Bibliography on ELECTROMECHANICAL TRANSDUCERS

WITH INDEXES

GPO PRICE $1.00
CFSTI PRICE(S) $0.50

Hard copy (HC) 50
Microfiche (MF) .50

ff 653 July 85

TECHNOLOGY UTILIZATION BIBLIOGRAPHY
Technology Utilization Division

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
TECHNOLOGY UTILIZATION BIBLIOGRAPHY

Bibliography on
ELECTROMECHANICAL TRANSDUCERS
WITH INDEXES

Material for this Bibliography was selected by
Applied Space Technology = Regional Advancement (ASTRA)
Midwest Research Institute
Kansas City, Missouri

This document is available from the Clearinghouse for Federal Scientific and Technical Information (CFSTI), Springfield, Virginia 22151, for $1.00.
NOTE

This document was prepared under the sponsorship of the National Aeronautics and Space Administration. Neither the United States Government nor any person acting on behalf of the United States Government assumes any liability resulting from the use of the information contained in this document, or warrants that such use will be free from privately owned rights.
FOREWORD

The Administrator of the National Aeronautics and Space Administration has established a technology utilization program for "the rapid dissemination of information...on technological developments...which appear to be useful for general industrial application." From a variety of sources, including NASA Research Centers and NASA contractors, space-related technology is collected and screened; and that which has potential industrial use is made generally available. Information from the nation’s space program is thus made available to American industry, including the latest developments in materials, management systems, processes, products, techniques and analytical and design procedures.

This publication is a part of a series of bibliographic publications intended to serve both scientific and technical personnel and the libraries and librarians who support them.

THE DIRECTOR, Technology Utilization Division
National Aeronautics and Space Administration
INTRODUCTION

This bibliography is designed to assess and identify the current literature on the applications and uses of electromechanical transducers.

The purpose of this series of publications is to provide industry with summarizing information on innovations contained in NASA and other space technology literature.

The bibliographies are intended to indicate the wealth of new information and new technology available from the collections of the National Aeronautics and Space Administration. It is the purpose of the Technology Utilization Bibliographies to select and list available information of special interest to the industrial user.

The format for this series has therefore been designed to permit a variety of forms of utilization. The bound volume provides for circulation among personnel who would be most likely to benefit from the material. At the same time, it serves as a permanent record for library filing and reference.
AVAILABILITY OF DOCUMENTS

N-accession numbers, e.g., N63-12345, identify technical reports which have been announced by NASA in Scientific and Technical Aerospace Reports (STAR), or its predecessor Technical Publications Announcements (TPA). They can normally be purchased from the following sales agency:

Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151
(formerly: Office of Technical Services, U. S. Department of Commerce)

Qualified requesters, e.g., NASA contractors, may also address inquiries about technical reports to: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Maryland, 20740.

A-accession numbers, e.g., A63-12345, identify published journal articles and books which have been announced in International Aerospace Abstracts (IAA), a journal published by the American Institute of Aeronautics and Astronautics. Articles are available for examination in those libraries that maintain sets of scientific and technical journals, and, in some instances, reprints may be obtained from the journal offices. Inquiries concerning books should be addressed to the publisher.

Abbreviations that frequently appear in the citations describing the references are listed below:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFSTI</td>
<td>Clearinghouse for Federal Scientific and Technical Information</td>
</tr>
<tr>
<td>OTS</td>
<td>Office of Technical Services</td>
</tr>
<tr>
<td>ph</td>
<td>Photostat. Full size copies of the document are available in photostatic form</td>
</tr>
<tr>
<td>mi</td>
<td>Microfiche. Copies of the document are available in microfilm form</td>
</tr>
<tr>
<td>MF</td>
<td>Microfiche. See mi</td>
</tr>
<tr>
<td>HC</td>
<td>Hardcopy. See ph</td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1962 TPA Entries (N62 Series)</td>
<td>1</td>
</tr>
<tr>
<td>1963 STAR Entries (A63 Series)</td>
<td>5</td>
</tr>
<tr>
<td>1964 STAR Entries (N63 Series)</td>
<td>8</td>
</tr>
<tr>
<td>1963 IAA Entries (A64 Series)</td>
<td>13</td>
</tr>
<tr>
<td>1964 IAA Entries (N64 Series)</td>
<td>16</td>
</tr>
<tr>
<td>Subject Index</td>
<td>I-1</td>
</tr>
<tr>
<td>Personal Author Index</td>
<td>I-13</td>
</tr>
</tbody>
</table>
Bibliography on
ELECTROMECHANICAL TRANSUDCERS
with indexes

FEBRUARY 1966

1962

TPA ENTRIES

N62-10071 Guggenheim Labs. for the Aerospace Propulsion Sciences, Princeton U., N. J.
TRANSIENT PRESSURE MEASURING METHODS; EFFECTS OF TUBING CONNECTION ON TRANSDUCER RESPONSE

Previously, the study of liquid propellant combustion instability has required the use of flush-mounted transducers to measure transient pressure fluctuations, particularly important in rocket-chamber combustion.

Flush-mounted transducers available at present however, are large in size, have poorer accuracy and are poor in dependability when subjected to high heat flux densities.

The feasibility of using tubing of various lengths to link the transducer to the chamber was studied as well as how the collected data would be influenced by the use of tubing.

The validity of using several inches or more of tubing between transducer and chamber is shown to depend upon the frequency range required, which is related to the size of the chamber and the mode of instability being measured.

N62-10591 New York U., Coll. of Engineering, N. Y.
MEASUREMENT OF TORSIONAL RIGIDITY OF STIFFENED PLATES.

TORSIONAL RIGIDITY OF STIFFENED PLATES.

A torsion testing machine was developed to measure torsional rigidity of stiffened plates and the data obtained with it is compared to the predictions of theory. The agreement of theory and experiment for two structures tested, flat and ribbed plates, revealed the reliability of the apparatus. Data measurements should apply with reasonable accuracy to thin shells as well as plates.

Basically, the torsion testing machine consists of a twist measuring system, and a loading machine. The twist measuring system measures the twist in plates by a differential normal motion over fixed lever arms using capacitor sensors connected electrically in pairs so that the signal is proportional to the rotation of the calibration bar. The loading machine uses a twisted trunnion that lies in a ball bearing. Friction is kept to a minimum by periodic cleaning and measurements reveal that starting friction torque can be kept below 0.002 in/lb.

Experimental errors may be generated in the model, the twist measuring system, the loading system, and possibly in interaction of the model with the loading system. Since torsional rigidity is proportional to the fourth power of the cross section dimension, slight errors in scaling from prototype to model would be reflected in inaccurate values of J = G(∂θ/∂X). Loading system errors were found to be chargeable to the radius arm and dead weight. In 10 measurements, radius arm variations were found to be 0.002 in. in an average arm length of 2.0175 in., and each load weight variation was found to be 2 x 10^-5 lb per dead weight of 0.16 lb. Errors due to interaction of the model with the loading system were traced to frictional resistance that could generate warping restraint in the model.

N62-10592 New York U., Coll. of Engineering, N. Y.
A FEASIBILITY STUDY ON THE MEASUREMENT OF THE TIME-DEPENDENT SHROUD PRESSURE OF A DUCTED PROPELLER.

A feasibility study on the measurement of the instantaneous incremental shroud pressure on a ducted propeller by means of a piezoelectric transducer is given. The instrumentation is described and
photographs of the observed pressure pattern presented. The feasibility of such measurements, the reproducibility and quality of the signal, and the magnitude and decay of the higher harmonics over a range of advance ratios are examined. Recommendations for future tests are outlined. (Author Abstract)


INDUCTION FLOWMETER FOR DIELECTRIC FLUIDS—OPERATIONAL MODEL.
First Quarterly Report.
(NASA Contract NASw-381; EPCO Proj. 105)
OTS: ph $3.60, mi $1.16.

A research program is under way to develop an electromagnetic flowmeter suitable for operational use with hydrogen (capable of passing one pps of liquid hydrogen) and suitable for calibration tests at the NASA Lewis Research Center. Unlike commercially available magnetic flowmeters which make use of electrically conducting liquids, the flowmeter under development will make use of the polarization currents in dielectric fluids to provide power for actuating an electronic voltage detector. Since polarization currents induced in a dielectric are proportional to the frequency of induction, it was necessary to employ a high frequency magnetic field in the flowmeter for use with dielectric liquids. Primarily because an accurate quantitative voltage measurement is limited by the state of the art to the audio frequency range, an induction frequency of 10 kc's was chosen, which should easily permit 100 or 200 cps resolution of flow oscillations.

The design requires a flow rate of one pps of liquid hydrogen and a pipe diameter of 1.5 in. (both for compatibility with Lewis Research Center facility), vacuum insulation wherever possible, and explosive proof construction.

Work completed during the first quarter involved the design, assembly, or testing of the following items: housing and fittings, magnetic coil, magnetic circuit, pipe transducer, liquid nitrogen test circuit, amplifier, magnet power generator, and phase sensitive detector. (V.D.S.)


TRANSIENT PRESSURE MEASURING METHODS; TRANSIENT PRESSURE TRANSDUCER DESIGN AND EVALUATION.
(Aeronautical Engineering Rept. 595b) (NASA Contract NASr-36)
OTS: ph $8.10, mi $2.66.

Owing to the need for improved dynamic pressure measurements in the combustion instability program at Princeton, consideration is given to transducer design, including the vibratory system, heat transfer characteristics, application to rocket chambers, and a description of a static and dynamic calibration system. Such shortcomings of present transducers as the lack of heat transferability and limited frequency response are discussed and are the targets of tests described. Details to be derived from the methods, procedures, and apparatus described will be used to report full details on several available transient pressure transducers. (V.D.S.)

N62-11146 Aeronautical Research Labs., Melbourne

MODIFICATIONS TO A HEIGHTLOCK PRESSURE TRANSDUCER FOR FLIGHT TESTS.
(Flight Technical Memorandum 13)
Modifications to a "heightlock" pressure transducer, mainly by fitting a high resolution potentiometer, and its applications in flight tests are described. When used in conjunction with a suitable recorder, changes of altitude of 2.5 feet at 10,000 feet can be detected. (Author Abstract)


INDUCTION FLOWMETER FOR DIELECTRIC FLUIDS: EXPERIMENTAL VERIFICATION.
Final Report.
(NASA Contract NASr-53; EPCO Proj. 105)

The concept of an electromagnetic flowmeter for use with dielectric fluids, particularly cryogenic propellants, has been experimentally verified and found to be practicable. The test set-up and the individual components of the flowmeter are described in detail. The description of component parts includes the following: housing and fittings, magnetic circuit, pipe/transducer, amplifier, hum compensator, and associated electronic equipment. (J.R.C.)

N62-11666 National Aeronautics and Space Administration, Lewis Research Center, Cleveland

MEASUREMENTS OF FLOW DURATION IN A LOW-PRESSURE SHOCK TUBE.
(NASA TN D-1218)
OTS: $0.50.

Hot-wire signals were used to evaluate the duration of uniform flow in a shock tube. The measurements were in good agreement with similar measurements of Roshko. The similarity correlation derived by Roshko from a boundary-layer analysis was a good first-order representation of the data; however, at the extreme low pressures a systematic deviation from the correlation was noted. (Author Abstract)

N62-12133 Westinghouse Electric Corp., Elmira, N.Y.

RESEARCH ON OPTICAL AMPLIFICATION EMPLOYING ELECTRONIC SCANNING TECHNIQUES.
OTS: $4.00.

The objective of the investigation was to determine a basis for subsequent development of a highly sensitive optical to electrical transducer or television camera tube for obtaining useful images at extremely low levels of illumination. (Author Abstract)

N62-12249 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

DYNAMIC TESTING OF PRESSURE TRANSDUCERS—A PROGRESS REPORT.

Testing methods and results are described for frequency response testing of pressure transducers and associated coupling tubing as part of a current program of dynamic testing of pressure measurement systems. A shock tube, low frequency tank, acoustic siren, and commercial testing equipment are used to excite pressure transducers. Results are analyzed either graphically or with a flying spot scanner/wave analyzer. Types of equipment are described in detail along with advantages of their use and problems encountered in their development and operation. Results of a test program to obtain maximum frequency response from a commonly used strain gauge pressure transducer are given along with general rules for selection of transducer types and coupling configurations. (Author Abstract)

N62-12358 National Aeronautics and Space Administration, Lewis Research Center, Cleveland

APPLICATION OF THE HOT-WIRE, RESISTANCE-TEMPERATURE TRANSDUCER TO THE MEASUREMENT OF TRANSIENT FLOW QUANTITIES.
OTS: ph $2.60, mi $1.04.
Properties of metallic conductors, semiconductors, thermistors, and insulators as resistance-temperature materials for use as transducers are investigated. Transient characteristics of resistance-temperature elements are discussed. Also, the use of transducers is outlined for flow fluctuation measurements such as anemometer application, free-molecule heat-transfer probe, hot-wire manometer, ion-beam hot-wire calorimeter, and temperature measurements. It is shown that, as a result of recent developments in heat-transfer correlation and electronic circuitry, resistance-temperature transducers, including semiconductors, can be introduced with good success in many new transient applications. (P.Z.)

N62-12482 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A NEW WIDE-RANGE PRESSURE TRANSDUCER.

A new transducer has been developed that will measure pressure over a wide range by sensing the damping of a vibrating diaphragm immersed in the gas whose pressure is being measured. It is capable of measuring pressures from approximately $10^3$ to $200$ mm Hg with an accuracy of about 1 percent over a large portion of the range. The device overcomes many of the shortcomings characteristic of other gages; it is small and rugged, with a fast response time at low pressures, and lends itself well to automatic operation. (Author Abstract)

N62-12659 Naval Ordnance Lab., White Oak, Md.

A PRESSURE-SENSITIVE DETECTOR FOR USE IN SHOCK-VELOCITY MEASUREMENTS IN SHOCKTUBES AND TUNNELS.
(NOL Tech. Rept. 61-117; Ballistics Res. Rept. 53.)

The pressure-sensitive detector described in this report was designed to overcome various difficulties outlined herein. Two novel features of the design are absence of soldered connections to the transducer and quick-change components of working parts. The latter feature enables one to select the type of material and the thickness of the diaphragm to suit the pressure and temperature ranges expected. (Author Abstract)

N62-12666 Naval Ordnance Lab., White Oak, Md.

PITOT PRESSURE MEASUREMENTS IN THE NOL 4-IN. HYPERSONIC SHOCK TUNNEL NO. 3.
(NavWeps-7329; Ballistics Res. Rept. 38.)

This report discusses various instruments that have been used in the measurement of pitot pressure in the test section of the NOL 4-in. hypersonic shock tunnel no. 3. (Author Abstract)

N62-12873 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

MEASUREMENT OF COOLING TEMPERATURE OF AN ELECTRIC-ARC AIR HEATER.

Instrumentation for measuring the temperature of cooling water in the vicinity of electric-arc air heaters encounters an environment of strong electric and magnetic fields, high pressure, and stray electric currents. In the transducer described here, a large signal-to-noise ratio was attained by multiplying tenfold the signal at the source and by extensively shielding against pickup. Recordings taken from the subject instrument show rapid response and large deflection with no visible noise level. (Author Abstract)
A TRANSUDER FOR THE CONTINUOUS EXTERNAL MEASUREMENT OF ARTERIAL BLOOD PRESSURE. Final Report.


The objectives of the research described were to develop a transducer that provides a continuous measure of arterial blood pressure, that does not encumber the subject, and that does not require cannulation. Two basic techniques were investigated, both analytically and experimentally. First, an indirect measure of blood pressure based on arterial deflection was attempted, but difficulties of calibration and sensitivity to physiological changes of skin and tissue around the artery resulted in a decision to attempt a more direct measurement of arterial blood pressure. In the second approach, arterial deflection is restrained by the transducer, and the resultant restraining force is measured. A mathematical model of the transducer-artery system was developed and was used as a guide for the design of the experimental prototype transducers. Tests performed on these experimental models show the effects of induced blood pressure changes, motion artifacts, and temperature changes.

(Author Abstract)

TWO-PORT NETWORK REPRESENTATION OF D.C. ELECTRO-MECHANICAL TRANSUDERS.


Two port network representations are derived for the general linear magnetic and electric field transducers. The constraints imposed by linearity requirements are discussed. It is shown that, for the most general form of transducer, the conversion of energy leads to nonlinear relationships; and a method of solving these equations is suggested. Typical applications are included to illustrate the analysis procedure and, in particular, the case of the d.c. motor is discussed in detail.

(Author Abstract)

WATER TANK NOZZLE TYPE GROUND EFFECT MACHINE: PRESSURE TRANSUDER.

D. O. Hornung and J. D. Cumming. Mar. 1962. 22 p. 4 refs. (Contract Nonr-222(71))

A pressure transducer is described for measuring the base pressure profile of the annular-jet ground effect machine. Design and production criteria are given. Transducer design specifications are as follows: one inch diameter; pressure range, 0 to 6 psig; sensitivity, 0.002 to 0.0007 psig; and frequency response, 170 cps. Response records of five transducers show good reproducibility of results.

(R.C.M.)

TRANSIENT RADIATION EFFECTS IN PRESSURE TRANSUDERS.


(AFSC-TDR-62-63)

The performance of two types of pressure transducers in a radiation environment has been evaluated by an experimental program. The devices were (1) a quartz piezoelectric crystal assembly and (2) a strain gauge transducer made by Armour Research Foundation. The most important perturbations of these transducers by a short pulse of radiation are the emission and absorption of secondary electrons by parts of the device and the conductivity of insulating materials, including quartz, cable connectors and cables. The experimentally measured results can be applied to evaluate the spurious signals and the perturbation of pressure-induced signals in a specified pulse radiation environment.

(Author Abstract)

DETERMINATION OF THE GEOMETRY OF HIDDEN DEFECTS BY ULTRASONIC PULSE ANALYSIS TESTING


The ultrasonic pulse echo method used in the detection of hidden defects in metals or other materials is investigated. In the ultrasonic pulse echo method, a single ultrasonic transducer acts as transmitter and as receiver of ultrasonic signals. The received echoes are amplified and displayed as vertical indications on a cathode ray tube. Experiments conducted indicate that the effectiveness of ultrasonic pulse echo testing can be greatly enhanced by the introduction of multi-frequency signals and defect echo analysis. The main benefit derived from this innovation is that differences in the configuration or orientation of concealed defects can be determined.

J.R.C.
A new strain transducer is described which is based on the sensitivity of shallow p-n junctions to suitably applied anisotropic stress. With the device subjected to forces of a few thousand dynes, resistance changes in excess of three orders of magnitude have been measured. The device can be operated at various impendance and sensitivity levels, depending on the electrical and mechanical stress biases applied. The fabrication and the results of some measurements of experimental structures serving as microphones are described. Inherently the p-n junction strain transducers can be fabricated in structures comparable in mass and size with present diodes and transistors.

1963
STAR ENTRIES

DESIGN AND DEVELOPMENT OF 3000°F TEMPERATURE-TRANS-DUCER SYSTEM Final Report
D. L. Roll Aug. 15, 1962 143 p 16 refs (Contracts AF 33(657)-7132 and AF 33(600):41517; P.O. 2-043005-9153)
(ADR-D-861)
The purpose of this program was to design, develop, and fabricate a transducer system, and method of installation, for measuring the skin temperature of the wing panel and leading edge of the Dyna-Soar vehicle during reentry into the earth's atmosphere. This system was intended for use in making temperature measurements during actual flight, as a means of developing a better understanding of the effect of descent rate, attack angle, and pitchup on aerodynamic heating during reentry. The specifications governing this system design, in general, require that the system be able to withstand skin temperatures up to 3000°F and lead-wire temperatures of up to 2000°F.

Author

N63-12272 Academy of Sciences (USSR). G. M. Krzhizhanovsky Inst. of Power Engineering, Moscow
THERMOCOUPLE MEASUREMENT OF THE TEMPERATURE IN A HIGH-VELOCITY GAS FLOW
E. V. Kudryavtsev In Israel Program for Scientific Translations, Ltd., Jerusalem Gas Dynamics and Physics of Combustion 1962 p 95-103 5 refs (See N63-12262 05-11) OTS: $1.75

The action of a high-velocity gas flow on a thermocouple is analyzed to determine the criteria for efficient design and use of transducers. Formulas are developed to compensate for the effect of heat conduction and radiation at the transducer. These are then applied to the design of transducers for both longitudinal and transverse measurements. The measurement error due to heat loss from the thermocouple junction is reduced to zero in both transducer designs by directing the thermocouple wires along an isotherm. Radiation transfer is eliminated by means of shields and the recovery factor is compensated for by standard calibration curves.

R.C.M.

DESIGN AND DEVELOPMENT OF 3000°F TEMPERATURE-TRANS-DUCER SYSTEM Program Progress Report [May 1-31, 1962]

D. L. Roll May 1962 6 p 3 refs (Contracts AF 33(657)-7132)
(ADR-D-811)

Preliminary thermal-response tests of 0.012-inch-thick skin-panel assemblies have been completed. Results for skins with 1-inch-thick Q-felt insulation indicate a transient error of approximately 8.5 to 10.5% as compared with 5% predicted from electrical analog studies. These data are in contrast with results for skins with 0.1-inch insulation, which showed reasonable agreement with predicted performance. Design-verification tests have been initiated. Hot- and cold-vibration tests were completed on six panels (four with 0.012-inch skin and two with 0.030-inch skin). Results indicate that sensor performance is unaffected by the vibration environment.

Author
density in a uniform electric field is on the order of $4.4 \times 10^5$ ergs/cm$^2$ under conditions which can be maintained in a transducer application. A comparison of this figure with the energy densities used in existing high-sensitivity capacitive transducers shows that present designs fall short of their ultimate capabilities by approximately a factor of 25, and that their performance can be improved by close to this factor by either evacuating or pressuring the sensor package. The characteristics of electrical discharges in the region to the left of the minimum in the Paschen's law curve are discussed, and a capacitor plate design is proposed which will allow transducers to be operated in this region. An experimental program confirmed the main features of the theoretical analysis despite experimental difficulties encountered in determining accurate breakdown potentials in the region to the left of the minimum.

Michael Mc Cally and George W. Barnard

N63-13937 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio


Michael McCally and George W. Barnard, Dec. 1962 13 p 35 refs

Within the last 5 years endoradiosondes or "radio pills," have been developed employing tiny transducers and transmitters which can be swallowed or implanted in man and animals. The present state of the art of these instruments, including design, construction, uses, advantages, and limitations, is reviewed. The literature in this area, to date, consists largely of suggestions for design principles and commercial transducers are used for measuring fluid pressure, acceleration, displacement of moving parts, and loads. Special transducers have been designed for measuring artillery recoil displacement, recoil rod, and trunnion loads. Conventional strain gages are used to measure loads and surface strains on various components, movement of parts, and projectile ejection from the barrel. Recording equipment with a frequency response of zero to 600 cps has been found to be adequate for the majority of measurements.

Author

N63-13937


Michael McCally and George W. Barnard

N63-14321 National Aero- and Astronautical Research Inst., Amsterdam (Netherlands)

NON-DESTRUCTIVE AND DESTRUCTIVE TESTS ON REDUX BONDED SINGLE AND DOUBLE LAY-JOINTS WITH VARIOUS GLUE LINE THICKNESSES

A. Hartman and J. B. de Jonge, Mar. 1962 33 p 12 refs

A series of Redux-bonded single and double lap-joints with nonporous glue layers of various thicknesses were tested ultrasonically by means of the Fokker Bond Tester. Tensile shear tests were carried out after completion of the ultrasonic tests. Bond Tester indications were in good agreement with theoretical results, indicating the instrument's ability to detect glue line stiffness. The static strength of double lap-joints turned out to be nearly independent of glue line thickness; for single lap-joints a strong dependence on glue line thickness was found. The analysis of the tensile shear test of adhesive bonded joints is discussed.

Author

N63-16806 Rock Island Arsenal, III.

INSTRUMENTATION FOR EVALUATION OF ARTILLERY AND ROCKET LAUNCHER PERFORMANCE AT ROCK ISLAND ARSENAL


All instrumentation measurements at Rock Island Arsenal under dynamic conditions have been utilized to obtain operating data on performance of research and development prototype

Author


EXPERIMENTAL EVALUATION OF A DULL-ELEMENT TRANSDUCER FOR HIGH-TEMPERATURE-GAS MEASUREMENTS [Final Technical Report]


An experimental evaluation was made of a dual-element transducer, in which gas-stream temperatures are inferred from simultaneous temperature-time measurements of two transducers of equal shape but unequal thermal capacity. The major effort was expended on measuring medium-temperature steam to prove the feasibility of the concept. The accuracy of the transducer was within ±6% in measurements from 1950° to 2250° F, which was the best experimental accuracy predicted by an earlier analysis of the concept. A limited number of measurements were made with the transducer directly in an oxyacetylene flame. The indicated flame temperatures were 4700° F and 4789° F, which agreed within 5% with measurements made by sodium-line-reversal techniques for equivalent combustion conditions in tests conducted at the University of California. In a third series of tests, the transducer was used to traverse a 2100° F gas stream, and from a single record the temperature profile in the stream was calculated within the accuracy to which the true profile could be established. It is concluded that the dual-element transducer is feasible for all the applications tested.

Author

N63-18139 California Inst. of Tech., Pasadena

I. DESIGN AND APPLICATION OF PIEZOCERAMIC TRANSDUCERS TO TRANSIENT PRESSURE MEASUREMENTS.

II. SOME MEASUREMENTS OF CURVATURE AND THICKNESS OF REFLECTING NORMAL SHOCKS AT LOW INITIAL PRESSURES

I. DESIGN AND APPLICATION OF PIEZOCERAMIC TRANSDUCERS TO TRANSIENT PRESSURE MEASUREMENTS.

Douglas S. Johnson 1962 97 p 27 refs

NASA Grant NsG-40-60

A small pressure transducer, using the piezoelectric properties of a manufactured ceramic, was designed, constructed, and installed in the end plate of the GALCIT 17-inch shock tube to obtain high-speed measurements of the pressure field behind a reflecting shock. The design problem for piezoceramic pressure transducers, and some possible solutions are discussed in detail. Results of transducer calibration and recommendations for improvement of the instrument are presented. An initial program to determine the curvature of a shock at low initial pressures was run concurrently with calibration of five

Author
of the above pressure transducers. The results of this program are described. At an initial pressure of 30 microns in the GALCIT 17-inch tube, the shock obtained at a Mach number of about 7.5 in argon is observed to have a total curvature of approximately 10 millimeters, or approximately two percent of the tube diameter. The shock thickness observed under these conditions is approximately 5 millimeters. Author

N63-18749 Aero. Inc. Arnold Air Force Station, Tenn.

VARIABLE RELUCTANCE PRESSURE TRANSDUCER DEVELOPMENT
(Contract AF 40(600)-1000)
(AEDC-TDR-63-13)

Pressure transducers whose time response and pressure ranges are suitable for test-section measurements in the hyper-velocity tunnels of the von Kármán Gas Dynamics Facility have been developed by the Instrumentation Branch of that facility. A description of these transducers, their theory of operation, and their performance characteristics are presented. Author

N63-18820 Royal Air Force. Inst. of Aviation Medicine, Farnborough (Gt. Brit.)

A SIMPLE TECHNIQUE FOR RECORDING SMALL EYE MOVEMENTS
G. H. Byford Air Ministry. Sept. 1961 21 p 7 refs
(FPRC/MEMO 162)

A contact lens photoelectric eye movement recording system is described. The transducer is carried on a dental bite. Sensitivities of the order of 40 sec/arc per cm of trace deflection are readily obtainable with a dynamic range in excess of 50 db. Although primarily designed as a device for measuring the movements of eyes, the technique has been used for other purposes. Author


MEASUREMENT OF SHOCK PRESSURES IN SOLIDS
D. G. Doran Apr. 1963 47 p 57 refs
(Poulter Labs. TR-002-63)

This report reviews the techniques for determining the pressure exerted by shock waves in solid media. Optical, electrical, and X-ray techniques used to measure shock and free-surface velocities are described, and the deduction of shock pressure therefrom is discussed. Pressure-electric transducers are described which employ the piezoelectric and piezoresistive effects and also the shock polarization of a polar solid. The report concludes with a brief discussion of the problems encountered in the comparison of shock and static data. Author


STATUS OF FLIGHT LEAK MEASURING TRANSDUCERS
Internal Note
C. T. N. Paludan July 5, 1962. 28 p
(NASA TM X-50421; M-ASTR-IN-62-14) OTS: $2.60 ph.
$1.04 mf

Transducers capable of measuring small flow rates resulting from leaks in flanges in the Saturn engine systems are being developed. Principles of operation of three basic types are given in detail. The inhouse environmental tests were satisfactory; operational tests are now being made. Leakage rates up to 1000 standard cubic centimeters per minute may be measured with the present units. These units are specifically designed for liquid oxygen leaks, but are also inherently capable of operation with other cryogenic fluids, gases at less than 100°C, or even hot gases. Author

N63-21974 Princeton U., N.J.

DYNAMIC RESPONSE TESTING OF TRANSIENT PRESSURE TRANSDUCERS FOR LIQUID PROPELLANT ROCKET COMBUSTION CHAMBERS
William C. Bentley and Joseph J. Walter June 1963 164 p 45 refs
(NASA Contract NASr-36)
(NASA CR-51516: Aeronautical Eng. Rept. -595g) OTS: $12.00 ph.
$5.12 mf

An investigation of the dynamic response of transient pressure transducers intended for use in liquid-propellant rocket combustion chambers was undertaken. Shock tube testing included optimization of operating techniques, especially the tailored interface, and the effects of ground shock and other mounting influences. The Kistler 601A quartz transducer was evaluated as a monitor for the Princeton Sinusoidal Pressure Generator (SPG), and a number of water-cooled transient transducers were evaluated for comparison with results from the SPG. An investigation was conducted which satisfactorily demonstrated the practical value of the SPG as a primary test device for transient pressure transducer evaluations to 10,000 cps. During evaluations, special consideration was given to developing operating techniques and improving SPG chamber design. The results from shock tube and the SPG show close agreement up to 10,000 cps, the present limit of usable SPG range. Transducers were then tested in experimental liquid-propellant rocket motors to compare laboratory measured characteristics with actual transducer performance. Author

N63-22047 Princeton U., N.J.

J. P. Layton, R. C. Knauer, and J. P. Thomas Sept. 1963 44 p refs
(NASA Contract NASr-36)
$1.52 mf

Progress is reported on research in transient pressure measuring methods as applied to liquid-propellant rocket combustion chambers from 1 March through 31 December 1962. The discussion includes flush diagram transient pressure transducers for current liquid-propellant rocket combustion chambers, transducer heat-flux capability, a small passage technique for transient pressure measurements in large rocket motors, response of tubing connected pressure transducers, and dynamic response testing of transient pressure transducers for liquid-propellant rocket combustion chambers. C.L.W.

N63-22048 Princeton U., N.J.

TRANSIENT PRESSURE MEASURING METHODS RESEARCH. AN ANALYTICAL AND EXPERIMENTAL STUDY OF THE RESPONSE OF A SMALL CHAMBER TO FORCED PRESSURE OSCILLATIONS
Clifton L. Carwile Oct. 15, 1962 71 p 5 refs
(NASA Contract NASr-36)
$2.33 mf

The various resonant modes of gas pressure oscillations in a Sinusoidal Pressure Generator, featuring a closed, flat cylindrical chamber, were theoretically determined and experimentally verified, using Freon-12 and nitrogen as test media. For chamber length-to-diameter ratios less than 1.71, the transverse modes were shown to be dominant. Since the test chamber of the Sinusoidal Pressure Generator had a length-to-diameter ratio of only 0.38, it was predicted analytically that the lowest obtainable resonant frequencies would be the first
and second tangential modes. Strong transverse, nearly sinusoidal waves corresponding to these two modes were obtained in the tests, but with frequencies somewhat less than those predicted by acoustic theory. The Sinusoidal Pressure Generator was evaluated for its designed function of determining pressure transducer frequency response. With helium as the test gas, the character of the pressure waves were shown to be essentially sinusoidal, and the amplitudes of the oscillations were adequate for transducer testing throughout a test range from 1,800 to 21,600 cps. However, a departure from uniform sinusoidal response was apparent as the frequency was increased, limiting the applicable range of the Sinusoidal Pressure Generator as currently designed to about 10,000 cps for pressure transducer evaluation.

N63-22395 Cornell Aeronautical Laboratory, Inc., Buffalo, N.Y.

TRANSDUCER FOR DIRECT MEASUREMENT OF SKIN FRICTION IN THE HYPERSONIC SHOCK TUNNEL
R.C. MacArthur Aug 1963 33 p 4 refs
(CAL-129)

The design considerations, construction details and operating characteristics are presented for a skin-friction transducer suitable for use in a hypersonic shock tunnel. The transducer consists of a flush diaphragm connected through a flexure to a lead-zirconium-titanate piezoelectric bimorph crystal which develops a charge when placed in bending by a surface shear on the diaphragm. An inactive diaphragm-flexure-crystal arrangement is provided within the case for acceleration compensation. The transducer is relatively insensitive to normal pressure, to surface forces applied transverse to the sensitive axis, and to thermal effects. The transducer is adaptable to contoured surfaces by the attachment to the diaphragms of lightweight, foam-plastic buttons that conform to the local surface contour of the model.

N63-22411 Aerospace Medical Div., School of Aerospace Medicine, Brooks AFB, Tex.

PHYSICAL TRANSDUCERS FOR SENSING OXYGEN
(lts Aeromedical Review 8-63)

A continuous oxygen analyzer based on polarography or electrochemical principles is described. The device requires no applied polarizing voltage, and its operation is feasible throughout wide ranges in environmental conditions because the electrolyte is completely encapsulated along with the electrodes. Gold is used as the indicator or polarizable electrode, and the reference electrode is made of cadmium. The overall cell reaction can be written as: 2Cd + O2 = 2CdO, so that the electrolyte solution is not depleted and does not limit the useful life of the device. The device used is a cylinder about 3 1/2 cm in diameter and 2 1/2 cm in length. The electrical output of the device depends on the area of the gold electrode exposed to the electrochemical action of oxygen, and the units normally used produce about 2.5 × 10^-8 amperes per 1 mm Hg of oxygen.

P. V. E.


HYDRAULIC POWER AMPLIFIERS [GIDRAVLICHESKIE USILITELI MOSCHNOSTI]
(FTD-77-62-1226/1+2; AD-413571)

The topics discussed are: (1) the components of hydraulic actuators and their characteristics, (2) classification and line diagrams of hydraulic actuators, (3) designs, basic parameters, and characteristics of hydraulic amplifiers, (4) analysis of the statics and dynamics of hydraulic amplifiers without feedback, (5) analysis of the statics and dynamics of hydraulic amplifiers with feedback, and (6) electromechanical transducers. R. T. K.

N64-12171 Aerojet-General Corp., Sacramento, Calif.

WEAPON SYSTEM 133A: QUALIFICATION-TEST REPORT ON STATHAM DIFFERENTIAL PRESSURE TRANSDUCER
Final Report
(Contract AF 33(600)-36810)
(Rept. 0162-01DR-24; AD-421712)

The Statham 3-psi-differential pressure transducer meets Minuteman requirements. Data obtained from the qualification tests of the 5-psi-absolute pressure transducer are applicable to the 3-psi-differential pressure transducer on the basis of similarity of materials, components, and manufacturing processes of the two units.

N64-12704 Radiation Inc., Melbourne, Fla.

TELEMETRY TRANSDUCER HANDBOOK
H. F. Fisher, Jr., Wright-Patterson AFB, Ohio. AF Flight Dynamics Lab., Sep 1963 768 p refs
(Contract AF 33(616)-8309)
(WADD-TR-61-67, Vol 1, Rev. 1; AD-421951) OTS: $5.60

The characteristics of the transmission system and its relation to transducers and telemetry systems are discussed in detail. The fundamentals involved in various physical measurements and how these fundamentals are employed in the general design of transducers are covered. Measurements of displacement, strain, pressure, fluid flow, rotary speed, fuel quantity, ac power, acceleration, temperature, shock and vibration, and thrust are discussed. Testing and calibration techniques and facilities available are presented. Also included are a bibliography, glossary of terms, IRIG Telemetry Standards, definitions of many basic physical effects and principles related to transducer design, and detailed data on acceleration, temperature, and thrust measurement fundamentals.


PRESSURE TRANSDUCER FOR MEASURING SHOCK WAVE PROFILES Final Report
D. D. Keough 1 Nov 1963 52 p refs
(Contract DA-49-146-ZX-096; Proj. Vela-Uniform)
(DASA-1414; AD-426910)

Calibration of pressure gages consisting of Manganin wire cast in epoxy or doped epoxy insulators shows that R(P) is linear within experimental errors up to the highest calibration pressures obtained. 200 kb Hysteresis seems to be nonexistent, as does the temperature dependence of R(P). These gages functioned satisfactorily in nuclear field tests where peak pressure and rate of pressure decay were obtained. Long duration
Various methods are discussed by which the response function of a transducer system can be expressed analytically as a function of time or transformed directly to the frequency domain.

The major part of this analysis is based on the evaluation of a transducer system. The response curve; the methods of generating precise input functions are the input functions considered.

The procedural steps of analytical analysis are introduced. These steps are applied to a linear transducer, which, for simplicity, is assumed to be a single-degree-of-freedom system. The characteristic differential equation of motion for this system is given. Response functions for the system are obtained for a given input function by both the classical and operational methods of analysis. The periodic (sine, square wave, and rectangular pulse) and aperiodic (rectangular pulse and step) functions are the input functions considered.
Fourier integral equation. To relieve the tedious and time-consuming task of computing the integral and finding the solution in elementary situations, different approximations and/or computing aids are introduced to simplify the evaluation. Some of the approximations considered are harmonic analysis, staircase function, straight-line segment, trapezoidal, sin x/x, number series transformation, and the pseudorectangular pulse. The computing aids considered are Henderson’s analyzer, Montgomery’s optical Fourier analyzer, a photoelectric Fourier transformer, and an electronic analyzer with magnetic transient storage.

N64-16240 Dresser Electronics, Houston, Tex. Southwestern Industrial Electronics Div.

ANALYSIS OF NONLINEAR TRANSDUCERS
D. F. Muster In its Methods for the Dyn. Calibration of Pressure Transducers, 12 Dec. 1963 p 53-67 refs (See N64-16236 08-15) GPO: $0.60

The physical and analytical aspects of nonlinearity are discussed. The discussion focuses on the physical parameters of damping and stiffness and the manner of their representation in the analysis of transducer systems. Consideration is also given to analytical methods as they are applied to nonlinear systems. Particular attention is given to those methods and solutions of systems where the nonlinearity is confined to the restoring force term only and to those where it is confined to the damping term only. Among the methods of analysis, the describing-function method, the bilinear approximation, and the phase-plane method are discussed in detail.

N64-17713 Joint Publications Research Service, Washington, D.C.

MEASURING THE PRESSURE OF HIGH-INTENSITY PULSE JETS BY THE TENSOMETER METHOD

A transducer is described for measuring dynamic pressures of the order of tens of thousands of atmospheres. The transducer is made in the form of a pitot tube with a cylindrical tensometer. The transducer is simple, reliable, and practically inertia-less. A jet stream was measured for dynamic pressure utilizing the tensometric method. A description is given of the dynamic pressure measurements by utilizing the transducer. By this method, successful high dynamic pressure measurements are possible.

N64-18918 School of Aerospace Medicine, Brooks AFB, Tex. Aerospace Medical Div.

CONSTRUCTION AND USE OF A SIMPLE, SELF-GUIDING CATHETER FOR RIGHT HEART AND PULMONARY ARTERY IMPLANTATION
William P. Fife Feb. 1964 7 p refs (SAM-TDR-64-10. AD-434425)

A catheter has been developed that can be easily and rapidly implanted in the right heart or pulmonary artery. Fabricated from Tygon tubing, the catheter contains a thin section...
located 2 cm from the distal end. This results in a tip that fol-
lowsthe bloodstream without special manipulation. During
implantation, its position is monitored by the use of a pressure
transducer, thus eliminating the need for fluoroscopy. Since the
catheter is self-guiding, it may be implanted with ease from
such distal locations as the femoral vein. It can be used to
inject substances directly into the heart or pulmonary artery,
or to withdraw blood samples. It also can be used to make
pressure recordings of high quality from these areas. Author

N64-19015* National Aeronautics and Space Administration.
Ames Research Center, Moffett Field, Calif.
MEASUREMENT OF THE HEARTBEAT OF BIRD EMBRYOS
WITH A MICRO-METEORITE TRANSDUCER
Technology Utilization Report
Vernon L. Rogallo Washington, NASA. Apr. 1964 16 p
(NASA-SP-5007) OTS: $0.50

A new ultrasensitive momentum transducer has been suc-
sessfully adapted as a ballistocardiograph to measure the heart
beat of avian embryos. Experiments have demonstrated that life
can be detected as early as 4 days in the incubation period and
monitored to maturity without damage to the avian embryo.
Changes in heart-beat rate and intensity resulting from tem-
perature changes, or other external stimuli were readily de-
dected by the instrument. The technique appears to open new
avenues of investigation for application in such areas as vac-
cine production and drug research. Author

N64-22660 Air Force Systems Command, Wright-Patterson
AFB, Ohio Foreign Technology Div.
MEASURING PULSATING PRESSURES WITH THE AID
OF MEMBRANE TRANSDUCERS
Yu. G. Zakharov 2 Jan. 1964 21 p refs Transl. into ENGL-
ISH from Prom. Aerodinamika (Oborongiz). no. 19. 1960
p 9-20
(FTD-77-63-737/1 1+1; AD-433076)

When using a transducer to measure pressure changes in
an airstream it is not always possible to place the transducer
directly at the point of interest. Under these conditions the
pressure that is being studied is brought to the transducer
through a channel consisting of an input nipple, a connecting
tube, and an air cavity formed by the transducer housing and
the membrane. An attempt is made to determine experimentally
the correction factors for the measured amplitude and phase of
a pulsating pressure, by considering the transducer and the
inlet tube as a single oscillating system. P.V.E.

N64-23527* Southwest Research Inst., San Antonio, Tex.
A RESISTIVE WHEATSTONE BRIDGE LIQUID WAVE
HEIGHT TRANSDUCER
Technical Report No. 3
Daniel D. Kana 10 May 1964 18 p refs
(Contract NASB-11045; SwRI Proj. 02-1391)
(NASA-CR-56651) OTS: $1.60 ph

The resistive-Wheatstone bridge liquid displacement trans-
ducer used in present liquid dynamics studies is a reliable
device, well suited to liquid amplitude and frequency ranges
usually employed for such studies. It appears that at frequen-
cies below 4 cps, its accuracy is within about 3% to 5% when used
in ordinary tap water, most of the errors being caused by
surface tension effects. If it is possible to use fixed wires
without a supporting glass rod, the error due to surface ten-
sion effects would be greatly diminished. A number of param-
eters of the system that can be changed to adapt this trans-
ducer to different experimental requirements are listed. N.E.A.

N64-24243 Air Force Systems Command, Wright-Patterson
AFB, Ohio Foreign Technology Div.
MEASUREMENTS OF STRESSES IN MACHINERY COM-
PONENTS
V. F. Yakovlev and I. S. Inyutin 30 Jan. 1964 145 p refs
Transl. into ENGLISH of the book "Izmereniya Napryazheniy
Detaley Mashin" Moscow, Gos. Nauchno-Tekhn. Izd. Mashi-
nostr. Lit., 1960 p 1-114
(FTD-77-63-731/1-2; AD-437115)

This volume considers methods for experimental measure-
ment of stresses within machinery components. The funda-
mentals of stress measurement by means of baseline wire
pickups at internal points in components are set forth. Ex-
amples in which a number of problems are solved experi-
mentally under the conditions of linear, two-dimensional, and
three-dimensional stressed states with static and dynamic
loads are given. Author

N64-29389 National Aeronautical Lab., Bangalore (India)
PRESSURE TRANSDUCERS USING THE LINEAR DIFFER-
ENTIAL TRANSFORMER
S. Balakrishna and S. Srinathkumar Jul. 1963 16 p refs
(TN-SE-3-63)

A pressure transducer is described that uses a linear vari-
able differential transformer to sense the displacement at the
center of a diaphragm subjected to the pressure being mea-
sured. Design details of the transducer are given, including
complete specifications for the differential transformer and
the electronic circuit used for indication. The diaphragm of
the transducer is changed to get different full-scale pressure
ranges. The accuracy of the transducer in all ranges is better
than ± 1 percent. Author

N64-29393 George Washington U., Washington, D.C. Center
for Measurement Science
TWO-PORT FORMULATION OF ELECTROMECHANICAL
TRANSDUCERS
Louis de Pian and Robert M. Moore 10 Jul. 1964 37 p refs
(Contract Nom.-7611(99))
(Rept.-1; AD-602216)

This report begins with a discussion of analogies as they
pertain to electromechanical transducers. Following this dis-
cussion, the linear operating equations of the general trans-
ducer are formulated as matrix equations, and the various pos-
sible matrix parameters and equivalent networks for such devices
are presented. The concept of reciprocity, nonreciprocity, and
antireciprocity are then introduced. And their significance is
discussed. Finally, a general development of the salient prop-
erties of linear electromechanical transducers, including nat-
ural (transient) and forced (steady state) response behavior,
is developed, and the techniques are illustrated. Author
Six electromechanical pressure transducer systems consisting of variable reluctance transducers, tubing, valves, and fittings with water as the pressure transmitting fluid were designed, built, and tested. The systems were used to measure transient pressure drops caused by transient flow conditions in thermal and hydraulic experiments, which simulate nuclear heating of pressurized water reactors through electrical heating of test sections. The frequency response and damping factor measurements for 21 combinations of transducer rating and system design are tabulated. The effect upon response and damping of various sizes of orifices is also tabulated.

Six electromechanical pressure transducer systems consisting of variable reluctance transducers, tubing, valves, and fittings with water as the pressure transmitting fluid were designed, built, and tested. The systems were used to measure transient pressure drops caused by transient flow conditions in thermal and hydraulic experiments, which simulate nuclear heating of pressurized water reactors through electrical heating of test sections. The frequency response and damping factor measurements for 21 combinations of transducer rating and system design are tabulated. The effect upon response and damping of various sizes of orifices is also tabulated.

The piezoresistance gage initially permitted recording of pressure profiles of 10- to 150-kbar peak gage pressure, and the insulator was reasonably matched to the shock impedance of desert surface. At the time of cancellation of Project Coach, work had been initiated to design, construct, and test gages matched to the shock impedance and, if possible, to the Hugoniot of salt. Matching the shock impedance proved quite feasible, and work was begun on matching the Hugoniot of salt. Matching procedures and materials are listed.

A new method of converting thermal energy to electricity has been investigated and the results are presented. The method employs electrochemical principles, and the device has been named the Electrothermally Regenerative Transducer. The study has shown a limiting efficiency of 35% conversion of heat. A transducer system capable of providing 500 A continuously at 28 V, with a maximum current of 5000 A at 18 V, has been designed. The average efficiency calculated for the design is 24% and the weight is 811 lb. Laboratory data obtained on single electrodes show current densities of more than 25 A/in.² to be possible.
1963

IAA ENTRIES

A63-10758
DRAG-BODY FLOWMETER.
Mead Stapler (Ramapo Instrument Co., Inc., Bloomfield, N.J.)
A description of a drag-type flowmeter for measuring the impact force of a moving stream in terms of flow rate in gallons per minute (0.1 to 10,000 gpm). In the design of a drag-body flowmeter the following basic features are considered: sensitivity, stability, finite resolution, negligible hysteresis, insensitivity to variations in line pressure and temperature, resistance to corrosion, and capability of withstanding flow rate and viscosity when entrance conditions and meter orientation are suitably controlled. It is pointed out that in addition to the specifically aeronautical applications, these pickups are adaptable to a wide range of problems, due to their capability to give simultaneously the mean pressure and the rapid variations of the instantaneous pressure. The transistorized versions of these pickups are of particular interest. The electronic detector which operates in conjunction with these pickups allows telemetering over long distances.

A63-12412
INSTRUMENTATION FOR SHOCK TESTING.
J. E. Rhodes (Endevco Corp., Pasadena, Calif.)
Paper 585A, 10 p. 10 refs.
Discussion of methods for measuring transient shock motions, emphasizing acceleration determinations. The distortion of rectangular pulses by low- and high-frequency, first-order and second-order transfer functions is described. Frequency response requirements are considered in relation to accelerometers and flowmeters. The ability of a drag-body flowmeter to withstand hydraulic shock is illustrated. It is seen that, in addition to high resonant frequency, an accelerometer should follow the characteristic response for an undamped single-degree-of-freedom mechanical system without spurious minor resonances. The galvanometer resonance frequency should be high so that minimum distortion of the basic transient is introduced. A review of shock transducers includes the following: (1) variable-potentiometer transducers, (2) seismic differential-transformer and variable-reluctance transducers, (3) strain-gage accelerometers, and (4) piezoelectric accelerometers. The calibration of transducers and the effects of mounting transducers in shock transducer resonance frequency are briefly discussed.

A63-12478
INSTRUMENTATION FOR SHOCK AND VIBRATION MEASUREMENTS.
R. R. Bouche (Endevco Corp., Pasadena, Calif.)
Description of the performance characteristics of the instruments and the techniques used in shock and vibration measurements including mechanical impedance. Shock and vibration measurements are made on structures, equipment, and high-performance vehicles. It is indicated that shock and vibration instrumentation is suitable for making accurate measurements over wide ranges of frequency, temperature, and vibration. Shock motion testing requires that the entire measurement system possess wide frequency response and linear phase-shift characteristics. It is also pointed out that the use of these instruments should lead to a better understanding of the dynamic behavior of structures, and permit more realistic testing of equipment.

A63-13024
THE TOROIDAL DISPLACEMENT TRANSDUCER.
Rolf K. Brodersen (Martin-Marietta Corp., Orlando Div., Orlando, Fla.)
Survey of the principles, characteristics, and relative merits of electrodynamic displacement transducers of both the variable-reluctance and constant-reluctance type, with particular reference to a novel toroidal displacement transducer of the latter type. This transducer has the salient features of operating with constant airgap reluctance, independent of rotor angular position, so that no tangential forces due to rotor angular displacement are developed. Both the primary and the secondary coils are stationary, and since
they are wound on the same stator ring, no flexleaks are required. The combination of the following two features is novel: (1) the primary coils can be tuned to provide magnetic support of the rotor, and (2) if magnetic suspension is not desired, the primary coils can be tuned so that the rotor is completely force-free in the radial direction. A schematic diagram of a circuit for four-pole toroidal pickoff, with tuned primary coils, is presented.

**A63-13914**

RESOLUTION OF PRESSURE IN TURBULENCE.

G. M. Corcos (University of California, Dept. of Engineering Science, Berkeley, Calif.)


Contract No. NSF-G-18115.

Discussion of the ability of a transducer to resolve the spatial details of a turbulent pressure field, with particular reference to two applications. The first is an evaluation of the adequacy of contemporary measurements of the properties of turbulent pressure fields in shear flows, and the second is an assessment of the possible discrimination by a sonar receiver between sound and local turbulent pressure fluctuations which act as background noise. To achieve this, an example of the mapping of a random function of several variables by a linear operator is examined. Making use of a formalism and of recent experimental information on the spatial structure of turbulent pressure fields in boundary layers, the second order moments of the pressure fields is demonstrated. The attenuation of the frequency-spectral density and of the cross-spectral density is presented in a table, in asymptotic form. The numerical results indicate that the attenuation caused by the finite size of transducers is generally more severe than is suggested by previous computations, mainly because the lateral correlation of pressure is highly frequency-dependent. Referred to the applications under consideration, these findings indicate the type of spatial relations required for the evaluation of transducer resolution.

**A63-13649**

ERROR BAND CONCEPT DEFINES TRANSDUCER PERFORMANCE.

Harry N. Norton (General Dynamics Corp., Astronautics Div., San Diego, Calif.)


Brief discussion of the error-band concept which simplifies specifications and performance verification of transducers. The inadequacy of the instrument-oriented specifications in terms of individual errors is briefly considered. The factors included in an error-band specification, which is based on maximum deviations of output values from a specified reference line or curve, are presented. The reference line is found to remain unchanged for all error bands of a transducer regardless of environmental or test conditions applicable for them.

**A63-13141**

SURVEY OF PRESSURE TRANSDUCERS.

G. Tegerdine.


Brief summary of the design, principles of operation, and applications of small displacement-force pressure transducers. Considered are the potentiometer-, the variable inductance-, and the variable capacitance-types of transducers, as well as the vibrating-cylinder and strain-gage pressure transducers. Specifications are presented for the commercially available transducers of these types which are manufactured by 10 British instrument firms.

**A63-13542**

A FAMILY OF DIGITAL TRANSDUCERS.

Myron L. Feistman and Paul Earkine Brown (Radio Corporation of America, Camden, N.J.)


Discussion of the function of digital transducers, the applications for which they are especially required, and the variables which they are best adapted to measure. A brief survey of the methods of digitizing is given in which the principles used in this system are presented. The practical problems involved in the design of a usable transducer are considered, and several transducers are described. It is concluded that with a 90-yr half-life material such as Pu238, and a count rate of 1 x 10^9 cps, the accuracy is expected to be better than ± 1%. The solid-state amplifier and counter weighs less than 0.5 lb and occupies less than 15 in.; transducer volume is less than 4 in., and power requirements are less than 1 watt.

**A63-15855**

A STRAIN GAGE PRESSURE TRANSDUCER WITH ALL-ROUND PERFORMANCES.

Yao T. Li (Massachusetts Institute of Technology, Dept. of Aeronautics and Astronautics, Cambridge, Mass.)


Description of a pressure transducer, the pressure-sensing element of which consists of a pair of concentric cylinders. Pressure is admitted to the space between the two cylinders to expand the outside one while compressing the inside one. A strain gage of wire foil, or solid-state material, is bonded to the outside of the outside cylinder and the inside of the inside cylinder to form the standard Wheatstone bridge. This configuration allows good temperature compensation and provides for four active arms. The reciprocal dimensional change of the inner and outer cylinders provides linearity compensation. The device has high accuracy, high overload characteristics, and high response speed with good damping properties.

**A63-15940**

TWISTED BEAM TRANSDUCER: FREQUENCY SHIFTS IN VIBRATING MODES OF BEAMS UNDER TWIST.


Description of a miniature electromechanical device which measures input angles, within a fraction of a second arc, through conversion from a mechanical angular displacement to a difference in frequency. The input angle is shown to be linearly dependent on the difference in transverse natural frequencies of two equally pretwisted flat tapes when their common-end junction is further twisted from its equilibrium pretwisted position by the desired input angle. A change in twist angle changes the natural frequency of the tape, and therefore, the measurement of the difference in frequency between the two tapes is a direct measurement of the input angle. Formulas presented for the natural frequency of a tape at zero twist, and for the natural frequency of a twisted tape, lead to a relation which provides the calibration formula. The sensing elements and the vibrating tapes are diagrammed and described. Experiments conducted from 0° to 360° of total twist angle confirm the theoretical relationships presented. The twisting beam transducer is a laboratory device that lends itself to a wide use in instrumentation, in space guidance components, and in telecommunications.

**A63-16327**

HALL-EFFECT TRANSDUCERS.

Joseph Star (Instrument Systems Corp., Halfsett Div., Westbury, N.Y.)


Study of the application of Hall-effect devices and of the characteristics associated with them. The principal fields of application are in the measurement and control of magnetic fields and currents, and in the multiplexing of currents. These applications are described, and the requirements which must be satisfied for semiconductors in the Hall generator are discussed.
A63-16703
MODE THEORY OF MULTITERMINAL TRANSDUCER CHAINS.
Israel Bar-David (Ministry of Defense, Scientific Dept., Hakirya, Tel Aviv, Israel).
Application of the mode concept to the analysis of linear multiterminal transducers operating at a discrete frequency. The transducer matrix is examined, with restrictions on reciprocity, symmetry, and losslessness introduced as special cases. The proper modes of signal transmission are classified into reactive, pseudo-active, and power-handling modes. Single and multiple mode operations are studied, and a mode-selector termination is developed for the multiple mode. An analysis of special multiterminal transducers shows that qualitative restrictions, such as losslessness and reciprocity, impose orthogonality relations upon the modes, while quantitative restrictions, such as symmetry and reciprocity, reduce the complexity of the problem by constraining the modes into pairs with reciprocal properties. The feasibility of achieving pseudo-active, growing modes in lossless nonreciprocal transducers is demonstrated by an example. Mode sorters are shown to be realizable as transformer banks in symmetrical chains. Appendices include the calculation of mode constants.

A63-16881
A DEVICE FOR MEASURING HEAT TRANSFER RATES IN HYPER VELOCITY WIND TUNNELS.
R. L. Ledford (ARO, Inc., von Karman Gas Dynamics Facility, Tullahoma, Tenn.)
(University of Denver, Denver Research Institute, Symposium on Hypervelocity Techniques, 2nd, Proceedings, Denver, Colo., Mar. 20-21, 1962.)
Contract No. AF 40(600)-800.
Description of a heat-transfer-rate transducer which may be employed to measure transient heat-transfer rates ranging upward to approximately 1,000 Btu/ft²/sec in intermittent, electric arc-driven wind tunnels. The transducer utilizes a copper disk as a calorimetric mass and a thermocouple as a temperature sensor. A detailed description of its associated instrumentation is also given along with results of an evaluation test conducted on the entire system.

A63-17170
A METHOD FOR DEFECT DISCRIMINATION IN AUTOMATIC, MULTIPLE TRANSDUCER INSPECTION SYSTEMS.
Walter A. Gunkel (Southwest Research Institute, San Antonio, Tex.)
Description of a multiple-transducer system designed and tested for automatic defect discrimination. Covered are primary discrimination, multiple-transducer inspection systems, and combination discrimination. The latter is obtained by an analysis of the combinations of signals existing on the nine output channels.

A63-18304
CRYOGENIC ACCELERATION AND TEMPERATURE TRANSDUCERS.
Earl L. Feder and Eric J. Strase (Gulton Industries, Inc., Instrumentation Div., Metuchen, N. J.)
Description of the design and calibration techniques for accelerometers and temperature probes at cryogenic temperatures. Several simple environmental test methods are shown covering a calibration temperature range from -150 to -450°F. Data are presented on the characteristics and performance of piezoelectric accelerometers at low temperatures. Also discussed is a temperature probe based upon the utilization of a carbon element, and capable of providing measurement and control of temperatures near absolute zero.

A63-19640
THE DEVELOPMENT OF AN IMPLANTABLE, NONOCCLUSIVE, NON-INVASIVE BLOOD PRESSURE MEASURING SYSTEM.
H. A. Gorman, R. Grau, J. Craig, and P. LaRue (Martin Marietta Corp., Martin Co., Denver, Colo.).
Review of hemodynamic investigations to develop an accurate, implantable blood-pressure transducer-transmitter system for sensing both the systolic and the diastolic pressures within intact arteries of subjects in orbiting vehicles, and for delivering the data from the subject to receiving-recording equipment. The feasibility of a nonoccluding, noninvasing system is established. The transducer developed is a silicone-rubber split cuff on which strain gages are bonded to give a circumferential deflection reading during the entire pulse wave. The signal is fed to the transmitter by a braided cable enclosed in the silicone rubber which isolates the strain gages and wiring from the humeral fluids of the body. The surgical implantation and calibration of the system are described.

A63-19670
A HALL EFFECT ACCELEROMETER.
Maciej Nalecz and Henryk Ziomeckl (Polish Academy of Sciences, Institute of Automatic Control, Electrotechnical Dept., Warsaw, Poland).
Description of a new measurement technique for accelerometers, using the Hall effect in semiconductors. The mechanical system of the accelerometer consists of a mass suspended from the frame by a flat spring. The accelerations to be measured are proportional to the deflection of the other end of the spring. The mechanical displacements are measured by the Hall voltage, with the Hall generator mounted at the end of the spring and moving in a nonuniform magnetic field. When the gradient of the magnetic field is linear the Hall voltage is proportional to the measured acceleration. Two magnetic systems with permanent magnets are discussed. Using the Hall generator with the gradient equal to about 10,000 gauss/mm, Earth accelerations from 1 g to 10^-5 g can be measured on the linear scale.

A63-20741
WHERE ULTRASONIC TRANSDUCERS ARE TODAY.
Description of the properties and applications of various classes of ultrasonic transducers. The classes discussed are piezoelectric single crystals, ferroelectric electrostrictive ceramics, and magnetostriuctive metals. Various characteristics of these types of transducers are tabulated, among them density and piezoelectric constant. The application of ultrasonic transducers for electrical circuit components, passive vibration and sound signal pickups, sound and vibration generation, and modulators of electromagnetic radiation are discussed, as are the power output and operating frequency limitations of these devices.

A63-20914
ALIGNMENT AND MEASUREMENT WITH ELECTRONIC LEVELS.
John M. Miller (Grumman Aircraft Engineering Corp., Bethpage, N. Y.).
Tool and Manufacturing Engineer, vol. 51, July 1963, p. 75-78.
Abridged.
Description of the electronic level, which incorporates the significant advance of a transducer to convert mechanical displacement of the pendulum or bubble into a proportional electrical signal.
that is recorded on a meter in seconds of arc. The application of an electronic level in checking bearing race alignment is illustrated in detail. Also described in the application for checking surface tables. The checking method is called isolleveling because lines of equal level are applied to the electronic level directly on the surface of the table with easily-removed grease pencil. It is noted that electronic levels cost less than autocollimation equipment and can be used by less-skilled personnel.

A64-10619
DIFFUSION LAYER ULTRASONIC TRANSDUCER.
N. F. Foster (Bell Telephone Laboratories, Inc., Whippany, N. J.)

Techniques which, by diffusing copper into the surface of conductive cadmium sulfide single-crystal samples enables the formation of thin piezoelectrically active layers. Such diffusion layers can act as ultrasonic transducers with operating frequencies well above 100 Mc. Short delay lines with less than 10 dB of insertion loss at 175 Mc have been made using such diffusion layer transducers.

A64-12483
SPECIFICATION CHARACTERISTICS OF PRESSURE TRANSDUCERS.
Harry N. Norton (General Dynamics Corp., General Dynamics/Astronautics, San Diego, Calif.).

Consideration of procedures for listing the specific characteristics of pressure transducers. These instruments are discussed in the context of the following outline, which can be used for specific purposes: (a) design characteristics, including mechanical and electrical properties; and (b) performance characteristics, including static, dynamic, and environmental performance, and performance reliability.

A64-13598
SELECTION OF AN AIRBORNE TRANSISTORIZED TRANSDUCER FOR USE IN AIRCRAFT SYSTEMS [WYBÓR UKŁADU PRZETWOR- NCY TRANSYSTOROWEJ PRZEZNACZONEJ DO PRACY W POKŁADOWYCH URZĄDZENIACH LOTNICZYCH].
Waldemar Makulski.

Discussion of the basic relations of a transistorized transducer, with particular reference to the relations which define the suitability of a transducer for aircraft applications. It is shown that a transducer coupled to two transformers exhibits the most suitable characteristics in aircraft environments. The technical and design data of this type of transducer are presented.

A66-13883
THE LIFT AND DRAG FORCES ON A CIRCULAR CYLINDER OSCILLATING IN A FLOWING FLUID.

Description of a transducer used to measure the fluctuating lift and drag forces, and the steady drag force, acting on a circular cylinder placed transversely to a fluid flow. The theory of the transducer is reviewed, and the method used to determine the lift forces at different amplitudes and frequencies is discussed. Response diagrams, obtained by keeping the flow rate constant and varying the amplitude of the oscillations, are presented.

A64-16625
LOW-PRESSURE MARVELS - SOLID-STATE TRANSDUCERS.
J. C. Sanchez (Micro Systems, Inc., Pasadena, Calif.).

Review of small-diaphragm transducers developed to improve the reliability, precision, sensitivity, and size of instrumentation for low-pressure measurements. Possible applications are: re-entry measurements on ablation heat shields of advanced space vehicles, transfer standard for condensable-vapor calibrations of gas-sensitive gages, measurement of model and tunnel pressures in hypersonic helium blowdown tunnels, replacement of radioactive gage, and capsule on thermocouples and strain gage, and capsule on thermocouples and strain gage, and capsule on thermocouples and strain gage.

A64-17210
EXPERIMENTAL MECHANICS IN THE DEVELOPMENT OF A NEW MINIATURE PRESSURE TRANSDUCER.
Charles W. Bert and Nelson A. Crites (Battelle Memorial Institute, Solid and Structural Mechanics, Columbus, Ohio).
Contract No. NOnr-2877(00).

Development of a miniature pressure transducer of the diaphragm type, with strain elements based on a new concept, to measure static and dynamic pressures acting on a helicopter rotor blade. With a number of these transducers installed along the blade chord, the pressure distribution can be measured under various flight conditions. This information is of importance in connection with a study of the aerodynamics of the blade and possible improvement in the blade design. With an overall volume of less than 0.001 in. , the instrument is believed to be the smallest pressure transducer that can measure static pressures as well as relatively high-frequency pressure fluctuations. It is also believed to offer promise for investigations of strain distributions in such small parts as gears, bearings, housings, and switches.

A64-17295
WHAT'S AHEAD IN BIOMEDICAL MEASUREMENTS?
L. E. Slater (Case Institute of Technology, Cleveland, Ohio).

Presentation of the design concept of biomedical measuring devices that may ultimately approach microcircuits. Removable probes having been used for measurements within living tissue; it is suggested that the transducer itself could be implanted as a semi-permanent device, transmitting information by radio. Semiconductor device technology is considered a promising source for micro-sized transducers. Speculation is made concerning the possibility of uniting the concepts of biomagnetism with quantum mechanics. A second speculation suggests that microcomputer sensing systems may be used for extending man's homeostatic (self-regulating) capabilities to permit adaptation to unusual environmental stresses.
INSTRUMENT TRANSDUCERS.
The book introduces the reader to the performance and design of a variety of instrument transducers, defined as devices which, for the purpose of measurement, convert physical input quantities into electric output signals. The discussion is limited to transducer types for which the technology is sufficiently advanced to satisfy the stringent conditions of high-tissue measuring instruments with predictable performance. Chapter 2 gives an overall view of instrument transducers with respect to their input and output quantities, linked by the particular transducing principle employed. It also discusses problems concerning classification of instrument transducers, and seeks to clarify the principle of electro-mechanical analogies, in which electro-mechanical devices are represented by all-electric circuits. A brief introduction to feedback-type transducers is included. Chapter 3 discusses the performance of instrument transducers, with mechanical input elements, constituting first- and second-order vibratory systems, which may be excited by static, sinusoidal, or transient input quantities. The three essential elements of these systems are discussed with respect to their concept and realization. Pressure-sensitive elements and their characteristics are examined. Chapter 4 deals with the output characteristics of variable-resistance, variable-inductance, and variable-capacitance electromagnetic generators, and of piezoelectric and magnetic transducers. Following an introduction to the basic physical principles involved, the discussion goes into details of design and materials peculiar to individual types of transducers, and concludes with a review of problems of transducer construction. Chapter 5 gives an account of force-balance transducers with a feedback path between transducer output and input. The application of the force-balance principle in dynamics is demonstrated by the example of a linear acceleration transducer. The book is intended for the instrumentation expert, the experimental physicist, and the electrical engineer. A bibliography is provided for each section of the book.

A SHEAR STRAIN MEASUREMENT IN SOLID PROPELLANT ROCKET MOTORS.
G. M. Dicken and J. H. Thacher ( Hercules Powder Co., Allegany Ballistics Laboratory, Cumberland, Md.).
American Institute of Aeronautics and Astronautics, Annual Meeting, 1st, Washington, D.C., June 29-July 2, 1964, Paper 64-506. 9 p. Members, $0.50; nonmembers, $1.00.
Discussion of a semiconductor transducer which is capable of measuring shear strains in low-modulus propellant-like materials. A survey of existing and/or proposed stress/strain measuring devices is included. The new low-modulus dc semiconductor transducer and the evaluation test procedure are then described. The test procedures used to characterize the inert propellant used in this work are given. The grain structural analysis is presented and utilized to evaluate experimental results. Finally, the proposed use of the transducer in live propellant rocket motors is outlined.

A TACHOMETER AND SYNCHROSCOPE FOR RECIPROCATING ENGINE AIRCRAFT.
Description of an electronic tachometer and synchroscope developed for light reciprocating engine aircraft. The dual tachometer, for use on multiple-engine aircraft, consists of an indicator unit and two magnetic transducers. The transducers, when installed on the aircraft's magnets, provide electrical pulses related to the crankshaft revolutions which operate the indicator unit. The indicator unit consists of a dual electronic circuit and a pair of panel meter mechanisms installed in a standard aircraft instrument case. The synchroscope drive signals are obtained from the tachometer transducers.

A MAGNETODYNAMIC MOTION TRANSDUCER.
IN: NATIONAL CONVENTION ON MILITARY ELECTRONICS, 7TH, WASHINGTON, D.C., SEPT. 9-11, 1963, PROCEEDINGS. Conference sponsored by the Professional Technical Group on Military Electronics, Institute of Electrical and Electronics Engineers. Edited by B. J. Goldfarb.
Recommendation of a means for measuring a physical characteristic of space known to exist, but never before measured by direct means. An MDM transducer is described which employs moving solid dielectric media to physically convey charge; it is stated that liquid or gaseous dielectrics could be employed, where quantitative correction could be made for the effects of ion mobility. It is concluded that, when the motion vector is finite, it should be measurable by means of a shielded MDM transducer in the electric field of a superposed potential gradient. The MDM-transducer should find numerous uses, including passive airborne ground speed sensing, as well as motion sensing deep in magnetized space. It might also find use as a surface means for sensing geographic north.

A NEW METHOD FOR MEASURING THE PRESSURE DISTRIBUTION ON HARMONICALLY OSCILLATING WINGS OF ARBITRARY PLAN FORM.
H. Bergh ( National Aeronautical and Astronautical Research Institute, Amsterdam, Netherlands).
International Council of the Aeronautical Sciences, Congress, 4th, Paris, France, Aug. 24-28, 1964, Paper 64-576. 8 p. 6 refs. Members, $0.50; nonmembers, $1.00.
Description of a method of measuring the pressure distribution by means of a pressure transducer mounted inside a scanning valve. The scanning valve, located outside the test section, is connected to the model orifices by equal pressure leads. The correction procedure is simplified so that the influence of the pressure leads is compensated. The equipment, developed to measure a large number of pressures automatically, is described. Examples are presented which are considered to demonstrate the usefulness of the technique.

TRANSDUCERS FOR DYNAMIC MEASUREMENTS.
R. R. Bouché (Endevco Corp., Pasadena, Calif.).
Discussion of the applications, principles, and performance of various types of transducers. Although some of the transducers described measure constant mechanical stimuli - i.e., zero frequency, the discussion is directed toward their use for dynamic measurements. The transducer types covered are: seismic transducers, variable resistance transducers, variable inductive transducers, piezoelectric transducers, and piezoresistive transducers. A variety of calibration methods is also presented.

A TRANSDUCERS FOR MEASUREMENT. I: INTRODUCTION AND THEORY OF PRESSURE MEASUREMENT.
L. E. Bollinger (Ohio State University, Dept. of Aeronautical and Astronautical Engineering, Columbus, Ohio).
Symposium on Environmental Measurements, Cincinnati, Ohio, Sept. 4-6, 1963.)
Discussion of pressure-sensing devices that can be actuated by waves from one or more transmission systems or media and that can supply related waves to one or more other transmission systems or media. In a brief introduction to transducers in general, the author
indicates that, ideally, transducers should respond instantaneously with respect to time. That is, for a step-function input, the output signal should follow the input signal without distortion in amplitude, frequency, or phase. Over a limited range, many actual transducers are said to approach this ideal. The type of transducer selected to obtain measurements of pressure in fluids is indicated to depend on a number of aspects of the particular application, including: range, accuracy, frequency response, location of detector and indicator, reliability, simplicity, availability, fluid temperature, fluid velocity, fluid corrosiveness, adaptability to automatic control, and cost. Discussions are also presented on Newtonian and non-Newtonian fluids, the influence of Reynolds number on flow, laminar and turbulent types of flow, fluid dynamics, and Bernoulli's equation.

A64-24737
A PIEZOELECTRIC ACCELEROMETER.
Jack Willis and Bruce Darrel Jimerson (California, University, Dept. of Engineering, Los Angeles, Calif.).

Presentation of a design for an accelerometer thought to have a potential sensitivity of 1.5 g for a 1-lb inertial mass. The proposed accelerometer is assumed to have: (1) a proof mass of 1 lb; (2) a frequency shift that is linear over the range of interest; (3) a constant operating temperature; (4) oscillator stability of about one part in 10^5 (achieved by controlling temperature); (5) a maximum range of 20 g; (6) a pair of crystals; and (7) ideal coupling between the proof mass and the transducer. The change in frequency expected when acceleration changes from 0 to 20 g is said to be of the order of 4 Kc for a crystal with an oscillator frequency of 100 Kc. Methods of improving both sensitivity and linearity are discussed, including the application of a dc bias voltage to the crystal.

A64-24919
MEASUREMENTS OF INTERNAL STRESS IN ELECTRONIC ENCAPSULATING RESINS WITH A SMALL SOLID STATE TRANSDUCER.
G. Dallimore, F. Stucki, and D. Kasper (Lockheed Aircraft Corp., Lockheed Missiles and Space Co., Research Laboratories, Palo Alto, Calif.).

Description of a small solid-state teromagnetic pressure transducer which can be embedded in an electronic package. Internal pressure data during thermal cycling and thermal shock, measured by the transducer on three types of resins, are provided. The effect of a silicone rubber coat on the transducer is also discussed. It is concluded that the transducer described offers the resin chemist, electronic packaging engineer, and design engineer a new tool for determining the effects of various catalysts, fillers, flexibilizers, dinites, and other agents on the cure shrinkage and internal stresses generated during thermal cycling and thermal shock. In addition, it is anticipated that this device can be used to measure the effects of vacuum and radiation environments on electronic embedment materials.

A64-25349
ACCURATE PRESSURE TRANSDUCERS FOR EXTREME ENVIRONMENTS.

Description of a recently developed, self-contained, force-balance pressure transducer. The instrument, complete with electronics, is said to operate over a temperature range of -40 to +150°C, to have errors limited to 1/3% of full scale, and to measure absolute pressures up to 15 psia. It can reportedly withstand very high vibration levels without giving erroneous readings, and can be mounted in an aircraft without antivibration mounts. Its response time is indicated to be of the order of 20 msec and its output is i vdc/pai from 1 k ohms. The choice of the force-balance element and of the pressure-sensing element is described, and characteristics of the null detector and the amplification and stabilization techniques are discussed.
WILDLIFE TELEMETRY. Lowell Adams (California University; George Williams Hooper Foundation, San Francisco, Calif.) and W. Conlev Smith (U.S. Navy, Monterey, Calif.). 7 p. 7 refs. [See A64-26460 22-08]

SESSION III - MULTIPLEXING AND SYNCHRONIZING. DEVELOPMENT OF OPTIMUM FRAME SYNCHRONIZATION CODES FOR GODDARD SPACE FLIGHT CENTER PCM TELEMETRY STANDARDS. Jesse L. Maury, Jr. and Frederick J. Styles (NASA, Goddard Space Flight Center, Md.). 10 p. 6 refs. [See A64-26460 22-08]

A SIMPLIFIED APPROACH TO OPTIMAL PCM FRAME SYNCHRONIZATION FORMATS. Robert C. Masching (Lockheed Aircraft Corp., Sunnyvale, Calif.). 17 p. [See A64-26461 22-08]

THE EFFECT OF BIT AND GROUP SYNCHRONIZATION ON THE RECEPTION OF PCM/FM TELEMETRY SIGNALS. F. A. Perkins (Radiation, Inc., Melbourne, Fla.). 18 p. 20 refs. [See A64-26462 22-08]


THE METAL-OXIDE-SEMICONDUCTOR TRANSISTOR IN PCM TELEMETRY SYSTEMS. L. Berner (Radio Corporation of America, Camden, N.J.). 16 p. 8 refs. [See A64-26463 22-09]

SESSION IV - TELEMETRY'S NEW FRONTIER - OCEANOGRAPHY. A METEOR BURST COMMUNICATION SYSTEM FOR SHORT-RANGE MASTER-SLAVE APPLICATIONS. J. E. Sparks and Q. C. Wilson (Ball Brothers Research Corp., Boulder, Colo.). 9 p. 13 refs. [See A64-26464 22-08]

ACQUISITION OF OCEANOGRAPHIC DATA VIA METEOR TRAIL FORWARD SCATTER. R. E. Johnson (Boeing Co., Seattle, Wash.). 7 p.

AN EXPERIMENT WITH A SHORT PATH LENGTH UNATTENDED EXHIBIT TELEMETRY LINK IN THE ARCTIC OCEAN. Beaumont M. Buck and Walter P. Brown (General Motors Corp., Santa Barbara, Calif.). 8 p. 7 refs. [See A64-26465 22-08]

RADIO REFRACTION BY THE MARINE LAYER AND ITS EFFECT ON MICROWAVE PROPAGATION. Earl E. Gossard (U.S. Navy, San Diego, Calif.). 7 p. 7 refs. [See A64-26466 22-08]

SATELLITE TELEMETRY OF OCEANOGRAPHIC OBSERVATIONS. George E. O'Rourke (Sylvania Electric Products, Inc., Waltham, Mass.). 5 p. 13 refs. [See A64-26467 22-08]


HIGH FREQUENCY TELEMETRY AND COMMUNICATIONS FOR OCEANOGRAPHY. James M. Shogdrazee (California University, La Jolla, Calif.). 7 p. 5 refs. [See A64-26469 22-08]

SESSION V - MODULATION AND DETECTION - THEORY AND TECHNIQUES. ON THE ALLOCATION OF POWER IN A SYNCHRONOUS BINARY PSK COMMUNICATION SYSTEM. J. J. Stiffer (California Institute of Technology, Pasadena, Calif.). 11 p. [See A64-26469 22-08]

IMPLEMENTATION OF AN ORTHOGONAL MULTIPLEXED COMMUNICATION SYSTEM. S. Karp and J. Rampacek (Douglas Aircraft Co., Inc., Santa Monica, Calif.). 7 p. [See A64-26470 22-08]

THE USE OF DOUBLE SIDEBAND SUPPRESSED CARRIER MODULATION AS A SUBCARRIER FOR VIBRATION TELEMETRY. A. C. Roche (Dynatronics, Inc., Orlando, Fla.). 8 p. [See A64-26471 22-08]

LABORATORY COMPARISON OF TANLOCK AND PHASELOCK RECEIVERS. M. Balodis (North American Aviation, Inc., Downey, Calif.). 11 p. [See A64-26472 22-09]

A PCM-PAM HYBRID TELEMETRY SYSTEM. Tamiya Nomura and Yasuhiko Yasuda (Tokyo, University, Tokyo, Japan). 7 p. 19
SESSION X - SPECIAL SYSTEMS FOR SPECIAL PURPOSES.
A MARS LANDER TELEMETRY RELAY SYSTEM. James F. Lee (Raytheon Co., Bedford, Mass.). 7 p. [See A64-26488 22-08]

GEMINI TARGET VEHICLE PCM-FM TELEMETRY SYSTEM. Thomas E. Lindens and Daniel A. Buka (Lockheed Aircraft Corp., Sunnyvale, Calif.). 5 p. [See A64-26489 22-08]

A RADATION HARDENED TELEMETRY SYSTEM. V. K. Smith and D. L. Trapp (Sandia Corp., Albuquerque, N. Mex.). 6 p. [See A64-26490 22-08]


AIRBORNE DATA LINK. Ernest A. Dahi (U.S. Naval Fleet Missile Systems Analysis and Evaluation Group, Corona, Calif.). 8 p. [See A64-26492 22-08]

SESSION XI - TELEMETRY FROM THE MOON - APOLLO.
SIGNAL CONDITIONING EQUIPMENT FOR THE APOLLO MANNED SPACECRAFT. Irvin J. Himmelberg and Ward J. Barrier (North American Aviation, Inc., Downey, Calif.). 10 p. [See A64-26493 22-09]

THE PREMODULATION PROCESSOR FOR THE APOLLO MANNED SPACECRAFT. Roy D. Sturkie (North American Aviation, Inc., Downey, Calif.). 9 p. [See A64-26494 22-09]

APOLLO PCM TELEMETRY EQUIPMENT WITH AUTOMATIC FAULT ISOLATION. Vernon A. Dorrell (North American Aviation, Inc., Downey, Calif.) and Donald R. Sorcech (Radiation, Inc., Melbourne, Fla.). 12 p. [See A64-26495 22-08]

APOLLO SPACECRAFT DATA STORAGE SYSTEM. Richard C. Collum, Jr. (Collins Radio Co., Cedar Rapids, Iowa) and P. M. Bryant (Leach Corp., Azusa, Calif.). 9 p. [See A64-26496 22-09]


EPILOG. 6 p.

AN ADVANCED AEROSPACE TELEMETRY TRANSDUCER.
R. H. Russell (Micro Systems, Inc., Pasadena, Calif.).
IN: NATIONAL TELEMETERING CONFERENCE, LOS ANGELES, CALIF., JUNE 1-4, 1964. PROCEEDINGS.
Conference sponsored by the American Institute of Aeronautics and Astronautics, Institute of Electrical and Electronics Engineers, and Instrument Society of America.

Description of a design approach to a second-generation aerospace telemetry transducer. The transducer described is for measurement of pressure, but the discussion is said to apply equally to temperature-sensing versions. The transducer uses a solid-state signal conditioner and solid-state sensors within the mechanical pickup. The signal conditioning module utilizes a dc-dc converter to provide dc isolation, and the associated problems of ac isolation and common mode output noise are discussed. The problems of a design compatible with specified operation under thermal shock conditions are considered, and a solution is indicated and applied to the system design. A very low mean time between failures was set as a design goal; through the use of ultralow power circuitry and careful parts choice, a significant improvement was found possible. The same approach permitted an excitation power requirement reduction of almost one order of magnitude.
Listing of Subject Headings of Reports

The following subject index has been prepared to enable the user to locate a particular reference as rapidly as possible. A brief statement, describing the content of a given reference, appears under each appropriate subject heading. An accession number, e.g., N65-12345 or A65-13456, assigned for purposes of identification, is located below and to the right of the descriptive statement. The same reference may be found under several different subject headings so that the user has a choice of more than one approach in his search for information.

AMPLIFIER
HYDRAULIC ACTUATORS AND AMPLIFIERS WITH & WITHOUT FEEDBACK, AND ELECTROMECHANICAL TRANSDUCERS
FTD-IT-62-1226/142
N64-11150

AMPLITUDE
PROPAGATION OF LARGE AMPLITUDE WAVES IN PURE LEAD
DRL-1158
N62-12968

ANEMOMETER
WHT WIRE RESISTANCE TEMPERATURE TRANSDUCER FOR MEASUREMENT OF TRANSIENT FLOW
N62-12358

ANGULAR MOTION
CAPACITIVE TRANSDUCERS FOR NARROW BAND VIBRATORY DISPLACEMENT OUTPUT OF ANGULAR MOTION SENSORS - ENERGY DENSITY CALCULATION FOR PARALLEL PLATE TYPE
ESL-R-153
N63-13604

ANNULAR NOZZLE
ANNULAR NOZZLE TYPE GROUND EFFECT MACHINE.
N62-12358

APERIODIC FUNCTION
TYPES OF APERIODIC FUNCTION GENERATORS
N64-16241

BIBLIOGRAPHY
ULTRASONIC PHENOMENA AND METHODS OF MEASUREMENT - BIBLIOGRAPHY
EM IC-6 146 N63-12769

TELEMETRY TRANSDUCER HANDBOOK WITH BIBLIOGRAPHY
ARD-TR-61-67, VDL. 1, REV. 1 N64-12704

BIRD
HEARTBEAT MEASUREMENT OF BIRD EMBRYOS WITH MICROMETEORITE TRANSDUCER AS BALLISTOCARDIOGRAPH
N64-19015

BLOOD PRESSURE
REMOTE BLOOD PRESSURE MEASURING AND MONITORING SYSTEM ON MAN IN FLIGHT
N62-10087

TRANSUDER FOR THE CONTINUOUS EXTERNAL MEASUREMENT OF ARTERIAL BLOOD PRESSURE
N62-13733

BLOOD PRESSURE TRANSDUCER-TRANSMITTER SYSTEM FOR MEASURING PRESSURES WITHIN INTACT ARTERIES OF SUBJECTS IN ORBITING VEHICLES AND TO RELAY DATA TO RECEIVING-RECORDING EQUIPMENT
N62-13733

BULOMETER
WHT WIRE RESISTANCE TEMPERATURE TRANSDUCER FOR MEASUREMENT OF TRANSIENT FLOW
N62-12358

A

ACCELEROMETER DESIGN AND CALIBRATION TECHNIQUES FOR ACCELEROMETERS AND TEMPERATURE PROBES AT CAYOGENIC TEMPERATURES
A63-18304

HALL EFFECT IN SEMICONDUCTORS TO MEASURE MECHANICAL DISPLACEMENTS AS A FUNCTION OF ACCELERATION
A63-19670

SENSITIVITY AND LINEARITY OF ACCELEROMETER USING PIEZOELECTRIC CRYSTS
A64-24737

AEROSPACE MEDICINE BLOOD PRESSURE TRANSDUCER-TRANSMITTER SYSTEM FOR MEASURING PRESSURES WITHIN INTACT ARTERIES OF SUBJECTS IN ORBITING VEHICLES AND TO RELAY DATA TO RECEIVING-RECORDING EQUIPMENT
AIAA PAPER 63-167 A63-19640

AIR COOLANT WATER TEMPERATURE MEASUREMENT IN ELECTRIC ARC AIR HEATER
N62-12873

AIR CURRENT MEMBRANE TRANSDUCERS TO MEASURE PRESSURE PULSE IN AIR STREAM
FTD-IT-63-737/1624 N64-22660

AIRBORNE ELECTRONIC EQUIPMENT TRANSISTORIZED TRANSDUCER SELECTION FOR AIRCRAFT APPLICATIONS, EMPHASIZING COUPLING WITH TRANSFORMERS
A64-13598

AIRCRAFT INSTRUMENT ELECTRONIC TACHOMETER AND SYNCHROSCOPE FOR RECIPROCATING ENGINES OF LIGHT AIRCRAFT, DESCRIBING TRANSDUCER AND INDICATOR
A64-21755

ALIGNMENT ELECTRONIC LEVEL, INCORPORATING A TRANSDUCER, TO CONVERT MECHANICAL DISPLACEMENT OF PENDULUM INTO ELECTRIC SIGNAL USED IN ALIGNMENT AND MEASUREMENT TECHNIQUES AT LOW INVESTMENT FOR LESS SKILLED PERSONNEL
A63-20914

ALTITUDE HEIGHTLOCK PRESSURE TRANSDUCER FOR FLIGHT TESTS
ARL/F-13 N62-11466

ALTITUDE HEAVY PRESSURE TRANSDUCER FOR FLIGHT TESTS
ARL/F-13 N62-11466

BIBLIOGRAPHY ULTRASONIC PHENOMENA AND METHODS OF MEASUREMENT - BIBLIOGRAPHY
EM-IC-8146 N63-12769

TELEMETRY TRANSDUCER HANDBOOK WITH BIBLIOGRAPHY
AWC-TR-61-67, VOl. 1, REV. 1 N64-12704

BIRD HEARTBEAT MEASUREMENT OF BIRD EMBRYOS WITH MICROMETEORITE TRANSDUCER AS BALLISTOCARDIOGRAPH
N64-19015

BLOOD PRESSURE REMOTE BLOOD PRESSURE MEASURING AND MONITORING SYSTEM ON MAN IN FLIGHT
N62-10087

TRANSUDER FOR THE CONTINUOUS EXTERNAL MEASUREMENT OF ARTERIAL BLOOD PRESSURE
N62-13733

BLOOD PRESSURE TRANSDUCER-TRANSMITTER SYSTEM FOR MEASURING PRESSURES WITHIN INTACT ARTERIES OF SUBJECTS IN ORBITING VEHICLES AND TO RELAY DATA TO RECEIVING-RECORDING EQUIPMENT
AIAA PAPER 63-167 A63-19640

EXTERNAL, ARTERIAL BLOOD PRESSURE TRANSDUCER
N64-17815
<table>
<thead>
<tr>
<th>Bonding</th>
<th>Bonding Use of Fokker Bond Tester in Destructive and Nondestructive Test on Redux Bonded Single and Double Lap Joints</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cadmium Sulfide</td>
<td>Ultrasonic Transducers produced by diffusing Copper into Surface of Cadmium Sulfide Single-Crystals, Forming Thin Piezoelectrically Active Layers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calibration</td>
<td>Calibration of Pressure Transducer System for Unsteady Pressure Measurements</td>
<td>AEDC-TDR-63-629</td>
<td>N63-13424</td>
</tr>
<tr>
<td>Dynamic Calibration of Pressure Transducers</td>
<td>NBS-Monograph-67</td>
<td>N64-16236</td>
<td></td>
</tr>
<tr>
<td>Types and Characteristics of Pressure Transducers and Concepts of Calibration and Analysis</td>
<td>N64-16237</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calorimeter</td>
<td>Hot Wire Resistance Temperature Transducer for Measurement of Transient Flow</td>
<td>N62-12350</td>
<td></td>
</tr>
<tr>
<td>Capacitance</td>
<td>Capacitive Transducers for Narrow Band Vibratory Displacement Output of Angular Motion Sensors - Energy Density Calculation for Parallel Plate Type ESL-R-153</td>
<td>N63-13604</td>
<td></td>
</tr>
<tr>
<td>Carbon</td>
<td>Hot Wire Resistance Temperature Transducer for Measurement of Transient Flow</td>
<td>N62-12350</td>
<td></td>
</tr>
<tr>
<td>Circulatory System</td>
<td>Catheter for Right Heart and Pulmonary Artery Implantation</td>
<td>SAM-TDR-64-10</td>
<td>N64-18918</td>
</tr>
<tr>
<td>Combustion Chamber</td>
<td>Dynamic Response of Transient Pressure Transducers for Liquid Propellant Rocket Combustion Chambers</td>
<td>NASA-CR-51516</td>
<td>N63-21974</td>
</tr>
<tr>
<td>Compensator</td>
<td>Electronic Compensator Designed to Extend Usable Frequency Range of Transducer Systems</td>
<td></td>
<td>N64-16244</td>
</tr>
<tr>
<td>Computer</td>
<td>Computer for Measuring Directivity Factor for Electroacoustic Transducers</td>
<td>NEL-1196</td>
<td>N64-14635</td>
</tr>
<tr>
<td>Conference</td>
<td>National Telemetering Conference at Los Angeles in June 1964</td>
<td>AEDC-TDR-62453</td>
<td></td>
</tr>
<tr>
<td>Contact Lens</td>
<td>Contact Lens Photoelectric Eye Movement Recording System</td>
<td>FPRC/MEMO-162</td>
<td>N63-18820</td>
</tr>
<tr>
<td>Coolant</td>
<td>Coolant Water Temperature Measurement in Electric Arc Air Heater</td>
<td>N62-12873</td>
<td></td>
</tr>
<tr>
<td>Coupling</td>
<td>Dynamic Testing of Pressure Transducers</td>
<td>JPL-TR-32-268</td>
<td>N62-12249</td>
</tr>
<tr>
<td>Cryogenic Propellant</td>
<td>Induction Flowmeter for Dielectric Fluids</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cryogenic Temperature</td>
<td>Design and Calibration Techniques for Accelerometers and Temperature Probes at Cryogenic Temperatures</td>
<td></td>
<td>A63-18304</td>
</tr>
<tr>
<td>Data Acquisition</td>
<td>Instrumentation for Dynamic Data Acquisition on Artillery and Rocket Launcher Weapons - Transducers and Recorders</td>
<td></td>
<td>N63-16606</td>
</tr>
<tr>
<td>Destructive Testing</td>
<td>Use of Fokker Bond Tester in Destructive and Nondestructive Test on Redux Bonded Single and Double Lap Joints</td>
<td>NRL-TN-M.2099</td>
<td>N63-14321</td>
</tr>
<tr>
<td>Detection</td>
<td>Ultrasonic Pulse Echo Detection of Defects in Metal</td>
<td></td>
<td>N62-17120</td>
</tr>
<tr>
<td>Detector</td>
<td>Pressure Sensitive Detector for Use in Shock Velocity Measurements in Shocktubes and Tunnels</td>
<td>NOLTR-61-117</td>
<td>N62-12659</td>
</tr>
<tr>
<td>Dielectric Material</td>
<td>Induction Flowmeter for Dielectric Fluids</td>
<td></td>
<td>N62-11123</td>
</tr>
<tr>
<td>Differential Equation</td>
<td>Corresponding Response Functions for Inputs from Characteristic Differential Equations of Motion of Transducer Systems</td>
<td>N64-16239</td>
<td></td>
</tr>
<tr>
<td>Analysis of Physical Nonlinear Transducers by Mathematical Models Characterized by Differential Equations</td>
<td>N64-16240</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital Transducer</td>
<td>Design and Application of a Family of Transducers Which Produce a Direct Digital Output, with Particular Reference to Aerospace Utilization</td>
<td></td>
<td>A63-15342</td>
</tr>
<tr>
<td>Diode</td>
<td>A Sensitive Magnetic Transducer Wescam Paper-32</td>
<td></td>
<td>N62-17796</td>
</tr>
<tr>
<td>Direct Current /DC/</td>
<td>Two Port Network Representation of DC Electro Mechanical Transducers</td>
<td>CCA-N-121</td>
<td>N62-15814</td>
</tr>
<tr>
<td>Displacement</td>
<td>Capacitive Transducers for Narrow Band Vibratory Displacement Output of Angular Motion Sensors - Energy Density Calculation for Parallel Plate Type ESL-R-153</td>
<td>N63-13604</td>
<td></td>
</tr>
<tr>
<td>Drag</td>
<td>Heightlock Pressure Transducer for Flight Tests ARL/F-13</td>
<td></td>
<td>N62-11466</td>
</tr>
<tr>
<td>Drag Measurement</td>
<td>Drag-Type Flowmeter for Measuring Impact Force of Moving Stream</td>
<td>A63-10758</td>
<td></td>
</tr>
<tr>
<td>Lift and Drag Force Measurements on a Circular Cylinder, Oscillating Transversely in a Flowing Fluid</td>
<td>A64-13885</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ducted Fan</td>
<td>Measurement of Time Dependent Shroud Pressure of a Ducted Propeller TAR-TR-612</td>
<td></td>
<td>N62-11007</td>
</tr>
<tr>
<td>Dynamic Response</td>
<td>Dynamic Response of Transient Pressure Transducers for Liquid Propellant Rocket Combustion Chambers</td>
<td>NASA-CR-51516</td>
<td>N63-21974</td>
</tr>
<tr>
<td>Transducers for Dynamic Measurements Covering Operation, Calibration and Applications</td>
<td></td>
<td>A64-23179</td>
<td></td>
</tr>
</tbody>
</table>
DYNAMICS
DYNAMIC TESTING OF PRESSURE TRANSDUCERS
JPL-TR-32-268 N62-12249

ECHO
ULTRASONIC PULSE ECHO DETECTION OF DEFECTS IN METAL N62-17120

ELECTRIC ARC
COOLANT WATER TEMPERATURE MEASUREMENT IN ELECTRIC ARC AIA HEATER N62-12873

ELECTRIC EQUIPMENT
STUDY OF THE APPLICATION OF HALL EFFECT TRANSUCERS AND THE CHARACTERISTICS ASSOCIATED WITH THEM A63-16327

ELECTROACOUSTIC WAVE
COMPUTER FOR MEASURING DIRECTIVITY FACTOR FOR ELECTROACOUSTIC TRANSDUCERS NEL-1196 N64-14635

ELECTROCHEMICAL CELL
THERMAL ENERGY CONVERSION TO ELECTRICITY - ELECTROCHEMICALLY REGENERATIVE TRANSDUCER DEVICE A64-10039

ELECTROMAGNETIC MEASUREMENT
MAGNETODYNAMIC MOTION TRANSDUCER FOR MEASURING MOTION VECTOR FOR MAGNETIC TO ELECTRIC FIELD TRANSFORMATION A64-22505

ELECTROMAGNETISM
INDUCTION FLUIDMETER FOR DIELECTRIC FLUIDS N62-11541

ELECTROMECHANICAL DEVICE
TWO PORT NETWORK REPRESENTATION OF DC ELECTROMECHANICAL TRANSDUCERS COA-N-121 N62-13814

DISCUSSION OF WORKING PRINCIPLES OF VARIOUS TYPES OF PRESSURE TRANSDUCERS USED IN TEST AND MONITORING INSTALLATIONS A63-15141

HYDRAULIC ACTUATORS AND AMPLIFIERS WITH & WITHOUT FEEDBACK, AND ELECTROMECHANICAL TRANSDUCERS FTD-62-1226/162 N64-11150

ELECTROMECHANICAL TRANSDUCERS AS LINEAR TWO-PORT DEVICES REPT.-1 N64-29393

ELECTROMECHANICAL TRANSDUCER SYSTEMS FOR TRANSIENT PRESSURE MEASUREMENTS WAPD-TM-343 N64-30127

ELECTROMETER
VIBRATING MEMBRANE ELECTROMETER WITH HIGH CONVERSION GAIN NASA-AP-289 N64-28352

ELECTRONIC EQUIPMENT
MICROMINIATURIZATION OF ELECTRONIC MEASURING DEVICES FOR BIOMEDICAL PURPOSES A64-17295

ELECTRONIC LEVEL
ELECTRONIC LEVEL, INCORPORATING A TRANSDUCER, TO CONVERT MECHANICAL DISPLACEMENT OF PENDULUM INTO ELECTRIC SIGNAL USED IN ALIGNMENT AND MEASUREMENT TECHNIQUES AT LOW INVESTMENT FOR LESS SKILLED PERSONNEL A63-20914

ELECTRONIC PACKAGING
SMALL SOLID STATE FERRIMAGNETIC TRANSDUCER FOR MEASURING INTERNAL STRESS IN ELECTRONIC ENCAPSULATING RESINS A64-29419

ELECTRONIC TRANSDUCER
DESCRIPTION OF PRESSURE PICKUPS WHICH HAVE A BROAD BANDWIDTH OR WHICH ARE IN DIRECT CONTACT WITH MEDIA UP TO 3700 DEGREES KELVIN A63-12250

APPLICATION OF THE MODE THEORY TO THE ANALYSIS OF SIGNAL TRANSMISSION PROPERTIES OF LINEAR MULTITERMINAL TRANSDUCER CHAINS AT A DISCRETE FREQUENCY A63-16703

METHOD FOR DEFECT DISCRIMINATION IN AUTOMATIC MULTIPLE TRANSDUCER INSPECTION SYSTEMS A63-17170

STRESSES IN PIZORESISTIVE STRAIN GAUGE AND CAPSULE OR DIAPHRAGM-TYPE TRANSDUCERS FOR LOW PRESSURE MEASUREMENTS A64-16625

AEROSPACE TELEMETRY TRANSDUCER DESIGN FOR MEASUREMENT OF PRESSURE AND TEMPERATURE A64-26454

ELECTRONICS
OPTICAL AMPLIFICATION EMPLOYING ELECTRONIC SCANNING TECHNIQUES ARL-154 N62-12133

HOT WIRE RESISTANCE TEMPERATURE TRANSDUCER FOR MEASUREMENT OF TRANSIENT FLOW N62-12358

EMBRYO
HEARTBEAT MEASUREMENT OF BIRD EMBRYOS WITH MICROTELEMETRY TRANSDUCER AS BALLISTOCARDIOGRAPH NASA-SP-5007 N64-19015

ENDORADIOSONDE
ENDORADIOSONDERS - STATE OF THE ART SURVEY ARHL-TOR-62-122 N63-13937

ENERGY DENSITY
CAPACITIVE TRANSDUCERS FOR NARROW BAND VIBRATORY DISPLACEMENT OUTPUT OF ANGULAR MOTION SENSORS - ENERGY DENSITY CALCULATION FOR PARALLEL PLATE TYPE ESP-R-193 N63-13604

ENERGY SPECTRUM
CAPACITIVE TRANSDUCERS FOR NARROW BAND VIBRATORY DISPLACEMENT OUTPUT OF ANGULAR MOTION SENSORS - ENERGY DENSITY CALCULATION FOR PARALLEL PLATE TYPE ESP-R-193 N63-13604

ENGINE FAILURE INDICATOR
TRANSDUCERS CAPABLE OF SMALL FLOW RATE MEASUREMENT FROM LEAKS IN FLANGES OF SATURN ENGINE SYSTEMS NASA-TM-X-50421 N63-21915

EPOXY RESIN
SMALL SOLID STATE FERRIMAGNETIC TRANSDUCER FOR MEASURING INTERNAL STRESS IN ELECTRONIC ENCAPSULATING RESINS A64-29419

EYE
CONTACT LENS PHOTODETECTIVE EYE MOVEMENT RECORDING SYSTEM PIRC/MEMO-162 N63-18820

FIBER
HOT WIRING RESISTANCE TEMPERATURE TRANSDUCER FOR MEASUREMENT OF TRANSIENT FLOW N62-12358

FLANGE
TRANSDUCERS CAPABLE OF SMALL FLOW RATE MEASUREMENT FROM LEAKS IN FLANGES OF SATURN ENGINE SYSTEMS NASA-TM-X-50421 N63-21915

FLIGHT TEST
HEIGHTLOCK PRESSURE TRANSDUCER FOR FLIGHT TESTS ARHL-F-13 N62-11666

FLIGHT TEST INSTRUMENT
AIR LOAD MEASUREMENTS DURING FLIGHT USING PRESSURE TRANSDUCER MOUNTED ON ROTOR BLADE SURFACE REPT.-299-099-200 N64-17461

FLOW
MEASUREMENTS OF FLOW DURATION IN A LOW PRESSURE SHOCK TUBE NASA-TN-1-1218 N62-11666

HOT WIRE RESISTANCE TEMPERATURE TRANSDUCER FOR MEASUREMENT OF TRANSIENT FLOW N62-12358

TRANSDUCER FOR VARIABLE PRESSURES IN HIGH TEMPERATURE FLOWS
FLOW MEASUREMENT

SURVEY OF TRANSDUCERS USED TO MEASURE STATIC AND DYNAMIC PRESSES IN FLUID-FLOW FIELDS

A63-11204

FLOW METER

INDUCTION FLOWMETER FOR DIELECTRIC FLUIDS

N62-11123

INDUCTION FLOWMETER FOR DIELECTRIC FLUIDS

N62-11541

DRAIN-TYPE FLOWMETER FOR MEASURING IMPACT FORCE OF MOVING STREAM

A63-10758

DISCUSSION OF THE PERFORMANCE OF TURBINE-TYPE OR PROPELLER FLOWMETERS, OPERATING ON LIQUID HYDROCARBONS, IN THE RANGE 0.5 TO 250 GPM

A63-11187

FLOW RATE

TRANSDUCERS CAPABLE OF SMALL FLOW RATE MEASUREMENT FROM LEAKS IN FLANGES OF SATURN ENGINE SYSTEMS

NASA-TM-X-50421 N63-21915

FLOW VELOCITY

TRANSDUCERS FOR HIGH VELOCITY GAS FLOW TEMPERATURE MEASUREMENT WITH DESIGN CRITERIA DETERMINED FROM THERMOCOUPLE MEASUREMENTS

N63-12272

FLUID MECHANICS

HOT WIRE RESISTANCE TEMPERATURE TRANSDUCER FOR MEASUREMENT OF TRANSIENT FLOW

N62-12358

TRANSDUCERS ARE PRESSURE SENSING DEVICES THAT CONVERT THEIR INPUT INSTANTANEOUSLY INTO ELECTRICAL SIGNALS WITHOUT DISTORTION

A64-24231

FOKKER BOND TESTER

USE OF FOKKER BOND TESTER IN DESTRUCTIVE AND NONDESTRUCTIVE TEST ON REDUX BONDING SINGLE AND DOUBLE LAP JOINTS

NRL-TN-M.2099 N63-14321

FREE MOLECULE

HOT WIRE RESISTANCE TEMPERATURE TRANSDUCER FOR MEASUREMENT OF TRANSIENT FLOW

N62-12358

FREQUENCY

ELECTRONIC COMPENSATOR DESIGNED TO EXTEND USABLE FREQUENCY RANGE OF TRANSDUCER SYSTEM

N64-16244

G

GAS FLOW

TRANSDUCERS FOR HIGH VELOCITY GAS FLOW TEMPERATURE MEASUREMENT WITH DESIGN CRITERIA DETERMINED FROM THERMOCOUPLE MEASUREMENTS

N63-12272

GAS STREAM

MEMBRANE TRANSDUCERS TO MEASURE PRESSURE PULSE IN AIR STREAM

FTD-IT-63-737/16264 N64-22660

GENERATOR

RESPONANT NODES OF GAS PRESSURE OSCILLATIONS IN SINUSOIDAL PRESSURE GENERATOR WITH FLAT CYLINDRICAL CHAMBER

NASA-CR-51517 N63-22048

TYPES OF APERIODIC FUNCTION GENERATORS

N64-16241

TYPES OF PERIODIC FUNCTION GENERATORS

N64-16243

GROUND EFFECT MACHINE

ANNUAL NOZZLE TYPE GROUND EFFECT MACHINE, PRESSURE TRANSDUCER

SER. 187, ISSUE 2 N62-14759

H

HALL EFFECT

STUDY OF THE APPLICATION OF HALL EFFECT

I-4
SUBJECT INDEX

IMPLANTATION
CATHETER FOR RIGHT HEART AND PULMONARY ARTERY
IMPLANTATION
SAM-TD-64-10 N64-18918

IN FLIGHT MONITORING
TEMPERATURE TRANSDUCER FOR IN-FLIGHT MONITORING
OF SKIN PANEL SURFACE TEMPERATURES - EFFECTS OF
INSULATION AND VIBRATION ON ACCURACY
ATL-D-811 N63-12288

INDUCTION
INDUCTION FLOWMETER FOR DIELECTRIC FLUIDS
N62-11123

INPUT
INPUT, OUTPUT, AND TRANSFER FUNCTION RELATIONS OF
LINEAR TRANSDUCERS N64-16238

INSTRUMENTATION
MEASUREMENT OF TIME DEPENDENT SHROUD PRESSURE OF A
DUCTED PROPPELLER
TAR-TR-612 N62-11017

PITOT PRESSURE MEASUREMENTS IN HYPERSONIC SHOCK
TUNNEL
NAVWEPS-7329 N62-12666

COOLANT WATER TEMPERATURE MEASUREMENT IN ELECTRIC
ARC AIR HEATER N62-12873

ION BEAM
HOT WIRE RESISTANCE TEMPERATURE TRANSDUCER FOR
MEASUREMENT OF TRANSIENT FLOW N62-12358

JET STREAM
UTILIZING A TRANSDUCER & TENSOMETER TO MEASURE
PRESSURES OF JETSTREAMS
JPRS-23920 N64-17713

LAP JOINT
USE OF FOKKER BOND TESTER IN DESTRUCTIVE AND
NONDESTRUCTIVE TEST ON REDUX BONDED SINGLE AND
DOUBLE LAP JOINTS
NRL-TR-5-2099 N63-14321

LEAD
PROPAGATION OF LARGE AMPLITUDE WAVES IN PURE LEAD
BRL-1158 N62-12986

LEADING EDGE
TRANSUDER SYSTEM FOR MEASURING SKIN TEMPERATURE
OF WING PANEL AND LEADING EDGE OF DYNA-SOAR
VEHICLE DURING REENTRY
ATL-D-861 N63-11421

LEAKAGE
TRANSUDERS CAPABLE OF SMALL FLOW RATE MEASUREMENT
FROM LEAKS IN FLANGES OF SATURN ENGINE SYSTEMS
NASA-TM-X-50421 N63-21915

LIFT FORCE
LIFT AND DRAG FORCE MEASUREMENTS ON A CIRCULAR
CYLINDER, OSCILLATING TRANSVERSELY IN FLOWING
FLUID A64-13885

LINEAR TRANSFORMATION
PRESSURE TRANSUDER USING LINEAR DIFFERENTIAL
TRANSFORMER
TN-5E-3-63 N64-29389

LIQUID FLOW
DISCUSSION OF THE PERFORMANCE OF TURBINE-TYPE OR
PROPELLER FLOWMETERS, OPERATING ON LIQUID
HYDROCARBONS, IN THE RANGE 0.5 TO 250 GPM
A63-11187

LIQUID PROPELLANT ROCKET ENGINE
DYNAMIC RESPONSE OF TRANSIENT PRESSURE TRANSUDERS
FOR LIQUID PROPELLANT ROCKET COMBUSTION CHAMBERS
NASA-CR-51516 N63-21974

LONGITUDINAL STABILITY
EQUIVALENT CIRCUIT OF A MAGNETOSTRICTIVE
TRANSUDER WORKING NEAR THE FUNDAMENTAL RESONANCE
AND THE ELECTRICAL EQUIVALENT CIRCUIT OF A STEP
TRANSFORMER FOR LONGITUDINAL AND TORSIONAL
VIBRATIONS A63-24318

MAGNETIC INDUCTION
MAGNETODYNAMIC MOTION TRANSUDER FOR MEASURING
MOTION VECTOR FOR MAGNETIC TO ELECTRIC FIELD
TRANSFORMATION A64-22505

MAGNETIC PROPERTY
A SENSITIVE MAGNETIC TRANSUDER
WESCON PAPER-3.2 N62-17796

MAGNETOSTRICTION
PIEZOELECTRIC SINGLE CRYSTALS, FERROELECTRIC
ELECTROSTRICTIVE CERAMICS AND MAGNETOSTRICTIVE
METALS FOR USE AS ULTRASONIC TRANSUDERS
A63-20741

EQUIVALENT CIRCUIT OF A MAGNETOSTRICTIVE
TRANSUDER WORKING NEAR THE FUNDAMENTAL RESONANCE
AND THE ELECTRICAL EQUIVALENT CIRCUIT OF A STEP
TRANSFORMER FOR LONGITUDINAL AND TORSIONAL
VIBRATIONS A63-24318

MANNEDE SPACECRAFT
REMOTE BLOOD PRESSURE MEASURING AND MONITORING
SYSTEM ON MAN IN FLIGHT N62-10687

MANOMETER
HOT WIRE RESISTANCE TEMPERATURE TRANSUDER FOR
MEASUREMENT OF TRANSIENT FLOW N62-12358

PRESSURE TRANSUDERS DESCRIBING MANOMETERS, PITOT
TUBES, BOURN TubeS AND RESISTANCE, CAPACITANCE
ANOE PIEZOELECTRIC GAUGES A64-25773

MATERIAL TESTING
METHOD FOR DEFECT DISCRIMINATION IN AUTOMATIC
MULTIPLE TRANSUDER INSPECTION SYSTEMS
A63-17170

MATHEMATICAL MODEL
ANALYSIS OF PHYSICAL NONLINEAR TRANSUDERS BY
MATHEMATICAL MODELS CHARACTERIZED BY DIFFERENTIAL
EQUATIONS A64-16240

MATRIX ANALYSIS
APPLICATION OF THE MODE THEORY TO THE ANALYSIS OF
SIGNAL TRANSMISSION PROPERTIES OF LINEAR
MULTITERMINAL TRANSUDER CHAINS AT A DISCRETE
FREQUENCY A63-16703

MEASURING APPARATUS
ELECTRONIC LEVEL, INCORPORATING A TRANSUDER, TO
CONVERT MECHANICAL DISPLACEMENT OF PENDULUM INTO
ELECTRIC SIGNAL USED IN ALIGNMENT AND MEASUREMENT
TECHNIQUES AT LOW INVESTMENT FOR LESS SKILLED
PERSONNEL A63-20914

TRANSUDER SYSTEM FOR MEASURING SKIN TEMPERATURE
OF WING PANEL AND LEADING EDGE OF DYNA-SOAR
VEHICLE DURING REENTRY
ATL-D-861 N63-11421

600K ON PERFORMANCE AND DESIGN OF INSTRUMENT
TRANSUDERS FOR MEASUREMENT APPLICATIONS
A64-17660

SEMOCONDUCTOR TRANSUDER FOR SHEAR STRAIN
MEASUREMENT IN LOW MODULUS PROPELLANT-LIKE
MATERIALS
AIAA PAPER 64-506 A64-25005

HIGH ACCURACY SELF-CONTAINED FORCE BALANCE
PRESSURE TRANSUDER FOR EXTREME ENVIRONMENTS
A64-25349

MEDICAL ELECTRONICS
BLOOD PRESSURE TRANSUDER-TRANSMITTER SYSTEM FOR
MEMBRANE
MEASURING PRESSURES WITHIN INTACT ARTERIES OF SUBJECTS IN ORBITING VEHICLES AND TO RELAY DATA TO RECEIVING-RECORDING EQUIPMENT
AIAA PAPER 63-167
ENDORADIOSONDES - STATE OF THE ART SURVEY
AMRL-TOR-62-122

MEMBRANE
VIBRATING MEMBRANE ELECTROMETER WITH HIGH CONVERSION GAIN
NASA-RP-289

METAL
ULTRASONIC PULSE ECHO DETECTION OF DEFECTS IN METAL
N62-17120

MODE SEQUENCE
APPLICATION OF THE MODE THEORY TO THE ANALYSIS OF SIGNAL TRANSMISSION PROPERTIES OF LINEAR MULTITERMINAL TRANSDUCER CHAINS AT A DISCRETE FREQUENCY
A63-16703

MONITOR
REMOTE BLOOD PRESSURE MEASURING AND MONITORING SYSTEM ON MAN IN FLIGHT
N62-10587

MOTION EQUATION
CORRESPONDING RESPONSE FUNCTIONS FOR INPUTS FROM CHARACTERISTIC DIFFERENTIAL EQUATIONS OF MOTION OF TRANSDUCER SYSTEMS
N64-16239

NETWORK
TWO PORT NETWORK REPRESENTATION OF DC ELECTROMECHANICAL TRANSDUCERS
CODA-H-121
N62-13814

NOISE
INDUCTION FLOWMETER FOR DIELECTRIC FLUIDS
N62-11541

NONDESTRUCTIVE TESTING
POINT-CONTACT TRANSDUCERS FOR ULTRASONIC TESTING
WAL-TR-143/5-1
N62-14557
USE OF FOKKER BOND TESTER IN DESTRUCTIVE AND NONDESTRUCTIVE TEST ON REDUX BONDED SINGLE AND DOUBLE LAP JOINTS
NRL-TN-M-2099
N63-14321

NONLINEAR SYSTEM
ANALYSIS OF PHYSICAL NONLINEAR TRANSDUCERS BY MATHEMATICAL MODELS CHARACTERIZED BY DIFFERENTIAL EQUATIONS
N64-16240

NOZZLE
ANNULAR NOZZLE TYPE GROUND EFFECT MACHINE, PRESSURE TRANSDUCER
IER SER. 187, ISSUE 2
N62-14759

OPTICAL AMPLIFIER
OPTICAL AMPLIFICATION Employing ELECTRONIC SCANNING TECHNIQUES
ARL-154
N62-12133

OPTICAL MEASUREMENT
ELECTRONIC LEVEL, INCORPORATING A TRANSDUCER, TO CONVERT MECHANICAL DISPLACEMENT OF PENDULUM INTO ELECTRIC SIGNAL USED IN ALIGNMENT AND MEASUREMENT TECHNIQUES AT LOW INVESTMENT FOR LESS SKILLED PERSONNEL
A63-20914
PRESSURE EXERTED BY SHOCK WAVES IN SOLID MEDIA - OPTICAL, ELECTRICAL AND X-RAY TECHNIQUES USED TO MEASURE SHOCK AND FREE SURFACE VELOCITIES
POULTER LABS. TR-002-63
N63-19134

OSCILLATING CYLINDER
LIFT AND DRAG FORCE MEASUREMENTS ON A CIRCULAR CYLINDER, OSCILLATING TRANSVERSELY IN FLOWING FLUID
A64-13885

OSCILLATING WING
PRESSURE DISTRIBUTION MEASUREMENT ON HARMONICALLY OSCILLATING WINGS
A64-13885

ICAS PAPER 64-28
A64-22766

OUTPUT
INPUT, OUTPUT, AND TRANSFER FUNCTION RELATIONS OF LINEAR TRANSDUCERS
N64-16238

OXYGEN DETECTOR
OXYGEN DETECTOR USING PHYSICAL TRANSDUCERS
N63-22411

P-N JUNCTION
P-N JUNCTION STRAIN TRANSDUCER
WESCION PAPER-3.4
N62-17790

PHOTOELECTRIC APPARATUS
CONTACT LENS PHOTOLECTRIC EYE MOVEMENT RECORDING SYSTEM
FPRC/MEM/O-162
N63-18820

PHYSIOLOGY
TRANSDUCER FOR THE CONTINUOUS EXTERNAL MEASUREMENT OF ARTERIAL BLOOD PRESSURE
N62-13733
ENDORADIOSONDES - STATE OF THE ART SURVEY
AMRL-TOR-62-122
N63-13937

PIEZOELECTRIC CRYSTAL
PIEZOELECTRIC SINGLE CRYSTALS, FERROELECTRIC ELECTROSTRICTIVE CERAMICS AND MAGNETOSTRICTIVE METALS FOR USE AS ULTRASONIC TRANSDUCERS
A63-20741
ULTRASONIC TRANSDUCERS PRODUCED BY DIFFUSING COPPER INTO SURFACE OF CADIUM SULFIDE SINGLE-CRYSTALS, FORMING THIN PIEZO-ELECTRICALLY ACTIVE LAYERS
A64-10619
SENSITIVITY AND LINEARITY OF ACCELEROMETER USING PIEZOELECTRIC CRYSTALS
A64-24737

PIEZORESISTIVE DEVICE
PIEZORESISTIVE TRANSDUCERS FOR TRANSPORT HIGH PRESSURE MEASUREMENTS - SHOCK IMPEDANCE MATCHING OF PIEZORESISTIVE GAUGE INSULATOR TO SALT ENVIRONMENT
AD-42669
N64-30204

PIEZOELECTRICITY
PIEZOCERAMIC PRESSURE TRANSDUCERS FOR SHOCK TUBE PRESSURE MEASUREMENT - SHOCK WAVE PROFILES OF REFLECTED WAVES, THICKNESS AND CURVATURE
NASA-CR-50495
N63-18139

PIEZORESISTIVE TRANSDUCERS FOR TRANSPORT HIGH PRESSURE MEASUREMENTS - SHOCK IMPEDANCE MATCHING OF PIEZORESISTIVE GAUGE INSULATOR TO SALT ENVIRONMENT
AD-442689
N64-30204

PITOT TUBE
PRESSURE TRANSDUCERS DESCRIBING MANOMETERS, PITOT TUBES, BOURDON TUBES AND RESISTANCE, CAPACITANCE AND PIEZOELECTRIC GAUGES
A64-25773

PLATE
MEASUREMENT OF TORSIONAL RIGIDITY OF STIFFENED PLATES
SM-61-14
N62-10591

POTENTIOMETER
HEIGHTLOCK PRESSURE TRANSDUCER FOR FLIGHT TESTS
ARL/F-13
N62-11466

I-6
PRESSURE MEASUREMENT OF TIME DEPENDENT SHROUD PRESSURE OF A DUCTED PROPELLER
TAR-TR-612 N62-11007

TRANSIENT PRESSURE MEASURING METHODS - TRANSDUCER DESIGN AND EVALUATION
AERONAUTICAL ENGR. REP'T - 595B N62-11126

DYNAMIC TESTING OF PRESSURE TRANSDUCERS
JPL-TR-32-268 N62-12249

PRESSURE SENSITIVE DETECTOR FOR USE IN SHOCK VELOCITY MEASUREMENTS IN SHOCKTUBES AND TUNNELS
NOLTR-61-117 N62-12659

PITOT PRESSURE MEASUREMENTS IN HYPERSONIC SHOCK TUNNEL
NAVWEPS-7329 N62-12666

TRANSDUCER FOR VARIABLE PRESSURES IN HIGH TEMPERATURE FLOWS
DNER-91 N63-12634

PRESSURE DISTRIBUTION MEASUREMENT ON HARMONICALLY OSCILLATING WINGS
ICAS PAPER 64-28164-22766

ABILITY OF A TRANSDUCER TO RESOLVE SPATIAL DETAILS OF TURBULENT PRESSURE FIELDS IN SHEAR FLOWS AND IN SONAR RECEIVERS
A63-13194

PRESSURE GAUGE MEASUREMENT - PRESSURE TRANSDUCER SYSTEM FOR UNSTEADY PRESSURE MEASUREMENTS
AEDC-TDR-63-29 N63-13424

PIEZOCERAMIC PRESSURE TRANSDUCERS FOR SHOCK WAVE TRANSDUCERS - SHOCK WAVE PROFILES OF REFLECTED WAVES, THICKNESS AND CURVATURE
NASA-CR-50495 N63-18139

DEVELOPMENT OF PRESSURE TRANSDUCER FOR PRESSURE MEASUREMENT IN HYPERVELOCITY WIND TUNNEL TESTING
AEDC-TDR-63-135 N63-18749

PIEZOCERAMIC PRESSURE TRANSDUCERS FOR SHOCK TUBE PRESSURE MEASUREMENT - SHOCK WAVE PROFILES OF REFLECTED WAVES, THICKNESS AND CURVATURE
NASA-CR-50495 N63-18139

DEVELOPMENT OF PRESSURE TRANSDUCER FOR PRESSURE MEASUREMENT IN HYPERVELOCITY WIND TUNNEL TESTING
AEDC-TDR-63-135 N63-18749

DYNAMIC RESPONSE OF TRANSIENT PRESSURE TRANSDUCERS FOR LIQUID PROPELLANT ROCKET COMBUSTION CHAMBERS
NASA-CR-51516 N63-21974

DESIGN AND PERFORMANCE CHARACTERISTICS OF PRESSURE TRANSDUCERS
A64-12483

MINIATURE PRESSURE TRANSDUCER OF DIAPHRAGM TYPE FOR MEASUREMENT OF STATIC PRESSURE AND HF PRESSURE FLUCTUATIONS
A64-17216

PRESSURE TRANSDUCERS DESCRIBING MANOMETERS, PITOT TUBES, BOURDON TUBES AND RESISTANCE, CAPACITANCE AND PIEZOELECTRIC GAUGES
A64-25773

AEROSPACE TELEMETRY TRANSDUCER DESIGN FOR MEASUREMENT OF PRESSURE AND TEMPERATURE
A64-26454

STATHAM DIFFERENTIAL PRESSURE TRANSDUCER - WEAPON SYSTEM 133A
AD-42171 N64-12171

PRESSURE TRANSDUCERS DESCRIBING MANOMETERS, PITOT TUBES, BOURDON TUBES AND RESISTANCE, CAPACITANCE AND PIEZOELECTRIC GAUGES
A64-25773

AEROSPACE TELEMETRY TRANSDUCER DESIGN FOR MEASUREMENT OF PRESSURE AND TEMPERATURE
A64-26454

STATHAM DIFFERENTIAL PRESSURE TRANSDUCER - WEAPON SYSTEM 133A
AD-42171 N64-12171

PRESSURE TRANSDUCERS DESCRIBING MANOMETERS, PITOT TUBES, BOURDON TUBES AND RESISTANCE, CAPACITANCE AND PIEZOELECTRIC GAUGES
A64-25773

AEROSPACE TELEMETRY TRANSDUCER DESIGN FOR MEASUREMENT OF PRESSURE AND TEMPERATURE
A64-26454

STATHAM DIFFERENTIAL PRESSURE TRANSDUCER - WEAPON SYSTEM 133A
AD-42171 N64-12171

PRESSURE TRANSDUCERS DESCRIBING MANOMETERS, PITOT TUBES, BOURDON TUBES AND RESISTANCE, CAPACITANCE AND PIEZOELECTRIC GAUGES
A64-25773

AEROSPACE TELEMETRY TRANSDUCER DESIGN FOR MEASUREMENT OF PRESSURE AND TEMPERATURE
A64-26454

STATHAM DIFFERENTIAL PRESSURE TRANSDUCER - WEAPON SYSTEM 133A
AD-42171 N64-12171

PRESSURE TRANSDUCERS DESCRIBING MANOMETERS, PITOT TUBES, BOURDON TUBES AND RESISTANCE, CAPACITANCE AND PIEZOELECTRIC GAUGES
A64-25773

AEROSPACE TELEMETRY TRANSDUCER DESIGN FOR MEASUREMENT OF PRESSURE AND TEMPERATURE
A64-26454

STATHAM DIFFERENTIAL PRESSURE TRANSDUCER - WEAPON SYSTEM 133A
AD-42171 N64-12171
RESISTANCE TEMPERATURE TRANSUDER
MEASUREMENTS OF FLOW DURATION IN A LOW PRESSURE SHOCK TUBE
NASA-TN-D-1218 N64-1166

HOT WIRE RESISTANCE TEMPERATURE TRANSUDER FOR MEASUREMENT OF TRANSIENT FLOW N62-12358

RESISTANCE THERMOMETER
THERMOMETERS; RADIATION PYROMETERS; THERMISTORS AND THERMOCOUPLES; DISCUSSING THEIR CALIBRATION, RANGE AND MEASURING ACCURACY A64-26403

REYNOLDS NUMBER
TRANSUDERS ARE PRESSURE SENSING DEVICES THAT CONVERT THEIR INPUT INSTANTANEOUSLY INTO ELECTRICAL SIGNALS WITHOUT DISTORTION A64-24231

RIGIDITY
MEASUREMENT OF TORSIONAL RIGIDITY OF STIFFENED PLATES SM-81-14 N62-10591

ROCKET LAUNCHING DEVICE
INSTRUMENTATION FOR DYNAMIC DATA ACQUISITION ON ARTILLERY AND ROCKET LAUNCHER WEAPONS - TRANSUDERS AND RECORDERS N63-16606

ROTOR BLADE
AIR LOAD MEASUREMENTS DURING FLIGHT USING PRESSURE TRANSUDER MOUNTED ON ROTOR BLADE SURFACE REPT.-299-099-200 N64-14761

SATURN LAUNCH VEHICLE
TRANSUDERS CAPABLE OF SMALL FLOW RATE MEASUREMENT FROM LEAKS IN FLANGES OF SATURN ENGINE SYSTEMS NASA-TM-X-50421 N63-21915

SCANNING DEVICE
OPTICAL AMPLIFICATION EMPLOYING ELECTRONIC SCANNING TECHNIQUES ARL-154 N62-12133

SEMICONDUCTOR
HOT WIRE RESISTANCE TEMPERATURE TRANSUDER FOR MEASUREMENT OF TRANSIENT FLOW N62-12358

HALL EFFECT IN SEMICONDUCTORS TO MEASURE MECHANICAL DISPLACEMENTS AS A FUNCTION OF ACCELERATION A63-19670

SEMICONDUCTOR DEVICE
SEMICONDUCTOR TRANSUDER FOR SHEAR STRAIN MEASUREMENT IN LOW MODULUS PROPELLANT-LIKE MATERIALS AIAA PAPER 64-506 A64-20505

SENSOR
ANNULAR NOZZLE TYPE GROUND EFFECT MACHINE, PRESSURE TRANSUDER IFR SER. 197, ISSUE 2 N62-14759

SHEAR FLOW
ABILITY OF A TRANSUDER TO RESOLVE SPATIAL DETAILS OF TURBULENT PRESSURE FIELDS IN SHEAR FLOWS AND IN SONAR RECEIVERS A63-13194

SHEAR STRAIN
SEMICONDUCTOR TRANSUDER FOR SHEAR STRAIN MEASUREMENT IN LOW MODULUS PROPPELLANT-LIKE MATERIALS AIAA PAPER 64-506 A64-20505

SHOCK
PRESSURE SENSITIVE DETECTOR FOR USE IN SHOCK VELOCITY MEASUREMENTS IN SHOCKTUBES AND TUNNELS NOLTR-61-117 N62-12659

SHOCK MEASURING APPARATUS
ANALYSIS OF INSTRUMENTATION FOR SHOCK AND VIBRATION MEASUREMENTS A63-12478

SHOCK TESTING MACHINE
DISCUSSION OF THE INSTRUMENTATION FOR SHOCK TESTING AND MEASUREMENT OF TRANSIENT MOTION, WITH EMPHASIS ON ACCELERATION DETERMINATIONS A63-14759
TEMPERATURE PROBE

SOLID STATE DEVICE
SMALL SOLID STATE FERRIMAGNETIC TRANSUCER FOR MEASURING INTERNAL STRESS IN ELECTRONIC ENCAPSULATING RESINS
A64-24919

AEROSPACE TELEMETRY TRANSUCER DESIGN FOR MEASUREMENT OF PRESSURE AND TEMPERATURE
A64-26454

STIFF STRUCTURE
MEASUREMENT OF TORSIONAL RIGIDITY OF STIFFENED PLATES
STM-61-114 N62-10591

STRAIN GAUGE
P-N JUNCTION STRAIN TRANSUCER
WESCONE PAPER-3.4 N62-17798

DESCRIPTION OF A STRAIN GAGE PRESSURE TRANSUCER
A63-15855

BONDED PIEZORESISTIVE STRAIN GAUGE AND CAPSULE OR DIAPHRAGM-TYPE TRANSUCERS FOR LOW PRESSURE MEASUREMENTS
A64-16265

MINIATURE PRESSURE TRANSUCER OF DIAPHRAGM TYPE FOR MEASUREMENT OF STATIC PRESSURE AND HF PRESSURE FLUCTUATIONS
A64-17216

STRESS MEASUREMENT
MEASUREMENT OF STRESS IN MACHINERY COMPONENTS USING BASELESS WIRE PICKUP
FTD-TR-63-731/1&2 N64-24243

STRUCTURAL DYNAMICS
INSTRUMENTATION FOR DYNAMIC DATA ACQUISITION ON ARTILLERY AND ROCKET LAUNCHER WEAPONS - TRANSUCERS AND RECORDERS N63-16606

SURFACE TEMPERATURE
TEMPERATURE TRANSUCER FOR IN-FLIGHT MONITORING OF SKIN PANEL SURFACE TEMPERATURES - EFFECTS OF INSULATION AND VIBRATION ON ACCURACY
ATL-D-811 N63-12288

TACHOMETER
ELECTRONIC TACHOMETER AND SYNCHROSCOPE FOR RECIPROCATING ENGINES OF LIGHT AIRCRAFT, DESCRIBING TRANSUCER AND INDICATOR
A64-21755

TELEMETRY
TELEMETRY TRANSUCER HANDBOOK
WADD-TR-61-67, VOL. II SUPP. I N62-13126

NATIONAL TELEMETRY CONFERENCE AT LOS ANGELES IN JUNE 1964
A64-26453

AEROSPACE TELEMETRY TRANSUCER DESIGN FOR MEASUREMENT OF PRESSURE AND TEMPERATURE
A64-26454

TELEMETRY TRANSUCER HANDBOOK WITH BIBLIOGRAPHY
WADD-TR-61-67, VOL. I, REV. 1 N64-12704

TELEVISION CAMERA
OPTICAL AMPLIFICATION EMPLOYING ELECTRONIC SCANNING TECHNIQUES
A6-194 N62-12133

TEMPERATURE
COOLANT WATER TEMPERATURE MEASUREMENT IN ELECTRIC ARC AIR HEATER
N62-12873

TEMPERATURE INDICATOR
TRANSUCERS FOR HIGH VELOCITY GAS FLOW TEMPERATURE MEASUREMENT WITH DESIGN CRITERIA DETERMINED FROM THERMOCOUPLE MEASUREMENTS
N63-12272

TEMPERATURE TRANSUCER FOR IN-FLIGHT MONITORING OF SKIN PANEL SURFACE TEMPERATURES - EFFECTS OF INSULATION AND VIBRATION ON ACCURACY
ATL-D-811 N63-12288

TEMPERATURE PROBE
DESIGN AND CALIBRATION TECHNIQUES FOR ACCELEROMETERS AND TEMPERATURE PROBES AT CRYOGENIC
VIBRATION TESTING MACHINE
ANALYSIS OF INSTRUMENTATION FOR SHOCK AND VIBRATION MEASUREMENTS A63-12478

VIBRATIONAL STRESS
FREQUENCY SHIFTS IN VIBRATING MODES OF BEAMS UNDER TWIST DETERMINED BY A MINIATURE ELECTROMECHANICAL DEVICE KNOWN AS A TWISTED BEAM TRANSDUCER A63-19540

VISCOUS FLOW
DRAG-TYPE FLOWMETER FOR MEASURING IMPACT FORCE OF MOVING STREAM A63-10758

WAVE
PROPAGATION OF LARGE AMPLITUDE WAVES IN PURE LEAD BRL-1158 N62-12988

WEAPON
INSTRUMENTATION FOR DYNAMIC DATA ACQUISITION ON ARTILLERY AND ROCKET LAUNCHER WEAPONS - TRANSDUCERS AND RECORDERS N63-16606

WEAPON SYSTEM 133A
STATHAM DIFFERENTIAL PRESSURE TRANSDUCER - WEAPON SYSTEM 133A AD-421712 N64-12171
QUALIFICATION TESTING OF STATHAM ABSOLUTE PRESSURE TRANSDUCER FOR WEAPON SYSTEM 133A REPT.-0162-010R-26 N64-14096

WHEATSTONE BRIDGE
RESISTIVE-WHEATSTONE BRIDGE LIQUID DISPLACEMENT TRANSDUCER USED TO MONITOR LIQUID SURFACE OSCILLATIONS NASA-CR-56551 N 64-23527

WIND TUNNEL
TRANSDUCER WHICH MEASURES HEAT TRANSFER RATES IN HYPERSONIC WIND TUNNELS A63-16801

WING PANEL
TRANSDUCER SYSTEM FOR MEASURING SKIN TEMPERATURE OF WING PANEL AND LEADING EDGE OF DYNA-SOAR VEHICLE DURING REENTRY ATL-D-861 N63-11421

X

X-RAY
PRESSURE EXERTED BY SHOCK WAVES IN SOLID MEDIA - OPTICAL, ELECTRICAL AND X-RAY TECHNIQUES USED TO MEASURE SHOCK AND FREE SURFACE VELOCITIES POULTER LABS. TR-002-63 N63-19134

X-20 AIRCRAFT
TRANSDUCER SYSTEM FOR MEASURING SKIN TEMPERATURE OF WING PANEL AND LEADING EDGE OF DYNA-SOAR VEHICLE DURING REENTRY ATL-D-861 N63-11421
# Personal Author Index

## Bibliography on ELECTROMECHANICAL TRANSDUCERS / with indexes

**February 1966**

### Listing of Personal Authors of Reports

The following index has been prepared to enable the user to locate references written by a particular author. The last name of each author is listed alphabetically. Immediately below the name appears a brief statement describing the content of each reference. An accession number, e.g. N65-12345 or A65-13456, assigned for purposes of identification, is located below and to the right of the descriptive statement. When an author has written more than one report or article that is included in the bibliography, the references are listed in chronological order based on their accession numbers.

<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
<th>Accession Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allen, T. H.</td>
<td>Oxygen Detector Using Physical Transducers</td>
<td>N63-22411</td>
</tr>
<tr>
<td>Armstrong, R. W.</td>
<td>Statham Differential Pressure Transducer - Weapon System 133A</td>
<td>N64-12171</td>
</tr>
<tr>
<td>Armstrong, R. W.</td>
<td>Qualification Testing of Statham Absolute Pressure Transducer For Weapon System 133A</td>
<td>N64-14096</td>
</tr>
<tr>
<td>Austin, R. F.</td>
<td>Calibration of Pressure Transducer System For Unsteady Pressure Measurements</td>
<td>AEDC-TDR-63-29</td>
</tr>
<tr>
<td>Balakrishna, S.</td>
<td>Pressure Transducer Using Linear Differential Transformer TN-SE-3-63</td>
<td>N64-29389</td>
</tr>
<tr>
<td>Bancroft, R. W.</td>
<td>Oxygen Detector Using Physical Transducers</td>
<td>N63-22411</td>
</tr>
<tr>
<td>Bar-David, I.</td>
<td>Application of the Mode Theory to the Analysis of Signal Transmission Properties of Linear Multiterminal Transducer Chains at a Discrete Frequency</td>
<td>A63-16703</td>
</tr>
<tr>
<td>Barnard, G. W.</td>
<td>Endoradiosondes - State of the Art Survey AMRL-TDR-62-122</td>
<td>N63-13937</td>
</tr>
<tr>
<td>Becker, H.</td>
<td>Measurement of Torsional Rigidity of Stiffened Plates SK-61-14</td>
<td>N62-10591</td>
</tr>
<tr>
<td>Bentley, W. C.</td>
<td>Dynamic Response of Transient Pressure Transducers For Liquid Propellant Rocket Combustion Chambers NASA-CR-51516</td>
<td>N63-21974</td>
</tr>
<tr>
<td>Bergh, H.</td>
<td>Pressure Distribution Measurement on Harmonically Oscillating Wings ICAS Paper 64-28</td>
<td>A64-22766</td>
</tr>
<tr>
<td>Bert, C. W.</td>
<td>Miniature Pressure Transducer of Diaphragm Type For Measurement of Static Pressure and HF Pressure Fluctuations A64-17216</td>
<td></td>
</tr>
<tr>
<td>Bishop, R. E. D.</td>
<td>Lift and Drag Force Measurements On A Circular Cylinder, Oscillating Transversely In Flowing Fluid A64-13085</td>
<td></td>
</tr>
<tr>
<td>Bollinger, L. E.</td>
<td>Transducers Are Pressure Sensing Devices That Convert Their Input Instantaneously Into Electrical Signals Without Distortion A64-24231</td>
<td></td>
</tr>
<tr>
<td>Borer, S. P.</td>
<td>Utilizing A Transducer &amp; Tensometer To Measure Pressures of Jetstreams JPRS-23920 N64-17713</td>
<td></td>
</tr>
<tr>
<td>Bouche, R. R.</td>
<td>Analysis of Instrumentation For Shock and Vibration Measurements A63-12478</td>
<td></td>
</tr>
<tr>
<td>Brodersen, R. K.</td>
<td>Transducers For Dynamic Measurements Covering Operation, Calibration And Applications A64-23179</td>
<td></td>
</tr>
<tr>
<td>Brown, P. E.</td>
<td>Design and Application of a Family of Transducers Which Produce a Direct Digital Output, With Particular Reference to Aerospace Utilization A63-15342</td>
<td></td>
</tr>
<tr>
<td>Burpo, F.</td>
<td>Air Load Measurements During Flight Using Pressure Transducer Mounted On Rotor Blade Surface Rept.-299-099-200 N64-14761</td>
<td></td>
</tr>
<tr>
<td>Byford, G. H.</td>
<td>Contact Lens Photoelectric Eye Movement Recording System FPRC/REM-162 N63-18820</td>
<td></td>
</tr>
<tr>
<td>Carwile, C. L.</td>
<td>Resonant Modes of Gas Pressure Oscillations In Sinusoidal Pressure Generator With Flat Cylindrical Chamber NASA-CR-51517 N63-22048</td>
<td></td>
</tr>
</tbody>
</table>
CHAMBERS, J. T.
EVALUATION OF DUEL ELEMENT TRANSUCER FOR HIGH TEMPERATURE GAS MEASUREMENTS
ARL-63-56
N63-17470

COLBURN, P. J.
HIGH ACCURACY SELF-CONTAINED FORCE BALANCE PRESSURE TRANSUCER FOR EXTREME ENVIRONMENTS
A64-25349

CODN, G. W.
A WIDE RANGE PRESSURE TRANSUCER
N62-12482

CORBIN, T.
HEMUL BLOOD PRESSURE MEASURING AND MONITORING SYSTEM ON MAN IN FLIGHT
N62-10687

CROS, G. W.
ABILITY OF A TRANSUCER TO RESOLVE SPATIAL DETAILS OF TURBULENT PRESSURE FIELDS IN SHEAR FLOWS AND IN SONAR RECEIVERS
A63-13194

CRAIG, J.
STRESS PRESSURE TRANSMITTER-TRANSMITTER SYSTEM FOR MEASURING PRESSURES WITHIN INTACT ARTERIES OF SUBJECTS IN ORBITING VEHICLES AND TO RELAY DATA TO RECEIVING-RECORDING EQUIPMENT
AIAA PAPR 63-167

CRITES, N. A.
MINIATURE PRESSURE TRANSUCER OF DIAPHRAGM TYPE FOR MEASUREMENT OF STATIC PRESSURE AND HF PRESSURE FLUCTUATIONS
A64-17216

CUMMING, J. O.
ANNULAR NOZZLE TYPE GROUND EFFECT MACHINE, PRESSURE TRANSUCER
ILR SEI. 187, ISSUE 2
N62-14759

CUSHING, V.
INDUCTION FLOWMETER FOR DIELECTRIC FLUIDS
N62-11123
INDUCTION FLOWMETER FOR DIELECTRIC FLUIDS
N62-11141

DALLIMORE, G.
SMALL SOLID STATE FERRIMAGNETIC TRANSUCER FOR MEASURING INTERNAL STRESS IN ELECTRONIC ENCAPSULATING RESINS
A64-24919

DAWSON, V. G. D.
PILOT PRESSURE MEASUREMENTS IN HYPERSONIC SHOCK TUNNEL
NAWMP-7329
N62-12666

DE JONGE, J. B.
USE OF FOWLER BOND TESTER IN DESTRUCTIVE AND NONDESTRUCTIVE TEST ON REDUX BONDED SINGLE AND DOUBLE LAP JOINTS
NRL-TR-M-2099
N63-14321

DE PIAN, L.
ELECTROMECHANICAL TRANSUCERS AS LINEAR TWO-PORT DEVICES
REPT.-1
N64-29393

DELANEY, M. J.
ELECTRONIC TACHOMETER AND SYNCHROSCOPE FOR RECIPRATING ENGINES OF LIGHT AIRCRAFT, DESCRIBING TRANSUCER AND INDICATOR
A64-21755

DICKEN, G. W.
SEMICONDUCTOR TRANSUCER FOR SHEAR STRAIN MEASUREMENT IN LOW MODULUS PROPELLANT-LIKE MATERIALS
AIAA PAPER 64-506
A64-20505

DIMEFF, J.
A WIDE RANGE PRESSURE TRANSUCER
N62-12482
VIBRATING MEMBRANE ELECTROMETER WITH HIGH CONVERSION GAIN
NASA-RP-289
N64-28352

DORAN, D. G.
PRESSURE EXERTED BY SHOCK WAVES IN SOLID MEDIA - OPTICAL, ELECTRICAL AND X-RAY TECHNIQUES USED TO MEASURE SHOCK AND FREE SURFACE VELOCITIES
POULTER LABS. TR-002-63
N63-19134

DZON-MOJ, L.
EQUIVALENT CIRCUIT OF A MAGNETOSTRICTIVE TRANSUCER WORKING NEAR THE FUNDAMENTAL RESONANCE AND THE ELECTRICAL EQUIVALENT CIRCUIT OF A STEP TRANSFORMER FOR LONGITUDINAL AND TORSIONAL VIBRATIONS
A63-24318

EDWARDS, D. H.
HEIGHTLOCK PRESSURE TRANSUCER FOR FLIGHT TESTS
ARL/F-13
N62-11466

EICHBERGER, L. C.
DYNAMIC CALIBRATION OF PRESSURE TRANSUCERS
N85-MONOGRAPH-67
N64-16236
TYPES AND CHARACTERISTICS OF PRESSURE TRANSUCERS AND CONCEPTS OF CALIBRATION AND ANALYSIS
N64-16237
INPUT, OUTPUT, AND TRANSFER FUNCTION RELATIONS OF LINEAR TRANSUCERS
N64-16238
CORRESPONDING RESPONSE FUNCTIONS FOR INPUTS FROM CHARACTERISTIC DIFFERENTIAL EQUATIONS OF MOTION OF TRANSUCER SYSTEMS
N64-16239

FEDER, E. I.
DESIGN AND CALIBRATION TECHNIQUES FOR ACCELEROMETERS AND TEMPERATURE PROBES AT CRYOGENIC TEMPERATURES
A63-18304

FEISTMAN, M. L.
DESIGN AND APPLICATION OF A FAMILY OF TRANSUCERS WHICH PRODUCE A DIRECT DIGITAL OUTPUT, WITH PARTICULAR REFERENCE TO AEROSPACE UTILIZATION
A63-15342

FIFE, W. P.
CATHERETER FOR RIGHT HEART AND PULMONARY ARTERY IMPLANTATION
SAM-TDR-64-10
N64-18918

FISHER, H. F. Jr.
TELEMTRY TRANSUCER HANDBOOK
WADD-TR-61-67, VOL. 11 SUPP. 1
N62-13126
TELEMTRY TRANSUCER HANDBOOK WITH BIBLIOGRAPHY
WADD-TR-61-67, VOL. 11, REV. 1
N64-12704

FOSTER, N. F.
ULTRASONIC TRANSDUCERS PRODUCED BY DIFFUSING COPPER INTO SURFACE OF CADMIUM SULFIDE SINGLE-CRYSTALS, FORMING THIN PIEZO-ELECTRICALLY ACTIVE LAYERS
A64-10019

GERARD, G.
MEASUREMENT OF TORSIONAL RIGIDITY OF STIFFENED PLATES
SW-61-14
N62-10951

GERICKE, O. R.
POINT-CONTACT TRANSUCERS FOR ULTRASONIC TESTING
WAL-TR-143/5/1
N62-14557
ULTRASONIC PULSE ECHO DETECTION OF DEFECTS IN METAL
N62-17120

GIEDE, W. H.
EVALUATION OF DUEL ELEMENT TRANSUCER FOR HIGH TEMPERATURE GAS MEASUREMENTS
ARL-63-58
N63-17470

GIRVES, J.
DESCRIPTION OF PRESSURE PICKUPS WHICH HAVE A BROAD BANDWIDTH OR WHICH ARE IN DIRECT CONTACT WITH MEDIA UP TO 3700 DEGREES KELVIN
A63-12250
PERSONAL AUTHOR INDEX

LAYTON, J. P.

TRANSDUCER FOR VARIABLE PRESSURES IN HIGH TEMPERATURE FLOWS
ONERA-91 N63-12634

GORMAN, H. A.
BLOOD PRESSURE TRANSDUCER-TRANSmitter SYSTEM FOR MEASURING PRESSURES WITHIN INTACT ARTERIES OF SUBJECTS IN ORBITING VEHICLES AND TO RELAY DATA TO RECEIVING-RECORDING EQUIPMENT
AIAA PAPER 63-167 A63-19640

GRAU, R.
BLOOD PRESSURE TRANSDUCER-TRANSmitter SYSTEM FOR MEASURING PRESSURES WITHIN INTACT ARTERIES OF SUBJECTS IN ORBITING VEHICLES AND TO RELAY DATA TO RECEIVING-RECORDING EQUIPMENT
AIAA PAPER 63-167 A63-19640

GREEN, C. E.
COMPUTER FOR MEASURING DIRECTIVITY FACTOR FOR ELECTROACOUSTIC TRANSDUCERS
NEL-1196 N64-14635

GUNKEL, W. A.
METHOD FOR EFFECT DISCRIMINATION IN AUTOMATIC MULTIPLE TRANSDUCER INSPECTION SYSTEMS
N63-17170

HALL, J. A.
OPTICAL AMPLIFICATION EMPLOYING ELECTRONIC SCANNING TECHNIQUES
ARL-154 N62-12133

HANSON, J. C.
INSTRUMENTATION FOR DYNAMIC DATA ACQUISITION ON ARTILLERY AND ROCKET LAUNCHER WEAPONS - TRANSDUCERS AND RECORDERS
N63-16606

HARTILL, D. L.
PRESSURE TRANSDUCER FOR MEASURING SHOCK WAVE PROFILES
POULTER LABS. TECH. REPT.-004- N62-13285

HARTMAN, A.
USE OF FOKKER BONO TESTER IN DESTRUCTIVE AND NONDESTRUCTIVE TEST ON REDUX BONDED SINGLE AND DOUBLE LAP JOINTS
NRL-TN-M.2099 N63-14321

HASSAN, A. Y.
LIFT AND DRAG FORCE MEASUREMENTS ON A CIRCULAR CYLINDER, OSCILLATING TRANSVERSELY IN FLOWING FLUID
A64-13085

HORNING, D. O.
ANNULAR NOZZLE TYPE GROUND EFFECT MACHINE, PRESSURE TRANSDUCER
IER SER. 187, ISSUE 2 N62-14759

HOUGH, G. R.
MEASUREMENT OF TIME DEPENDENT SHROUD PRESSURE OF A DUCTED PROPELLER
TAR-TR-612 N62-11007

HUNT, T. W.
ELECTROMECHANICAL TRANSDUCER SYSTEMS FOR TRANSIENT PRESSURE MEASUREMENTS
WAPD-TR-343 N64-30127

INSKEEP, J.
DYNAMIC TESTING OF PRESSURE TRANSDUCERS
JPL-TR-32-268 N62-12249

INYUTIN, I. S.
MEASUREMENT OF STRESS IN MACHINERY COMPONENTS USING BASELESS WIRE PICKUP
FTD-C-73ジ731/162 N64-24243

JIMERSON, B. D.
SENSITIVITY AND LINEARITY OF ACCELEROMETER USING PIEZOELECTRIC CRYSTALS
A64-24737

JOHNSON, D. S.
PIEZOCERAMIC PRESSURE TRANSDUCERS FOR SHOCK TUBE PRESSURE MEASUREMENT - SHOCK WAVE PROFILES OF REFLECTED WAVES, THICKNESS AND CURVATURE
NASA-CR-50495 N63-18139

JOHNSON, L. F., JR.
OXYGEN DETECTOR USING PHYSICAL TRANSDUCERS
N63-22411

JONES, H. B., JR.
TUBING CONNECTION EFFECTS ON TRANSDUCER RESPONSE FOR TRANSIENT PRESSURE MEASUREMENT
N62-10071

TRANSIENT PRESSURE MEASURING METHODS - TRANSDUCER DESIGN AND EVALUATION
AERONAUTICAL ENGR. REPT.-5958 N62-11126

KANA, D. D.
RESISTIVE-WHEATSTONE BRIDGE LIQUID DISPLACEMENT TRANSDUCER USED TO MONITOR LIQUID SURFACE OSCILLATIONS
NASA-CR-56551 N64-23527

KAPLAN, M. N.
MAGNETODYNAMIC MOTION TRANSDUCER FOR MEASURING MOTION VECTOR FOR MAGNETIC TO ELECTRIC FIELD TRANSFORMATION
A64-22505

KEOUGH, R. C.
TRANSIENT PRESSURE MEASURING METHODS APPLIED TO LIQUID PROPELLANT ROCKET COMBUSTION CHAMBERS
NASA-CR-51515 N63-22047

KOMAR, G. A.
ULTRASONIC PHENOMENA AND METHODS OF MEASUREMENT - BIBLIOGRAPHY
DM-IC-8146 N63-12769

KUDRAYTSEV, E. V.
TRANSDUCERS FOR HIGH VELOCITY GAS FLOW TEMPERATURE MEASUREMENT WITH DESIGN CRITERIA DETERMINED FROM THERMOCOUPLE MEASUREMENTS
N63-12272

LANE, J. W.
A WIDE RANGE PRESSURE TRANSDUCER
N62-12482

VIBRATING MEMBRANE ELECTROMETER WITH HIGH CONVERSION GAIN
NASA-RP-289 N64-28352

LARU, F.
BLOOD PRESSURE TRANSDUCER-TRANSmitter SYSTEM FOR MEASURING PRESSURES WITHIN INTACT ARTERIES OF SUBJECTS IN ORBITING VEHICLES AND TO RELAY DATA TO RECEIVING-RECORDING EQUIPMENT
AIAA PAPER 63-167 A63-19640

LAYTON, J. P.
TRANSIENT PRESSURE MEASURING METHODS APPLIED TO LIQUID PROPELLANT ROCKET COMBUSTION CHAMBERS
NASA-CR-51515 N63-22047
LEOFORD, R. L.  
TRANSDUCER WHICH MEASURES HEAT TRANSFER RATES IN HYPERSONIC WIND TUNNELS  A63-16881

Li, Y. T.  
DESCRIPTION OF A STRAIN GAGE PRESSURE TRANSDUCER  A63-15695

LION, K. S.  
SURVEY OF TRANSDUCERS USED TO MEASURE STATIC AND DYNAMIC PRESSURES IN FLUID-FLOW FIELDS  A63-11204

MAC ARTHUR, R. C.  
SKIN FRICTION TRANSDUCER FOR USE IN HYPERSONIC SHOCK TUNNEL  CAL-129  N63-22395

MADDOX, W. V.  
DEVELOPMENT OF PRESSURE TRANSDUCER FOR PRESSURE MEASUREMENT IN HYPERSONIC WIND TUNNEL TESTING  AEDC-TDR-63-135  N63-18749

MAKULSKI, W.  
TRANSISTORIZED TRANSDUCER SELECTION FOR AIRCRAFT APPLICATIONS, EMPHASIZING COUPLING WITH TRANSFORMERS  A64-13598

MARSHALL, J. M.  
PRESSURE SENSITIVE DETECTOR FOR USE IN SHOCK VELOCITY MEASUREMENTS IN SHOCKTUBES AND TUNNELS  NOLTR-61-117  N62-12659

MC CALLY, M.  
ENDORADIOSONDES - STATE OF THE ART SURVEY  AMRL-TDR-62-122  N63-13937

MICHAELS, E. L.  
DYNAMIC CALIBRATION OF PRESSURE TRANSDUCERS  NBS-MONOGRAPH-67  N64-16236

MILLER, J. W.  
ELECTRONIC LEVEL, INCORPORATING A TRANSDUCER, TO CONVERT MECHANICAL DISPLACEMENT OF PENDULUM INTO ELECTRIC SIGNAL USED IN ALIGNMENT AND MEASUREMENT TECHNIQUES AT LOW INVESTMENT FOR LESS SKILLED PERSONNEL  A63-20914

MOORE, R. M.  
ELECTROMECHANICAL TRANSDUCERS AS LINEAR TWO-PORT DEVICES  REPT.-1  N64-29193

MUSTER, D. F.  
DYNAMIC CALIBRATION OF PRESSURE TRANSDUCERS  NBS-MONOGRAPH-67  N64-16236

N ALENCZ, M.  
HALL EFFECT IN SEMICONDUCTORS TO MEASURE MECHANICAL DISPLACEMENTS AS A FUNCTION OF ACCELERATION  A63-19670

NELSON, R.  
P-N JUNCTION STRAIN TRANSDUCER  WESCON PAPER-3.4  N62-17798

NEUBERT, H. K. P.  
BOOK ON PERFORMANCE AND DESIGN OF INSTRUMENT TRANSDUCERS FOR MEASUREMENT APPLICATIONS  A64-17660

NEVILLE, J. R.  
OXYGEN DETECTOR USING PHYSICAL TRANSDUCERS  N63-22411

NEWGARD, P. M.  
TRANSDUCER FOR THE CONTINUOUS EXTERNAL MEASUREMENT OF ARTERIAL BLOOD PRESSURE  N62-13733

EXTERNAL, ARTERIAL BLOOD PRESSURE TRANSDUCER  NASA-CR-53362  N64-17815

NORTON, H. N.  
DISCUSSION OF THE ERROR-6RAND CONCEPT WHICH SIMPLIFIES SPECIFICATIONS AND PERFORMANCE VERIFICATION OF TRANSDUCERS  A63-13649

DESIGN AND PERFORMANCE CHARACTERISTICS OF PRESSURE TRANSDUCERS  A64-12483

PALUDAN, C. T. N.  
TRANSDUCERS CAPABLE OF SMALL FLOW RATE MEASUREMENT FROM LEAKS IN FLANGES OF SATURN ENGINE SYSTEMS  NASA-TM-X-50421  N63-21915

PASINI, J., III  
ULTRASONIC PHENOMENA AND METHODS OF MEASUREMENT - BIBLIOGRAPHY  BM-TC-8146  N63-12769

PASKUZ, G. F.  
DYNAMIC CALIBRATION OF PRESSURE TRANSDUCERS  NBS-MONOGRAPH-67  N64-16236

PRESSMAN, G. L.  
ELECTRONIC COMPENSATOR DESIGNED TO EXTEND USABLE FREQUENCY RANGE OF TRANSDUCER SYSTEM  N64-16244

PAUL, R. J. A.  
TWO PORT NETWORK REPRESENTATION OF DC ELECTROMECHANICAL TRANSDUCERS  COA-N-121  N62-13814

POLL, R. A.  
TRANSIENT RADIATION EFFECTS IN PRESSURE TRANSDUCERS  AFSC-TDR-62-63  N62-16174

PRESSMAN, A.  
TRANSDUCER FOR THE CONTINUOUS EXTERNAL MEASUREMENT OF ARTERIAL BLOOD PRESSURE  N62-13733

EXTERNAL, ARTERIAL BLOOD PRESSURE TRANSDUCER  NASA-CR-53362  N64-17815

RAII, D. L.  
TRANSDUCER SYSTEM FOR MEASURING SKIN TEMPERATURE OF WING PANEL AND LEADING EDGE OF DYNAA-SIAR VEHICLE DURING ENTRY  ATL-D-661  N63-11421

TEMPERATURE TRANSDUCER FOR IN-FLIGHT MONITORING OF SKIN PANEL SURFACE TEMPERATURES - EFFECTS OF INSULATION AND VIBRATION ON ACCURACY  ATL-D-611  N63-12288

EVALUATION OF DUEL ELEMENT TRANSDUCER FOR HIGH TEMPERATURE GAS MEASUREMENTS  ARL-63-58  N63-17470

REILLY, D.  
INDUCTION FLOWMETER FOR DIELECTRIC FLUIDS  N62-11123

INDUCTION FLOWMETER FOR DIELECTRIC FLUIDS  N62-11541

RHODES, J. E.  
DISCUSSION OF THE INSTRUMENTATION FOR SHOCK TESTING AND MEASUREMENT OF TRANSIENT MOTION, WITH EMPHASIS ON ACCELERATION DETERMINATIONS  SAE PAPER 62-9059A  A63-12412

RINDNER, W.  
A SENSITIVE MAGNETIC TRANSDUCER  WESCON PAPER-3.2  N62-17796

P-N JUNCTION STRAIN TRANSDUCER  WESCON PAPER-3.4  N62-17798
PERSONAL AUTHOR INDEX

ROGALLO, V. L.
HEARTBEAT MEASUREMENT OF BIRD EMBRYOS WITH MICROMETEORITE TRANSDUCER AS BALLISTOCARDIOGRAPH
NASA-SP-5007 N64-19015

ROGOLDO, J. R.
COMPUTER FOR MEASURING DIRECTIVITY FACTOR FOR ELECTROACOUSTIC TRANSDUCERS
NEL-1196 N64-14635

RUSSELL, R. H.
AEROSPACE TELEMETRY TRANSDUCER DESIGN FOR MEASUREMENT OF PRESSURE AND TEMPERATURE
A64-26454

SANchez, J. C.
BONDED PIEZORESISTIVE STRAIN GAUGE AND CAPSULE OR DIAPHRAGM-TYPE TRANSDUCERS FOR LOW PRESSURE MEASUREMENTS A64-16625

SANDBORN, V. A.
MEASUREMENTS OF FLOW DURATION IN A LOW PRESSURE SHOCK TUBE NASA-TN-0-1218 N62-11666

SCHMID, A. P.
INDUCTION FLOWMETER FOR DIELECTRIC FLUIDS N62-11123

SCHNEIDER, T. R.
INDUCTION FLOWMETER FOR DIELECTRIC FLUIDS N62-11123

SCHMIDT, E.
A SENSITIVE MAGNETIC TRANSDUCER WESCUN PAPER-3.2 N62-17796

SCHWEPPES, J. L.
DYNAMIC CALIBRATION OF PRESSURE TRANSDUCERS NBS-MONOGRAPH-67 N64-16236

SCHMIDT, A. P.
A SENSITIVE MAGNETIC TRANSDUCER WESCUN PAPER-3.2 N62-17796

SCHWEPPES, J. L.
DYNAMIC CALIBRATION OF PRESSURE TRANSDUCERS NBS-MONOGRAPH-67 N64-16236

SCHMIDT, A. P.
DYNAMIC CALIBRATION OF PRESSURE TRANSDUCERS NBS-MONOGRAPH-67 N64-16236

SCHMIDT, A. P.
TYPES AND CHARACTERISTICS OF PRESSURE TRANSDUCERS AND CONCEPTS OF CALIBRATION AND ANALYSIS N64-16237

SCHMIDT, A. P.
TYPES OF APERIODIC FUNCTION GENERATORS N64-16241

SHABANOWITZ, H.
OPTICAL AMPLIFICATION EMPLOYING ELECTRONIC SCANNING TECHNIQUES ARL-154 N62-12133

SHAFER, M. R.
DISCUSSION OF THE PERFORMANCE OF TURBINE-TYPE OR PROPELLER FLOWMETERS, OPERATING ON LIQUID HYDROCARBONS, IN THE RANGE 0.5 TO 250 GPM A63-11187

SITTING,
PIEZOELECTRIC SINGLE CRYSTALS, FERROELECTRIC ELECTROSPORTIVE CERAMICS AND MAGNETOSTRICTIVE METALS FOR USE AS ULTRASONIC TRANSDUCERS A63-20741

SLATER, L. E.
MICROMINIATURIZATION OF ELECTRONIC MEASURING DEVICES FOR BIOMEDICAL PURPOSES A64-17295

SMOTHERMAN, W. E.
DEVELOPMENT OF PRESSURE TRANSDUCER FOR PRESSURE MEASUREMENT IN HYPERSONIC SHOCK TUNNEL TESTING AEDC-TOR-63-135 N63-18749

SPERAZZI, J.
PROPAGATION OF LARGE AMPLITUDE WAVES IN PURE LEAD BRL-1158 N62-12988

SRINATHKUMHR, S.
PRESSURE TRANSDUCER USING LINEAR DIFFERENTIAL TRANSFORMER TN-5E-3-63 N64-29389

STAPLER, M.
DRAG-TYPE FLOWMETER FOR MEASURING IMPACT FORCE OF MOVING STREAM A63-10798

STAV, J.
STUDY OF THE APPLICATION OF HALL EFFECT TRANSDUCERS AND THE CHARACTERISTICS ASSOCIATED WITH THEM A63-16327

STRAUS, E. J.
DESIGN AND CALIBRATION TECHNIQUES FOR ACCELEROMETERS AND TEMPERATURE PROBES AT CRYOGENIC TEMPERATURES A63-19304

STUCKEY, P.
SMALL SOLID STATE FERRIMAGNETIC TRANSDUCER FOR MEASURING INTERNAL STRESS IN ELECTRONIC ENCAPSULATING RESINS A64-24919

TEGERDING, G.
DISCUSSION OF WORKING PRINCIPLES OF VARIOUS TYPES OF PRESSURE TRANSDUCERS USED IN TEST AND MONITORING INSTALLATIONS A63-15141

THACHER, J. H.
SEMICONDUCTOR TRANSDUCER FOR SHEAR STRAIN MEASUREMENT IN LOW MODULUS PROPELLANT-LIKE MATERIALS AIAA PAPER 64-506 A64-20505

THOMAS, J. P.
TRANSIENT PRESSURE MEASURING METHODS APPLIED TO LIQUID PROPPELLANT ROCKET COMBUSTION CHAMBERS NASA-CR-51515 N63-22047

THAIL, G. C.
CALIBRATION OF PRESSURE TRANSDUCER SYSTEM FOR UNSTEADY PRESSURE MEASUREMENTS AEDC-TOR-63-29 N63-13424

VAN LINT, V. A. J.
TRANSIENT RADIATION EFFECTS IN PRESSURE TRANSDUCERS AFWC-TOR-62-63 N64-16174

VOUTAS, A. M.
FREQUENCY SHIFTS IN VIBRATING MODES OF BEAMS UNDER TWIST DETERMINED BY A MINIATURE ELECTROMECHANICAL DEVICE KNOWN AS A TWISTED BEAM TRANSDUCER A63-15940

WALD, D.
COOLANT WATER TEMPERATURE MEASUREMENT IN ELECTRIC ARC AIR HEATER N62-12073

WALTER, J. J.
DYNAMIC RESPONSE OF TRANSIENT PRESSURE TRANSDUCERS FOR LIQUID PROPPELLANT ROCKET COMBUSTION CHAMBERS NASA-CR-51516 N63-21974

WASER, R. H.
PITOT PRESSURE MEASUREMENTS IN HYPERSONIC SHOCK TUNNEL NAVWEPS-7329 N62-12666

WEAVER, R. D.
THERMAL ENERGY CONVERSION TO ELECTRICITY ELECTROTHERMALLY REGENERATIVE TRANSDUCER DEVICE AD-403290 N64-30900

WITTMAN, J. G.
CAPACITIVE TRANSDUCERS FOR NARROW BAND VIBRATORY DISPLACEMENT OUTPUT OF ANGULAR MOTION SENSORS ENERGY DENSITY CALCULATION FOR PARALLEL PLATE TYPE ESL-R-153 N63-13604

WILLS, J.
SENSITIVITY AND LINEARITY OF ACCELEROMETER USING PIEZOELECTRIC CRYSTALS A64-24737

WOLFE, R.
ABILITY OF A TRANSDUCER TO RESOLVE SPATIAL DETAILS OF TURBULENT PRESSURE FIELDS IN SHEAR...
FLOWS AND IN SONAR RECEIVERS  A63-13194

Y

YAKOVLEV, V. F.
MEASUREMENT OF STRESS IN MACHINERY COMPONENTS USING BASELESS WIRE PICKUP
FTD-TT-63-731/1&2  N64-24243

Z

ZAKHAROV, Yu. G.
MEMBRANE TRANSDUCERS TO MEASURE PRESSURE PULSE IN AIR STREAM
FTD-TT-63-737/1&2  N64-22860

ZIOMCIZL, H.
HALL EFFECT IN SEMICONDUCTORS TO MEASURE MECHANICAL DISPLACEMENTS AS A FUNCTION OF ACCELERATION A63-19670