeronautics Board.

SUBCOMMITTEE ON SEAPLANES

Military operation of seaplanes has resulted in large increases in wing and beam loadings. The dynamic stability during take-off and landing with overloads, an important problem, has received considerable study. Data on the hydrodynamic loads acting upon hulls for various conditions of the water and of aircraft loading have also been obtained. Membership of this subcommittee during 1942 was:

Capt. H. C. Richardson, United States Navy, Navy Department, Chairman.
E. T. Allen, Boeing Aircraft Co.
Prof. K. S. M. Davidson, Stevens Institute of Technology.
Capt. Walter S. Diehl, United States Navy, Navy Department.
Michael Gluhareff, United Aircraft Corporation.
Capt. H. E. Gray, Pan American Airways.
Paul E. Hovgard, the Glenn L. Martin Co.
B. V. Korvin-Kroukovsky, Edo Aircraft Corporation.
Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).
Lt. Col. Charles K. Moore, United States Army, Army Air Forces.
Alan L. Morse, Civil Aeronautics Administration.
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).
Capt. H. E. Saunders, United States Navy, Navy Department.
H. A. Sutton, Consolidated Aircraft Corporation.
Starr Truscott, National Advisory Committee for Aeronautics.

SUBCOMMITTEE ON VIBRATION AND FLUTTER

Each new design of a high-performance military air plane requires a thorough analysis of its flutter characteristics. In this connection both theoretical and experimental investigations of the various phases of the flutter phenomena have been extended. The following were members of this subcommittee during 1942:

H. J. E. Reid, National Advisory Committee for Aeronautics, Chairman.
E. Forest Critchlow, Civil Aeronautics Administration.
Lt. Comdr. J. P. Den Hartog, United States Naval Reserve, Navy Department.
Col. Frederick R. Dent, Jr., United States Army, Army Air Forces.
Commander Robert S. Hatcher, United States Navy, Navy Department.
Capt. C. L. Helber, United States Navy, Naval Aircraft Factory.
Charles H. Helms, National Advisory Committee for Aeronautics.
Prof. Otto C. Koppen, Massachusetts Institute of Technology.
Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).
Albert London, Civil Aeronautics Administration.
Dr. Walter Ramberg, National Bureau of Standards.
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).
Lt. Benjamin Smilg, United States Army, Army Air Forces.
Dr. Theodore Theodorsen, National Advisory Committee for Aeronautics.

SUBCOMMITTEE ON PROPELLERS FOR AIRCRAFT

Increases in engine power and speed, especially at high altitude, have required intensification of propeller research in the Committee's laboratories. The subcommittee membership during 1942 comprised the following:

Frank W. Caldwell, United Aircraft Corporation, Chairman.
David Biermann, National Advisory Committee for Aeronautics.
Werner J. Blanchard, Aeroproducts Division, General Motors Corporation.
Col. Howard H. Couch, United States Army, Army Air Forces.
Dr. Hugh L. Dryden, National Bureau of Standards.
Louis H. Enos, Curtiss-Wright Corporation.
Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).
Erle Martin, Hamilton Standard Propellers.
Commander W. B. Mechling, United States Navy, Navy Department.
John C. Morse, Civil Aeronautics Administration.
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).
Fred E. Weick, Engineering and Research Corporation.

SUBCOMMITTEE ON VIBRATION OF DUAL-ROTATION PROPELLERS FOR AIRCRAFT

Before dual-rotation propellers could be used to absorb efficiently and satisfactorily the increased power of new aircraft engines, it was necessary to investigate both theoretically and experimentally the vibration characteristics of these propellers. Extensive research on this subject was done in the Committee's laboratories. The membership of the subcommittee during the past year was as follows:

Frank W. Caldwell, United Aircraft Corporation, Chairman.
Capt. Rico Botta, United States Navy, Navy Department.
Col. Howard H. Couch, United States Army, Army Air Forces.
Lt. Comdr. J. P. Den Hartog, United States Naval Reserve, Navy Department.
R. M. Guerke, Curtiss-Wright Corporation.
Charles M. Kearns, Jr., United Aircraft Corporation.
Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).
Dr. Theodore Theodorsen, National Advisory Committee for Aeronautics.

SUBCOMMITTEE ON ROTATING-WING AIRCRAFT

During the past year, the Committee has made important theoretical studies contributing to the further development of autogiros, gyroplanes, and helicopters. The following were members of this subcommittee:

John Easton, Civil Aeronautics Administration, Chairman.
Frederick J. Bailey, Jr., National Advisory Committee for Aeronautics.
Capt. Walter S. Diehl, United States Navy, Navy Department.

Col. Hollingsworth F. Gregory, United States Army, Army Air Forces.
Prof. Alexander Klemin, New York University.
A. E. Larsen, Pecker-Simpson-Gladeck & Assoc.
W. Laurence LePage, Platt-LePage Aircraft Co.
Dr. G. W. Lewis, National Advisory Committee for Aeronautics (ex officio member).
R. H. Prewitt, Kellett Autogiro Corporation.
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).
I. I. Sikorsky, United Aircraft Corporation.
Paul H. Stanley, G. & A. Aircraft, Inc.

COMMITTEE ON POWER PLANTS FOR AIRCRAFT

The military necessity for airplanes capable of carrying greater loads at higher speeds and altitudes over longer distances, and under tropical and arctic conditions, has presented a multitude of new problems for aircraft engine designers. In the case of pursuit and fighter type airplanes, it has been necessary to furnish increased horsepower for brief take-off and combat intervals, while in long-range airplanes, fuel economy and reliability have had to be improved. In almost all combat type airplanes, improvements in supercharging and engine cooling have been necessary.

In attacking these various problems, the Power Plants Committee has been assisted by five subcommittees which cover problems in the following fields: Exhaust gas turbines; supercharger compressors, heat exchangers; fuels and lubricants; and lubrication, friction and wear. The membership of the Power Plants Committee during 1942 was:

Dr. George J. Mead, Chairman.
Prof. E. S. Taylor, Massachusetts Institute of Technology, Vice Chairman.
Capt. Rico Botta, United States Navy, Navy Department.
Frank W. Caldwell, United Aircraft Corporation.
Dr. H. C. Dickinson, National Bureau of Standards.
R. M. Hazen, General Motors Corporation.
S. D. Heron, Ethyl Corporation.
L. S. Hobbs, Pratt & Whitney Aircraft.
Carlton Kemper, National Advisory Committee for Aeronautics.
Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).
Arthur Nutt, Wright Aeronautical Corporation.
Col. E. R. Page, United States Army, Army Air Forces.
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).
Stephen Rolle, Civil Aeronautics Administration.

EXHAUST GAS TURBINES SUBCOMMITTEE

The problems arising in the design of turbines, particularly those utilizing the energy in the engine exhaust gases to drive the engine supercharger, have received the attention of this group. Increased efficiency of the turbine itself as well as greater utilization of the available energy in the fuel burned in the cylinder has been the objective of this subcommittee. Because of the relation of various components in the engine system, this subcommittee has also studied the over-all relations of engine power, supercharging, back pressure, and turbine output. The following were members of the subcommittee in 1942:

John G. Lee, United Aircraft Corporation, Chairman.
A. L. Berger, Army Air Forces.
Rudolph Birmann, Turbo Engineering Corporation.
K. A. Browne, Wright Aeronautical Corporation.
Opie Chenoweth, Army Air Forces.
S. R. Puffer, General Electric Co.
Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).
E. S. Thompson, General Electric Co.
Commander C. J. Pfingstag, United States Navy, Navy Department.
Benjamin Pinkel, National Advisory Committee for Aeronautics.
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).

SUBCOMMITTEE ON SUPERCHARGER COMPRESSORS

One of the most valuable contributions of this subcommittee has been a standardization of methods of testing supercharging equipment. Valuable studies have also been made of designs of various superchargers with a view to increasing the efficiency and output of these compressors. The 1942 membership of this subcommittee was as follows:

Kenneth Campbell, Wright Aeronautical Corporation, Chairman.
Rudolph Birmann, Turbo Engineering Corporation.
Lt. William Bollay, United States Naval Reserve, Navy Department.
Opie Chenoweth, Army Air Forces.
Norman A. Dunnells, Pratt & Whitney Aircraft.
W. J. King, General Electric Co.
Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).
V. G. Raviolo, Ford Motor Co.
Dr. J. T. Rettaliata, Allis-Chalmers Manufacturing Co.
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).
Oscar W. Schey, National Advisory Committee for Aeronautics.
Commander S. B. Spangler, United States Navy, Navy Department.
John Stack, National Advisory Committee for Aeronautics.

SUBCOMMITTEE ON HEAT EXCHANGERS

This subcommittee, which held its first meeting on May 11, 1942, was formed for the purpose of studying in greater detail the design of intercoolers and heat exchangers of various types used in aircraft. The problems of de-icing, cabin heating, intercooling, and flame suppression have received the consideration of this group. The following are members:

Prof. W. H. McAdams, Massachusetts Institute of Technology, Chairman.
Lt. Comdr. A. L. Baird, United States Navy, Navy Department.
M. J. Brevoort, National Advisory Committee for Aeronautics.
Dr. Allan P. Colburn, University of Delaware.
Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).

Dr. John Marchant, Pratt & Whitney Aircraft.
Rollin Hosmer Norris, General Electric Co.
Benjamin Pinkel, National Advisory Committee for Aeronautics.
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).
L. P. Saunders, General Motors Corporation.
Edmund C. Sulzman, Wright Aeronautical Corporation.
Weldon Worth, Army Air Forces.

SUBCOMMITTEE ON AIRCRAFT FUELS AND LUBRICANTS

The performance of aircraft engines under combat conditions requires the best fuel that can be made available. Research on the various components of aviation fuel is in progress to insure that those of highest quality are utilized. Research on lubricants is in progress both in the Committee's laboratory and in cooperating laboratories. The 1942 membership was as follows:

Prof. W. G. Whitman, War Production Board, Chairman.
S. D. Heron, Ethyl Corporation, Vice Chairman.
Dr. D. P. Barnard, Standard Oil Co. of Indiana.
T. A. Boyd, General Motors Corporation.
Kenneth S. Cullom, Civil Aeronautics Administration.
H. K. Cummings, National Bureau of Standards.
G. H. B. Davis, Standard Oil Development Co.
Lt. Comdr. H. R. Dozier, United States Navy, Navy Department.
Dr. J. Bennett Hill, Sun Oil Co.
Robert V. Kerley, Army Air Forces.
Lt. Comdr. George G. Lamb, United States Naval Reserve, Navy Department.
George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).
Addison M. Rothrock, National Advisory Committee for Aeronautics.

SUBCOMMITTEE ON LUBRICATION, FRICTION, AND WEAR

The subcommittee, which met for the first time on August 5, 1942, was organized for the purpose of studying limitations placed on engine operation by lubrication, friction, and wear phenomena. Fundamental studies of bearings, piston rings, and cylinder walls have come under the scope of its work. The subcommittee is composed of the following:

R. J. S. Pigott, Gulf Research & Development Co., Chairman.
Prof. J. W. Beams, University of Virginia.
Lt. John T. Burwell, United States Naval Reserve, Navy Department.
W. E. Campbell, Bell Telephone Laboratories.
Dr. J. Bennett Hill, Sun Oil Co.
Lt. Comdr. George G. Lamb, United States Naval Reserve, Navy Department.
Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).
Russell G. Robinson, National Advisory Conmittee for Aeronautics (ex officio member).
Dr. Robert Selden, National Advisory Committee for Aeronautics.
Prof. C. Fayette Taylor, Massachusetts Institute of Technology.
Arthur F. Underwood, General Motors Corporation.
Edgar A. Wolfe, Army Air Forces.

SUBCOMMITTEE ON INDUCTION SYSTEM DE-ICING

The removal or prevention of ice formations in carburetors, air scoops, and other parts of aircraft-engine induction systems is highly important because of the critical effect of such ice formations on engine performance. The Committee has investigated the conditions under which ice forms in the induction systems of several types of aircraft engines, and at the same time has developed methods of safeguarding engines against the danger of such ice formation. The results of this research are expected to greatly reduce the hazards of flying through ice-forming atmospheric conditions. The members of this subcommittee during 1942 were:

William C. Lawrence, American Airlines, Inc., Chairman.
Stephen Rolle, Civil Aeronautics Administration.
M. G. Beard, American Airlines, Inc.
Arthur A. Brown, Pratt & Whitney Aircraft.
Lt. Col. M. C. Demler, United States Army, Army Air Forces.
Dr. H. C. Dickinson, National Bureau of Standards.
Lt. J. O. Taylor, United States Navy, Navy Department.
Harvey L. Hansberry, Civil Aeronautics Administration.
A. W. Young, National Advisory Committee for Aeronautics.
Willson H. Hunter, B. F. Goodrich Co.
Robert E. Johnson, Wright Aeronautical Corporation.
R. D. Kelly, United Air Lines Transport Corporation.
Milton J. Kittler, Holley Carburetor Co.
Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).
Dr. Irving R. Metcalf, General Motors Corporation.
Frank C. Mock, Bendix Aviation Corporation.
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).

COMMITTEE ON AIRCRAFT MATERIALS

In addition to the usual consideration of ratio of strength to weight, the Committee on Aircraft Materials has, in searching for new and improved materials, considered the available supplies. While continuing the investigation of aluminum and magnesium alloys and stainless steel, the committee has studied newer materials, including various plastics and plywoods. In order to provide supervision over the detailed problems involved in developing these materials, the committee has been assisted by subcommittees in the following fields: Metals, miscellaneous materials and accessories, metals for turbosupercharger wheels and buckets, and welding problems. The membership of the Materials Committee during the past year has been:

Dr. Lyman J. Briggs, National Bureau of Standards, Chairman.
Prof. H. L. Whittemore, National Bureau of Standards, Vice Chairman.
S. K. Colby, Aluminum Co. of America.
Edgar H. Dix, Jr., American Magnesium Corporation.
John Easton, Civil Aeronautics Administration.
Warren E. Emley, National Bureau of Standards.
Charles H. Helms, National Advisory Committee for Aeronautics.

J. B. Johnson, Army Air Forces.
Col. Paul H. Kemmer, United States Army, Army Air Forces.
Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).
H. S. Rawdon, National Bureau of Standards.
John W. Sands, International Nickel Co.
E. C. Smith, Republic Steel Corporation.
Commander James E. Sullivan, United States Naval Reserve, Navy Department.
Paul V. Voigt, Jr., Carnegie-Illinois Steel Corporation.
Albert A. Vollmecke, Civil Aeronautics Administration.
Dr. Edward Warner, Civil Aeronautics Board.
A. W. Winston, the Dow Chemical Co.
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).

SUBCOMMITTEE ON METALS USED IN AIRCRAFT

This group has been particularly interested in developing metals capable of carrying high loads at high temperatures. The members in 1942 were as follows:

H. S. Rawdon, National Bureau of Standards, Chairman.
E. H. Dix, Jr., American Magnesium Corporation.
H. J. Huester, Reynolds Alloys Co.
J. B. Johnston, Army Air Forces.
Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).
Alan L. Morse, Civil Aeronautics Administration.
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).
E. C. Smith, Republic Steel Corporation.
Commander J. E. Sullivan, United States Naval Reserve, Navy Department.
Paul F. Voigt, Jr., Carnegie-Illinois Steel Corporation.
Prof. H. L. Whittemore, National Bureau of Standards.
A. W. Winston, the Dow Chemical Co.

SUBCOMMITTEE ON METALS FOR TURBOSUPERCHARGER WHEELS AND BUCKETS

This group, which is a unit of the Subcommittee on Metals, studies the particular problems of materials used in the construction of turbosuperchargers. The following were members of the subcommittee in 1942:

W. L. Badger, General Electric Co., Chairman.
Lewis S. Bergen, Crucible Steel Co.
V. Browne, Allegheny Ludlum Steel Corporation.
C. T. Evans, Jr., Universal Cyclops Steel Corporation.
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).
Russell Franks, Union Carbide & Carbon Research Laboratories.
Dr. Marcus A. Grossmann, Carnegie-Illinois Steel Corporation.
Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).

SUBCOMMITTEE ON MISCELLANEOUS MATERIALS AND ACCESSORIES

The relative scarcity of various metals and alloys has placed increased significance on the development of substitute materials such as plastics and plywoods. The subcommittee is directing several laboratory projects to develop these materials for various applications in aircraft construction. The following were included in the membership during 1942:

Warren E. Emley, National Bureau of Standards, Chairman.
Charles J. Cleary, Army Air Forces.
Dr. Henry A. Gardner, Henry A. Gardner Laboratory.
Charles H. Helms, National Advisory Committee for Aeronautics.
E. F. Hickson, National Bureau of Standards.
Dr. Gordon M. Kline, National Bureau of Standards.
Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).
Alan L. Morse, Civil Aeronautics Administration.
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).
Commander James E. Sullivan, United States Naval Reserve, Navy Department.
George W. Trayer, United States Forest Service.

SUBCOMMITTEE ON WELDING PROBLEMS

Because of the increased use of mass-production methods and the use of a great variety of alloys, research on welding has increased in importance. Research projects on the welding of aluminum and magnesium alloys have been sponsored by the subcommittee. The 1942 membership was as follows:

Col. G. F. Jenks, Moore Machinery Co., Chairman.
Dr. Rupen Eksergian, Edward G. Budd Manufacturing Co.
Charles Gallant, North American Aviation, Inc.
Dr. Wendell F. Hess, Rensselaer Polytechnic Institute.
H. W. Hudson, National Tube Co.
E. S. Jenkins, Curtiss-Wright Corporation.
J. B. Johnson, Army Air Forces.
Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).
Paul Merriman, the Glenn L. Martin Co.
George S. Mikhalapov, Aircraft Resistance Welding, Standards Committee.
Alan L. Morse, Civil Aeronautics Administration.
Dr. Maurice Nelles, Lockheed Aircraft Corporation.
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).
W. E. Roeser, National Bureau of Standards.
H. G. Runde, Vought-Sikorsky Aircraft.
Commander J. E. Sullivan, United States Naval Reserve, Navy Department.
A. J. Williamson, Summerill Tubing Co.

COMMITTEE ON AIRCRAFT STRUCTURES

Many new problems have arisen in connection with the design of efficient structures for military airplanes. In addition to continuing general research investigations, the Committee has undertaken special research relating to structural problems of particular military airplanes.

More extensive investigations have also been made to determine the loads imposed on aircraft structures arising from violent maneuvers in military operation and from atmospheric disturbances. Statistical data regarding accelerations experienced by aircraft in both military and civil operation are being continually collected and analyzed by the committee. The following were members in 1942:

Dr. Lyman J. Briggs, National Bureau of Standards, Chairman.
John Easton, Civil Aeronautics Administration.
Commander Robert S. Hatcher, United States Navy, Navy Department.

Col. Paul H. Kemmer, Army Air Forces.
Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).
Eugene E. Lundquist, National Advisory Committee for Aeronautics.
Maj. E. H. Schwartz, Army Air Forces.
Prof. Joseph S. Newell, Massachusetts Institute of Technology.
Dr. Walter Ramberg, National Bureau of Standards.
Richard V. Rhode, National Advisory Committee for Aeronautics.
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).
Edward I. Ryder, Civil Aeronautics Administration.
Capt. C. L. Helber, United States Navy, Naval Aircraft Factory.
R. L. Templin, Aluminum Co. of America.
Dr. L. B. Tuckerman, National Bureau of Standards.
Dr. Theodor von Karman, California Institute of Technology.
Dr. Edward Warner, Civil Aeronautics Board.

COMMITTEE ON OPERATING PROBLEMS

During the past year, the Committee on Operating Problems was established to consider problems of aircraft operation. The Subcommittee on Meteorological Problems, the Subcommittee on Lightning Hazards to Aircraft, and the Subcommittee on De-icing Problems are under the supervision of this committee. The members of the Committee on Operating Problems are—

Dr. Edward Warner, Civil Aeronautics Board, Chairman.
Edmund T. Allen, Boeing Aircraft Co.
Dr. Charles H. Colvin, New York University.
John Easton, Civil Aeronautics Administration.
Lt. Harold A. Elliott, United States Navy, Navy Department.
Col. L. G. Fritz, United States Army, Army Air Forces.
Col. Mervin E. Gross, United States Army, Army Air Forces.
Commander John W. Harris, United States Navy, Navy Department.
Dr. Irving Langmuir, General Electric Co.
Jerome Lederer, Airlines War Training Institute.
John C. Leslie, Pan American Airways System.
Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).
William Littlewood, American Airlines, Inc.
W. C. Mentzer, United Airlines Transport Corporation.
Dr. F. W. Reichelderfer, United States Weather Bureau.
Richard V. Rhode, National Advisory Committee for Aeronautics.
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).
Dean C. Smith, Curtiss-Wright Corporation.
Donald Stuart, Civil Aeronautics Administration.

SUBCOMMITTEE ON METROLOGICAL PROBLEMS

During the past year the Subcommittee on Meteorological Problems has given consideration to the questions of the effect of wind discontinuities such as gusts and air mass fronts on aircraft operation, electrical charges in thunderstorms, methods of measuring cloud ceiling and visibility, apparatus for upper air soundings, and standards of scales and terminology used in reporting ceiling visibility and icing. The membership of the subcommittee during 1942 was as follows:

Dr. Francis W. Reichelderfer, United States Weather Bureau, Chairman.
Thomas B. Bourne, Civil Aeronautics Administration.
C. E. Buell, American Airlines, Inc.
George M. French, Civil Aeronautics Board.
Maj. J. J. George, Joint Army-Navy Weather Central.
Lt. Col. H. T. Harrison, United States Weather Bureau.
Prof. H. G. Houghton, Massachusetts Institute of Technology.
Dr. William J. Humphreys, United States Weather Bureau.
Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).
Delbert M. Little, United States Weather Bureau.
Dr. Charles F. Marvin, Washington, D. C.
Col. Arthur F. Merewether, United States Army, Army Air Forces.
E. J. Minser, Transcontinental & Western Air, Inc.
Commander Howard T. Orville, United States Navy, Navy Department.
Richard V. Rhode, National Advisory Committee for Aeronautics.
Dr. Carl G. Rossby, University of Chicago.
Prof. A. F. Spilhaus, New York University.
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).

SUBCOMMITTEE ON LIGHTNING HAZARDS TO AIRCRAFT

During the past year the Lightning Hazards Subcommittee has been largely concerned with tests on vulnerability of fuel tanks and ball bearings to lightning, cloud charge indicators for aircraft, possible effects of ionized exhaust gases in initiating lightning discharges, electrical flashes, possible application of radioactive materials for dissipating static charges from aircraft, and, to an intensive degree, the question of effects of lightning on nonmetallic aircraft. The 1942 membership was as follows:

Delbert M. Little, United States Weather Bureau, Chairman.
Dr. O. H. Gish, Carnegie Institution of Washington.
L. P. Harrison, United States Weather Bureau.
Joseph C. Hromada, Civil Aeronautics Administration.
Lt. Comdr. F. G. Kear, United States Naval Reserve, Navy Department.
Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).
Dr. Karl B. McEachron, General Electric Co.
E. J. Minser, Transcontinental & Western Air, Inc.
Lt. Col. Charles K. Moore, United States Army, Army Air Forces.
Maj. Peter Sandretto, Washington, D. C.
Dr. F. B. Silsbee, National Bureau of Standards.
Prof. E. J. Workman, University of New Mexico.
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).

SUBCOMMITTEE ON DE-ICING PROBLEMS

The Committee has found through research that direct application of heat affords a suitable means of removing ice from the exposed surfaces of airplanes in flight. Thermal anti-icing equipment has been designed and installed in several types of military air planes in the NACA laboratories. Flight research conducted in natural icing conditions has resulted in the further refinement of these heat de-icing systems. The 1942 membership was as follows:

Karl Larson, Northwest Airlines, Chairman.
Kemper P. Brace, Navy Department.
Frank R. Collbohm, Douglas Aircraft Co.
John W. Crowley, Jr., National Advisory Committee for Aeronautics.
Lt. Col. Rudolph Fink, United States Army, Army Air Forces.
Dr. W. C. Geer, Ithaca, N. Y.
Prof. H. G. Houghton, Massachusetts Institute of Technology.
Willson H. Hunter, B. F. Goodrich Co.
C. L. Johnson, Lockheed Aircraft Corporation.
Ralph S. Johnson, United Air Lines.
Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).
Alan L. Morse, Civil Aeronautic Administration.
Dr. F. W. Reichelderfer, United States Weather Bureau.
Russell G. Robinson, National Advisory Committee for Aeronautics (ex officio member).
Capt. D. W. Tomlinson, Navy Department, Fairfax Airport, Kansas City, Mo.

COMMITTEE ON JET PROPULSION

This group was appointed to study the design of jet systems for propelling aircraft. The following are members of the committee:

Dr. W. F. Durand, Stanford University, Chairman.
Prof. C. Richard Soderberg, Massachusetts Institute of Technology, Vice Chairman.
R. C. Allen, Allis-Chalmers Manufacturing Co.
Dr. L. W. Chubb, Westinghouse Electric & Manufacturing Co.
Prof. A. G. Christie, Johns Hopkins University.
Dr. Hugh L. Dryden, National Bureau of Standards.
Col. Donald J. Keirn, United States Army, Army Air Forces.
Rear Admiral S. M. Kraus, United States Navy, Bureau of Aeronautics.
Dr. George W. Lewis, National Advisory Committee for Aeronautics (ex officio member).
Commander S. B. Spangler, United States Navy, Navy Department.
Dr. A. R. Stevenson, Jr., General Electric Co.
Prof. E. S. Taylor, Massachusetts Institute of Technology.

COOPERATIVE ACTIVITIES

The production of superior fighting aircraft can only be attained through a unified cooperative effort involving research design, and manufacture, guided by experience on the fighting fronts.

The NACA recognizes the importance of this coordinated effort and its organization has been set up to obtain maximum effectiveness in this regard. A special coordination office has been established to maintain contact with aircraft manufacturers, and to insure use of the Committee's facilities to the best advantage of the industry. In this liaison work, members of the Coordination staff make periodic visits to the manufacturers of aircraft, aircraft engines, propellers, and accessories, to discuss engineering problems of common interest. Similar visits are made to research laboratories of other organizations working on related problems. One of the objects of this activity is to insure that the technical problems arising in the industry in connection with our aeronautic war program are considered in the planning of NACA research, so that this research will be of maximum practical value to the war effort.

Contact between the industry and research work at the Committee's laboratories is likewise accomplished by frequent visits of representatives of aircraft or engine manufacturers while their products are being investigated. Military liasion offices are established at the various laboratories to maintain constant touch with the projects under way.

Through the reports of the Coordination office, the Committee's laboratory staff is advised of the work of others in the aeronautical field and of new problems that constantly arise, while the exchange of information and experience among other groups engaged in aeronautical development or research is promoted. In this way many individual visits to the Committee's laboratories that would interfere with the prosecution of laboratory research are dispensed with. Members of the Coordination staff often render direct engineering assistance to manufacturers during the course of their visits, and in other cases are able to accelerate the handling of urgent aeronautical problems by the NACA technical staff.

Coordination of research.—The Coordination staff also administers a program of research projects sponsored by the Committee, in the laboratories of universities and scientific institutions. During the past year 54 such projects have been initiated. These projects cover a wide range of problems in all of the four main aeronautical fields: Aerodynamics, power plants, structures, and materials. Some of the projects parallel or supplement similar research conducted in the Committee's laboratories. In other university projects, problems not otherwise investigated in the Committee's laboratories, such as spot welding of aluminum alloys, the development of superior metals for special applications, and the development of plastic materials, are studied. In order that there will be thorough integration with NACA laboratory work, the investigations are carefully planned as the result of communications and conferences between the NACA laboratory staff, the Coordination office, and the technical staff of the laboratory concerned.

Because of such coordinated research, the NACA laboratories are able to concentrate their attention on problems which require more elaborate and specialized equipment and a high degree of specialization by the personnel. Through this program of university research, the Committee makes effective use of research facilities in private institutions and obtains the services of outstanding scientists throughout the country.

Technical publications.—The Committee's technical publications are the official means of communicating to the proper responsible officials of the military services and of the aircraft industry the results of the laboratory studies. Such results constitute "classi-

fied" information, designated as "restricted," "confidential," or "secret," and their status is protected by the provisions of the Espionage Act. This has resulted in a limitation in the distribution of such information, while, at the same time, the volume of reports has greatly increased due to expanding research activity and the increased needs of the aircraft manufacturers and military services for technical data.

In order to place information in the hands of persons needing it with the least possible delay, the Committee has established a policy of releasing preliminary and advance data prior to the issuance of a final report. It has, therefore, been possible to place the results of laboratory tests in the hands of manufacturers and of the Army and Navy immediately upon completion of tests.

The Committee has continued the publication of technical memorandums containing translations and reproductions of outstanding aeronautical articles which appear in foreign publications. This series is available for general distribution.

Aeronautical inventions.—Another cooperative function of the Committee is the consideration of aeronautical inventions and designs. Aeronautical ideas presented to other Government agencies by inventors are referred to the NACA for analysis and report upon their technical merits. Such reports are then forwarded to the Aeronautical Patents and Design Board which consists of the Assistant Secretaries of the Departments of War, Navy, and Commerce. That Board is authorized, upon the favorable recommendation of the Committee, to "determine whether the use of the design by the Government is desirable or necessary and evaluate the design and fix its worth to the United States in an amount not to exceed $75,000."

During the past year the inventions section has considered and evaluated a large number of suggestions and designs, and has, through correspondence and personal interviews with inventors and their representatives, discussed these proposals.

In August 1940 the Secretary of Commerce created the National Inventors Council to serve as a central Government clearinghouse for suggestions and inventions pertinent to the war effort. Dr. G. W. Lewis, Director of Aeronautical Research of the NACA is a member of the Council and serves as Chairman of the Council's Technical Committee on Aircraft and Aeronautics.

General.—The substantial increase in the size of the Committee's organization, together with handicaps created by war conditions, has placed a heavy burden on administrative units. Before the outbreak of war, overtime and night shifts had been instituted to rush urgent projects to completion. Due to losses of men inducted into the Army, a concerted effort to employ women and non-draft-eligible men has been made. An apprentice school has been established to train unskilled workers to perform difficult mechanical operations.

Acquisition of essential supplies and construction of new research facilities, although hampered by wartime material shortages and transportation delays, have been expedited with good results.

FINANCIAL REPORT

Appropriations for fiscal year 1942.—The general appropriation for the National Advisory Committee for Aeronautics for the fiscal year 1942, as contained in the Independent Offices Appropriation Act approved April 5, 1941, was $4,567,890. Additional funds were provided in the Second Deficiency Appropriation Act, 1941, approved July 3, 1941, and in the Second Supplemental National Defense Appropriation Act, 1942, approved October 28, 1941, in the amounts of $465,000 and $1,162,575, respectively, making the total amount available for expenditure during 1942 for general expenses $6,195,465. The amount expended during 1942 was $6,195,430.68, itemized as follows:

Personal services	$3,433,306.89
Travel expenses	62,907.05
Transportation of things	27,338.98
Communication service	23,965.57
Utility services	110,966.32
Repairs and alterations	113,358.14
Special and miscellaneous investigations	100,000.00
Contracts for research	299,997.00
Supplies and materials	740,066.54
Equipment	1,283,524.19
Expended and obligated	6,195,430.68
Unexpended balance	34.32
Total, general appropriation	6,195,465.00

The appropriation for printing and binding was $25,000, of which amount $12,218 was expended.

The Independent Offices Appropriation Act, approved April 5, 1941, also provided $3,409,020 for continuing the construction and equipping of the Ames Aeronautical Laboratory, Moffett Field, Calif., making the total cash appropriation to that date for that laboratory $9,500,000. The Third Deficiency Appropriation Act, fiscal year 1939, approved August 9, 1939, provided for entering into contracts not to exceed the amount of $10,000,000. In the Second Supplemental National Defense Appropriation Act, 1942, approved October 28, 1941, the contract authorizations amount was increased to $16,207,500. Of this fund, the amount of $5,666,019 was obligated during the fiscal year 1942.

The Independent Offices Appropriation Act, approved April 5, 1941, also provided $5,600,000 for continuing the construction and equipping of the Aircraft Engine Research Laboratory, Cleveland, Ohio, the amount of $2,000,000 having been provided for starting work on this laboratory in the First Supplemental National

Defense Appropriation Act, 1941, approved June 26, 1940; and provision having been made for entering into contracts not to exceed $8,400,000. The Second Deficiency Appropriation Act, 1941, approved July 3, 1942, provided for an increase in the amount of contract authorizations to $13,300,000. The Sixth Supplemental National Defense Appropriation Act, 1942, approved April 28, 1942, provided an additional amount of $3,500,000 for this laboratory and increased the limit of cost to $18,171,000. Of this fund, the amount of $13,539,893 was obligated during the fiscal year 1942.

The Second Deficiency Appropriation Act, 1941, approved July 3, 1941, provided an amount of $875,000 for additional construction and equipment at Langley Field, Va., while the Second Supplemental National Defense Appropriation Act, 1942, approved October 28, 1941, provided an additional amount of $261,425 for this laboratory, making total cash appropriations for this purpose $4,276,425. Of this fund, the amount of $1,262,444 was obligated during the fiscal year 1942.

The First Supplemental National Defense Appropriation Act, 1941, approved June 26, 1940, provided $1,200,000 for construction and equipment at Langley Field, Va., including a power generating plant. No additional funds were provided for this purpose for the fiscal year 1942. The amount of $43,793 was obligated during the fiscal year 1942 to complete the construction and equipping of this plant.

The amount of $700 was received during the fiscal year 1942 to cover the cost of completing scientific investigations for manufacturers. This amount, with $4,260 remaining from the previous fiscal year, made the amount of $4,960 available for the remaining tests. These investigations were completed during 1942, resulting in the deposit of $3,495 in the Treasury to the credit of "Miscellaneous receipts," as proceeds, and the return of $1,465 to depositors.

Appropriations for fiscal year 1943.—The general appropriation for the fiscal year 1943, as contained in the Independent Offices Appropriation Act, 1943, approved June 27, 1942, was $8,986,736, and the amount provided for printing and binding was $25,000. This act also provided $3,000,000 for construction and equipment at the Ames Aeronautical Laboratory at Moffett Field, Calif., and $7,071,000 for construction and equipping of the Aircraft Engine Research Laboratory at Cleveland, Ohio. The total amount provided for the Committee in this act, therefore, was $19,082,736.

CONCLUSION

The past year has been a year of hard work. Personnel, both officials and employees, have worked long hours to extract a maximum of useful results from the facilities at their disposal. As a result, a large amount of vital information has been made available to the Army, Navy, and aircraft industry. The value and effectiveness of this work will be reflected during the coming months in the increased power of the air forces of the United Nations.

Respectfully submitted.

NATIONAL ADVISORY COMMITTEE
FOR AERONAUTICS,
JEROME C. HUNSAKER, *Chairman.*