Aviation Week

Including Space Technology

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November 17, 1958

Transland AG-2 Pilot Report

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Telemetry Data Channels Added

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How Soviets Manage Wea

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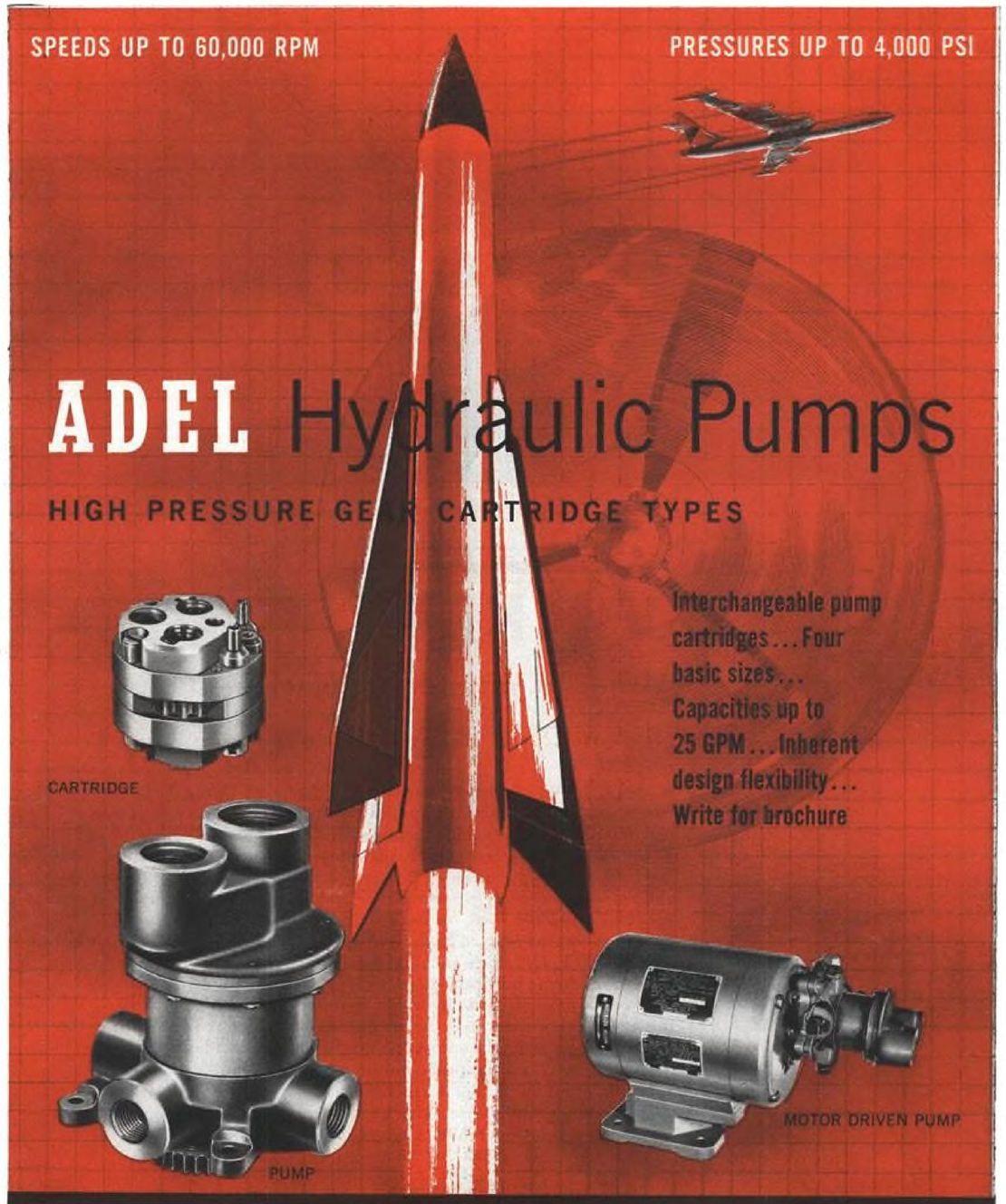

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AVIATION CALENDAR

Nov. 28—Fourth Convertible Aircraft Congress, the Franklin Institute, Philadelphia, Pa.

Nov. 28-30—Snowbird Soaring Meet, Harris Hill, Elmira, N. Y.

Nov. 28-Dec. 4—First Electronic Computer Exhibition and Symposium, Olympia, London, England.

Dec. 1-5—Annual Meeting, American Society of Mechanical Engineers, Hotels Statler-Hilton and Sheraton-McAlpin, New York, N. Y.

Dec. 2-4—Third Conference on Reliable Electrical Connection, sponsored by Electronic Industries Assn., Dallas, Tex.

Dec. 3-5—Second National Symposium on Global Communications, sponsored by the Institute of Radio Engineers and American Institute of Electrical Engineers, Colonial Inn, St. Petersburg, Fla.

Dec. 3-5—Eastern Joint Computer Conference and Exhibit, Bellevue-Stratford Hotel, Philadelphia, Pa.

Dec. 4-5—Ninth National Conference, Professional Group on Vehicular Communications, Institute of Radio Engineers, Hotel Sherman, Chicago, Ill.

Dec. 8—Symposium on High Speed Testing, sponsored by Plas-Tech Equipment Corp., Sheraton-Plaza Hotel, Boston, Mass.

Dec. 9-11—Mid-America Electronics Convention, sponsored by Kansas City Section, Institute of Radio Engineers, Municipal Auditorium Arena, Kansas City, Mo.

Dec. 17—22nd Wright Brothers Lecture, Maurice Roy on French aeronautical research, Natural History Bldg., Smithsonian Institution, Washington, D. C.

Dec. 27-30—Fifth Annual Meeting, American Astronautical Society, Hotel Statler, Washington, D. C. Meeting will be held in conjunction with the 125th An-

(Continued on page 6)

AVIATION WEEK Including Space Technology

November 17, 1958

Vol. 69, No. 20

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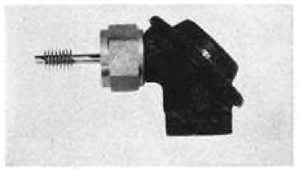

Type 2135

Type 2135 has ±0.25 F accuracy and interchangeability over a range of 0 to +125 F. The platinum element is enclosed in a nickel-plated bulb, and the unit will withstand a working pressure of 4500 psi.

OPEN TYPE for non-corrosive gases and liquids

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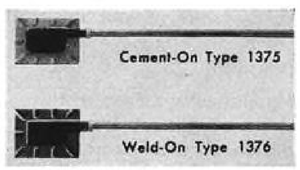
1350 Series transducers are available in ranges from −300 F to +600 F, with an accuracy of ±1% full scale. The platinum sensing element comes in direct contact with the gas or liquid being measured, resulting in a typical response time of 0.2 second in agitated liquid.

Type 1321 is designed for extreme low temperature measurements, with special calibrations to −425 F. Operating interval is 30 F in ranges up to +250 F, with ±1% accuracy. A perforated shield protects the platinum sensing element from high flow rates.

SURFACE TYPE for all kinds of surfaces



These platinum temperature transducers can be installed by a variety of methods on any surface . . . flat or curved, metallic or non-metallic. The following types are available in ranges from −400 F to +1850 F: Cement-On, Weld-On, Tape-On, Thermopaper, Sub-Surface, and Surface Transferable.

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Precision Transducers

AVIATION CALENDAR

(*Continued from page 5*)

nual Meeting of the American Assn. for the Advancement of Science.

Dec. 27-30—Fifth King Orange International Model Plane Meet, Miami, Fla.

Jan. 12-14—Fifth National Symposium on Reliability and Quality Control in Electronics, Bellevue-Stratford Hotel, Philadelphia, Pa.

Jan. 19-21—11th Annual Convention, Helicopter Assn. of America, Villa Hotel, San Mateo, Calif.

Jan. 26-29—27th Annual Meeting, Institute of the Aeronautical Sciences, Sheraton-Astor Hotel, New York, N. Y. Honors Night Dinner, Jan. 27.

Jan. 27-29—Fifth Annual Radar Symposium (classified), Rockham Bldg., University of Michigan, Ann Arbor, Mich.

Jan. 27-30—15th Annual Technical Conference, Society of Plastics Engineers, Hotel Commodore, New York, N. Y.

Jan. 28-29—Fifth Annual Midwest Welding Conference, sponsored by Armour Research Foundation, Illinois Institute of Technology, Chicago, Ill.

Feb. 3-5—14th Annual Technical and Management Conference, Reinforced Plastics Division, Society of the Plastics Industry, Inc., Edgewater Beach Hotel, Chicago.

Feb. 12-13—1959 Solid State Circuits Conference, sponsored by Institute of Radio Engineers' Professional Group on Circuit Theory, American Institute of Electrical Engineers' Committee on Electronics and the University of Pennsylvania, Philadelphia, Pa.

March 3-5—1959 Western Joint Computer Conference, sponsored by Institute of Radio Engineers, American Institute of Electrical Engineers and Assn. for Computing Machinery, Fairmont Hotel, San Francisco, Calif.

March 5-6—Flight Propulsion Meeting (classified, Institute of the Aeronautical Sciences, Hotel Carter, Cleveland, Ohio.

March 8-11—Engineering meeting on the turbine in action, sponsored by Gas Turbine Division of the American Society of Mechanical Engineers, Cincinnati, Ohio.

March 16-20—11th Western Metal Exposition and Congress, American Society for Metals, Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles, Calif.

March 31-Apr. 2—Polytechnic Institute of Brooklyn's Ninth International Symposium. Subject: Millimeter Waves. Auditorium, Engineering Societies Bldg., New York, N. Y. Co-sponsors: Department of Defense Research Agencies and Institute of Radio Engineers.

Apr. 7-10—1959 Welding Show and 40th Annual Convention, American Welding Society, International Amphitheatre and Hotel Sherman, Chicago, Ill.

May 4-7—Fifth Annual Flight Test Instrumentation Symposium, sponsored by the Instrument Society of America, Seattle Section, Olympic Hotel, Seattle, Wash.

May 25-27—1959 National Telemetering Conference on Investigation of Space, Brown Palace and Cosmopolitan Hotel, Denver, Colo. Sponsors: American Rocket Society, Institute of the Aeronautical Sciences, American Institute of Electrical Engineers and Instrument Society of America.

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Space Technology Laboratories, Inc., previously a division of The Ramo-Wooldridge Corporation, became a separate company on October 31, 1958. Space Technology Laboratories will be directed by Lieut. Gen. James H. Doolittle, Chairman of the Board (after January 1, 1959); Dr. Louis G. Dunn, President; and Dr. Ruben F. Mettler, Executive Vice President. The other members of the Board of Directors are Robert F. Bacher, Head of the Division of Physics, Mathematics and Astronomy at the California Institute of Technology; James T. Brown, Vice President of the Mellon National Bank, Pittsburgh, Pennsylvania; and Samuel E. Gates, Attorney with the New York firm of Debevoise, Plimpton and McLean.

Space Technology Laboratories has the largest professional scientific and engineering staff in the nation devoted exclusively to Ballistic Missile and Space programs. STL is responsible for the systems engineering and technical direction of the Air Force THOR, ATLAS, TITAN, and MINUTEMAN ballistic missile programs. While it does not engage in production, STL performs experimental and analytical research projects in advanced space technology, including the fabrication and assembly of special equipment and the conduct of test programs. A recent example is the lunar probe project assigned to STL by the Air Force and the National Aeronautics and Space Administration.

Space Technology Laboratories, Inc., plans to maintain a combination of technical competence and organizational strength appropriate to its special and continuing role in the important national program of space weapons development.

SPACE TECHNOLOGY LABORATORIES, INC.

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Thompson Ramo Wooldridge Inc.

On October 31, 1958, **Thompson Ramo Wooldridge Inc.** was formed by the merger of *Thompson Products, Inc.,* and *The Ramo-Wooldridge Corporation.*

Thompson Ramo Wooldridge will be directed by J. D. Wright, Chairman of the Board; Dean E. Wooldridge, President; Simon Ramo, Executive Vice President; and F. C. Crawford, Chairman of the Executive Committee. The other members of the Board of Directors are B. W. Chidlaw, A. T. Colwell, J. H. Coolidge, H. L. George, R. P. Johnson, and H. A. Shepard. Each is a Vice President of the merged company.

Thompson Products, Inc., has been for many years a large manufacturer of components and accessories for the automotive and aircraft industries. In recent years, it has also been active in the fields of Missiles, Electronics, and Nuclear Energy. Thompson has concentrated on products which require a high level of competence in engineering and precision manufacturing.

The Ramo-Wooldridge Corporation was organized five years ago to conduct research, development, and manufacturing operations in the field of electronic and missile systems having a high content of scientific and engineering newness. In addition to the work performed by Space Technology Laboratories, Inc., Ramo-Wooldridge has been engaged in major systems work in such areas as digital computers and control systems, communications and navigation systems, infrared systems, and electronic countermeasures.

The merger of the two companies into Thompson Ramo Wooldridge Inc. is intended to provide an integrated team having strong capabilities for scientific research, engineering development, and precision manufacturing.

Thompson Ramo Wooldridge Inc.

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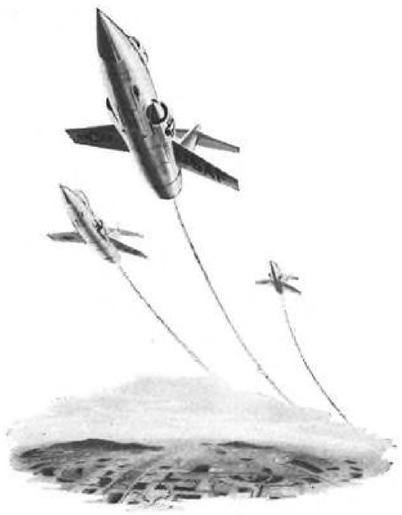

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High Performance Starter-Generators by BREEZE

For critical applications in jet aircraft, these units serve the dual purpose of starting the jet engine and providing the electrical power necessary to charge the ship's batteries and operate the electrical equipment.

These units are designed to military aircraft standards, have radio noise filters and are either blast cooled or self cooled. Vibration dampeners may be incorporated when required.

Our engineers will be pleased to furnish information on the listed units upon request and will submit engineering proposals for special units.

BW-125 Direct Cranking Starter — 24 volt systems D.C. Compensated overload clutch at 60 lb. feet maximum setting. Weight, 20 lbs.

STARTER-GENERATORS — 30 VOLT, D.C.				
Part No.	Rating	Speed Range Full Output	Reduced Output from	Weight
VG600	100 AMPS	4700/8000 rpm	3800 rpm	33 lbs.
VG700	200 AMPS	4200/8000 rpm	3700 rpm	38 lbs.
VG770	200 AMPS	3000/8000 rpm	2500 rpm	45 lbs.
VG840	100 AMPS	7300/12000 rpm	6500 rpm	14 lbs.
VG460	75 AMPS	5000/10000 rpm	4000 rpm	29 lbs.

GE-5 Brushless Generator — 400 Amps, 30 volts, speed 3,000 to 10,000 rpm, weight 58 lbs. Available with static (transistorized) voltage regulator. Weight 5 lbs.

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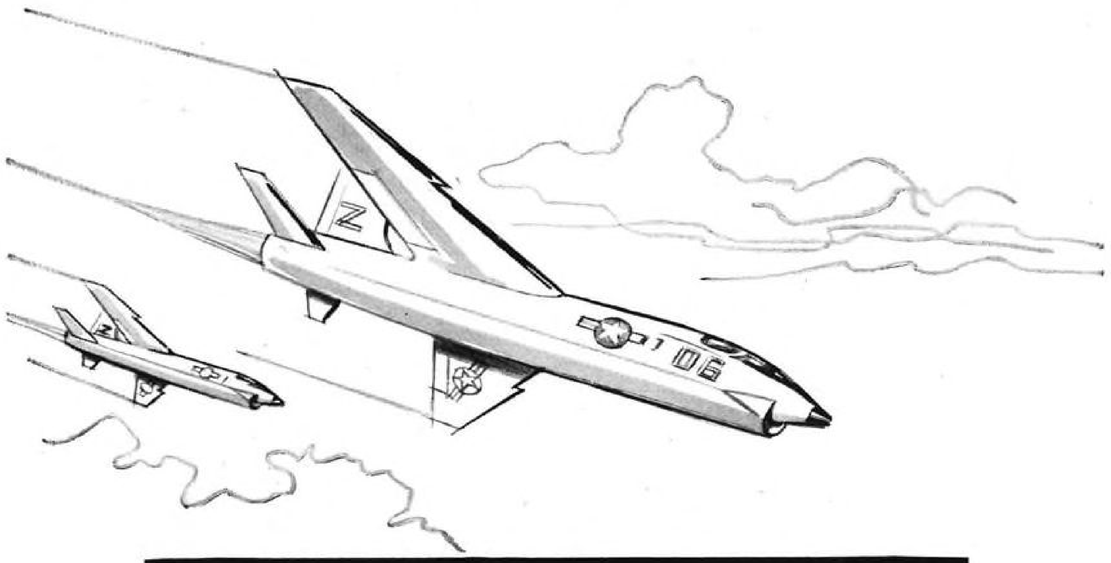

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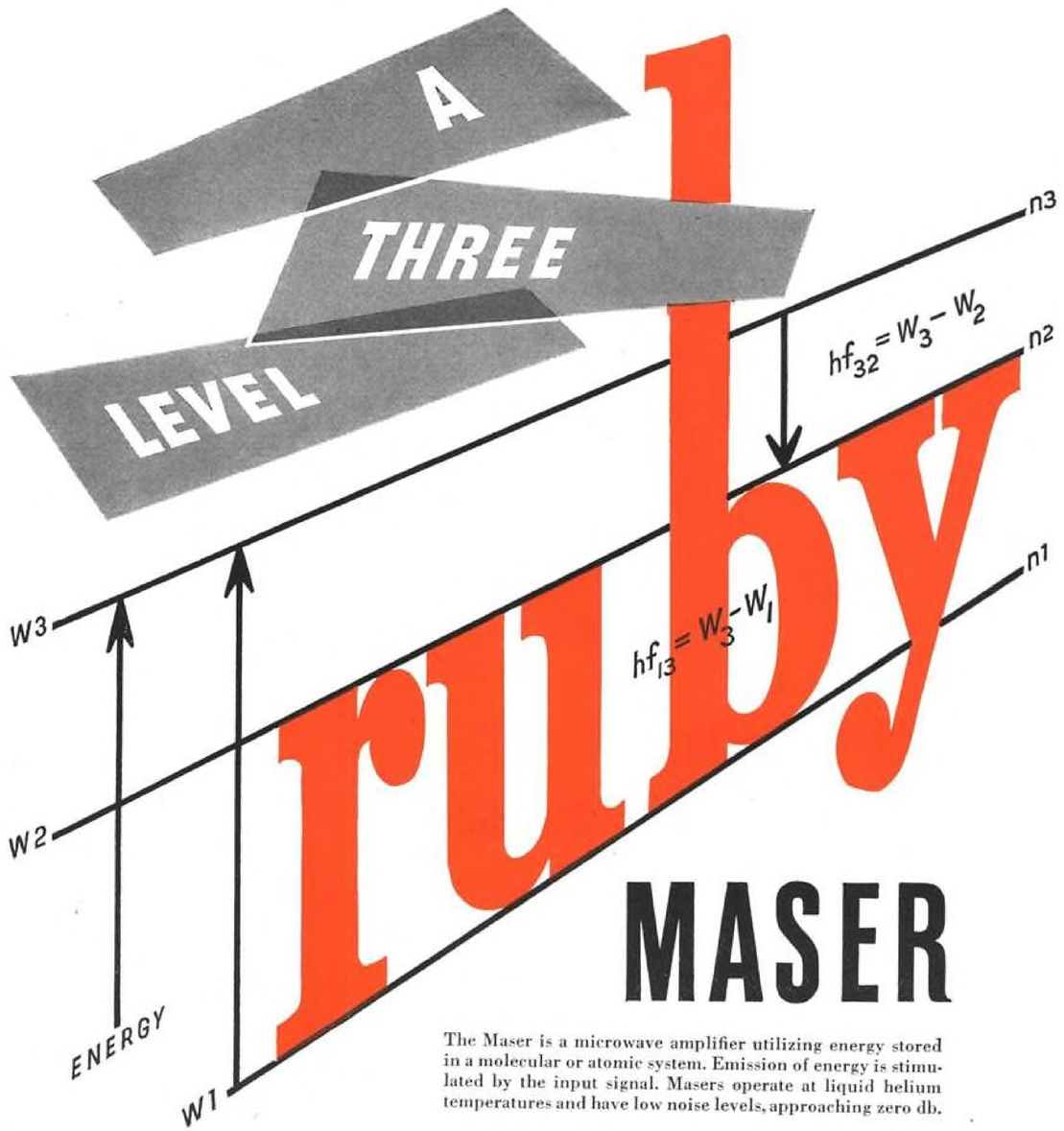

The Maser is a microwave amplifier utilizing energy stored in a molecular or atomic system. Emission of energy is stimulated by the input signal. Masers operate at liquid helium temperatures and have low noise levels, approaching zero db.

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LINDE supplies other crystals, including rutile, spinel, and sapphire. (Al_2O_3). Sapphire is used in infrared optical systems, windows for higher power microwave tubes, spacers and supports in vacuum tubes, radiation pipes. It has strength at elevated temperatures, melts at 2040°C., is hard, inert, nonporous, and can be sealed to metals and glasses. Sapphire is available in the shape of domes, windows to 4½ inches in diameter, rods and special configurations.

For more information, write Crystal Products Department, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y.

†*Maser Action in Ruby*, by G. Makhov. C. Kikuchi. J. Lambe, and R. W. Terhune. "Physical Review," Vol. 109, No. 4, p. 1399, Feb. 15, 1958.

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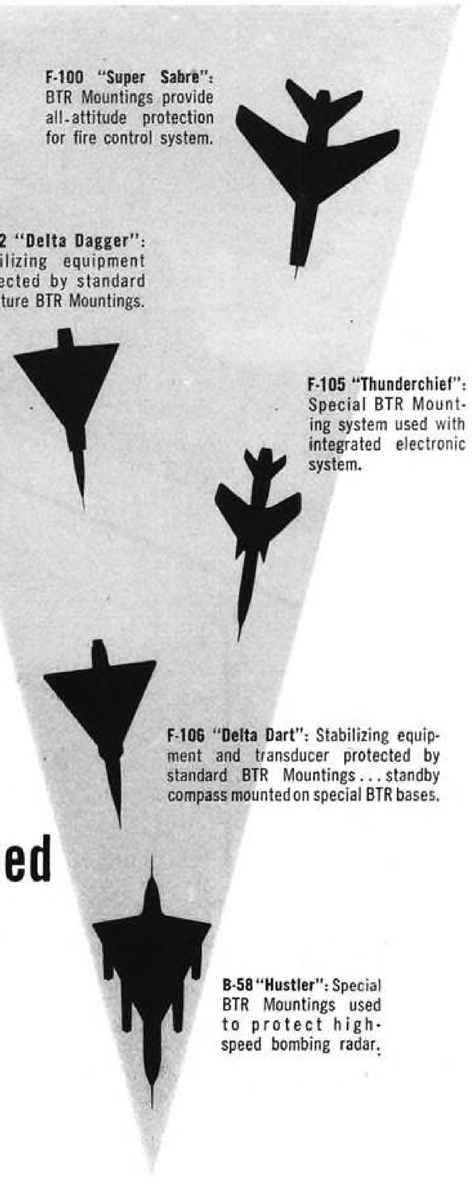

F-100 "Super Sabre": BTR Mountings provide all-attitude protection for fire control system.

F-102 "Delta Dagger": Stabilizing equipment protected by standard miniature BTR Mountings.

F-105 "Thunderchief": Special BTR Mounting system used with integrated electronic system.

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B-58 "Hustler": Special BTR Mountings used to protect high-speed bombing radar.

new BTR mountings* protect reliability of advanced aircraft components

Achieving the high component reliability specified for today's advanced aircraft often requires control of severe vibration, shock and noise. Special techniques, materials and systems must be employed to keep vital equipment within their fragility envelopes.

Typical of the advanced materials required in mounting systems for the high-performance aircraft shown here are Lord's new BTR Elastomeric Mountings. These broad temperature range isolators provide excellent shock and vibration protection under extreme environmental conditions. Incorporation of BTR mountings in the suspension system simplifies design providing maximum economy and assures better performance and higher reliability.

Aircraft and missiles of the future will introduce new vibration and shock problems. Lord has the engineering background plus the research and production facilities to meet these challenges in mounting system design.

For further information contact your nearest Lord field engineer or the Home Office, Erie, Pa.

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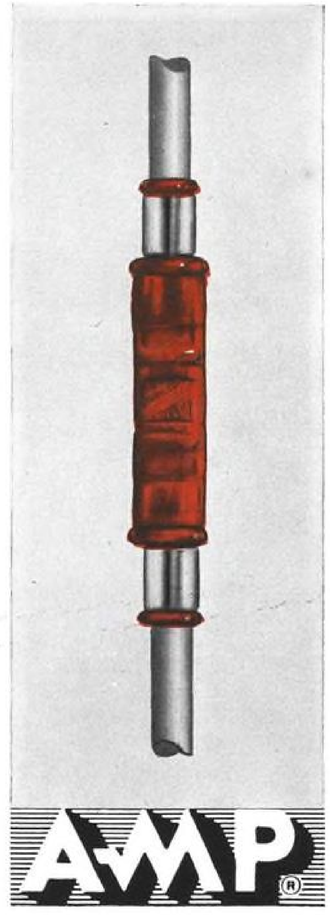

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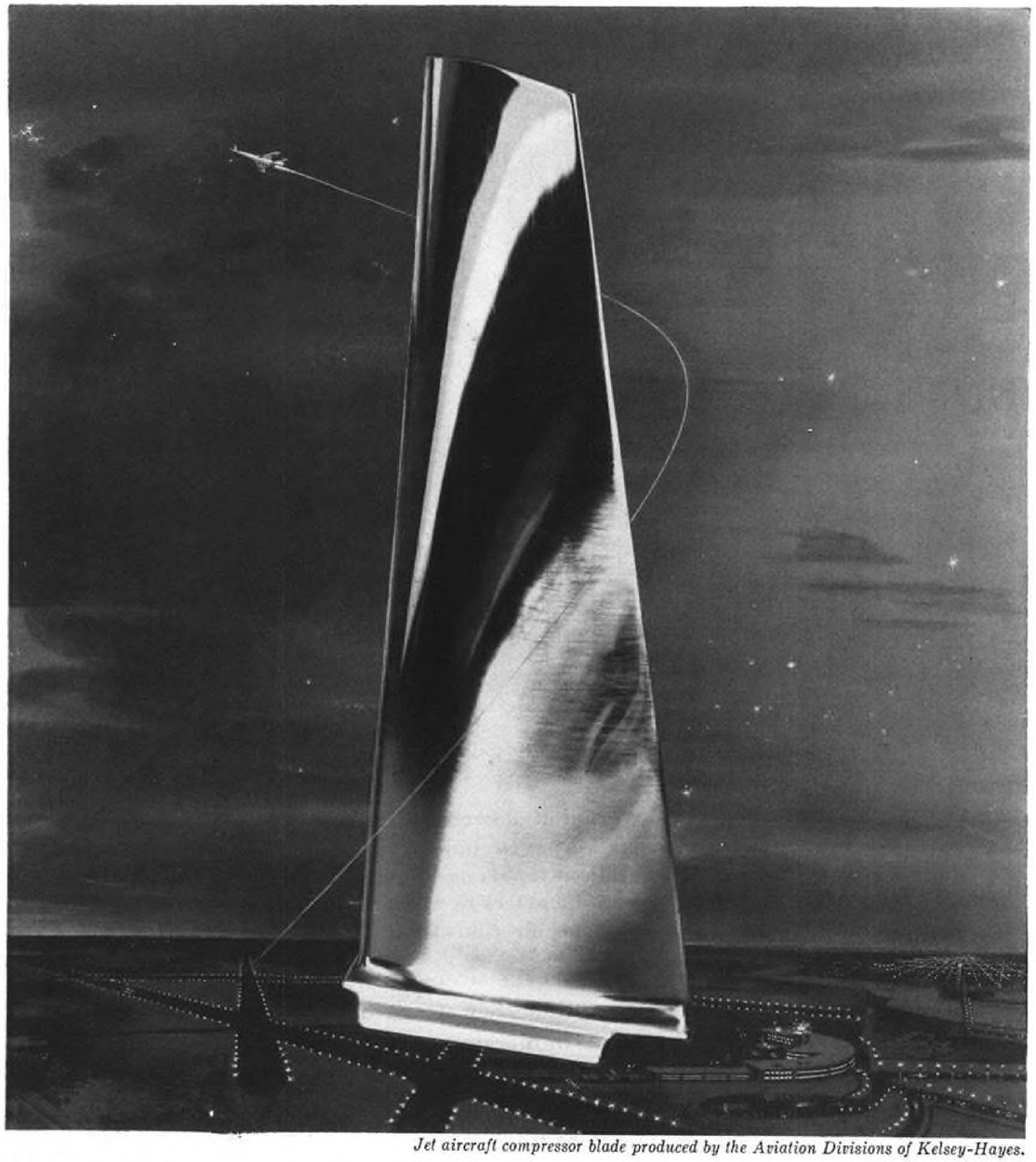

Jet aircraft compressor blade produced by the Aviation Divisions of Kelsey-Hayes.

precision blades for flight propulsion

Superalloy blades, buckets and vanes—*precision components for rotating and static assemblies*—are products of the Aviation Divisions of Kelsey-Hayes. Kelsey-Hayes also produces through its own vacuum melting facilities, the special alloy metals that go into these and other products demanding high tensile strength in the high temperature field. Kelsey-Hayes Company, General Offices: Detroit 32, Michigan.

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Ryan Firebee

jet drone missiles

are flying longer, farther,

higher, faster on target missions—

and more of them "live" to fly another day.

For example, at Vincent Air Force Base recently, the 4750th Drone Squadron launched 44 Firebees *in a row,* which averaged one hour's flight duration each. And 39 of them—many after target "hits"—were recovered successfully for re-use!

Other Firebee firsts: the one that completed 19 missions; the one that flew 1 hour, 42½ minutes; the one that made a flight 152 miles away from ground control and returned to be recovered in a pre-selected area; the drones that regularly fly target missions at Mach .9; and the *production* "birds" that have flown above 50,000 feet.

An elusive, pilotless plane, the Ryan Firebee is the most widely used jet target in training operations . . . the most realistic stand-in for "enemy" aircraft. That's why the Firebee is used as the target for such weapons as the Air Force Falcon and Genie; Navy Sidewinder, Sparrow, and Terrier; and Army Nike. That's why the Firebee was the exclusive target drone used in the Air Force's recent Project William Tell to evaluate the combat readiness of America's air defense system.

RYAN BUILDS BETTER

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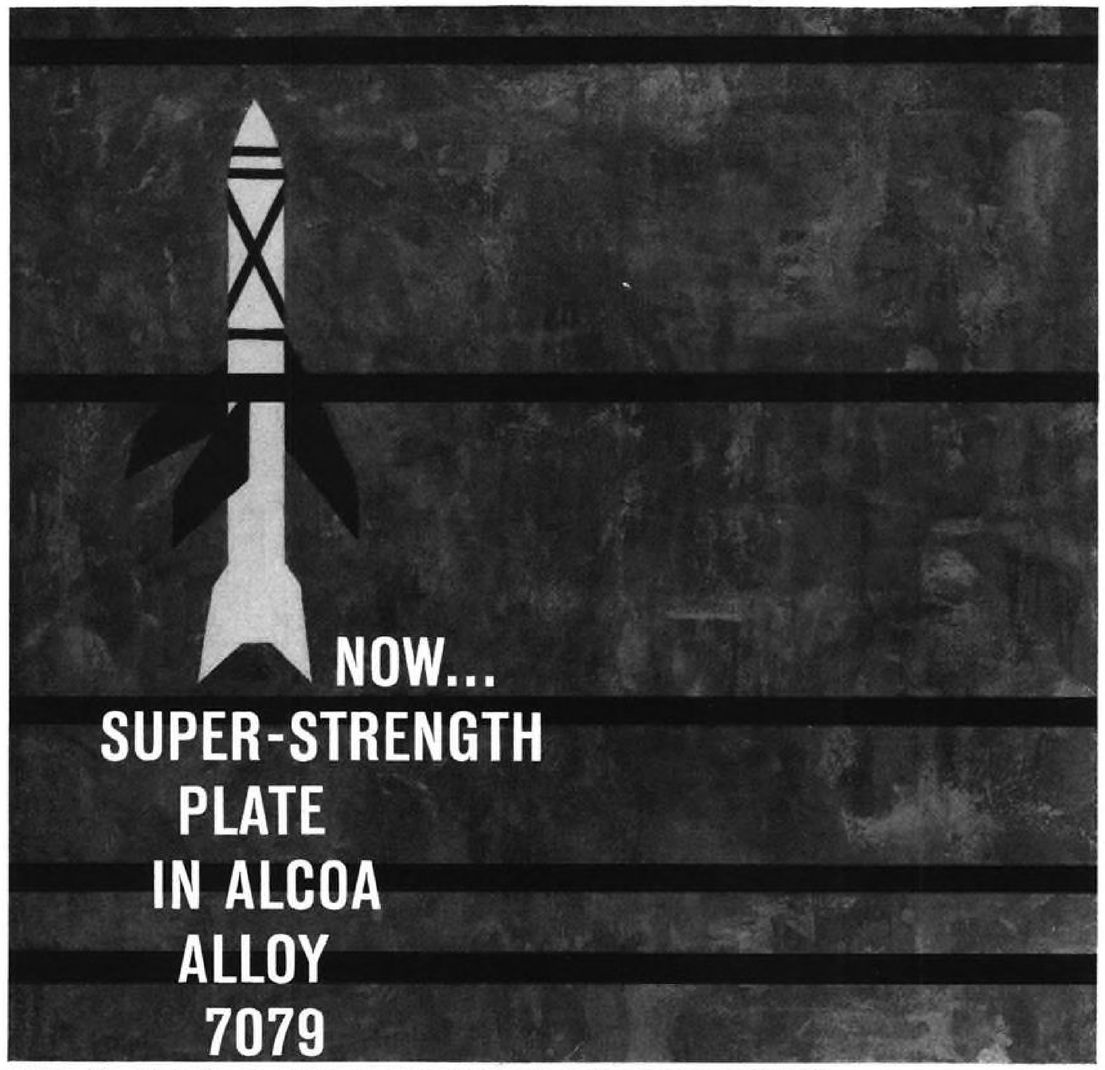

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Thickness Inches	Direction	Tensile Strength ksi	Yield Strength ksi	Elongation Per Cent in 2 in. or 4D
3.001-4.000	Longitudinal	70	60	6
	Long transverse	70	60	5
	Short transverse	64	55	2
4.001-4.500	Longitudinal	68	58	6
	Long transverse	68	58	5
	Short transverse	62	54	2
4.501-5.000	Longitudinal	68	58	5
	Long transverse	68	58	5
	Short transverse	61	53	2
5.001-5.500	Longitudinal	67	58	4
	Long transverse	67	58	4
	Short transverse	60	53	2
5.501-6.000	Longitudinal	67	58	4
	Long transverse	67	58	4
	Short transverse	59	52	2

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EDITORIAL
How Research Investments Pay Tremendous Dividends... 20

COVER: North American Aviation T-39 Sabreliner has been ordered into production by the Air Force. Seven of the twin-jet utility aircraft will be built under the order (AW Nov. 10, p. 23). Sabreliner, which made its first flight in September, has a 500 mph. cruise speed and 1,400 mi. range. Aircraft, which is designed to carry a crew of two and four passengers, will be used as a jet proficiency trainer, a navigator trainer, tow target or chase plane, and for shipment of high priority spare parts. For another photo, see p. 32.

PICTURE CREDITS

Cover, 32—North American; 26, 27—Aviation Week; 28, 29—USAF; 62, 63—R. Applebee; 63 (bottom)—Ryan Aeronautical; 71—Applied Science Corp.; 75—Westinghouse; 91 (top)—Douglas; 91 (center)—Convair; 98, 99, 105—Transland.

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EDITORIAL

How Research Investments Pay Tremendous Dividends

About a year ago, when the Air Force canceled the North American Navaho missile development program after an expenditure in excess of $700 million, there was a great hue and cry in Congress, the daily press and by some timid bookkeepers in the Defense Department over the tremendous "waste" of funds on a project that failed to produce operational military hardware. The example of the Navaho project's $700 million was cited time and again to prove that what was really needed was not a larger military and development program but a more cautious investment of the funds already available.

It is this lack of understanding of the genuine value of research and development investments and their payoff that has contributed more than any other single factor to the artificially slow pace of our military technology development during the past decade. Research and development investments cannot be handled effectively with the conservative 3% interest philosophy of a savings account. They must be handled as high risk capital, accepting the prospect of big gambles and some failures, to achieve the significant state of the art gains that are necessary to maintain military superiority and a dynamic economy.

For the past century, the American economy was based primarily on expanding to the geographical limits of the continent and developing its natural resources. For the next century, the American economy must depend on the expansion of basic knowledge to new frontiers and the development of the resulting technologies.

Navaho Dividends

The Navaho program provides a perfect case history of how a sound investment in research and development pays tremendous dividends in basic new knowledge and technology, even though the original weapon goals are never reached. Far from being a tremendous "waste" of funds, the work on the Navaho project has paid large dividends in a wide variety of military weapon systems, ranging from nuclear submarines to Mach 3 aircraft, and has planted the seed for important new dynamic elements to grow in the civilian economy.

Let us examine the Navaho project in detail and trace the exact genealogy of its research and development by-products into working hardware of the present and immediate future. The Navaho concept was hatched in the fading days of World War II when the first data on the truly remarkable German wartime research in supersonics, guidance and high energy propulsion was being siphoned from the ruins of the Third Reich.

Because future developments in these key areas were only dimly perceived, the military specified only broad requirements for basic state of the art advancement. As this development work bore fruit, it was possible to expand the military requirements of the Navaho system from its original low supersonic speed and 500 statute mile range to Mach 3 and a 5,500 nautical mile range. Today, we find too many research and development programs cramped and hamstrung by too rigid military requirements and lacking the freedom required for broad advances offered by the Navaho project approach.

Early Problems

The first problem was facilities. At the end of World War II there were no development or test facilities in this country for big rocket engines, Mach 3 aerodynamic designs or inertial guidance systems. The first propulsion research on Navaho consisted of firing small rockets using liquid oxygen and hydrogen peroxide in the parking lot of North American's Los Angeles division. These experiments produced little data but considerable damage to parked cars by fragments from exploding test vehicles. But out of this development need came the huge Rocketdyne facilities at Canoga Park and Santa Susanna on which virtually all large liquid fueled rocket development in this country has been dependent during the past decade.

North American began work on a supersonic wind tunnel in 1946 designed for a 16 x 16 in. test section and a capability through Mach 3. This supersonic wind tunnel was the first of its kind to be built and operated by an individual company in the aircraft industry. It began running in 1948 and has been a valuable research tool for the last 10 years. Facilities for development of gyro-stabilized platforms, extremely sensitive accelerometers and accurate distance measuring equipment also were developed and expanded into what is now North American's Autonetics Division.

Gaining Technical Experience

Along with these facilities went the development of a capable technical staff to carry the program load in what was to prove to be a basic state of the art advance on the three technical fronts of aerodynamics, propulsion and guidance.

A decade of research and development effort went into the Navaho program before the rapid progress of ballistic missiles dictated a cut-off to this line of air-breathing missile development. There will never be any Navaho SM-64 missiles in the inventory of the Strategic Air Command poised on launchers to strike potential enemies across intercontinental ranges.

Does this mean that the $700 million in taxpayers' money spent by the Air Force on Navaho are a complete loss? Certainly not! The dividends already paid and looming in the near future show clearly the tremendous return cranked into both military and civil technology by this research and development investment.

In aerodynamics, the Navaho project charted a course to Mach 3, a current goal of both military and civil aircraft. The X-10 test vehicle developed for the program proved clearly the value of the supersonic wind tunnel work.

Its basic configuration was never altered from the final wind tunnel model. It made 28 successful flights, hitting a peak of over Mach 2 without any trouble in the critical transonic range, and provided much of the supersonic aerodynamic data used in the GAM-77 Hound Dog missile, the F-108 Mach 3 long-range interceptor and the B-70 Mach 3 intercontinental bomber.

As an added dividend, the recoverable X-10 test vehicles are now being used as the first supersonic targets for the Boeing Bomarc surface-to-air missile test program, and the 12 XSM-64 missiles are being used for further research in the RISE program (Research into Supersonic Environments) to develop additional data for the B-70 and F-108 projects, particularly for temperature and pressure data necessary for application of boundary layer control.

Guidance Benefits

Guidance development also was a long-term program that progressed from the first crude beginnings of early stabilized platforms through the X-1 system, the first inertial guidance system to fly in the U. S. (in 1950 controlling a C-47), through the N-5 system used in the Navy's atomic submarines on their successful pioneering voyages under the polar ice cap. Inertial guidance systems that resulted from advanced component development for Navaho are also being utilized in the Hound Dog missile and a fighter guidance system, while the possibilities of more payoffs even farther in the future are not yet exhausted. Among the key inertial guidance components developed during the Navaho program are accelerometers sensitive from fifty one-thousandths of a G to forces of 8Gs; paired and reversing gyros to reduce drift errors; extremely accurate distance measuring equipment; and a daytime celestial navigation system to correct inertial guidance errors.

A completely automatic and self-contained recovery system was developed and successfully operated in the pilotless X-10 vehicles that also can be applied to the development of automatic recovery systems for space vehicles.

Perhaps the biggest payoff has come in rocket propulsion where the early Navaho work has become the basis for all the high thrust liquid fueled rocket engines powering U. S. ballistic missiles today; the million-pound thrust single chamber engine, and the million-and-a-half pound thrust cluster now under development for space exploration.

First step in the Navaho rocket engine development was the 75,000 lb. thrust model developed as the first booster for the ramjet-powered cruise missile which later became the standard production engine for the Army's Redstone ballistic missile. With increasing range requirements for Navaho, the booster rockets were developed to a maximum total of 415,000 lb. thrust for a cluster of three used in the final XSM-64 configuration. And from this development program came the rockets for the Army's Jupiter and the USAF Thor and Atlas, all now in production at North American's Rocketdyne division. These engines also propelled the first successful U. S. satellites and all five lunar probes now scheduled. They also will be used in satellite reconnaissance systems and manned space exploration.

Manufacturing Developments

On the manufacturing side, the Navaho configuration required circular structures that could not be machined so a chemical milling process was developed and patented by North American (Chem-Mill) that is now used in the manufacture of 80 other aircraft and missiles.

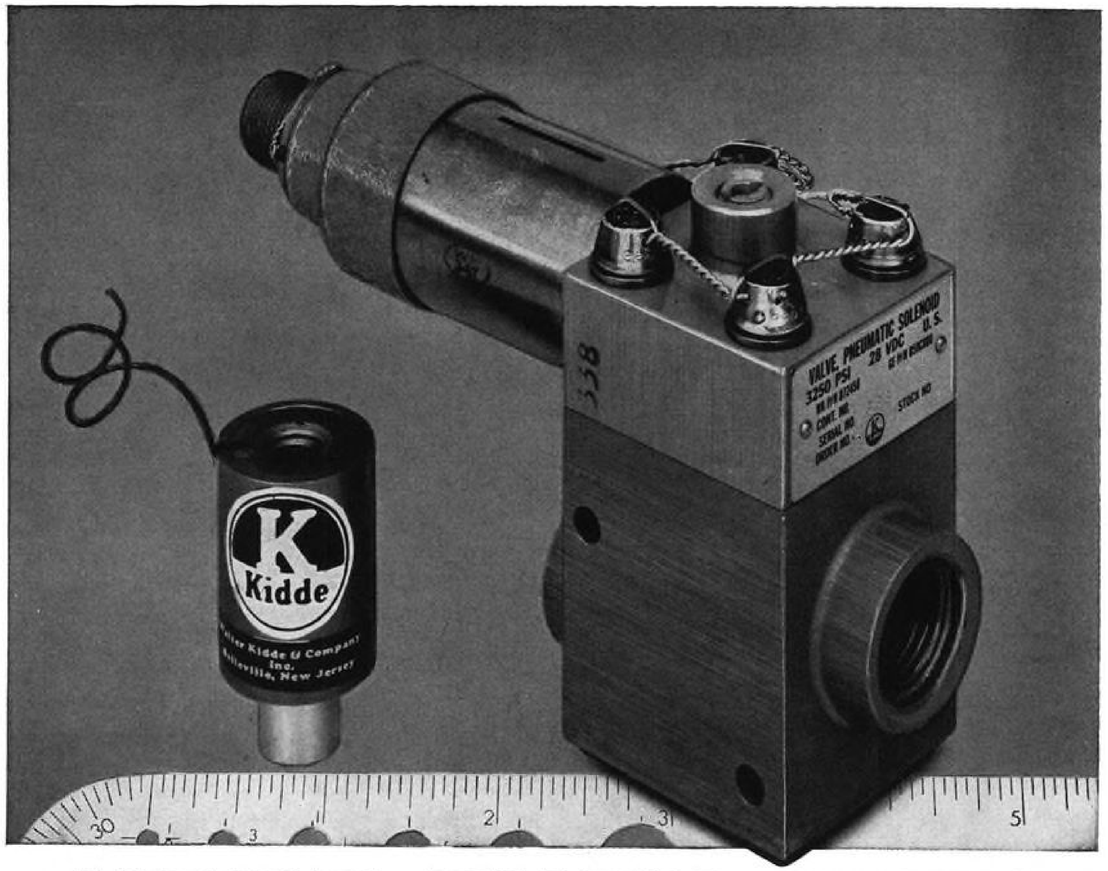
New welding techniques were developed to cope with the shape and size of missile skins that also now have wide applications, including the X-15 rocket research aircraft. Space metal, a corrugated sandwich material combining strength and low weight was developed along with automatic facilities for its production.

The requirement for automatic check-out equipment to give a swift "Go, No-Go" reading in the field faster than human crewmen could possibly manage became apparent early in the Navaho development. Equipment developed to fill this need is now being produced for the Hound Dog missile going into service with Strategic Air Command and for Navy's A3J attack bomber.

Prime Example

The case history of the Navaho research and development program should be carefully studied by every congressman concerned with military appropriations, by the comptrollers at all levels in the executive branch of the government and by the taxpayers whose $700 million were invested and who stand to collect the real benefit from these dividends in a stronger defense capability and new additions to the dynamic technology that is required to keep the civilian economy rolling. It is a prime example of how a wise investment in military research and development can pay handsome dividends for the future.

—Robert Hotz



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Weight .19 lbs.

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Brig. Gen. H. F. Gregory (USAF, ret.), vice president and assistant to the president, Midwestern Instruments, Inc., Tulsa, Okla.

Boeing Airplane Co.'s Systems Management Office has announced the following assignments: **Harvey D. Gunning**, Dyna-Soar weapon system manager, and **Roy R. Rotelli**, Dyna-Soar engineering manager, Pilotless Aircraft Division; **Roy H. Anderson**, Minuteman manager, **Howard Hurst**, assistant Minuteman manager, Seattle Division.

George J. Grabner, financial vice president and treasurer, the Weatherhead Co., Cleveland, Ohio.

Lance Call, a director and president, Taylorcraft, Inc., Conway, Pa.

Herman F. Scheurer, Jr., vice president-administrative and legal, West Coast Airlines, Inc.

John H. Hunt, a vice president, Stavid Engineering, Inc., Plainfield, N. J.

Graham B. Brown, vice president, Mallory-Sharon Metals, Niles, Ohio.

Dan W. Burns and **Robert T. Campion**, vice presidents, The Siegler Corp., Los Angeles, Calif. Mr. Burns continues as president of The Hufford Corp., a Siegler subsidiary; Mr. Campion continues as secretary of Seigler. Also: **Edward C. Lindsay**, vice president-manufacturing, The Hufford Corp.

Charles A. Sereno, head of Air Associates Division Electronic Communications, Inc., St. Petersburg, Fla. Mr. Sereno is executive vice president of Electronic Communications.

A. G. Cole, a vice president, Aircraft Engineering & Maintenance Co., Oakland.

Mansfield D. Sprague, vice president-public and industrial relations, American Machine & Foundry Co., New York, N. Y.

Philip W. Scott, a group vice president, The Budd Co., Philadelphia, Pa.

Trilan Corp., is the new corporate name of Consolidated Aircraft Products, El Segundo, Calif., and the following appointments have been announced: **Guy O. Gessell**, vice president and general manager, and **Roy M. Knox**, vice president-engineering. **Don E. Bryant** continues as president.

Bruce A. Willsey, vice president and general manager, newly established Des Moines, Iowa, division of Solar Aircraft Co., San Diego, Calif.

D. P. Renda, corporate secretary, Western Air Lines, Inc. Mr. Renda continues as vice president-legal.

A. J. Rizzi, comptroller, Stratos Division, Fairchild Engine and Airplane Corp., Bay Shore, N. Y.

John F. Cain, treasurer, Greer Hydraulics, Inc., Jamaica, N. Y.

Honors and Elections

Maj. Gen. Donald N. Yates, Commander of the Air Force Missile Test Center, Patrick AFB, Fla., has received the Order of Aeronautical Merit from the Brazilian Government in recognition of ". . . outstanding services rendered to aviation and to the security of the free world."

(Continued on page 123)

INDUSTRY OBSERVER

► Technique that reportedly can make radar systems virtually free from intentional or accidental jamming has been developed by Bell Aircraft Co. engineers. Application of technique involves relatively minor modification and is applicable to most existing and projected radar systems.

► **Watch for Air Force to let a contract at about the first of the year for a new early warning and control airplane to replace the Lockheed RC-121. AEW mission will be broadened to include control of interceptors. USAF says airframes must be essentially off-the-shelf items. Engines specified are Allison T61 5,000 eshp. two-spool turboprops. Boeing is proposing a version of its KC-97 (AW Oct. 20, p. 23); Lockheed a hybrid including elements of the Model 1649 and the Electra; Douglas a variation of the DC-7D turboprop transport which, thus far, has found no civilian market. Team of Convair and Canadair is proposing a development of Canadair's CL-44 Argus.**

► Air Force has called for industry proposals for a supersonic tactical bomber and reconnaissance aircraft based on the existing state of the art. North American is expected to propose a modified version of its Navy A3J, Republic a modified version of its F-105 and McDonnell a modified version of its F-101 long-range interceptor.

► **Navy-North American A3J attack bomber will be the first aircraft designed from the start to use completely automatic check-out equipment for flight-line testing of all of its avionic sub-systems and accessory equipment. Automatic check-out equipment is being developed by North American's Autonetics Division.**

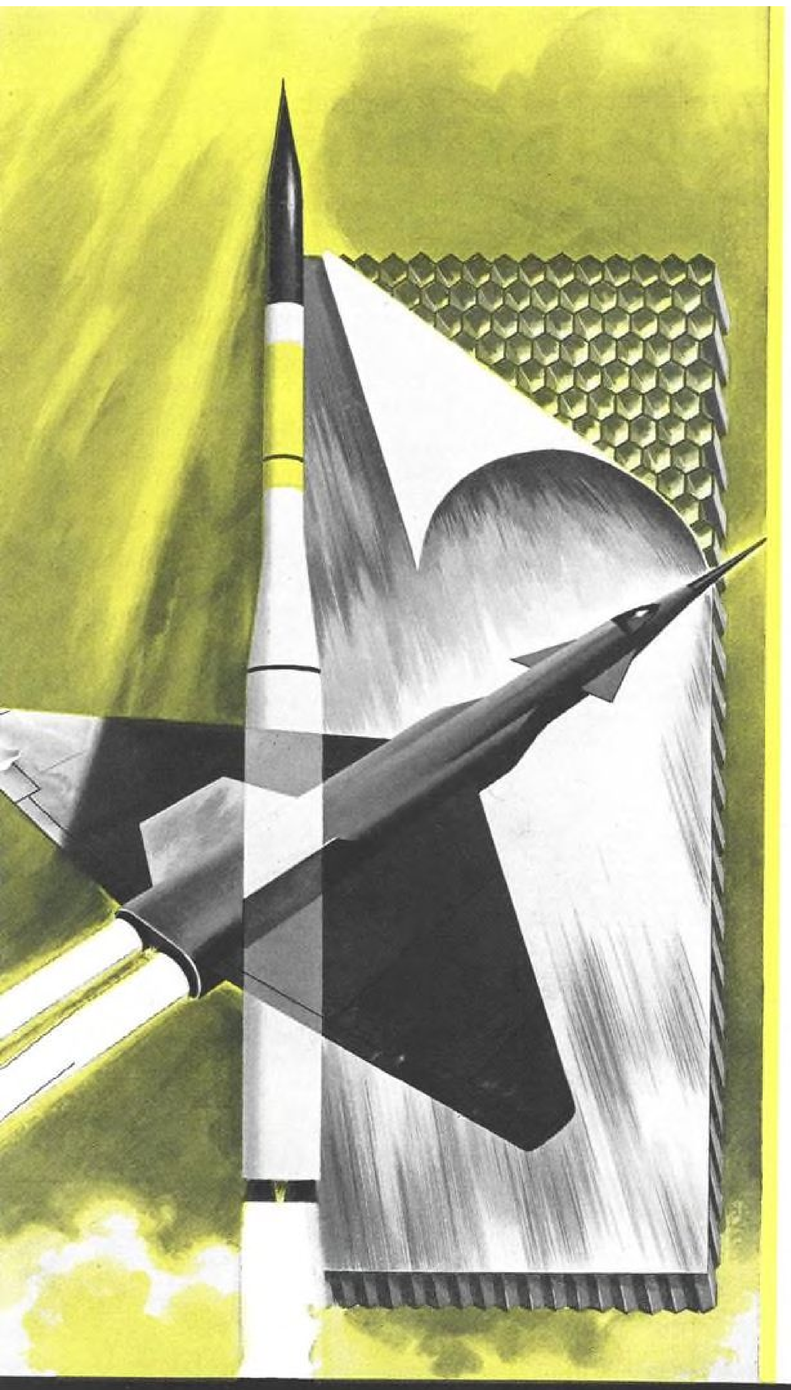
► A3J also will use inertical guidance system being developed by North American's Autonetics Division as a primary tactical navigation aid but will carry Raytheon Doppler radar for back-up. Autonetics, which is responsible for the entire bombing-navigation system, will use surveillance radar developed by Convair and a closed-circuit television system designed by Eastman Kodak for visual bombing.

► **Royal Canadian Air Force is considering the de Havilland Firestreak air-to-air missile as a replacement for the Douglas Sparrow II missile whose production was formally canceled several weeks ago. Purchase of the Firestreak depends upon the Canadian government's ultimate decision as to whether fighter planes are to be dropped from Canada's air defense system (AW Sept. 29, p. 22; Nov. 10, p. 31).**

► Pratt & Whitney Division of United Aircraft Corp. has been purchasing fluorine in experimental quantities, possibly for use as the high energy oxidizer for the division's hydrogen-fueled rocket engine (AW Nov. 10, p. 26). Engine, designed for use as the second stage of a manned satellite vehicle, is almost certain to derive its power from conventional chemical reaction of fuel and oxidizer. Liquid fluorine will provide a higher specific impulse than liquid oxygen and is now only slightly more difficult to handle and use than liquid oxygen.

► **Army Chemical Corps hopes to develop a short-range 200-600 yd. rocket for accurately placing napalm on enemy strong points, eventually pushing the range to 3,000 yd. One development item now under test, the F42, is an eight-inch-diameter fire rocket powered by a standard 2.25 in. rocket motor. E42 has a treated cardboard cylinder fuel container and a point detonating white phosphorous igniter. Fire rocket's length is 64 in., weight 60 lb. Rocket has a capacity of 5.7 gal. of jellied gasoline, is designed for firing from an expendable launcher or mobile multiple launcher.**

► More than 50 Nike Hercules anti-aircraft missile sites are scheduled to be operational by next July. Sites will include defense areas in the Fort Richardson-Elmendorf AFB-Anchorage and the Eilson AFB-Ladd AFB-Fairbanks complexes in Alaska. First units became operational last June, and five continental sites are now operational at New York, Philadelphia, Washington, Chicago and Los Angeles.



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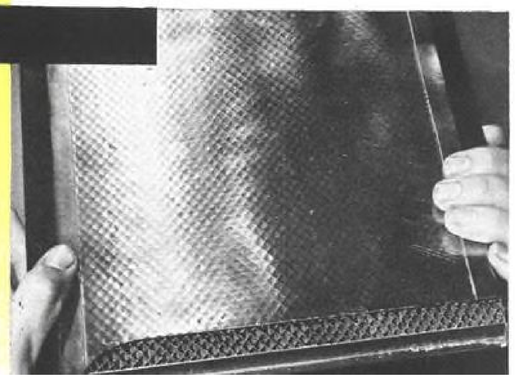
For more information, write to: Vice President, Defense Products Marketing, Crosley Division, Avco Manufacturing Corporation, Cincinnati 25, Ohio.



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Washington Roundup

Space Capsule Contract

National Aeronautics and Space Administration expects to award a contract leading to the ultimate development of a manned space capsule sometime after the first of the year. Final specifications for the capsule (see page 26) were laid out for representatives of 38 firms attending a recent NASA bidders conference at the Langley Research Center, Langley Field, Va. (AW Nov. 10, p. 27). Bids are due by Dec. 4.

Soviet Nuclear Tests

Russian nuclear test series that ended several weeks ago represented the most intense conducted by any nation thus far from the standpoint of the number of shots in a limited period. Some shots were quite large, and one late in October produced the highest fallout radiation ever recorded, according to Japanese scientists. U. S. Atomic Energy Commission Chairman John A. McCone said that particular shot "gave us a great deal of concern." Japanese also reported that one shot produced a large amount of neptunium in its fallout but no uranium 237. They speculated that this might mean a new type of weapon. Russia reported that the U. S. fired 32 shots in Operation Hardtack, the recent AEC test series in the Pacific. McCone said the Russian tally contains "some errors but it was reasonably precise." U. S. announced only 16 of these shots.

Space Council Silence

White House failure to release information on civilian space matters after National Space Council meetings is causing a growing concern within the House and Senate space committees. Staff members feel that withholding information on matters involving the military or national security is justified but that the policy should not extend to civilian programs. In creating the National Aeronautics and Space Administration, Congress directed the agency to "provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof."

In Congress

House Armed Services Investigating Subcommittee headed by Rep. Edward Hebert (D.-La.) will begin hearings Nov. 24 on charges that the military services are financing new facilities for weapons that could be produced in closed-down government-owned installations. Floyd Bryant, Assistant Secretary of Defense for Properties and Installations, will be the first witness.

In another area, public hearings on Civil Aeronautics Board ethics will be held by the House Legislative Oversight Subcommittee "in November or early December," according to committee counsel Robert Lishman. The presentation is expected to be routine.

House Space Committee

Chances look good for Dr. Charles S. Sheldon II, assistant staff director of the House Committee on Astronautics and Space Exploration, to become head of the new House committee staff during the next session of Congress. George F. Feldman, director and general counsel of the present committee, hopes to return to his law practice in New York after the first of the year. During the last session, the House approved an across-the-board Committee on Science and Astronautics but delayed naming members until the coming session. Sheldon, before joining the space committee, had been professor of economics and transportation at the University of Washington and more recently served as senior specialist on transportation with the Legislative Reference Service, Library of Congress.

Airline Labor Huddle

Top airline labor leaders turned their attention to the three week old Capital Airlines strike last week and the mutual aid pact (AW Nov. 10, p. 40) under which the carrier reportedly already has collected more than $100,000 from the five other airline members. In a move to combat the pact, the legislative subcommittee of the AFL-CIO called a special Washington meeting with representatives of the Transport Workers Union, Brotherhood of Railroad Clerks, Air Line Pilots Assn., Flight Engineers International Assn., and International Assn. of Machinists. The unions represent an estimated 80,000 airline workers.

Labor Election

National Labor Relations Board has directed an election within 30 days by employes of Convair's Pomona, Calif., plant to decide which union will represent them in collective bargaining. Choice is between Associated Tool and Die Makers of America and the International Assn. of Machinists, District 20, Guided Missile Lodge No. 1254, AFL-CIO.

New Defense Appointment

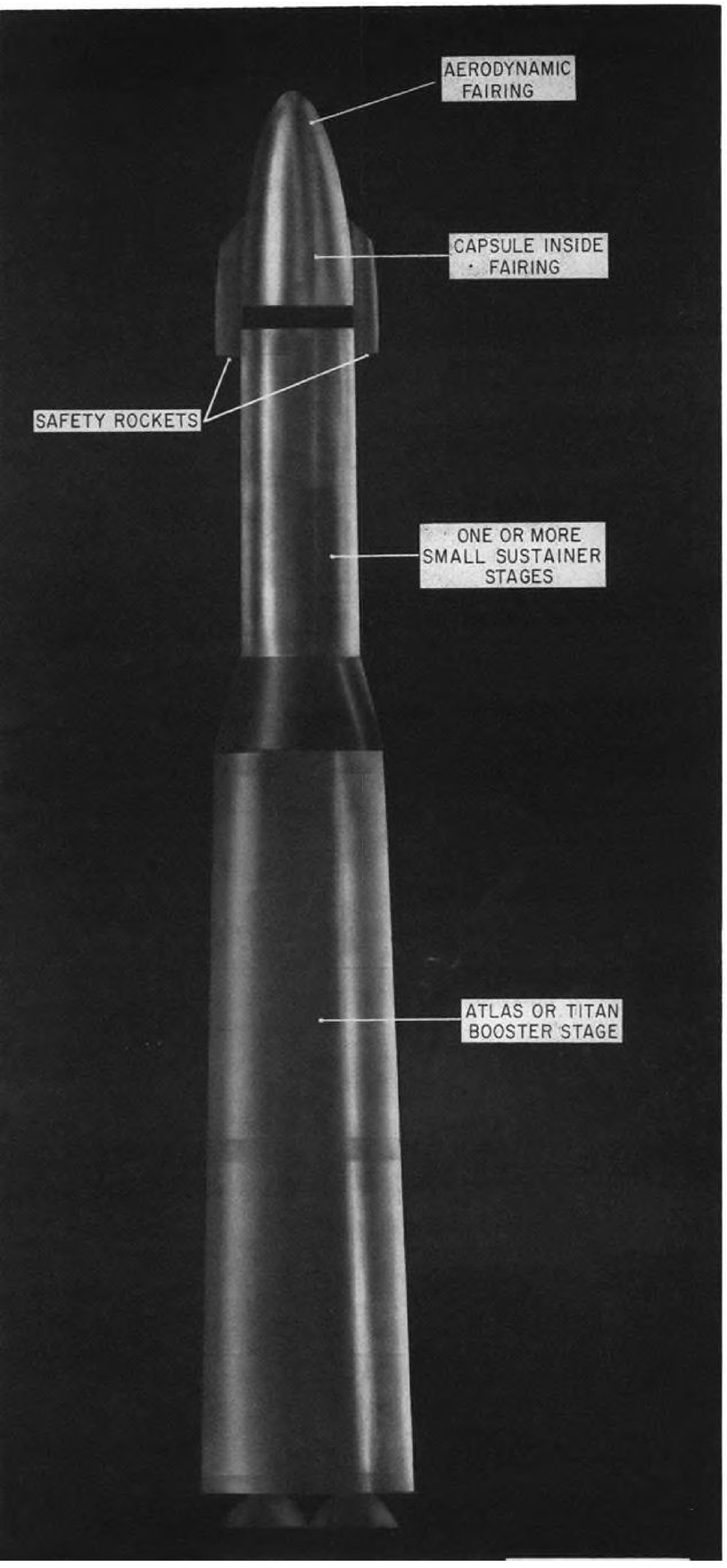
Robert H. Knight, New York attorney, last week was appointed Deputy Assistant Secretary of Defense for International Security Affairs, succeeding Mansfield D. Sprague who resigned last month. Sprague is now vice president, public and industrial relations, for the American Machine & Foundry Co. Knight, who has been associated with the law firm of Shearman, Sterling and Wright of New York since 1949, has specialized in general corporate matters with particular emphasis on international arrangements.

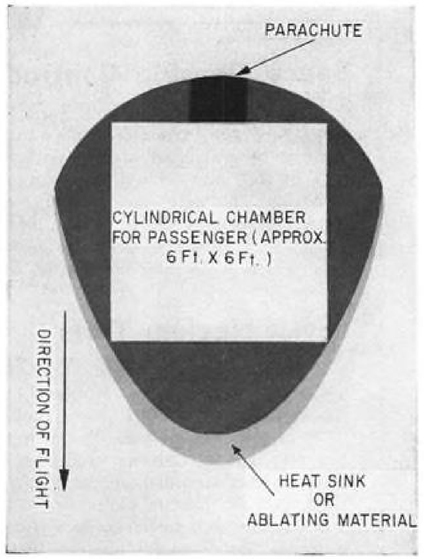
Bi-Partisan Bid

In a bid for Democratic support after its serious setback at the polls earlier this month, the Republican Administration last week named Senate majority leader Sen. Lyndon Johnson (D.-Tex.) U.S. representative to the United Nations debate on outer space exploration. In announcing the appointment, Secretary of State John Foster Dulles said:

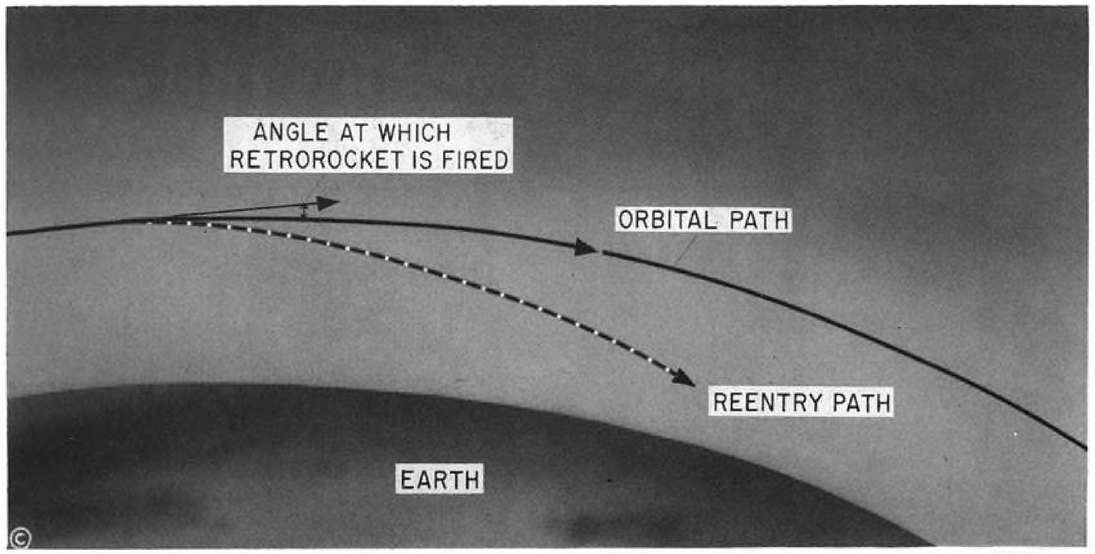
"It will be recalled that our delegate to the United Nations General Assembly is, as always, bi-partisan and on alternate years, including this year, includes members of the Senate.

—Washington staff





CAPSULE, contained in aerodynamic fairing, has ablative nose cone, landing parachute.



RETROROCKET would be fired slightly upward to transfer man-in-space capsule from an orbital path to a re-entry trajectory. Vehicle consists of Atlas or Titan plus smaller upper stages. Program is handled jointly by ARPA and National Aeronautics and Space Administration.

Space Technology

ARPA Official Gives Details on Man-in-Space Program

By Evert Clark

Washington—Satellite in which man will make his first attempt to exist in space, orbiting the earth for as many as six to 15 circuits, will be a pure drag shape with no lift or thrust devices except for a small retrorocket designed to bring man back toward earth at the end of his flight.

These and other details of the U.S. man-in-space program have been revealed by Dr. Herbert York, chief scientist of the Defense Department's Advanced Research Projects Agency.

Either an Atlas or Titan intercontinental ballistic missile booster will be used as a first stage. It will be topped by "some small added stages on top and safety rockets to lift the capsule high enough to activate the capsule system" in case trouble develops in the vehicle during the launch attempt.

Weight of the capsule will be approximately 2,000 lb. Almost all the estimates of the capsule weight needed to put a man up, sustain him for a short orbital flight and bring him back safely has fallen within the 1,500 lb. to 2,500 lb. range, York said. Man probably will be contained in a cylindrical chamber some six ft. long and six ft. in diameter.

Capsule's nose will handle the re-entry heating problem, either with a heat sink of metal having a high heat capacity and high conductivity or with an ablating material similar to that used on some missile nose cones.

AVIATION WEEK artist's conception of U.S. man-in-space capsule and launching vehicle was drawn from rough sketches made by Dr. Herbert York, chief scientist, Advanced Research Projects Agency, last week.

Retrorocket Positioning

Retrorockets, which will require no more than 10 to 20% of the capsule's weight, will fire forward and slightly upward from the orbital path, bringing the capsule into the denser part of the atmosphere in a shallow dive that will begin at an angle of two degrees or less from the direction of flight.

Although the man-in-space program is a joint effort between the civilian National Aeronautics and Space Administration and York's agency, which is a part of the military establishment, York spoke more freely and discussed the program in more detail than the civilian agency has. He addressed the University of Maryland's Space Technology Institute here.

York said both agencies are participating in the program "since its purposes are of interest to both agencies." Basis of the present program, he said, is to study psychological and physiological reactions of man in space and to determine whether he is capable of doing any useful work there.

Main problem still is weightlessness, York said. Although man's reaction to acceleration from 1G to a number of G's has been studied on the ground, there is a "distinct possibility" that the results will be different when man is accelerated from zero, or weightlessness, to the number of G's he would experience in re-entry, York said. Even with a shallow re-entry angle of two degrees, maximum acceleration may reach 10G.

Approach to the orbital vehicle is to use "the simplest and surest and therefore the safest vehicle—a capsule—and to re-enter solely through atmospheric drag."

His remarks indicated that the retrorocket would be used only to move the capsule out of orbit and into a descent trajectory and not to cushion its landing on earth. A parachute would be deployed only after the capsule had slowed to about Mach 1 and, therefore, would be a landing parachute rather than a drag 'chute.

Orientation

Mechanics of determining the need for orientation and method of orienting the satellite are being developed "in connection with other missile and satellite programs," York said.

Manned flights in the capsules, he said, would "no doubt" be preceded by "a few flights with animals."

Exact shape of the capsule and the details of whether it would land on water and whether it could be controlled during the last phases of landing have not been worked out, York said.

NASA has held a bidders' conference, attended by 38 companies, and asked for capsule design proposals by Dec. 4 (AW Nov. 10, p. 27).

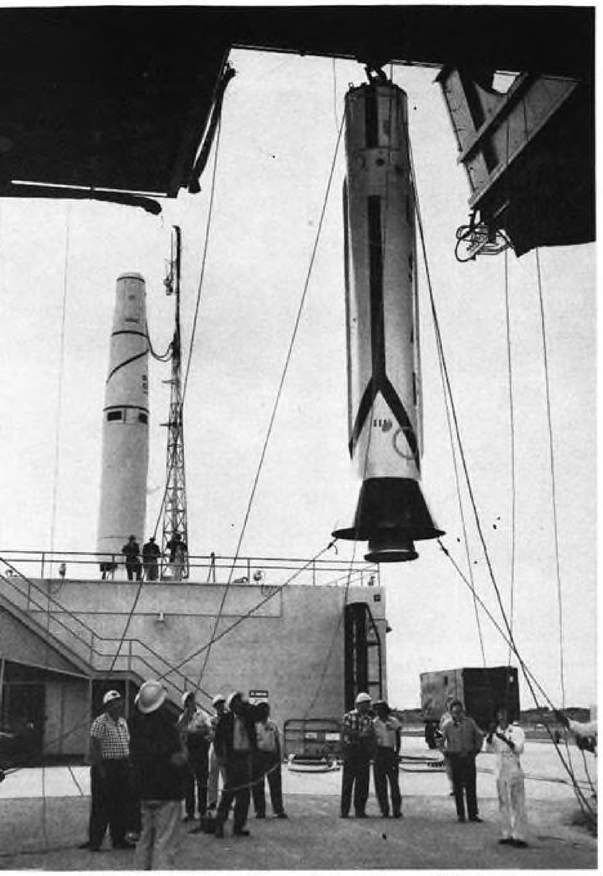
York said it will take "a number of years" to get the vehicle and capsule system to the point where man can be orbited safely, but he said "nearly everything we want exists, is about to exist or is solidly under development."

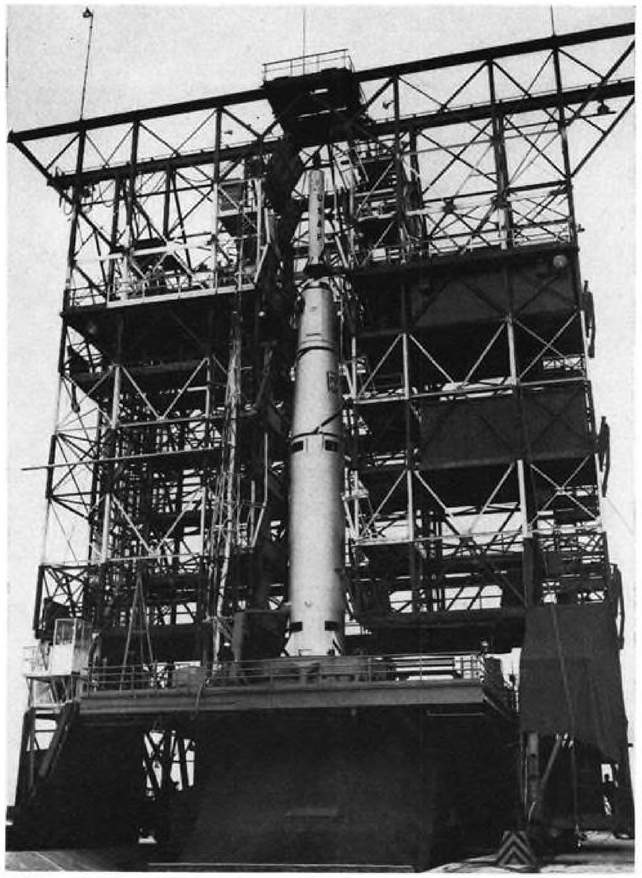
The capsule will include instruments for observing the passenger and others to provide him with continuous communication with the ground.

USAF J58 Order

Washington—Air Force has awarded Pratt & Whitney Division of United Aircraft Corp. a limited contract for its 30,000 lb. plus J58 turbojet engine as a backup project for North American Aviation's Mach 3 B-70 bomber and F-108 interceptor.

The contract throws the J58, originally developed under Navy cognizance, into competition with the General Electric X279 (J93) as the powerplant for both the B-70 and F-108. Defense Department has ordered Air Force to make a final decision between the two engines within one week of Jan. 1.





SECOND STAGE of Pioneer II launching vehicle is raised by modified Thor gantry crane (left) for assembly at Cape Canaveral, Fla. In background is Thor first stage on launching pad. Second stage included command cutoff for 7,500 lb. thrust Aerojet-General AJ-10 liquid fuel engine. At right, second stage is lowered onto Douglas Thor first stage by modified gantry crane.

Space Technology

Army Plans Two Moon Shots Next Month

SOLID propellant ABL-248 engine for Pioneer II lunar probe is lowered into position in the top of the second stage on a service tower. Engine is built by Allegany Ballistic Laboratory, weighs 4,500 lb. and produces 2,500 lb. thrust.

Cape Canaveral, Fla.—Army plans to make two trys next month to place small instrumented payloads in the vicinity of the moon. Scheduled dates are Dec. 5 and Dec. 19.

First shot will be an attempt to orbit the moon. The second probe will be aimed to go near the moon but pass beyond it to measure radiation in translunar space.

Launchings from the Air Force Missile Test Center here will be made by Army's Ballistic Missile Agency using the Juno II vehicle, a modified Jupiter intermediate range missile with small upper stages added.

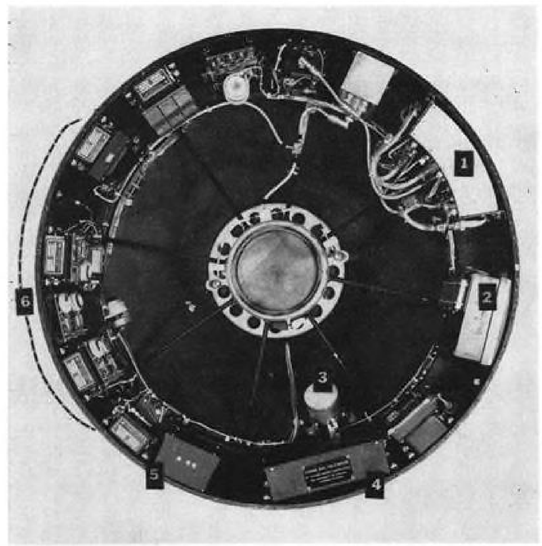
These dates have not been announced officially. Space probe launchings now are under the supervision of the civilian National Aeronautics and Space Administration and are part of the scientific International Geophysical Year program.

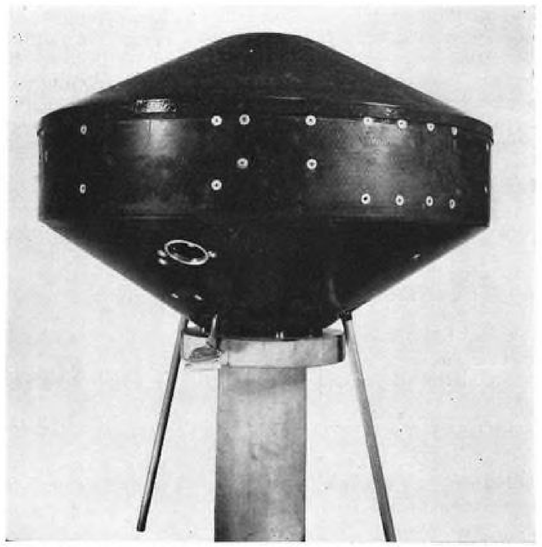
But the space agency, IGY personnel, Defense Department's Advanced Research Projects Agency and the military services currently are operating under a White House-dictated publicity policy that is designed to generate maximum favorable publicity if a launching is successful, and minimum public discussion—before and after the launching—if the firing is a failure.

For example, this policy forbids NASA to discuss details of the instrumentation carried in the Pioneer II satellite, since the satellite burned up over East Central Africa instead of making a successful flight. It also prevents NASA from releasing to the public the detailed specifications of its manned satellite capsule, even though these have been declassified and distributed to some 38 industrial firms.

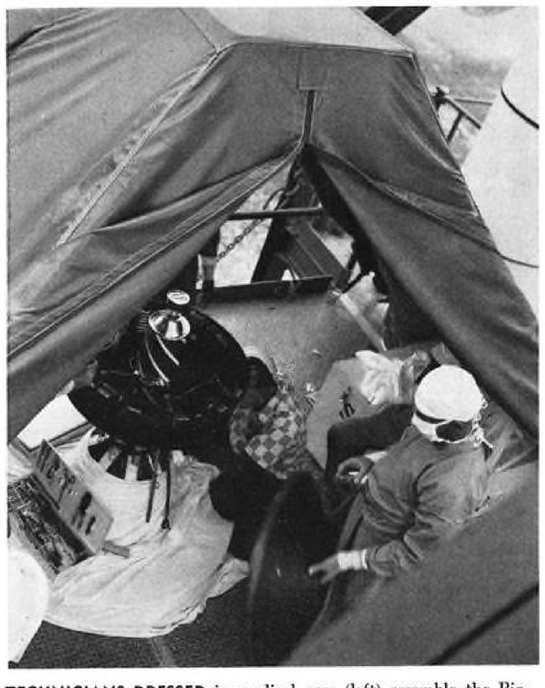
Pioneer II Launching

Pioneer II was launched at 2:30 EST Nov. 8 after a one-day postponement. First and second stages of the Thor-Able vehicles performed successfully and separated from the upper stages. The payload then separated





INSTRUMENT PACKAGE of the Pioneer II lunar probe (left) incorporates a number of changes since Pioneer I. Components are: 1—Doppler command receiver; 2—Television avionics; 3—Television scanner telescope; 4—Cosmic ray telescope; 5—Ion chamber; 6—Micrometeorite and magnetometer instruments. Electronic scanner, developed by Space Technology Laboratories, replaces heavier one developed by Naval Ordnance Test Station. Cosmic ray telescope was added to study Cherenkov effect and different types of batteries also were used. An external view of the honeycomb Fiberglas Pioneer II satellite (photo at right) shows two 16 in. antennas and the port for the television scanner, which was moved from the flat waist of the instrument package, where it was installed on Pioneer I, to the sloping underbody. The satellite reached an altitude of 1,000 mi., traveled 7,500 mi, before burning up over Africa.



TECHNICIANS DRESSED in medical gear (left) assemble the Pioneer II satellite atop the Thor-Able I launching rocket on the service tower at Cape Canaveral, Fla. Man at right holds the top of the instrument package, which slips over the retrorocket, shown protruding upward from the main body of the satellite. In photo at right, technicians use operating room cleanliness procedures to avoid contamination of portions of the lunar probe satellite. This ring containing eight vernier rockets, being fastened on top of the third stage, can be separated from the instrument package by ground command. Rockets, fired in pairs, improve velocity vector.

from the third stage, but the third stage had not ignited. Payload burned up over Africa after reaching an altitude of about 1,000 mi., a speed of approximately 16,000 mph. and after it had traveled some 7,500 mi.

Postponement from the preferred launching date of Nov. 7 was ordered after a valve stuck in the pumping system between the tankage and the combusion chamber of the first stage engine.

Actually, the valve was put into operating order by the desired launch time, but the decision to try to fix it and fire or to postpone had to be made well before the fix itself was completed, and project personnel decided in favor of caution.

Third USAF Try

Launching of the Pioneer II was the third attempt by USAF's Ballistic Missile Division to put a payload into an orbit some 40,000 mi. or less away from the moon's surface.

No further firings of lunar probes have been authorized for Air Force, although there is no doubt that others will be approved.

Changes made in the vehicle between Oct. 11 and the third launching included:

• **Second stage.** Doppler command engine cutoff was substituted for accelerometer cutoff, which had left fuel unburned in the October flight. Two retrorockets were added to retard the second stage at separation and ensure that it did not bump the third stage, which it is suspected of having done in the October flight.

Delay of one second was introduced between separation of second stage and ignition of third stage—again to ensure clean separation. In the October launching, separation of the second and ignition of the third were simultaneous. Spin rockets, designed to stabilize the upper stages, were increased from eight to 12 for the November launching. Spin rockets in the previous shot are suspected of having failed to give the stages the two revolutions per second desired for proper moon scanning, Air Force said. They also are suspected of having thrown the upper stages off course (AW Oct. 27, p. 34).

• **Payload.** Lighter Space Technology Laboratories television-type infrared scanner was substituted for the Naval Ordnance Test Station scanner previously used. STL scanner also was supposed to give better resolution. Cosmic ray telescope was added to study the Cherenkov effect. Measuring range of the ion chamber was narrowed to provide more precise information. Separate transmitter for the scanner was removed and a second telemetry transmitter, broadcasting on 108.09 megacycles was installed. First transmitter used 108.06 mc. The second would have provided continuous reporting of measured data, while the first was being used to receive Doppler command signals for firing of the eight vernier velocity rockets, jettisoning of the vernier rocket ring and firing of the retrorocket. Battery types also were changed, because batteries in the October payload apparently failed due to low temperatures. Weight of the Pioneer II was about 86.3 lb.

Mouse Orbit Planned

Cape Canaveral, Fla.—Attempt to put a mouse into orbit in a small satellite launched by a Thor-Able vehicle has been postponed from its target date of Dec. 15. Failure of the Pioneer II Thor-Able launching vehicle plus the crowded firing schedule at the Atlantic Missile Range was blamed for the delay.

Shot is part of an extensive program to test living matter under orbital and reentry conditions. Specimens will include microbes, mice, monkeys and, eventually, man. All but the man can be fired in the Thor-Able vehicle.

Von Braun Outlines Moon Program

By Craig Lewis

San Antonio—Army will try to hit the moon with its lunar probe by firing it along a flight path that calls for a travel time of less than a day and a half from launch to impact.

Fired east from Air Force Missile Test Center, Cape Canaveral, Fla., the Army probe is scheduled to reach the moon 33 hr. and 45 min. after launch. Intercept is scheduled to take place at a time the moon is within line-of-sight view of a tracking station in California's Mojave desert.

Schedule for the Army probe was described by Wernher von Braun, technical director of the Army Ballistic Missile Agency, at a Symposium on the Physics and Medicine of the Atmosphere and Space sponsored here by the Southwest Research Institute and the Air Force School of Aviation Medicine.

The relatively short, high-velocity flight path for the Army lunar probe was chosen because higher initial velocity provides a wider sweep of impact possibilities across the face of the moon. This allows a wider range of error in velocity of the probe.

Von Braun said this direct attempt to hit the moon is a simpler approach than the Air Force took with its longer flight time and its attempt to orbit the Pioneer probe around the moon.

Commenting on the relative complexity of the two approaches, Maj. Gen. Bernard A. Schriever, commander of the Ballistic Missile Division of Air Research and Development Command, estimated that the Air Force probe was more sophisticated by a factor of three or four because of the attempt to orbit.

Air Force has a satellite program, Schriever said, although it has no connection with International Geophysical Year efforts. USAF may operate satellites with high elliptical orbits for NASA in measuring radiation levels, and Schriever said the Air Force may do some satellite work for the Advanced Research Projects Agency, particularly in the area of communication relay satellites of a type described here by von Braun. This system envisions three satellites orbiting 120 deg. apart in an equatorial orbit.

Discussing the bands of radiation around the earth, Dr. James A. Van Allen of the State University of Iowa, said there is considerable uncertainty remaining in the wake of Air Force's Pioneer I flight.

Since there was a leak in the probe's ion chamber, the data can be taken for certain only as a measure of the minimum intensity. The ion chamber was supposed to be pressurized to 200 psi., but it was only at about 20 psi. at launch, and it is not known how much further it leaked down during flight.

Describing weight limitations and capabilities in rocket-powered manned space operations, Schriever said that Thor plus a second stage could put a man into a low altitude orbit, and Atlas or Titan with an added stage could put a man into high altitude orbit. Manned circumlunar flights on high elliptical orbits could be achieved, he said, with Titan plus "an appropriate added stage."

Schriever said that Air Force expects to be able to achieve a 300 naut. mi. orbit with about 30 lb. of gross launch weight per pound of payload in the near future. "Of more significance is an estimated 75 lb. per pound of payload to go around the moon and return," he said.

Entering a plea for a significant military role in space work, Gen. Schriever said:

"At this state in the development of the propulsion art for space exploration, the dividing line between military and civilian applications of rocket power is very thin to date—it is scarcely discernible. And, for the foreseeable future, our progress in the conquest of space will depend in large measure on the extent to which we can creatively pool civilian and military resources, both human and material."

A similar view was expressed by Air Force Chief of Staff Gen. Thomas D. White in a message to the group.

Boeing Renegotiation Bid May Set Pattern

By Irving Stone

Seattle—Outcome of the legal battle between Boeing Airplane Co. and the Renegotiation Board of the U. S. in the Tax Court of the U. S. is being watched by key members of the aircraft industry with intense interest.

The reason: This is the first Tax Court trial under the Renegotiation Act of 1951 involving a major member of the aircraft industry in which the recurrent, critical question of excessive profits under incentive-type contracts will be resolved. The feeling is that the decision will establish a precedent in pending and future cases where the issue is industry contention of confiscated earnings versus the government claim of too much profit.

Boeing's petition in the Tax Court concerns profits made in 1952. For that year, about $5.8 million of Boeing's earnings came from its share of savings under incentive-type contracts. Almost all the major aircraft industry companies have petitions pending in this Tax Court for redetermination of profits for 1953 and 1954. For all of them, the stake is large, and the Boeing case generally is considered to be the test in the contract renegotiation controversies involving aircraft industry members.

Justice Department Stand

The government is aware of this implication, in fact admits it. In his opening statement before the Tax Court, Justice Department attorney representing the Renegotiation Board indicated that the Boeing case may well become a leading case of 12 airframe cases involving some excessive profits totaling $84 million before credit for taxes, largely in 1952, 1953 and 1954.

"It is probably fair to say that this is the first time that the Renegotiation Board has been subjected to what amounts to a frontal attack by an industry. It is an attack on the board both from a judicial and legislative point of view," the Justice Department attorney declared.

One industry spokesman bluntly views the effects of renegotiation this way: "You can liken it to the Pied Piper of Hamlin—after we carry out our part of the bargain, we don't get to keep what we earned. Department of Defense has found and continues to find it desires to use incentive-type contracts. Renegotiation Board is of a contrary mind, believes they are a fraud and a sham and has succeeded in recapturing practically entire amounts of incentive rewards for cost reduction."

In the recent session of the Tax Court, Boeing as petitioner presented its case, and the Renegotiation Board as respondent began its presentation, which was temporarily halted when the presiding judge recessed the trial until Jan. 5 in Washington.

Attorney for the Renegotiation Board in his opening statement revealed the nature of the defense to be pitted against Boeing's attack, by declaring:

"Evidence is going to show that Boeing's operations in Wichita and Seattle, viewed from the over-all picture, were not efficiently carried out."

He predicted that "evidence will also show that Boeing had acquired a reputation with the Air Force as a high-cost producer."

Background of the Boeing case goes back to the renegotiation proceeding conducted by the Los Angeles Regional Board to which the matter had been delegated. This board concluded that Boeing has earned no excessive profits for 1952 and recommended a clearance.

The Renegotiation Board took over the case, determined on its own that Boeing had earned excessive profits (base and incentive type) of $10 million, less state and federal tax credits. Boeing and the board then filed its petition for redetermination in the Tax Court, as provided by Section 108 of the Renegotiation Act of 1951. There is no appeal from the Tax Court's decision, hence it is binding. The Tax Court hearing is a de novo procedure—a new, fresh determination based upon evidence presented in the Tax Court, and no prior proceedings before the Renegotiation Board are considered. This means, in effect, that the Tax Court substitutes its own independent judgment in the matter on the basis of stipulations between attorneys and evidence presented points.

Boeing Statement

Boeing's opening statement and presentation to the court covered these points:

• **Major product manufactured** in 1952 was the B-47, and 299 of these bombers were delivered in that year. In addition to its own production of this aircraft, Boeing was given responsibility for the B-47 joint production program, for which it received about $1.1 million in 1952.

• **Other activities during 1952** included delivery of 120 KC-97 tankers, 22 B-50s, which represented the tail end of production for this aircraft, and continued research and development on the Bomarc ground-to-air guided missile. Boeing also advanced the B-52 as important in judging company performance in 1952, pointing out that development work on this aircraft began back in 1946.

• **Total sales for 1952 was** about $740 million, with about 74% performed under incentive-type Air Force contracts (B-47 and KC-97). Net earnings before taxes were between $54 million and $56 million, depending on treatment given certain items of expense. This, it was pointed out, was less than 8% of sales before taxes.

• **Under the incentive-type contract,** USAF and the contractor (Boeing) start out with the production amount agreed upon for billing purpose only, based on estimates of what will be achieved in way of costs under contract. Contract states that after a certain number of these planes have been produced—in the case of the B-47, it was 100—parties then use cost experience data accumulated on these aircraft, plus any experience on production under previous contracts on the same type of airplane, and negotiate and agree on a target price for operation during the remainder of production under the contract. Target price consists of target cost and agreed profit rate. An underrun by the contractor below the target price gives savings divided 80% to government, 20% to Boeing. In an overrun, 20% is borne by the contractor, 80% by the government.

• **In fixing the profit rate,** 8% in the case of the B-47, USAF took into account practically all factors mentioned in the Renegotiation Act, such as volume of business, use of government facilities, extent of subcontracting, etc. In 1952, about $5.8 million of Boeing's earnings came from incentive savings, while the government received about $23 million under the contract.

• **Renegotiation Act of 1951** for the first time states that favorable recognition must be given to the efficiency of the contractor, and that this is set out before the statute begins to list the other factors that are to be considered. In addition to efficiency, the act relates to reasonableness of costs and profits, net worth, extent of risk assumed, contribution to defense effort, character of business such as complexity, extent of subcontracting, etc., and such other factors as the board may publish.

• **Item of $1.7 million taken as an** expense in 1952 costs in connection with the Model 367-80 prototype, which led to the KC-135 jet tanker and 707 commercial jet transport, is in issue. This was allowed by the Renegotiation Board as an expense, but in this Tax Court proceeding, the government is contending that it should have been capitalized and not taken as an expense.

Some of the vital points of the con-

T-39 Sabreliner Shows Speed Brake, Flush Antenna

Belly-mounted speed brake is extended for letdown in this view of North American T-39 Sabreliner twin-turbojet utility transport. Dark area on dorsal fin is an automatic direction-finding sense antenna; dark area at top of vertical stabilizer is VHF antenna. Flight view points up aft placement of General Electric J85 lightweight, low fuel consumption engines.

troversy were revealed in preliminary skirmishes before the case got under way. The Boeing attorney objected to the Renegotiation Board's stipulation comparisons between 1952 and 1946 through 1949, in terms of Boeing's profits, executive compensation paid and various other factors. The ground for the objection was:

". . . We believe that the period 1946 to 1949 is not a proper basis for any comparison on which to judge performance in 1952." This view was based on the contention that 1946 through 1949 was a sub-normal period —1946 and 1947 were loss years for Boeing, while 1948 and 1949 showed 2 or 3% sales profits before taxes.

The Renegotiation Board attorney, countering that Congress had said that a review of normal earnings shall be used in determining excessive profits, declared:

". . . We believe that a common sense meaning of the phrase 'normal earnings' means that it would be a review of a non-peak defense or war period earnings of a contractor, so that the court may compare what are normal earnings in peacetime against the inflated earnings of a renegotiable period."

Court Position

This issue was not decisively resolved, the court declaring:

". . . In my view, this is a rather peculiar situation . . . I gather that this petitioner (Boeing) had very little business that could be called normal in the sense that it sold its product to the general public prior to the beginning of hostilities in World War II.

"I think this court is going to need all the information it can get regarding its (Boeing's) experience before that time, and during and subsequent to that time . . . However, the weight to be given any of this evidence . . . is a matter of brief and argument . . ."

On another controversial and vital point, the Renegotiation Board attorney revealed that Boeing had sought, by subpoena, to compel the production of matter which "entirely reflects the internal considerations of respondent (Renegotiation Board) in reaching its determination of the $10 million of excessive profits in this case." It was claimed that Boeing wanted all reports, letters or written information submitted by or on behalf of the Air Materiel Command or Air Force officials to the Renegotiation Board or its Los Angeles delegate for information in connection with the renegotiation of Boeing for 1952.

The attorney also said that Boeing wanted all reports, recommendations, correspondence and data submitted by the Los Angeles Board to the Renegotiation Board in connection with the 1952 proceedings, as well as all profits made by Board advisory offices—the Office of Review and Office of Economic Review.

"It is plain from this group of subpoenaed matter that petitioner (Boeing) wants to go into complete details of what the board thought about its deliberations, the material it sifted, the years of its own integral parts, as well as the views of the Air Force which were submitted to the board, presumably at its request," the attorney for the Renegotiation Board declared.

"We feel," he said, "and I must say quite strongly, that this is entirely contrary to the statutory prohibition against review of the proceeding by the board and contrary, of course, to the equally firm statutory mandate that this (Tax Court hearing) shall be a proceeding de novo."

Boeing Rebuttal

In defense of the subpoena for the production of these records, the Boeing attorney pointed out, as an example, that a certain Air Materiel Command report was related to Boeing's performance in 1952 under its government contracts. "We know," he declared, "it covers such matters as whether Boeing delivered airplanes on schedule, what the quality of the airplanes was, what Boeing's performance was as to cost."

The court refrained from immediately ruling on this critical issue, declaring:

". . . Well, now, with the understanding that I will and intend to rule consistently that proceedings between the board and the Los Angeles Board, the internal workings of the board with respect to previous negotiations of the contracts here in issue are not material and I won't listen to any matter concerning that renegotiation proceeding, or their documents which go to that point . . . I do feel that . . . Boeing has a perfect right to search these files for the purpose of determining what, if anything, they contain which would be material to this proceeding . . . I am not going to rule on this motion at this time, but . . . unless you can stipulate together that the petitioner has a right to investigate the renegotiation files for the purpose of determining what they contain which is material to this case . . . and if you can't, I will then rule on this motion."

BuAer Plans Expansion of Industry Role

By Philip J. Klass

Virginia Beach, Va.—Weapon system and sub-system manufacturers will play an increasing role in the formation and shaping of Navy Bureau of Aeronautics' operational requirements under the bureau's new Industry Stimulation Program, a top Navy official reported here at the Navy-Industry Conference on Aeronautical Materiel Reliability.

Vice Adm. R. B. Pirie, deputy chief of naval operations for air, predicted greater participation by manufacturers at the early stages of weapon system planning and said industry will be given more information about the requirement and its accompanying military or operational analysis.

Adm. Pirie warned contractors that, in future Navy design competitions and evaluations, "the manufacturer with the reputation for making it work reliably will have the definite edge. We aim to concentrate our spending with those who can design and deliver . . . the least sophisticated gear that will do the job."

BuAer-Industry Board

Another Navy spokesman reported that Bureau of Aeronautics is establishing a 15-man group known as the BuAer-Industry Reliability Board for an all-out attack on growing problems of reliability and maintainability.

The new Reliability Board, consisting of Navy and industry representatives, will recommend ways to improve reliability, maintainability and safety and will disseminate technical information from field activities, operating forces and industry, according to Rear Admiral Leonidas D. Coates, BuAer's assistant chief for research and development.

Although naval aviation achieved its best safety record in Fiscal 1958 in terms of number of aircraft lost, the mushrooming cost of new aircraft sent total dollar losses spiraling, Adm. Coates told the conference. Average cost per accident has increased by a factor of five in the past five years, he reported.

Fiscal 1958 losses, 26% of them attributed to materiel failure, totaled $328 million, Adm. Coates said. Figures on the current year's first quarter accidents indicate that the Fiscal 1959 figure will climb to $371 million, he added. The 521 aircraft lost last year represent 17 jet fighter squadrons, 10 attack squadrons and three helicopter squadrons, plus 98 miscellaneous types.

Total of 38 man-hours of maintenance are required for each hour of jet fighter flight time, approximately two-and-one-half times the figure for fighter aircraft in 1948, Adm. Coates reported.

Other examples of the Navy's growing reliability and maintainability problems cited by Adm. Pirie include:

- **Combat availability** of carrier jet aircraft was only 36% in 1957.
- **Only 16% of Navy's jet** engines operate for a normal overhaul life.
- **Number of aviation enlisted** ratings now totals 28, compared with the five ratings that sufficed during World War II.
- **Avionics equipment in aircraft** has increased 400% since 1948.

Adm. Pirie called for "red-hot concerted effort to build in simplicity and reliability at the operational requirement and development characteristic stage."

The BuAer-Industry Reliability Board, which will be headed by Adm. Coates, will seek to identify specific reliability and maintainability problems in Navy aircraft and missiles and be responsible for seeing that they are attacked, either by its own committees or by other agencies, Adm. Coates said.

Navy and industry must jointly shoulder responsibility for the present state of affairs according to Capt. Robert H. Fagan, assistant director of Bureau of Aeronautic's Office of the Systems Director. "All too frequently we ask for operational performance which we are not willing to pay for in terms of funds, time or reliability. Often we are abetted in this folly by contractor's representatives and project officers within the Navy who underestimate what it will cost," Fagan said.

Reliability Estimates

Capt. Fagan called for an engineering estimate of the reliability of every new aircraft for its assigned mission, with reliability estimates for each of its component sub-systems. These reliability estimates must be based upon controlled tests of all aircraft sub-systems under anticipated environmental conditions, he said.

Such reliability programs will be expensive, Fagan conceded, but added that "this is an initial expense which can be predicted and not a hidden expense such as presently accrues in accidents, ground aircraft and supply problems."

Fagan also called for reliability program expenses to be set out as a separate cost item, not lumped in with other overhead items, in order to give Navy a measure of the amount of reliability effort that is required for a new weapon system.

In response to an AVIATION WEEK question, Capt. Fagan said BuAer is currently negotiating a new airplane contract which is the first to provide incentive payment for reliability as such. Contractor's profit will depend upon the new airplane's reliability, performance and cost, Fagan said. The manufacturer is believed to be Grumman Aircraft and the airplane Grumman's new A2F-1 attack plane (AW Nov. 10, p. 28).

Navy spokesmen reported that a number of steps are under way, or planned, to accelerate the flow of failure data from field installations to the manufacturers. Naval Air Technical Service Facility, Philadelphia, will soon take over processing of the 70,000 field failure reports received every month in an effort to slash the previous time of several months required to prepare monthly summaries that are sent out to manufacturers.

These Failure Unsatisfactory Reports (FURs) and Electronic Failure Reports (EFRs), which must be turned in by a maintenance man in order to draw a replacement part, give some data on cause and nature of a failure, but their meager information limits them generally to pinpointing trouble areas, manufacturers' comments indicated.

Industry Request

Several company representatives asked that Navy provide failure reports on competitor's aircraft in order to inform all industry designers of reliability of different components and sub-systems to aid in selecting reliable components and sub-systems for future aircraft.

Disassembly and Inspection Report (DIR) which Navy put into operation during the past year, a punch-card system for reporting the condition of components received for overhaul, is expected to provide more detailed data on field performance and experience, Lewis Jones, technical adviser to Naval Aviation Safety Center said.

However, Jones said the Navy is far from satisfied with its field trouble reporting system and is seeking methods to improve it, both in detail and in timeliness. He said existing automatic data processing systems tied in by leased lines to field facilities could provide accurate daily reports on field failures and operating experience.

Field service engineers should be brought into new weapon system development projects at the start to provide guidance to designers for improving reliability and maintainability, Rear Adm. Robert M. Reynolds told the conference. Adm. Reynolds is BuAer's assistant chief for field activities. "Service engineers have a lot of valuable knowledge and designers should listen to them," Adm. Reynolds said. He also called on manufacturers to give their

reliability engineers "sufficient stature in the organization and sufficient authority."

Adm. Reynolds also warned manufacturers that the Navy plans to get tough about reliability. "Aircraft companies should expect their production lines to be slowed or stopped when reliable weapon systems are not being delivered. Those companies that deliver aircraft of high reliability will be those companies that have a future."

USAF Ballistic Missiles Projects Face Accounting Office Probe

By Katherine Johnsen

Washington—General Accounting Office announced last week that it will conduct a thorough investigation of "all administrative aspects" of Air Force's ballistic missile program. Its report on the investigation will be submitted to Congress and will be made public.

Announcement of the investigation was made by Comptroller General Joseph Campbell at a hearing before the House Government Information Subcommittee to air GAO's five-month-old controversy with Air Force over the release of a report by the Air Force Inspector General entitled "Survey of Management of the Ballistic Missiles Program."

Campbell declared that USAF's refusal is illegal and is blocking GAO in its statutory function to appraise the self-investigation systems of government departments. He has formally protested to the chairman of five congressional committees: the House and Senate Armed Services committees; House and Senate Government Operations committees, and the House Armed Services Investigating Subcommittee.

Air Force Secretary James H. Douglas has countered that release of the report would have "a serious adverse effect on the effective administration of the Department." He said that "the public interest would best be served by not releasing the report . . . the goal of objective self-criticism can be attained only if the inspector general's organization has the assurance that its reports will, without exception, be kept within this Department."

The subcommittee is firmly in GAO's camp. Referring to Air Force's action as "this unwarranted restriction on information needed by the General Accounting Office to perform its duties," the chairman, Rep. John Moss (D.-Calif.) assured Campbell that the group "will fully support your position and insist that USAF faithfully observe the laws as written. . . ."

USAF is expected to have the support of Secretary of Defense Neil McElroy in its conflict with the General Accounting Office.

In March, Campbell said, the General Accounting Office and Defense Department Comptroller, Assistant Secretary W. J. McNeil, reached "complete agreement" on what defense information should be released to GAO. Subsequently, Campbell reported, the Secretary of Defense adopted two restrictions to the agreement "over our objection." These were included in the Defense Department order issued in July. The changes place limitation on the availability of information in Inspector General reports and in the furnishing of information to Congressional committees via the GAO.

A "statement of facts" contained in the ballistic missile report was submitted to GAO by the Air Force. Campbell said he considers this inadequate. "Analysis of this material indicates that some of the 'facts' are actually conclusions. In order to evaluate the facts and determine the reasonableness of these conclusions, additional information is needed." Campbell presented these three examples:

- **"The statement is made** . . . that 'test programs were integrated with minimum duplicate testing of components and maximum use of test facilities.' . . . However, the extent of the survey which led to the conclusions stated is not disclosed.
- **"Similarly . . . 'the statement** of facts' reports . . . that 'throughout the entire period of this survey, no individual interviewed could state that funds had not been available to support the approved annual program.' Without knowledge of the scope of the survey and extent of verification, we cannot appraise the significance of this statement.
- **"Also, . . . the material submitted** contains many instances of deficiencies in procurement practices but does not indicate the actions proposed or implemented to correct these deficiencies or recoup the additional costs incurred. We are, therefore, unable to ascertain the effectiveness of this survey or determine what prompt corrective action has been taken."

The Air Force statement, publicly released by the subcommittee, included this information on Ramo-Wooldridge Corp., manager of USAF's ballistic missile program and is now merged with Thompson Products Inc.:

- **"Much criticism was expressed** (by industry officials) with regard to the role and activities of the R-W Corp. . . . However, in large measure it was unwarranted since it failed to show any competitive harm or contractor detriment in carrying out contract terms."
- **Original $178,500 capital** contribution made in 1953, consisting of $6,750 each by Dean E. Wooldridge and Simon Ramo and $165,000 by Thompson Products, had been expanded to a total shareholders' equity of over $9.1 million as of last Dec. 31.
- **Fee on the basic management** contract for the May, 1954-November, 1955, period was $668,000, 14.3% of the estimated cost. In 1957, the fee was reduced to 10% of estimated cost.
- **Total assets had increased** from $248,000 on Dec. 31, 1953, to more than $29 million, as of Dec. 31, 1957.
- **Ramo-Wooldridge personnel** assigned to the Ballistic Missile Division's Ballistic Missiles Office increased from 18 in 1953 to 3,269 in 1957.
- **Total of 21,000 sq. ft.** of facilities space were in use in December, 1953, by Ramo-Wooldridge and government personnel assigned to the Ballistic Missiles Office. This had increased to 920,000 sq. ft. by December, 1957, with an additional 214,000 sq. ft. under construction and 283,000 sq. ft. of facilities in the planning stage. Buildings occupied were 56% owned by Ramo-Wooldridge, 11% by the government and 33% leased.

Hard Bases for Thor Planned by USAF

Los Angeles—Douglas Thor intermediate range ballistic missile soon can be launched from beneath the ground so that only a direct hit can destroy the missile before it leaves the muzzle of its launching tube, Maj. Gen. Bernard A. Schriever, commander of Air Research and Development Command's Ballistic Missile Division, told a meeting of the world affairs council here.

Schriever's report marked the first official announcement that any of the first-generation liquid propelled ballistic missiles will share the sub-surface launch capability usually attributed only to the solid propelled Minuteman and Polaris and the second generation Titan liquid-fueled ICBM. Present plans indicate that the land-based missiles will not use compressed air for initial launch like that planned for Polaris. Rocket powerplants will begin firing at the bottom of the tube. It may be necessary to provide some gas venting, but back pressure in the rocket combustion chambers is not expected to be an especially difficult problem.

Early Martin Titans may use a similar "silo" launch site, but the missile may be lifted to the surface before launching by an elevator.

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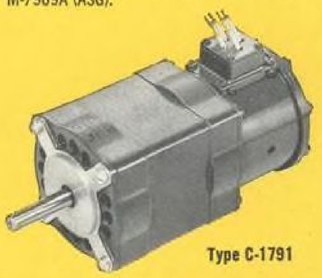

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Advisory Panels Listed by Killian

Washington—Presidential science adviser Dr. James R. Killian has reported the names of five of the 15 special Science Advisory Committee panels that are playing a major role in shaping U.S. policy on scientific and defense programs.

All five are concerned primarily with civilian scientific matters. Killian has until recently refused to name any of the panels or those serving on them. He told the House Government Information Subcommittee last spring that executive privilege extended to the panels because they advise the President, adding that their makeup changes frequently, anyway.

In addition to naming the committee and its panels, Killian said he has "special consultants, task forces and staff which are dealing with problems of considerable urgency." These and the committee itself total more than 50 scientists and engineers.

As special assistant to the President for science and technology, Killian attends some cabinet and National Security Council meetings and sits with the National Aeronautics and Space Council.

Killian said there apparently has been "a misconception abroad that my office and the . . . committee have operating responsibilities in government. We do not.

"We have no operational responsibility, for example, for the development of missiles or satellites. We have, of course, made intensive studies of various aspects of our missile and space programs for the information and use of the President . . ."

Panels he named and a summary of their activities are:

• **Science and Technology in Foreign** Affairs: Advises on the role of science and technology in supporting foreign policy objectives and seeks to help government agencies use science and engineering effectively in foreign programs, furthering international cooperation.

• **Scientific Information:** Now completing a study of government's responsibilities in coordination, acquisition, publication, translation, abstraction, storage, retrieval and dissemination of scientific and technical information. Killian quoted a UNESCO estimate that about one-tenth of one per cent of U.S. scientists and engineers can read Russian, while some 50% of their Soviet counterparts read English.

• **Space Science:** "Took the lead last winter and spring in suggesting the elements of a 'down-to-earth' program in space science and in providing a basis for proposals which were subsequently made by the Administration on the organization of a space agency (NASA)."

• **Research Policy:** Examines conduct of research and use of science by government, "especially the government's methods for formulating policy and achieving coordination in this field." Killian said "not only the nation's security but its long-term health and economic welfare, the excellence of its scientific effort and the quality of American higher education are affected by the care and thoughtfulness with which the government supports research." Panel also attempts to nurture important scientific fields such as meteorology, geology, geophysics, oceanography, radio astronomy, and studies of the upper atmosphere and combustion.

• **Science and Engineering Education:** Now completing a study "aimed at clarifying and highlighting objectives and needs of that part of our educational system which has the responsibility for preparing adequate numbers of first-rate scientists and engineers and for achieving a high degree of scientific literacy in the U.S."

Aircrafts Report Sales Up, Profits Off

New York—Cost increases and write-offs for commercial programs tempered what might have otherwise been an optimistic tone of nine-month financial results reported by major airframe and engine companies last week.

Typical of the paradoxical trend was Boeing Airplane Co. which reported healthy increases in sales and earnings for the period—sales up from $1,068,149,816 to $1,276,095,539 and earnings up from $24,077,427 to $27,328,805. But Boeing reported that the 2.14% profit margin the increased earnings represented was a decline from the first six months and the company expects a further decline for the full year.

Besides increased costs on B-52G and increased commercial write-offs, Boeing pointed out that actual costs to date on the 707 programs have exceeded earlier estimates. However, sales prices of the transports delivered or now on order will slightly exceed the costs, Boeing said, exclusive of research, developmental and general and administrative type expenses, written off as incurred.

Commercial jet transport write-offs also were cited by General Dynamics Corp. for a decline in earnings for the first nine months though sales increased to $1,153,498,834 compared with $1,133,182,305 for the period last year. Net income was $58,940,152 as against $66,709,954 last year.

Other major financial reports:

• **Curtiss-Wright Corp.** reported sharp declines in sales and earnings. Sales fell from $455,740,323 for the 1957 period to $288,456,741 this year and earnings dropped to $15,500,062 from $28,975,889.

• **Lockheed Aircraft Corp.** posted gains, earnings rising from $11,311,000 or $3.83 a share last year to $13,302,000 or $4.48 a share this year. Sales reached a nine-month record of $681,867,000, or 6% more than the $645,727,000 recorded for the same period last year.

Lockheed directors voted last week to split the company's common shares two for one, and the move sent the share price up 5⅝ to $62 in a single day.

• **United Aircraft Corp.** sales rose to $914,245,345 for the nine months this year compared with $869,241,138 last year but earnings declined from $38,300,349 last year to $30,504,323 for the period this year.

News Digest

New version of the Douglas A4D-2N Skyhawk will be built by Douglas Aircraft Co., which has received a U. S. Navy contract for more than $79 million for the job. Third version of basic Skyhawk design features improved weather and navigation equipment, pressure fueling and in-flight refueling provisions. Aircraft is about 1 ft. longer.

British team from Ministry of Supply and Vickers-Armstrongs Ltd left last week for the U.S. to discuss pooling U.S. and British studies of variable geometry aircraft. Team includes Dr. Barnes Wallis, designer of the Vickers 1,800 mph. folding-wing bomber Swallow (AW May 19, p. 34) and P. A. Hufton, director of the Royal Aircraft Establishment, Bedford. They will meet with officials of the National Aeronautics and Space Administration.

Beech Aircraft Corp. Boulder (Colo.) Division will evaluate dependability of propellant system components in USAF Titan intercontinental ballistic missile, under contract from the Martin Co. Program will include tests of extremes of vibration, temperature and pressure effects under various flow, shock and temperature conditions.

Radio Corp. of America has established an Advanced Military Systems group to create and develop advanced weapon system concepts.

Thor and Atlas test missiles are now carrying small, buoyant data recovery capsules to cover gaps in telemetered information during re-entry and to ensure against chance radio interference throughout flight. Located in nose cone, capsules are ejected at a predetermined point prior to cone impact.

Bilaterals May be Redrafted for Jet Era

France leads way in denouncing present bilateral; sweeping changes may come within next 12 months.

By L. L. Doty

Paris—Introduction of jet transports on international routes is bringing about sweeping changes in relations between U.S. airlines and foreign flag carriers that will call for a complete redrafting during the next 12 months of most bilateral air pacts now in effect.

Already, France has denounced its bilateral air agreement with the U.S. (AW July 28, p. 30) on grounds that principles agreed to in 1946, date of last agreement signed, covering operations of Douglas DC-4s and DC-3s, no longer have any significance in route planning for turbojet transports. France now intends to stand pat on the renunciation and will not give any ground until the U.S. is ready to concede to the majority of French demands for more routes beyond New York in the U.S.

This does not mean that France will close the route between Paris and New York to air travel. Under its present strategy, France will permit U.S. carriers (Trans World Airlines and Pan American) to serve Paris without an air agreement between the two countries after the present pact becomes ineffective next June. If the U.S. agrees to such an arrangement, and France is confident it will, Air France will retain unwritten reciprocal rights to continue its present Paris-New York service.

Renunciation by the French does mean this, however: U.S. carriers will lose their Fifth Freedom rights to operate beyond Paris. Fifth Freedom is the right of an airline of one country to carry traffic from a second to a third country.

Air France officials believe this threat is strong enough to persuade the State Department to relent in its position against giving France any more routes in America than it already has. Behind this belief lies a new interpretation, on the part of France, of the Bermuda principles—the pattern of which has guided the U.S. in the formulation of all its air transport bilateral agreements.

The U.S., in the past, has always insisted that traffic rights of carriers will be determined by the traffic-producing potential of the countries involved. In the case of the New York-Paris route, the U.S. has consistently pointed out that New York generates more original traffic than Paris and, therefore, route privileges between the two countries will be pulled far out of line in favor of France if Air France is given more U.S. routes. At the present time, Air France's Paris-New York route accounts for about 26% of all its traffic while the U.S. carriers receive about 6% of their total traffic from the route.

However, France has now put this interpretation on the Bermuda principle of equality of traffic rights: admitting that New York generates more traffic than Paris, it claims that the traffic is created, not because New York is a source, but because France is a traffic lure to tourists. French government officials stress this point and insist that the route is lucrative only because travelers seek holidays in France in preference to other tourists areas.

In planning future route patterns, Air France admits it may be on the conservative side in making forecasts designed to determine fleet requirements for jet operations. For example, studies conducted in France show that yearly increases of international traffic amounting to about 16% can be expected through 1961. This means an increase of 67% in traffic volume during the next four years which compares with one U.S. study that predicts a 96% traffic increase in the same period.

Air France has based its forecasts on statistical market studies of the areas it serves but has also been guided by the economic and political implications of jet operations in mapping future schedules and route structures.

Airlines Study Future

Most airlines now are studying future fleet composition of their competitors as one basis for the formulation of bilateral terms. Air France has ordered no turboprop planes on grounds that earning power of turbojets will far exceed that of the turboprop. Thus, Air France will seek route equality with countries using like or similar equipment to that ordered by Air France as a means of maintaining competitive power.

However, economic and political factors will begin to play a heavier role than they have in the past dealing with other airlines. So far, the economic implications of jet operations have outshadowed technical aspects of turbine power among international carriers. Conferees at the International Air Transport Assn. technical conference in Monte Carlo dwelt heavily on air traffic control problems but gave every indication that the major technical problems of jet transports have been all but solved.

The technical conference closed with some sharp differences on minor engineering points but unanimity of opinion on major issues was strongly evident during the course of the meeting. But the economic aspects of jet operations threw the IATA traffic conference last month at Cannes into a disastrous breakdown. According to airline officials here, the persistence shown by airlines in rigidly holding out for individual economic and political gains will characterize future negotiations on bilateral agreements.

The question in aviation circles here is: will the State Department, in bilateral negotiations, display the same strong resistance to the demands of foreign flag carriers at the risk of a break-down in talks that representatives of U.S. airlines showed at Cannes?

This reverse interpretation will be used by other foreign nations with popular tourist areas when negotiations with the U.S. are resumed for new bilaterals. It is a clue to the strategies the U.S. must cope with in future bilateral discussions when an attempt is made to apply the traffic generating power of the U.S. as pressure to offset the demands of foreign flag carriers.

Italy will take a stand similar to that held by the French. Spain has already hinted it will hold out against the grant of any further Fifth Freedom routes beyond Madrid to U.S. airlines until it is ready to bargain for more routes within the U.S., and Spain has indicated it will be ready for that bargaining only when its fleet of aircraft is expanded which, presumably, will be when the Douglas DC-8s on order are delivered in 1960.

Basically France is seeking a route from New York to the West Coast. However, it will ask for even more privileges as negotiations, which were resumed last month, progress. In effect, the French will insist that the U.S. match each Fifth Freedom route it receives from France for either TWA or Pan American with a similar route within the U.S. for Air France.

France is taking this new position because of an admitted fear of the big increase in seat capacity which it says will result with the introduction of turbojets. An Air France official here told AVIATION WEEK that operation of Pan American's Boeing 707-120 between Paris and Rome would saturate that market because of the high speed—and thus increased capacity with high utilization of the aircraft—and the "inevitable" attractiveness of the jets.

Pan American's recent announcement that reservations are over 300% higher this year than last as the result of new Boeing 707-120 service on th North Atlantic route has only serve to confirm these fears of Air France officials.

France also feels the U.S. is bluffing slightly in its statements that it wants no more routes beyond Paris than it already has. French officials here are convinced that the U.S. will refuse to surrender any of its present Fifth Freedom rights regardless of the cost and that it will willingly make further sacrifices in exchange for a route from Paris to Beirut, for example.

Unlike Italy and Spain, France does not expect to lose its competitive position during the next year while it operates in competition to the medium-range Boeing 707-120s and de Havilland Comets. Its sole purpose in asking for more rights is to give Air France competitive equality on all major international routes covered by U.S. carriers.

The airline begins to receive the first of its fleet of Sud Caravelle 210 turbojets early in 1959 and the first of its 17 Boeing 707-320s are scheduled for delivery in late 1959. The Caravelles will serve medium-range European routes. The Boeings will be placed on the North, Central and South Atlantic and Far East routes with a strong possibility they will be used on any European routes on which competitive carriers operate jets.

Capital Reports Gain For Third Quarter

Washington—Capital Airlines last week reported a third quarter operating profit of $1,467,517 and a net profit of $564,874 as compared with an operating profit of $394,422 and a net loss of $478,920 for the third quarter of 1957.

However, in a statement filed with the Civil Aeronautics Board, Capital said it had obtained a moratorium on payments for its Viscount turboprop transports to Vickers-Armstrongs (Aircraft) Ltd. in July, August and September totaling $2.4 million. Depreciation of $2,523,859 for the three-month period was taken on equipment.

Continental Airlines last week also reported a gain in third-quarter operating revenues—a total of $8,003,575, representing a 21% gain over the same period of 1957. The airline ended the period with a loss of $73,499.

Delta Airlines for the third quarter reported operating revenues of $21,907,985 and operating expenses of $20,993,240, leaving an operating profit of $914,745. After all charges, the net income after taxes amounted to $362,135 as compared with $355,938 for the third quarter of 1957.

KLM Royal Dutch Airlines for the first nine months reported a drop in revenues to $100,193,000 from $100,431,000 reported for the corresponding period of last year.

Third-Crewman-in-Cockpit Crisis Impedes Airlines' Jet Age Plans

By Glenn Garrison

New York—The new-born commercial jet age, still hampered by an unresolved flight crew crisis and other problems, continued its growth last week with these developments:

• **Pan American World Airways** began jet service to Rome, previously stalled by Italian demands that jet transports pay a surcharge over piston engine service. The issue is in abeyance, and PanAm's Boeing 707-121s are serving Rome at least temporarily without surcharge.

• **New York-London service** by Pan American was expected to begin Nov. 16 on schedule, but not with daily flights as originally planned. Frequencies are restricted by the failure of PanAm and its pilots to come up with a new contract including an answer to the third crewman controversy. Supervisory pilots are flying the jet runs, but there aren't enough to handle daily service to London as well as Paris. Daily flights to Paris will continue.

• **British Overseas Airways Corp.** expected to resume scheduled transatlantic service between London and New York last Friday, this time on a daily basis with its de Havilland Comet 4s. BOAC put the first commercial jet service on the run Oct. 4, but was forced by labor troubles to withdraw the weekly flights in order to concentrate on training for the daily service (AW Nov. 3, p. 38).

• **National Airlines** pilots were taking ground training at New York International Airport for PanAm jets in preparation for New York-Miami service scheduled by National beginning Dec. 10 with leased PanAm 707-121s. There were conflicting reports as to whether National would suffer from the pilot union problem.

• **American Airlines** was also busy checking out supervisory pilots in its provisionally-certificated 707-120 and gaining experience with the plane. Plans still call for first commercial jet service Jan. 11, although American's pilot problem also is still unsolved.

Pan American began serving Rome with its jets on Nov. 9, two weeks after opening commercial service to Paris. The Rome segment had been served with piston planes because of the surcharge issue. The surcharge question at Rome has now been deferred, according to PanAm, until International Air Transport Assn. takes up the whole hot surcharge subject next year. The association failed to reach agreement on the surcharge subject during very recent conferences (AW Nov. 10, p. 38).

While enjoying temporary relief from the Rome problem, PanAm was still saddled with another serious situation in the pilot issue. Plans were to round out November with a London service Nov. 16, 17, 23, 25, 27, 28, 29 and 30, with return trips Nov. 17, 18, 24, 26, 28, 29 and 30. Supervisory pilots will fly these schedules, according to the plan, and it is hoped that some break in the situation will have occurred by the end of the month.

A National spokesman told AVIATION WEEK that the airline has an "unwritten understanding" with its pilots covering the leased 707-121 operation. National and its pilots have signed a contract, but the third crewman issue was left open.

Air Line Pilots Assn. told AVIATION WEEK, on the other hand, that rank and file National pilots will not fly the jets until agreement on the crew issue has been reached.

Pilots in Training

National plans to fly two daily round trips between New York and Miami beginning Dec. 10, and it seems unlikely the airline could muster enough supervisory pilots to handle this schedule. Furthermore, the pilots undergoing training at Idlewild are not all supervisors, AVIATION WEEK has learned.

Pan American was scheduled to have received four of its jets by the end of last week, and may have a fifth by the time National's leased service begins. The sixth and final Pan American 707-121 is due for delivery before the end of next month.

National's colors will not appear on the New York-Miami jet run during the initial lease operation this winter. The airline won't have the 707-121s on a full-time basis, but will sandwich their utilization in between Pan American schedules, generally speaking. For example, one of the planes would finish a westbound flight from Paris in the early morning, be turned over to National for a round trip to Miami and go back on the North Atlantic for a Pan American late afternoon schedule.

American Airlines is going ahead with training for its supervisory pilots, but within another week or so will have run out of this category of pilot and the issue will be squarely on the table: will the other pilots agree to begin jet training in their turn? The airline had no definite answer last week.

Eastern, with five of its Lockheed Electra turboprops now delivered and

B.F.Goodrich

B. F. Goodrich Unilock Rivnuts® designed especially for aircraft and missiles

New lightweight steel Rivnuts with thread-locking feature preserve structural strength... save assembly time and costs

Ordinary anchor type fasteners used in aircraft and missiles require as many as three holes. And installation is made by two men who must have access to both sides of the work.

But new B. F. Goodrich Unilock Rivnuts can be installed by *one* man from *one* side of the work. Only one hole is needed. And the job can be done at any time during or after assembly.

This greater flexibility in manufacturing procedure means a substantial savings in cost. In addition, with only one hole required instead of three, greater structural strength is maintained.

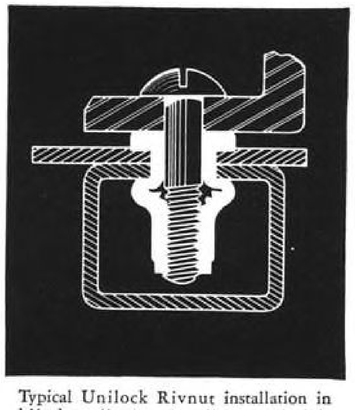
B.F.Goodrich Unilock Rivnuts, in fact, actually reinforce holes. That's because the equally spaced V-teeth under the Rivnut heads lock the Rivnuts to the material in which they are installed. This eliminates the need for a key and keyway – elements which ordinarily set up points of stress concentration.

The thread-locking feature is a short crimp in the shank of B. F. Goodrich Unilock Rivnuts. This provides attaching screws with an all-metal interference fit that locks them securely in place.

Made from aircraft quality alloy steel, B. F. Goodrich Unilock Rivnuts are actually lighter than most anchor type fasteners. Yet they will meet strength and torque requirements of Military specification MIL-N-25027 for lock-type nuts.

B. F. Goodrich engineers will be happy to make recommendations concerning the use of Unilock Rivnuts in your products. For complete information write *B. F. Goodrich Aviation Products, a division of The B.F.Goodrich Company, Akron, Ohio.*

B.F.Goodrich Unilock Rivnuts are basically the same in appearance and function as regular type Rivnuts. However, the Unilock design is identified by the V-teeth under the head and the crimped shank end which provides the thread-locking feature. Radial marks on top of the head readily indicate grip range.



Typical Unilock Rivnut installation in blind application. Installation principle is same as for regular Rivnuts.

Equally spaced V-teeth, made as an integral part of the under side of the head, engage with surface of material in which the Rivnut is installed, thus providing high torque resistance and eliminating need for keyed head and slot.

B.F.Goodrich ***aviation products***

at Miami, last week was still training supervisory pilots and hoping to negotiate a solution to the crew issue. It may be possible that an agreement covering the Electras but not future jets will be reached.

Transatlantic Service

Pan American's daily roundtrip transatlantic revenue operation is producing excellent passenger load factors with the jets–an overall average eastbound and westbound of about 95% from the first flight Oct. 26 through Nov. 8. During that period, Pan Am's 707-121s carried 540 de luxe passengers and 881 economy passengers eastbound, 558 de luxe and 972 economy passengers westbound, for a total of 2,951 passengers.

Only one revenue flight was able to fly nonstop during the above period–the New York-Paris flight of Nov. 4, which was accomplished in a record 7 hr. 1 min. of air time, or 7 hr. 26 min. block to block. This flight carried 37 de luxe and 56 economy passengers. It took off from runway 13R at Idlewild, low down in the Port of New York Authority's anti-noise runway priority scheme but the only really nonstop runway under present conditions (AW Nov. 3, p. 38).

Average elapsed time of the eastbound flights from Oct. 28 through Nov. 8 was 9 hr. 16 min. block to block. Average air time was 7 hr. 23 min. Westbound, average elapsed time was 10 hr. 16 min. and average air time was 8 hr. 58 min. Most eastbound flights stopped once, usually at Goose Bay but several times at Boston, while one eastbound flight stopped twice because of weather problems.

Westbound, all flights one-stopped from Paris, with the stops split about evenly between Keflavik and Santa Maria.

Airlines Win Depreciation Victory

By Robert H. Cook

Washington–Refusal of the U.S. Supreme Court to back a Civil Aeronautics Board rule regulating airline depreciation accounting procedures last week is regarded as a major victory by airlines.

Declining to review a decision of the Court of Appeals, which held that the Board has no authority to dictate airline depreciation policies, the Supreme Court also upset a lower court ruling in favor of the CAB-imposed depreciation regulations which have been in effect since Jan. 1, 1957.

As ordered by the Board, the policy set an across-the-board standard of seven years depreciation and a 15% residual value for aircraft. Scheduled carriers formerly used different formulas, ranging between four and seven years depreciation and 5 to 10% residual value.

Key to Problem

Key to the entire issue is the airline industry's ability to dispose of surplus piston engine equipment on a profitable basis. The Board has steadfastly maintained that its stretched-out policy and higher residual values would give the carriers sufficient leeway to recapture the cost of its piston engine aircraft.

On the other hand, the airlines contend that CAB not only lacked legal authority to impose such regulations but based them upon an "arbitrary" physical life of aircraft. Carriers further point out that their only practical hope of avoiding heavy losses in disposing of surplus aircraft is by measuring depreciation tables on the basis of competitive life of certain types of transports.

In addition, they said, varying delivery dates for jet transports and different equipment needs, makes any depreciation plan the distinct task of individual airline managements.

Collectively, the scheduled carriers feel they have gained an undeniable victory that also may remove at least one major stumbling block to solving their financial problems. (AW Oct. 6, p. 49). Financial circles have long criticized the maze of regulations which control the airlines and have singled out the lower depreciation schedules imposed by CAB as inflating airline profits to provide an unrealistic picture of industry earnings.

Attracting Capital

Financial analysts say removal of this "unrealistic" policy places airline earnings in a more "logical perspective allowing carriers to improve their cash asset position in preparation for jet deliveries."

Other sources say that brokers also have been counting heavily on a general fare increase to attract more capital for the industry. The CAB-imposed depreciation policy had the effect of causing a jump in net incomes, which created a false impression of their true economic status, the analysts say.

Civil Aeronautics Board spokesmen greeted the final court ruling as a clear opening for airlines to establish their own depreciation policies unless Congress should enact legislation placing this responsibility on the Board. The Board said it instituted the new policy as a method of "policing" accounting practices and that the Supreme Court action would have no effect upon the Board's powers or rate making or determination of what may be depreciated or at what rate. American Airlines first tested the legality of the CAB order in the U.S. District Court for the District of Columbia.

The decision, favoring the Board, not only covered the agency's authority but recommended that only aircraft spare parts which could be repaired would be depreciated, cost of major overhauls of airframes would be depreciated through a charge to a special maintenance reserve instead of being carried as current expense. This decision was later upset by the Appeals Court.

A second case involving depreciation on airframes is pending a decision from the District Court, although the Supreme Court ruling is believed to have predetermined its probable outcome.

American typifies the thinking of most major carriers which opposed the controversial depreciation policy. Planning an all-jet fleet by 1961, the carrier said its present Douglas DC-7 fleet, acquired since 1956 was ordered with the expectation that it would be obsoleted by jets thus requiring they be depreciated by the end of 1961.

Depreciation of the entire fleet of DC-7s over seven years with a 10% residual, the carrier says, would have left American with unrecovered costs of $30.3 million by the end of 1961. Its present depreciation policy of retiring this piston engine fleet by a common date will result in a residual value of $11.2 million by the end of 1961.

BEA Plans Reduction In Package Air Fares

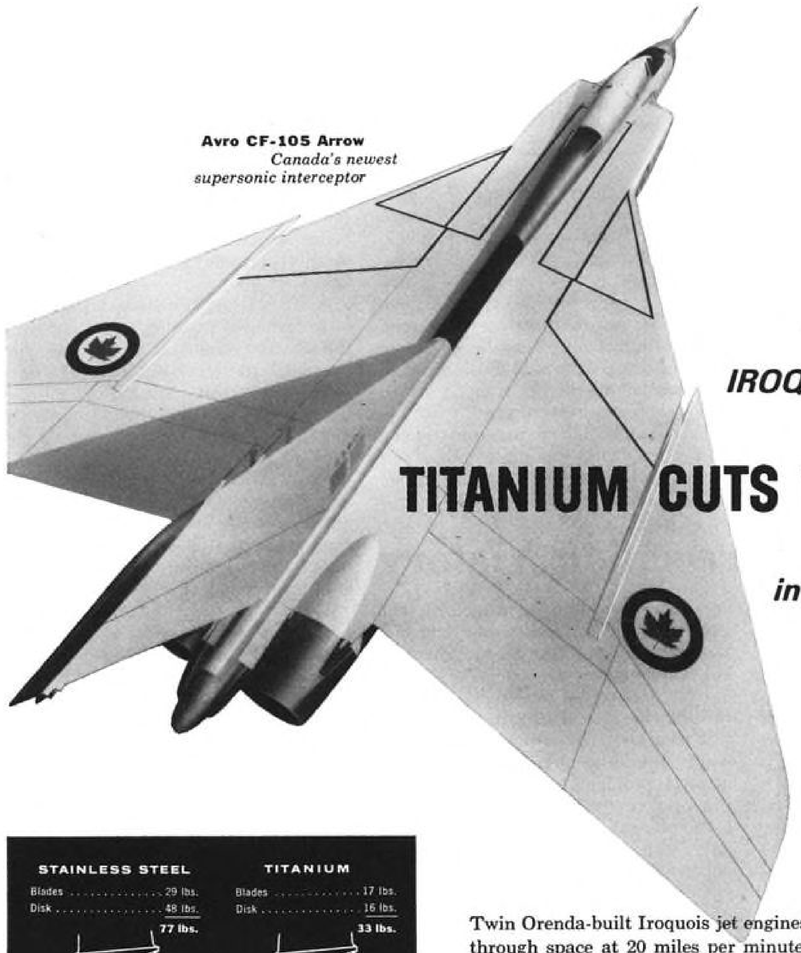
London–British European Airways is planning to reduce "package" tour air fares next year on mid-week night flights to 15 popular European vacation resorts. Giving some details of the plan, which is subject to International Air Transport Assn. and government approval, BEA said it would give cheaper Viscount air fares to travel agents selling "all-in" vacations. Company hasn't made public amount of proposed reductions.

JetStar Production

Lockheed will begin immediate production of its 600-mph. JetStar CL-329 utility jet transport at its Marietta, Ga. plant (AW Oct. 6, p. 23). First airplane will be off the line in 18 months.

More than 70 production positions have been sold to private companies. Jet also will be offered on off-the-shelf basis to potential government users and to USAF and air forces of other countries.

Both CAA and RCAF are interested in the $1 million jet. No military or foreign orders have been received yet.



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in compressor blade assemblies

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producing over 20,000 lbs. (dry) thrust.

Twin Orenda-built Iroquois jet engines will speed the Avro Arrow through space at 20 miles per minute. In these advanced design turbojets, as in the aircraft structure itself, every pound of weight-saving becomes a vital consideration.

To Orenda designers, titanium's high strength-to-weight ratio proved a double bonanza. By using titanium in place of stainless steel for compressor blading, much lighter titanium disks could also be used. *Result: A total weight saving in the assembly of 57%* (see diagram). In addition, lighter structural members could be used, contributing further weight savings and improving performance.

Mallory-Sharon, in cooperation with Atlas Titanium, Ltd., produced many of the titanium alloys which help make possible the Iroquois' superior performance. These same technical and production facilities are available to you *now* . . . to assist you in using titanium's outstanding physical and mechanical properties to maximum advantage. Write us for information or technical assistance.

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Integrated producer of Titanium • Zirconium • Special Metals

U. S. Urged to Tighten Bilateral Policy

Washington—Pan American World Airways is pointing to its heavy Latin American losses as evidence of what may happen to the balance of U. S. flag carriers in the international market if the government fails to strengthen its bargaining with foreign powers.

Although the airline is immediately concerned with the price cutting practices of foreign carriers in the Latin American market, Wilbur Morrison, Pan American executive vice president, feels that the powerful support a number of foreign governments lend their airlines in competing with U. S. carriers may eventually force the return of all U. S. international flag carriers to a subsidy operation. The only possible answer, he contends, is the active intervention of the U. S. government to avert a possible all-out price war in Latin America and a change in philosophy to demand equal rights for American carriers when foreign airlines seek new routes or authority. Both Pan American and Pan American Grace Airways are feeling the pinch on their Latin American routes by the low fares offered by their foreign competition (AW Oct. 13, p. 39; Nov. 3, p. 37).

Emphasizing the need for government backing "as vigorously as other governments back their own flag lines," Morrison says Pan American seeks the right to compete on a fair and equal basis "freed of artificial nationalistic restrictions on the service we can offer."

As an example, he said, Brazil restricts Pan American to 430 seats a week, the same number assigned several years ago, while the Brazilian airline, Varig, has subsequently increased its flights between Brazil and New York, and another Brazilian carrier, REAL, provides two round-trip flights a week linking Brazil with Miami and Chicago.

On the other hand, Morrison charges that the U. S. imposes no such restrictions on foreign airlines operating into this country and often allows "giveaway" routes which benefit foreign carriers at the expense of the U. S.

A demonstration of how this "generous" policy has harmed our international airlines, according to Pan American, was the agreement giving Lufthansa, the West German airline, authority to serve Boston, New York, Philadelphia, Chicago and either San Francisco or Los Angeles.

In return, American carriers were awarded the right to serve five German points: Frankfurt, Hamburg, Stuttgart, Munich and Dusseldorf-Cologne-Bonn.

New York alone, Pan American points out, has almost three times the combined population of all the German cities that U. S. carriers serve.

KLM, Royal Dutch airline, which also competes with Pan American in Latin America, realized revenues of $12.8 million out of New York, while American flag airlines were taking $109,000 out of Amsterdam, a ratio of about 130 to one, according to Pan American.

In the competitive picture in the Latin American market area, there are more airlines than there are in the rich domestic market of the U. S. Pan American says that in the last five years foreign flag carriers have increased from 11 to 23 along the routes between Miami, the coasts of South America, Panama, Central America and Cuba. These carriers' flights have jumped from 89 to 187 a week, the airline says.

An indication of this "crazy quilt of competition," Morrison says, is the 125-mi. hop between Buenos Aires and Montevideo, where 17 airlines compete.

Today, he adds, there are 60 airlines competing in the Latin American market. Of these, 45 fly between the U. S. and Latin America: 34 foreign flag and 11 domestic carriers.

Cut rate prices are only one of many factors which place American flag carriers at a disadvantage, according to Pan American. While the fare problem is generally charged to rate cutting by non-members of the International Air Transport Assn., Pan American says some foreign IATA member carriers, possessing domestic operations within their countries not subject to IATA regulations, are compounding the problem by offering "something for nothing" gimmicks to passengers.

One such carrier, owned by Argentine interests, offered a free aerial tour of the country if delegates to a Buenos Aires technical convention would fly the line from New York to Buenos Aires. Another carrier, Pan American charges, offered to charter a plane to the delegates at the regular round-trip fare and carry wives and children free.

Pan American's passenger revenues were down $3.3 million on its Latin American division during the first nine months of this year, forcing it to reduce its thrift fares in order to meet competition. Devaluation of soft South American currencies further decreased the yield of dollars taken to the U. S. since tickets are sold in local currency.

Pan American has particularly taken issue with the Civil Aeronautics Board's stand on reciprocal rights during which Board members stated that any foreign carrier route granted would be based on traffic between the U. S. and the country of the carrier's origin, as opposed to Fifth Freedom traffic.

Again using KLM as an example, Pan American contends that CAB interpretation of its stand can be taken many ways. KLM operates unrestricted in the heavily traveled U. S.-Venezuela market on a reciprocal rights agreement between the U. S. and the Dutch possessions of Curacao and Aruba.

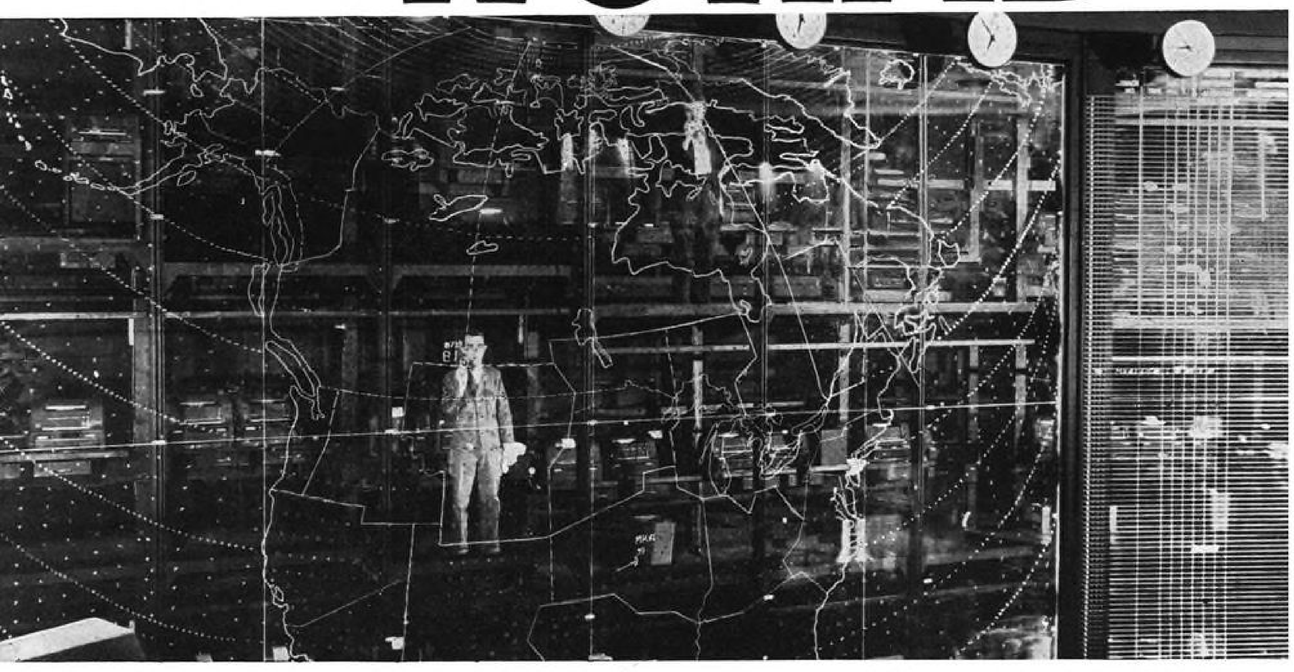
Final Assembly Starts on Continental 707-120

First Boeing 707-120 jet transport for Continental Air Lines has moved onto final assembly line at Boeing's Renton, Wash., plant after mating of fore and aft sections and wings (AW Oct. 27, p. 39). Aircraft will be delivered to Continental next spring.

Preserver of Peace . . .

Wrap-around bumper for a continent

NORAD



Headquarters—NORAD—Colorado Springs

Like a huge "bumper" wrapped around the North American continent and reaching down along both the Atlantic and Pacific shores, the North American Air Defense Command (NORAD) has been created for operational control of air defense units of the Army, Navy and Air Force of the U.S. and the RCAF Air Defense Command of Canada. Its field includes the vast area between the southern border of the United States and the northernmost limits of Canada and Alaska. Under the functional control of NORAD will be BMEWS (Ballistic Missile Early Warning System) and SAGE (Semi-Automatic Ground Control Environment) for the defense of specified sectors. In addition to its responsibility as prime contractor for BMEWS, the Radio Corporation of America is working on other important electronic assignments for NORAD.

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SHORTLINES

► **Allegheny Airlines** reports that it carried 49,062 passengers in October, setting a new company record for the fifth consecutive month. The carrier flew more than eight million passenger miles during the month, a 15% increase over October, 1957. The airline attributed some of the increase to the strike against Capital Airlines, some of whose routes parallel Allegheny's, called by the International Assn. of Machinists.

► **British Overseas Airlines Corp.** last week flew demonstration flights of its Comet 4 jet transport in four U.S. cities: Washington, Chicago, Detroit and Boston.

► **Civil Aeronautics Administration** lists Berlin as the leading foreign city in passenger origination on U.S. international carriers during 1957. At Berlin, 318,491 persons boarded U.S. flag carriers. Other leading foreign cities and the number of passengers boarded include: Havana, 185,950; Frankfurt, 143,115; Mexico City, 104,103; Nassau, 95,115; Montreal, 91,437.

► **Emery Air Freight Corp.** recorded a third quarter net income of $156,394, down from last year's $181,491, and a nine months net income of $325,162, which also falls below last year's $540,827. Compared with second quarter figures, however, third quarter revenues were up 21%, earnings 79%.

► **Pacific Northern Airlines** air cargo figures in October were 33% higher than those registered in October, 1957. Pacific Northern carried a total of 480,190 lb. of cargo between Alaska and the Pacific Northwest, with its sharpest increase in southbound traffic, up 100% over October, 1957. The airline also carried 11,018 lb. of air express during the 1958 period.

► **Shannon Free Airport,** Ireland, reports a 47.5% increase in landings during the third quarter of this year over those for the same period of 1957. A total of 3,858 landings were made during the record quarter to bring the total number of in-transit passengers to 176,156, a gain of 29.8% over last year's third quarter figure of 123,759 passengers.

► **TSA-Transcontinental of Argentina** has signed interline agreements with four U.S. carriers. The agreements, covering interchange of passenger tickets, baggage tags and cargo way-bills, were signed with American, Allegheny, Trans World Airlines and United Air Lines.

AIRLINE OBSERVER

► Watch for the Flight Engineers International Assn. to back up its strike threats in any negotiations involving the use of pilot-qualified engineers. FEIA regards its third crew member dispute with the Air Line Pilots Assn. as a last-ditch stand to avoid being swallowed by the more powerful union. ALPA says it feels that its demands that the third crew member be pilot-qualified will eventually be adopted by all carriers, based upon a Presidential Emergency Board recommendation to Eastern Air Lines. The pilots' union also says that approximately 50% of the airline industry now employs pilot-qualified engineers who are ALPA members.

► **Alitalia, the Italian airline, will finance the purchase of four Douglas DC-8s and a Link flight simulator through the Export-Import Bank, Douglas and Link Aviation. Purchase agreement calls for a total expenditure of $24 million, with the airline making a $6 million down payment. Balance of the funds will be: $13.7 million from the Export-Import Bank, $4.3 million from Douglas and $202,000 from Link. The airline plans to install 16,500-lb.-thrust Rolls-Royce Conway bypass engines in aircraft and is completing financial arrangements for the powerplants in Britain.**

► Purchase price for the Fairchild F-27 and F-27A turboprop transports will be boosted on Nov. 30—the F-27 from $590,000 to $635,000; the F-27A from $660,000 to $695,000. Fairchild Engine & Airplane Corp. officials attribute the increase to climbing production costs.

► **Costa Rican government authorities are expected to pass new taxes which will levy a charge of one dollar per person on all passengers entering the country on an international airline. Further tax proposals to be imposed on the carriers call for a per-kilo levy on arriving international air freight and an aircraft landing tax of approximately five cents per kilo. Pan American World Airways, KLM, TACA and LACSA, the Costa Rican airline, are fighting the proposal. Pan American estimates that the five-cent tax will increase its present monthly landing fees by a minimum of $7,000.**

► Philippine Air Lines is scheduled to resume service between Manila and Tokyo on Jan. 1 under terms of a recently signed bilateral agreement between Japan and the Philippines. Japan Air Lines, however, does not plan to inaugurate similar service for another two or three years, according to government sources in Tokyo.

► **Japan Air Lines and Canadian Pacific Airlines have cut rates on their Pacific routes by introducing a family plan on routes between Japan and the West Coast. Tokyo is expected to approve the new fares in the near future. Fares, which permit wives and children over 12 to purchase round trip tickets at the price of a one-way fare, will be effective daily between Dec. 1 and March 1. Pan American and Northwest airlines are reportedly considering similar fares.**

► Air Line Pilots Assn. has charged Civil Aeronautics Administration with "too hasty implementation" of its new air traffic control procedures. During its annual convention in Miami, the union particularly criticized a recent Civil Aeronautics Administration order combining CAA and Air Defense Command radar for en route traffic control. Under the joint agreement, radar advisory service for civil jet transports above 24,000 ft. was recently put into effect on three routes linking New York with Nantucket Island, Mass.; Bangor and Presque Isle, Me.; Boston and Montreal. By Dec. 1, the plan also will be implemented on two routes between New York and Miami and, by Jan. 1, on several transcontinental routes. Pilots have complained they were not briefed on the plan, merely informed that it was to be instituted five days before it was begun. ALPA passed a resolution authorizing legal action if necessary to ensure that any agency charged with air traffic control responsibility will not adopt any procedures that could deny turbojet operations use of the available airspace.

► **ARIA, the Israeli airline, has announced plans to purchase three Noratlas cargo planes from Nord Aviation of France. Prior orders for the twin engine aircraft were placed by the Israeli government for military purposes.**

Test your cross-country memory

Can you name this airport?

Clue: *the citrus fruit center it serves is the spring training site of the Washington Senators baseball team. (Answer below)*

Now test your aviation oil memory: Do you remember the two important reasons why Gulf oils are better for your engine?

1. In addition to providing efficient, thorough lubrication, Gulf aviation oils help keep engines *clean*—and safe!

2. Gulf-clean engines can go longer between overhauls, because there's less wear and tear on engine parts.

Choose either new Gulfpride Aviation Oil Series D, the detergent oil, or Gulf Aircraft Engine Oil, the straight mineral oil—both keep your engine Gulf-clean and safe.

The airport pictured above is the Orlando, Florida Municipal Airport, two-and-half miles east of the city. It has five paved runways, the longest of these being 5,500 feet.

Here you'll find friendly Gulf service under the supervision of Howard Showalter, president of Showalter Flying Service.

GULF AVIATION PRODUCTS

Fly safely with a Gulf-clean engine

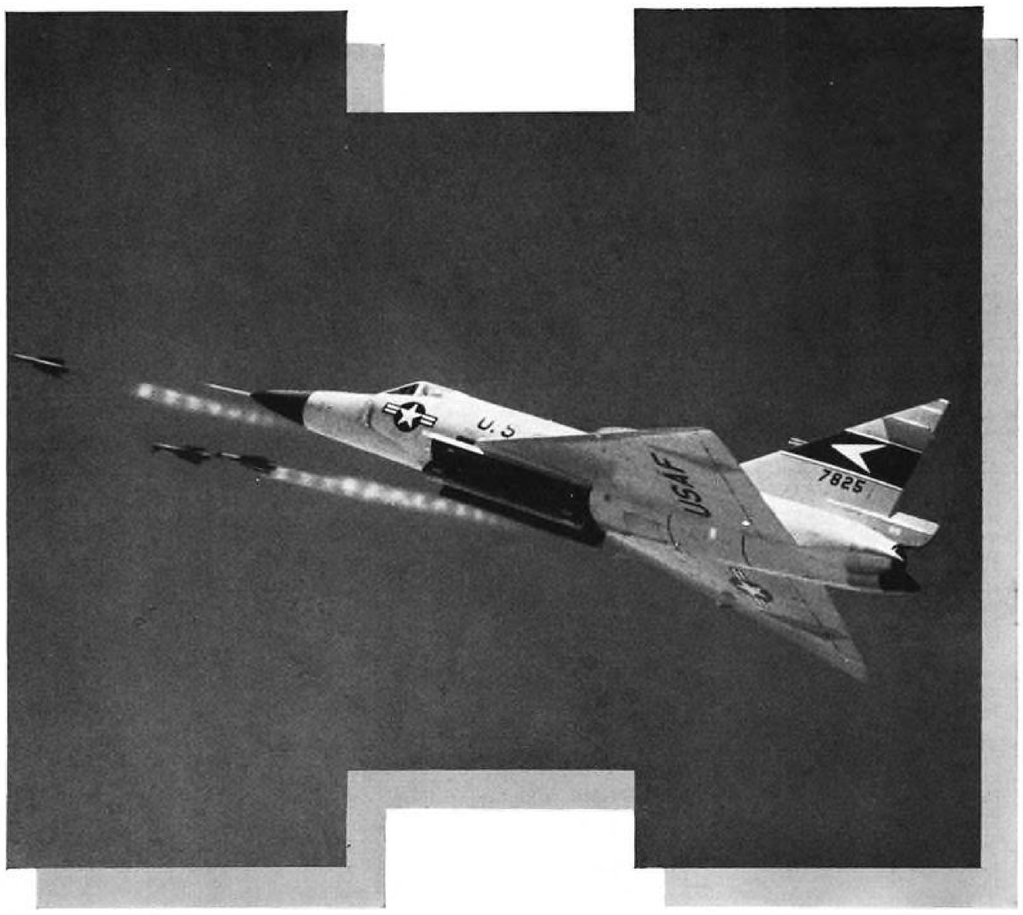
Airline Traffic—September, 1958

	Revenue Passengers	Revenue Passenger Miles (000)	Load Factor %	U. S. Mail	Express	Freight	Total Revenue Ton-Miles	% Revenue to Available Ton-Miles
DOMESTIC TRUNK								
American	630,213	432,160	66.9	1,630,181	872,292	9,241,214	53,357,256	58.9
Braniff	174,138	75,387	58.8	295,115	170,694	578,078	8,289,456	49.0
Capital	336,410	135,124	59.7	517,345	298,253	406,382	14,179,427	49.5
Continental	74,519	38,389	46.8	92,683	42,123	191,030	4,014,653	40.5
Delta	217,261	101,847	54.3	359,825	269,621	1,139,100	11,568,747	51.1
Eastern	600,526	302,496	46.98	879,973	510,749	1,308,637	31,871,260	42.91
National	99,067	54,573	46.1	231,455	50,179	448,205	6,024,192	39.4
Northeast	72,527	23,118	35.3	61,751	28,459	86,826	2,392,467	29.6
Northwest	141,736	104,808	57.0	470,340	252,681	1,021,783	11,831,622	50.7
Trans World	391,701	337,712	65.0	1,083,267	651,185	2,360,319	36,445,859	58.6
United	598,523	447,205	63.8	2,343,723	1,012,359	6,978,628	53,375,357	57.3
Western	113,301	60,270	49.9	223,118	83,672	343,403	6,429,172	41.6
INTERNATIONAL								
American	10,661	9,534	51.9	9,043	851	244,162	1,249,029	52.9
Braniff	3,625	6,940	47.6	14,161	.....	118,742	887,830	43.7
Caribbean-Atlantic	17,033	1,156	54.79	1,359	.....	3,483	125,204	59.34
Delta	4,453	5,493	52.1	6,799	.....	35,563	657,311	45.7
Eastern	30,068	43,230	46.96	79,071	.....	147,525	4,624,355	45.91
Mackey	5,253	1,209	39.7	.....	.....	1,651	132,142	42.6
National	7,867	5,656	58.1	9,483	5,538	41,481	661,017	52.1
Northwest	13,681	28,842	59.6	1,329,960	15,960	866,129	5,260,345	71.1
Pan American								
Alaska	4,110	4,408	52.0	27,874	.....	173,891	648,230	51.5
Atlantic	136,756	183,565	67.3	1,129,906	.....	3,013,139	23,213,995	65.1
Latin America	87,026	96,641	63.9	351,342	.....	3,888,648	13,756,060	63.7
Pacific	21,801	84,791	74.1	1,254,501	.....	1,996,217	12,119,356	73.6
Panagra	10,954	12,955	50.2	61,997	.....	419,005	1,899,443	54.1
Resort	.....	.....	....	.....	.....	3,753,133	3,753,133	76.3
Trans Caribbean	6,110	13,182	85.6	.....	.....	148,087	1,297,590	80.6
Trans World	34,296	101,007	61.6	902,330	.....	818,842	12,207,196	61.4
UMCA	161	53	42.4	.....	.....	1,565	7,251	52.7
United	8,933	22,200	61.5	142,645	.....	97,564	2,509,215	59.8
Western	1,626	2,503	47.4	1,577	.....	2,020	275,676	47.3
LOCAL SERVICE								
Allegheny	42,911	7,429	46.5	11,028	23,171	28,874	773,131	47.1
Bonanza	13,575	3,138	45.3	4,888	2,480	9,913	317,965	39.7
Central	12,436	2,386	34.4	5,682	3,668	12,677	250,929	31.5
Frontier	19,660	4,636	44.5	14,304	8,886	65,739	536,511	54.1
Lake Central	15,601	2,412	36.5	3,209	19,634	.....	253,872	40.6
Mohawk	39,347	7,439	51.0	8,160	17,101	16,906	752,036	51.5
North Central	68,258	11,560	48.1	23,829	40,960	.....	1,177,673	49.0
Ozark	38,106	6,453	48.0	10,275	23,373	23,214	672,330	50.7
Pacific	32,148	7,030	49.8	9,519	4,282	10,616	695,241	48.1
Piedmont	34,907	6,970	50.0	13,752	15,158	16,171	713,502	50.2
Southern	17,597	3,220	37.5	7,765	10,578	11,272	338,441	37.6
Trans-Texas	20,005	4,562	38.5	13,001	7,499	26,171	483,611	39.1
West Coast	21,155	3,975	48.75	5,179	2,367	16,385	403,752	47.57
HAWAIIAN								
Hawaiian	32,273	12,105	74.1	4,341	.....	118,661	1,273,397	74.7
Trans-Pacific	15,013	2,167	53.3	642	.....	7,646	182,235	52.2
CARGO LINES								
AAXICO	.....	.....	....	5,348	10,957	3,289,297	3,305,602	*
Aerovias Sud Americana	.....	.....	....	.....	.....	647,203	647,203	73.2
Flying Tiger	8,177	36,358	99.9	35,821	33,787	6,963,527	10,668,860	87.3
Riddle								
Domestic	.....	.....	....	20,941	33,499	4,376,722	4,431,162	90.3
International	.....	.....	....	.....	.....	721,543	721,543	81.8
Seaboard & Western	993	3,874	100.0	149,481	.....	2,918,918	3,456,229	61.04
Slick	248	2,057	90.06	.....	.....	392,892	598,625	96.10
HELICOPTER LINES								
Chicago Helicopter	11,591	215	39.9	1,297	.....	.....	21,875	28.3
Los Angeles Airways	2,682	104	52.9	4,065	2,304	.....	16,231	59.5
New York Airways	9,708	187	49.0	1,665	855	521	20,929	47.1
ALASKA LINES								
Alaska Airlines	6,958	3,970	46.9	51,751	3,316	256,009	723,866	*
Alaska Coastal	4,418	399	60.0	3,880	.....	4,270	49,154	64.2
Cordova	1,046	173	41.5	4,702	.....	29,797	52,427	51.4
Ellis	5,673	319	59.74	2,078	.....	2,168	36,784	68.85
Northern Consolidated	2,141	702	51.0	23,723	.....	81,666	184,028	67.0
Pacific Northern	10,311	9,578	53.1	100,728	6,207	316,638	1,461,961	65.3
Reeve Aleutian*	.....	.....	....	.....	.....	.....	.....	....
Wien Alaska	3,955	1,268	18.8	30,199	.....	179,193	340,222	48.2

* Not available.

Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board.

Sharpening the Falcon's claw



Faster flying, higher climbing, farther reaching ...the new supersonic Falcon air-to-air guided missile. Conceived, developed, and manufactured by Hughes Engineers, it is today's best performing air-to-air missile.

The Super Falcon GAR-3, newest in the family of Falcon missiles, is powered by a new and longer-lived solid propellant rocket engine. It can climb far beyond the altitude capabilities of the interceptor and destroy an enemy H-bomber in any kind of weather.

Hughes Research & Development Engineers, always moving forward, are also developing the GAR-9, a new atomic air-to-air missile which will be used with the F-108, a fantastically swift long range interceptor being built for the Air Defense Command.

The new atomic missile will be able to reach out over extremely long distances and destroy enemy bombers long before they reach their U.S. and Canadian targets.

Advanced Research & Development at Hughes is not confined to just guided missiles. Investigations presently underway at the Hughes R&D Laboratories include Space Vehicles, Advanced Airborne Systems, Nuclear Electronics, and Subsurface Electronics...just to name a few. At Hughes in Fullerton engineers are engaged in the Research, Development and Manufacture of advanced three-dimensional radar systems. At Hughes Products, the commercial activity of Hughes, advanced Research & Development is being performed on automatic control systems, microwave tubes, and new semiconductor devices.

The challenging nature and diversity of Hughes projects makes Hughes an ideal firm for the Engineer or Physicist interested in advancing his professional status.

Photo at left shows Convair F-102 firing salvo of Falcon GAR-1 air-to-air guided missiles.

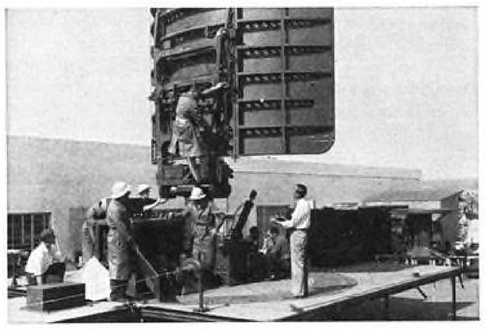
An immediate need now exists for engineers in the following areas:

Computer Engineering	Systems Analysis
Field Engineering	Microwaves
Semiconductors	Circuit Design
Technical Training	Communications
Microwave Tubes	Radar

Write in confidence, to Mr. Phil N. Scheid,
Hughes General Offices, Bldg. 6-R-1, Culver City, California.

© 1958, HUGHES AIRCRAFT COMPANY

Sophisticated Hughes Electronic Armament Systems control high-speed jet interceptors from take-off to touch down, and during all stages of the attack.



Ground Systems being developed at Hughes in Fullerton provide mobile three-dimensional radar protection and high-speed data handling.

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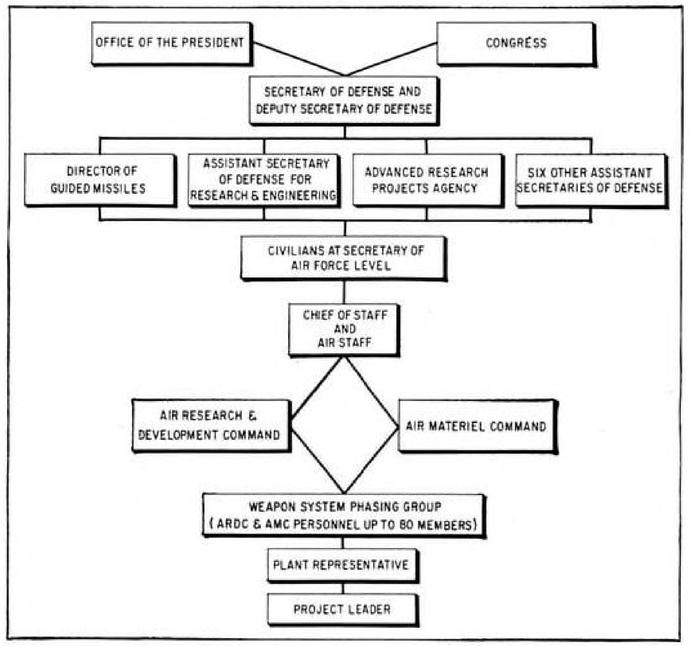
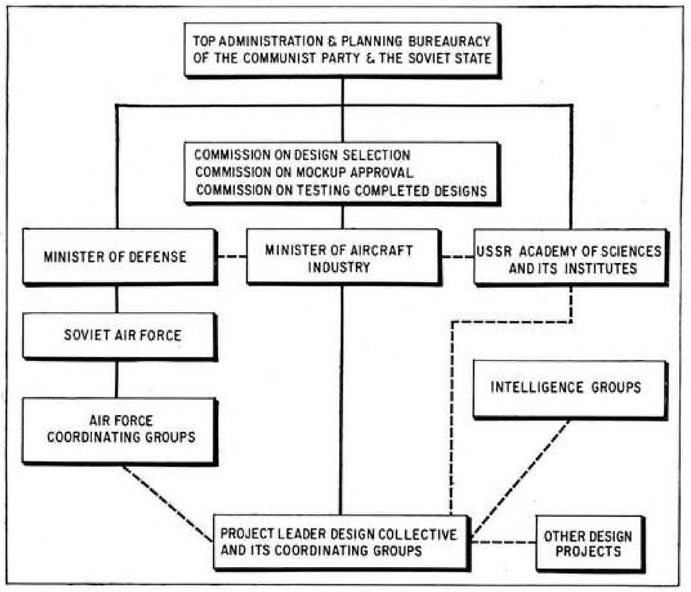


Decision Channels Compared

Major command channels are shown for the average United States (above) and Soviet Union (below) combat aircraft projects. The Soviet designer has considerable technical freedom and is responsible only to the Minister of the Aircraft Industry. The only schedule control the military exercises is through the commissions above the minister which select the designer for each project, approve mockups and conduct final flight testing. United States designers must constantly go up the chain of command, usually as far as the Department of Defense, to get approval for every facet of their work. Solid lines shown here are those of direct authority; advisory and liaison relationships are dashed lines.



Soviet Union

By J. S. Butz, Jr.

(This is the first of two articles detailing the structure of the Soviet Union's weapon system management organization.)

Washington—The Soviet Union is employing the U.S. big business management technique of decentralizing authority to accelerate its rate of technical progress. Following this U. S. business pattern, Soviet bureaucracy is delegating power to make decisions to the working engineering level and placing it in the hands of individuals rather than with committees.

Best available sources and Soviet technical literature agree that authority over Russian aircraft and weapon programs has been largely decentralized, with each project being placed in the hands of a single technical expert in Soviet industry.

Once the Russian armed forces, fiscal authorities, Academy of Sciences of the USSR and other interested organizations have collaborated on the policy decision and laid down general specifications for the development of a new aircraft, a single designer in industry normally is given primary control over the project.

Conversely, the U. S. government has moved toward centralization, placing over-all authority within a few Pentagon offices, ostensibly to watch expenditures and save money. Leadership by groups rather than through the auspices of individuals has been the rule in these offices.

Charles E. Wilson, former Secretary of Defense, said shortly before leaving office in the fall of 1957:

"The bigger the enterprise, the greater the need to decentralize the actual operations, retaining for top management the function of establishing and clarifying policy and following up on performance . . . After more than four years in the Pentagon, I am convinced that centralization or consolidation, in itself, is not the panacea of our management problems."

The military's role in aircraft and weapon development in the Soviet Union is essentially that of an adviser with no direct authority over the designers.

Any complaint the Soviet Air Force wants to make concerning an aircraft design in progress must be taken to authorities high in the Ministry of Defense. These authorities, if sympathetic, must then go to the Minister of the Aircraft Industry and convince him that he should correct his designers.

This does not mean that the Soviet Air Force is not in constant contact with the designers within industry or that it does not coordinate the vast number of detailed decisions that must be made in the design of modern weapons. Neither does it mean that the Russian designer disregards Air Force thinking. The Soviets have, however, placed the authority to make decisions with the designer rather than scattering authority around and above him in the indeterminable number of offices that compose any bureaucracy.

Soviet industry engaged in design work is free to proceed at maximum speed and is not required to obtain the military's approval at every step. No complicated or involved bureaucratic process is required to keep Russian design projects moving since the authority is invested in one man. Only the power to disapprove is tied up in the layers of bureaucracy that seem inevitable in the management of any organization as large as the Russian military establishment and state-run economy.

In decentralizing control over weapon development and placing authority over, and responsibility for, each project in the hands of an individual, the Soviet Union has approached the key problem regarding large enterprises in the same manner that a number of American corporations began to answer the question in the 1920s.

The key to successful decentralization is for the top leaders to convince themselves that they can safely decentralize their authority over detailed administration and expand their power only by rigidly controlling general policy.

General Motors, duPont, General Electric and most other large U. S. industrial complexes have pursued a policy of management decentralization that became more extensive as they grew larger.

Most of these corporations are split into divisions that are essentially operated as separate companies. The divisions are further divided in a number of different ways, but the management technique is nearly always the same. Complete responsibility and authority for each division and subdivision is placed firmly in the hands of one individual.

As a general rule, the Russian decentralization of control over weapon development places most authority and responsibility for each project with a project leader. In the case of combat aircraft, for example, someone with the technical background, experience and success of a Tupolev or Mikoyan is ordinarily the project leader.

When the planning decision has been made to proceed with a particular new aircraft, the fate of the project is essentially in the hands of a single technical leader who is assisted by administrative and fiscal specialists as well as by his technical group.

The Air Force and other Soviet military customers play a prominent role in selecting the designer to develop each aircraft, in the State mockup evaluation and in the State flight test of each finished design. This also includes the determination of the size of any bonus that the designer and his technical people are to receive.

The designer usually is not bound by a detailed set of specifications. His primary guarantees to the ministry and the military usually are top speed, ceiling, payload and range. The Air Force is definite in establishing broad requirements for the equipment it wants to perform a certain job, but it has turned over to industry the customer's prerogative of insisting that it be done in a particular manner.

Any deviation from Soviet Air Force equipment practices, personnel capabilities, design methods and standards are officially explained at the State evaluations, with the designer detailing why his ideas are an improvement.

Unofficial Air Force reaction to every

Decentralizes Weapon System Authority

Decision-Making Process

Steps	United States[1]	Average Time, United States	USSR[2]	Average time, USSR
I. Determine requirement	3 years	Total planning time, 5–6 years.[3]	.....	Total planning time, 1½ years.
1. Development planning objective (DPO):				
(a) Strategic and tactical need.				
(b) Scientific concept.				
2. Feasibility study.				
3. General operational requirement (GOR).				
II. Plan development	2–3 years	.....	.....	
1. Development plan (DP).				
2. Development directive (DD).				
3. Selection of contractor.				
III. Design and develop weapon	2¼ years	Total development and production time, 5 years.	2½ years	Total development and production time, 3½ years.
1. Research and development contract.				
2. Mockup.				
3. Design approval.				
4. Prototype production.				
5. Prototype testing.				
IV. Production for inventory	2¾ years	.....	1 year	
1. Production contract.				
2. Engineering and configuration changes.				
3. Production tooling authorization.				
4. Production acceleration authorization.				
5. Operational testing.				
Total	.....	10–11 years	.....	5 years.

[1] Defense Department Study Group on Manned Aircraft Systems. (Robertson Report)
[2] Col. William F. Scott, USAF (master's thesis).
[3] Planning time for ballistic missiles—ICBM Atlas (1946–54), 8 years; IRBM Thor (1951–55), 4 years.

SOVIET UNION apparently holds its main time advantage over the United States in weapons development during the planning stages. Since World War II, the United States has spread control over the development of weapons through many offices rather than giving single commands the authority, responsibility, personnel and funds for the task.

CASE HISTORIES

Two precision ball bearings, one concentric within the other, are periodically rotated in alternating directions during operation—thus reducing random drift to 0.25 degree per hour.

Photo: courtesy Sperry Gyroscope Co.

1,200% Gain In Gyro Accuracy With N/D Ball Bearings

CUSTOMER PROBLEM:

Get new, advanced gyro bearing design "off the board" and into production. Sperry Gyroscope Company, in developing its new Rotorace (TM) gyro, designed a special bearing capable of "averaging out" error-producing effects of friction on sensitive gyro gimbals. New manufacturing techniques would be required to achieve high degree of precision required by Sperry design.

SOLUTION:

N/D Engineering, when approached by Sperry, created special manufacturing techniques for the high precision production of these unique piggy-back gimbal ball bearings. Used in the Rotorace design, the bearings helped achieve reduction of the gyro's random drift rate. The 2 or 3 deg. per hour drift, recently considered very good, is now cut to as little as 0.25 deg. per hour, with still lower rates in sight. Another example of New Departure's ability to meet exacting instrument bearing requirements through broad engineering experience and precision manufacturing techniques.

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NOTHING ROLLS LIKE A BALL

U. S. Lead-Time Lag

"A nation can achieve a basic advantage if it is able either to develop or to produce weapons more rapidly than its opponents. One of the major weaknesses in our strategic posture has been our inordinately long lead time . . . the interval between conception and execution."—Rockefeller Report, 1958.

"Some of our weapon systems take from seven to 10 years from conception to operational availability. Unfortunately, Russia has worked out systems whereby they are able to do the same thing in about one-half the time."—William C. Foster, co-chairman of the Gaither Committee.

"It is easy to see that precisely the time element is the decisive factor which should be grasped in the completion with the capitalist countries in the field of technology."—A. Blagonravov, member of the USSR Academy of Sciences working in the field of armaments, 1958.

"There is a growing lack of trust in the capability and performance of individuals at the working level in research and development, not only in the Air Force but throughout the government. This growing lack of trust has resulted in taking away from the working level the authority, but not the responsibility, for research and development projects and diffusing the authority in a host of organizations and individuals in higher echelons; it has resulted in an increase in staff work of all sorts on matters of minutia; it has resulted in increasingly detailed technical direction from higher policies and planning echelons to working-level echelons in the research and development organizations; it has resulted in an increase in the constraint on the use of money, people, facilities and on the resources required at the working level to do the research and development job. The lack of trust is extended into contractual relations with industry, academic and other private organizations.

"Unless trust is restored and these symptoms of distrust eliminated, the Air Force can never hope to reduce the length of its development cycle to that required to maintain technical superiority in weapons over our potential enemy."—Report of the Stever Committee on Research and Development of the Air Force Scientific Advisory Board, 1958.

facet of the new aircraft is available to the designer at all times through military and industry coordinating groups.

The project leader, along with being in charge of the bureau which is designing the new aircraft, usually also is manager of an experimental aircraft plant. Both the bureau and plant have coordinating groups that maintain liaison with the Soviet Air Force, the Ministry of the Aircraft Industry, the USSR Academy of Sciences, the central planning organs of the Soviet State and many authorities.

Main purpose of these coordinating groups is to keep all interested parties informed of the course that the project leader is following and his rate of progress.

Another function of the coordinating group is to give the project leader a means of keeping up to date on the various design and exploratory work going on in the Soviet and foreign aircraft industries.

Procedure for Halt

If there is friction or disagreement, the only way to halt the project's course is to work through the Minister of the Aircraft Industry. The Minister is the only man with technical authority over the project leader during the design and test period.

In such an arrangement, the top echelon of Soviet bureaucracy that has delegated such substantial authority to a subordinate also has taken the responsibility of shielding the subordinate from outside disturbances that might impede his work.

This has particular significance in the Russian system, with its high rewards and severe penalties. The top bureaucrat in a ministry, as well as the project leader, has a vital interest in seeing that the project is completed successfully in a short time period.

Tupolev's Experience

A. N. Tupolev, one of Russia's oldest and most experienced designers, has experienced both sides of the Communist reward and penalty arrangement.

In the post-war period he has received the Stalin prize first class, which carries an award of 200,000 rubles; has been decorated with the Order of Lenin; holds the title of General Designer of the Ministry of the Aircraft Industry, and is manager of a large aircraft complex with many design collectives under his direction.

Prior to World War II, however, he was confined for a prolonged period by the Soviet police. While his primary difficulty was political, the charges against him included professional incompetence. He regained his freedom about the time of the war with Finland in 1939 when many technical shortcomings were apparent in the Soviet Air Force.

Russian scientists today imply that

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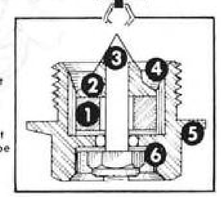
They eliminate oil loss during inspection and reduce fire hazards due to draining into cowling and airframe.

Illustrated above is the vertical-seal design with a Lisle Magnetic Chip Detector fully removed (top photo) and halfway installed (bottom).

Lisle Self-Closing Valves make it more convenient to service Magnetic Chip Detectors and Magnetic Plugs.

CHIP DETECTORS by LISLE



One of the many Lisle Magnetic Chip Detector Designs, showing
(1) Alnico Magnet
(2) Magnet Extension
(3) Non-Magnetic Terminal Shaft
(4) Insulating Tube
(5) Plug Body
(6) O Ring.

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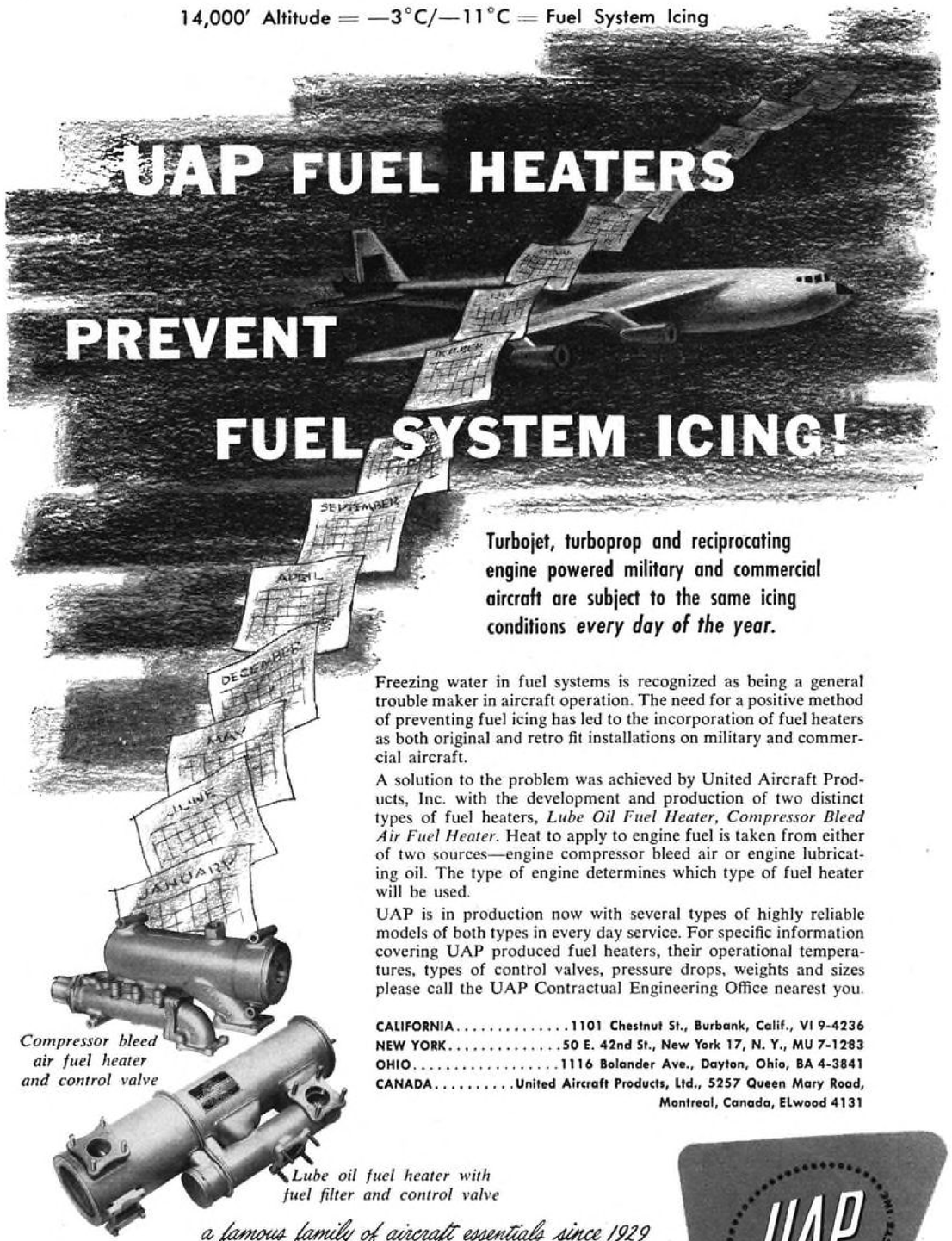

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UAP is in production now with several types of highly reliable models of both types in every day service. For specific information covering UAP produced fuel heaters, their operational temperatures, types of control valves, pressure drops, weights and sizes please call the UAP Contractual Engineering Office nearest you.

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they are allowed to stay fairly free of politics, but the Soviet press continually carries stories of incompetent managers and "lazy" workers who have lost their jobs. In Communist terminology, these people become "free-workers" who are usually transferred to Siberia where they must meet their work quotas to earn their daily meals. Serious incompetency is labeled sabotage and usually results in a prison sentence.

Evolution of the present Russian industrial management system, with its wide decentralization of authority, has been a stormy one with many changes, although the fundamental centralization policy of the Soviet rulers has not changed since the Revolution.

Party Centralization

Absolute centralization of power does exist in the Soviet government, and with two overriding objectives. The first is to keep all political power firmly in the hands of the leaders of the Communist party; the second is to allow the State to control the industry and economy.

The highest party officials maintain strong centralized control of policy making and exercise detailed administrative power in police organizations and political activity.

Industrially, and particularly in recent years, the story is vastly different. In this area, centralization has extended primarily to policy making and overall planning.

Much of the trouble that has arisen in Soviet industrial management has occurred because of the insistence of the party that political theory and doctrine be made a part of the professional life of all Russians. Two overlapping and formal chains of command have been used by the Communists since the Revolution to implement this political control and to serve as a double check on the activities of those in authority. One line of authority is the Soviet State, the other is the Communist Party.

Party Interference

Plant directors and enterprise managers who are state officials were seriously handicapped during most of the 1920s because the party and trade union organizations in their plants were able to interfere with any and all of their actions. This situation produced industrial chaos, with production falling below the pre-revolution level.

In 1928, the top leadership of the party began clarifying the management rights of the directors, the unions and the party. The main result was that within a few years the trade unions had lost most of their power.

During the 1930s, when great efforts were made to improve the output of the individual worker, the unions became

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Flight-test programs for the latest jet bombers, transports, and airliners are now utilizing PLEXICODERS for commutation and PDM coding of strain gage and thermocouple data. Feeding into CEC magnetic-tape systems, the PLEXICODERS make possible direct recording of single- or double-ended, positive or negative, low-level inputs for hours of flight time.

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What's new in TITANIUM welding:

Resistance and fusion welding as fabrication procedures have become increasingly important with the advent of missiles and aircraft designed for sustained operation at Mach 3 and better.

Titanium alloys are available which provide fusion-weld efficiencies of 100 percent, and spot-welded joints with excellent load carrying capacities.

Through its new Toronto, Ohio, rolling mills —designed specifically for titanium operations —Titanium Metals Corporation of America can provide light-gage flat-roll weldable products of consistently highest quality, on the fastest delivery schedules, at the lowest possible price in the industry today.

Q. What are the leading welding grades?

A. Ti-75A, a single-phase unalloyed grade which is readily formable; Ti-5Al-2.5Sn, a single-phase alloy grade which provides excellent resistance to oxidation up to 1200°F; and Ti-6Al-4V, a duplex-phase alloy grade with guaranteed minimum tensile strengths to 130,000 psi. Guaranteed minimum mechanical properties of these grades are:

GRADE	DENSITY lb/cu in	Guaranteed Room Temperature Properties 0.2% YS	UTS	Elong, % in 2"
Ti-75A	0.163	70,000	80,000	20
Ti-5Al-2.5Sn	0.162	110,000	115,000	10
Ti-6Al-4V	0.161	120,000	130,000	10

Q. Are special precautions required for welding these grades?

A. Titanium is spot-welded more readily than aluminum and many of the carbon and low alloy steels, and requires no special precautions. Spot-weld machine settings used for titanium and stainless steel are very similar.

Titanium is fusion-welded with inert-gas-shielded arc welding techniques and joint designs which are also similar to those used for other metals. Two fundamental principles must be considered:

1. Coated electrodes and other fluxing compounds cannot be used.
2. Titanium weld joints must be shielded from the normal atmosphere with an inert blanket of argon or helium during welding.

Q. Does that mean chambers are mandatory for fusion weldng?

A. No. Open air welding is adaptable to production operations when both root and face of the weld are protected from the air. Small parts and complex shaped weldments which are difficult to shield adequately may still be welded more easily and economically inside a chamber. This is described in detail in TMCA's publication, *Titanium Welding Techniques,* Engineering Bulletin #6.

Successful titanium welding techniques have enabled fabricators to produce missile propellant storage bottles which resist internal pressures of 8000 psi at —300°F. This all-titanium bottle, produced by Rheem Manufacturing Company, Downey, Calif., is Ti-6Al-4V, fusion-welded in an argon atmosphere. Designers say use of titanium bottles can add up to 700 miles to the range of an IRBM.

Q. Are titanium welds more susceptible to corrosion attack than the base metal?

A. Titanium welds offer the same excellent corrosion resistance as the base metal. Stabilizing heat-treatments, employed with many other materials, are *not* required.

Successful welding is a key factor in today's designs. It enables designers to draw upon titanium's unique combination of properties: light weight, corrosion resistance, and ability to withstand operating temperatures from –300°F to 1000°F — for the added performance vital to these uniquely critical times.

Titanium Metals Corporation of America has just completed the first comprehensive study of welding techniques yet published by the industry. This 32-page publication draws upon metallurgical considerations to recommend and explain techniques required for quality titanium weldments.

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little more than organizations which attempted to teach the workers how to meet their work quotas.

This situation was not really changed until World War II. A diumverate of plant manager and party chief managed most enterprises from about 1930 to 1942. With great pressures being applied to improve and increase output, this dual command degenerated into a proposition where each man took credit for all that was good and accepted no blame for failure.

The first broad attempt to clear this situation was to appoint party members as plant managers, but at that time most people in the party did not have technical experience. Soviet journals reported that manufacturing costs rose appreciably under party managers, although quantitative goals were met in many cases. Such reports in the Soviet press were a sign that party members who had failed as managers were on the way out.

Today, Russian text books, magazines and other publications all speak of the principle of "one-man management" and managers with "undivided authority." A typical quote that appears in virtually all Soviet economic texts today is the following one from "The Economy of USSR Industry" published in Moscow in 1956:

"One of the basic principles in the organization of socialist industry is the principle of one-man management. An individual possesses complete administrative-managerial authority . . ."

Appointing a Manager

The managers of both experimental and production aircraft plants operate under this single manager system, and they are responsible for the entire technical, productive, economic, financial and personnel activity of their enterprises. The experimental plant director is appointed by the Minister of the Aircraft Industry in Moscow and can only be removed by him. The production plant manager is appointed by, and is responsible to, the regional Councils of National Economy.

In addition to giving the manager absolute authority over all plant activities, his prestige and power has been strengthened in most cases by giving him prominence in the party as well as commissions in the armed forces. Tupolev, for example, is a lieutenant general in the Soviet Engineering Technical Service.

The manager also has control over hiring and firing of the employes of the enterprise, and he is free to call upon the large open market that exists in the Soviet Union.

If an aircraft plant is in need of materials, parts or services, the manager of the plant may deal with other plant managers to acquire what he needs.

The primary duty that any plant manager has to the State is to fulfill the production or development plan that is drawn up for the plant.

Must Show Profit

This plan, while stipulating a definite quantity and quality of production, also is based upon a strict cost-accounting system to ensure that the production is economical and to keep overhead as low as possible. The ultimate test of the Soviet plant manager is the same as the ultimate test of any western business man—he must show a profit.

Any re-sale of material, small subcontracting, etc., in which an aircraft plant manager is able to engage is permissible and can help him satisfy the plant's economic plan so long as it can show a profit. This type of activity is wide-spread in Russia, and aircraft enterprises engage in a large amount of subcontracting.

Party influence in industrial management, while not a constant interference under the present system, still remains as an ever-present influence. A university text printed in Moscow in 1956 entitled "The Economy of Socialist Industry" contained a statement typical of such books:

"In order to direct the economy correctly, it is necessary to ensure a

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LORAN has long been recognized as the reliable, highly accurate system of long range navigation. LORAN is already implemented and in service over North Atlantic and Pacific air routes, with immediate expansion planed to cover other important areas, too.

Now, LORAN becomes an even more practical navigation system, with the development by Edo of a simplified, lightweight, *pilot-operated* unit. This compact equipment, weighing only 29 pounds installed, can be mounted in the cockpit. From it the pilot obtains directly read line-of-position information, without having to consult tables or make complicated calculations.

Thoroughly tested in transoceanic operation, Edo LORAN has been ordered by Pan American, BOAC, KLM, Air France, Sabena, Qantas, Cubana, Lufthansa and Varig Airlines for installation in their jet and turboprop fleets. Other international carriers have also indicated their intention to use LORAN to assure precise, reliable, long range navigation.

EDO AIRBORNE LORAN, Model 345

Control panel and 3-inch scope are mounted in cockpit for operation by pilot or co-pilot. Receiver (left) occupies ¾ ATR rack. Installed weight of complete system is only 29 lbs., and compact unit requires only a small fraction of space formerly required. Designed and manufactured by Edo, a major supplier of advanced electronic systems for the United States Navy —sonar, radar, ASW equipment.

For the complete data on Edo Model 345 Airborne Loran send for Technical Manual #501, Dept. C-11.

Edo

EDO Corporation

College Point, Long Island, New York

Manufacturers of a Trusted Line of Marine and Airborne Electronic Equipments

political approach to decisions on economic problems. This means that economic problems must be solved on the basis of party politics."

Another text says, "One-man management envisages a close relation between the manager and the party and other social organizations, the leader knowing how to listen to the voice of the masses, to teach the masses and himself being taught by them."

Steel Industry Report

Last June, the representatives of the American Steel and Iron Ore Industries made a report after a wide tour of the Soviet steel industry. All basic Soviet industries, such as the petroleum, steel, electrical power and aircraft apparently are operated in the same fundamental manner and have all reached a considerable state of efficiency. The group reported:

". . . Steel plants visited in the Soviet Union are modern, efficient and well managed. They compare favorably indeed with plants of the same type in the U. S. The men who run them are well qualified technically, and they have a good grasp of sound management principles. They show a proprietary interest in the work they are doing and in the industry of which they are a part. . . .

"The Soviet managers are aware of the deficiencies as well as the achievements of their industry and are planning remedial action accordingly. In view of their past success in the areas of greatest concentration, and the priority steel enjoys in Soviet planning, there is reason to believe that they will be able to correct any deficiencies that they consider handicaps to the industrial progress of the Soviet Union."

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USAF Devises Plan For Subcontractors

Washington—Air Force's new "make or buy" plan—designed to farm out a substantial portion of weapon system subcontracts to small companies (AW Oct. 6, p. 26) faces scrutiny by Department of Defense, the General Accounting Office and a number of congressional committees both before and after it becomes effective.

Air Force and Aircraft Industries Assn. representatives have neared accord on details of the plan. Industry's first reaction a few months ago was vigorous opposition. As a result of modifications in the administrative aspects, however, manufacturers have decided to go along with the plan.

Concomitant aim of the plan is to curtail government spending on new tools and facilities required by weapon system prime contractors.

Air Force, prodded into taking action, told industry representatives: "As industrial complexes grow these large installations become the source of political pressures."

Under the plan, components and sub-assemblies involved in a prime contract will be listed, with justifications, as to whether they are to be manufactured in the prime contractor's facilities or subcontracted.

New developments include:

• **Perkins McGuire, Assistant Secretary** of Defense for Supply and Logistics, will review Air Force's "make or buy" proposal when it is submitted in its final form. Defense Department is expected to issue an order making the policy also applicable to Army and Navy.

Air Force, however, has been the main target of charges of unnecessary expenditures for industrial facilities and failure to subcontract with small companies. Last spring, Navy reported excellent results on two pilot projects in which specifications for Sidewinder and Talos components, including the Talos airframe, were let on competitive bids. Vice Adm. E. W. Clexton, chief of naval materiel, told the House Appropriations Committee that the Sidewinder price dropped 30%, and the Talos price 50%.

• General Accounting Office is conducting an investigation of manufacturing in government facilities versus that in private facilities. GAO claims that the investigation, which has been under way for several months, is now being blocked by Air Force's refusal to grant access to information on ballistic missile weapon system programs. Hearings on the charge have been scheduled by House Government Information Subcommittee headed by Rep. John Moss (D.-Calif.). First witness will be Lawrence J. Powers, director of GAO's Defense Accounting and Auditing Division. Air Force witnesses will be headed by Secretary James H. Douglas and Lt. Gen. E. J. Rogers, USAF inspector general.

• **House and Senate Small Business** Committees, which have long protested the effects of weapon system procurement on small companies, already have received complaints that Air Force's proposed "make or buy" plan is not strong enough in its directive to prime contractors to break down systems into components for subcontracting. Meanwhile, Senate Small Business has a survey under way of government tools and facilities used by private contractors.

• **House Armed Services Committee** headed by Rep. Edward Hebert (D.-La.) will open hearings Nov. 24 on charges that the military services have financed private facilities for weapons that could be produced in closed government facilities at less over-all cost. Floyd Bryant, Assistant Secretary of Defense for Properties and Installations, will be the first witness.

B-58 to be Evaluated In Alaskan Environment

Convair B-58 will go to Eielson AFB, Alaska, in December for evaluation tests of the bomber's subsystems in cold weather conditions. B-58 has completed cold weather tests at Eglin AFB, Fla. In Operation Raw Deal, B-58 Joint Task Force personnel from Air Research and Development Command, Strategic Air Command and Convair will move to Alaska to conduct the tests. Support equipment for the program is being flown to Eielson AFB in a weekly Douglas C-124 airlift operation.

Argentina Flight-Tests Morane-Saulnier 760

Initial flight tests have begun on Morane-Saulnier 760 five-place jet now being assembled in Argentina. Latter government has ordered 48 models of an armed version of the jet executive aircraft. Most of these will be assembled in Argentina. Armament consists of four machine guns and 12 or 14 rockets. Six 110 lb. bombs or two 250 lb. bombs represent alternate armament loads.

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For technical information write to Townsend Company, Cherry Rivet Division, P.O. Box 2157-N, Santa Ana, California.

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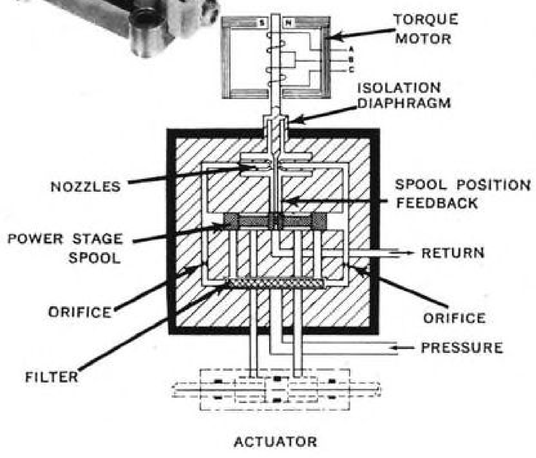

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Typical Electrical Input	80 milliwatts
Operating Pressure Range	150 to 4000 psi
Hysteresis	3% max.
Threshold	½% max.
Null Shift Due to Temperature Changes	5% max. —65 to +450°F.
Null Shift Due to Acceleration, Vibration, Shock	5% max. up to 100G
Operating Temperatures	—65 to +450°F.
Weight	1.0 lb. nominal
Flow Gain Linearity	±5%

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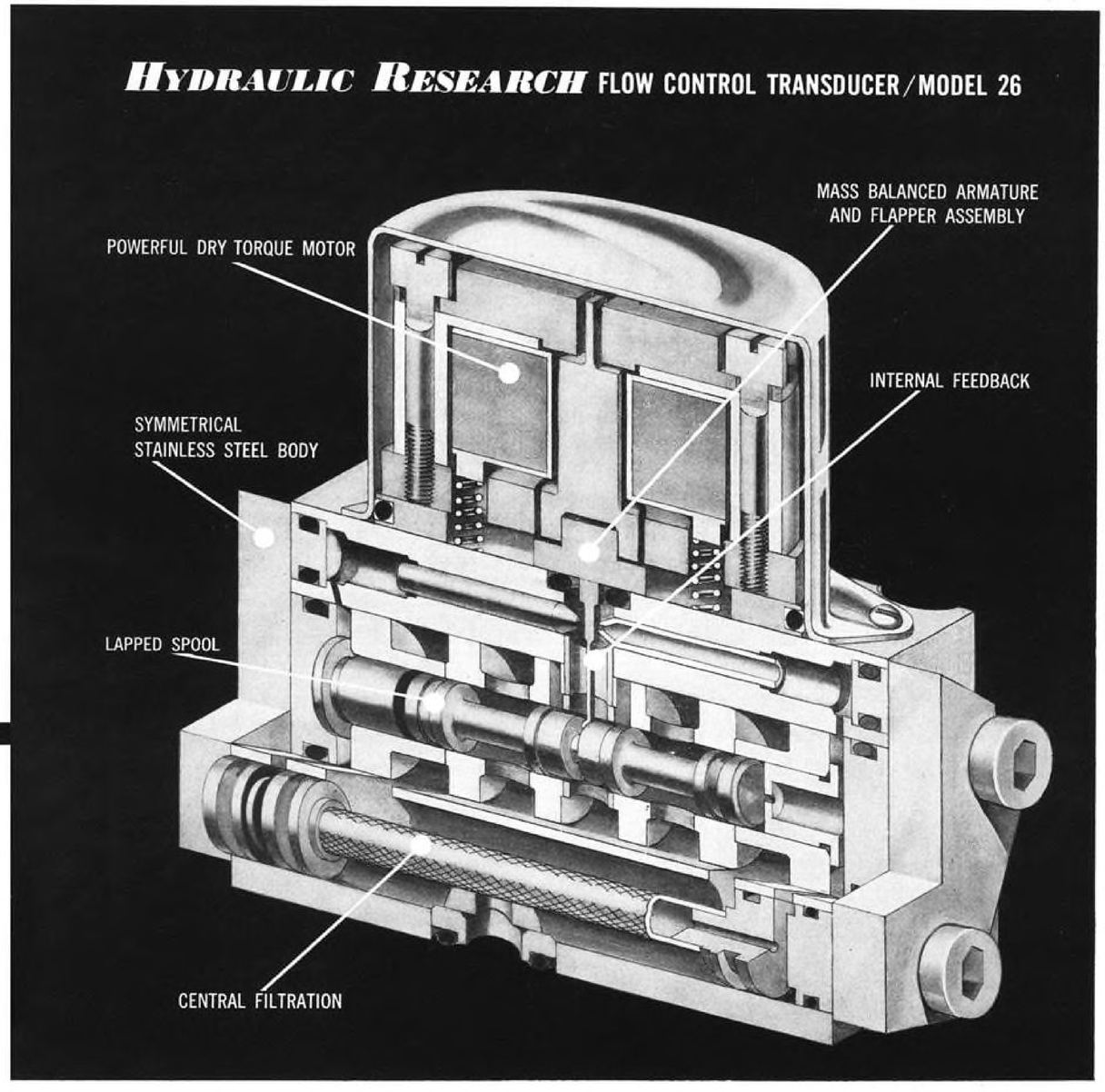

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BLOODHOUND missiles are placed in firing position on concrete launching pads. Note transporter (center) and radar (background).

Bloodhound Nears Operational Capability

By John Tunstall

London—First fully operational Bloodhound guided missile station in the United Kingdom is located at North Coates, a remote World War II Coastal Command station near Grimsby, on the Yorkshire coast.

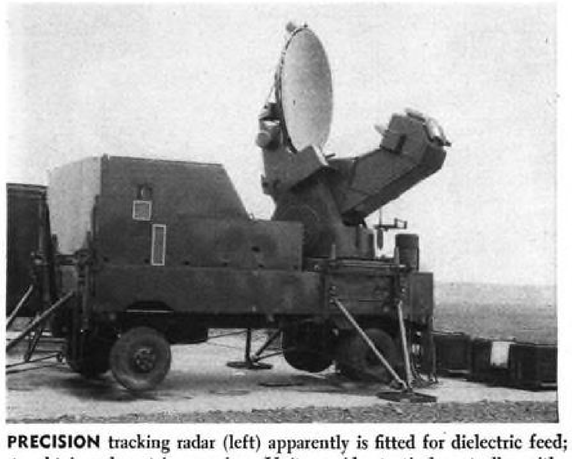
A three-phase trial program of the Bristol/Ferranti semi-active homing weapon is currently in progress at the station "but we could assume operational posture overnight," according to station commander Group Captain J. A. Leathart. Proving trials have already been satisfactorily concluded, and will be followed by acceptance trials and service trials.

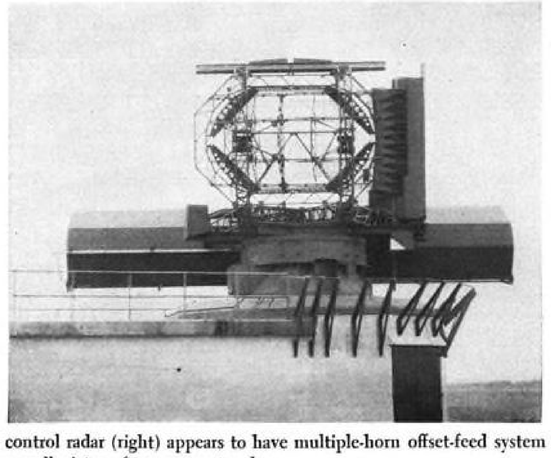
Execution of acceptance trials by the Royal Air Force creates a precedent as this phase is normally carried out by the Ministry of Supply. New procedure is expected to save both time and money.

Trials and operational training will be carried to the point of actual firing at North Coates. Actual firing tests at the Ministry of Supply test station at Aberporth will also be under the control of North Coates. Other joint Ministry of Supply-RAF trials are proceeding at Woomera, Australia.

North Coates setup is analogous to that of a fighter wing and comprises three squadrons called firing units. Squadrons are divided into two flights of eight missiles, each flight having its own target illuminating radar sited adjacently. Every target illuminating radar is allotted its own frequency. To ensure that each flight of missiles responds only to its respective parent, the missile has two receivers—one is locked onto the transmitter and tunes the homing receiver.

The squadrons are mounted on parallel concrete strips, leading directly from a perimeter track. The wing has its own tactical control radar, operations room and computers and electronic stores for holding target data.





PRECISION tracking radar (left) apparently is fitted for dielectric feed; control radar (right) appears to have multiple-horn offset-feed system to obtain volumetric scanning. Unit provides tactical controller with over-all picture from support radars.

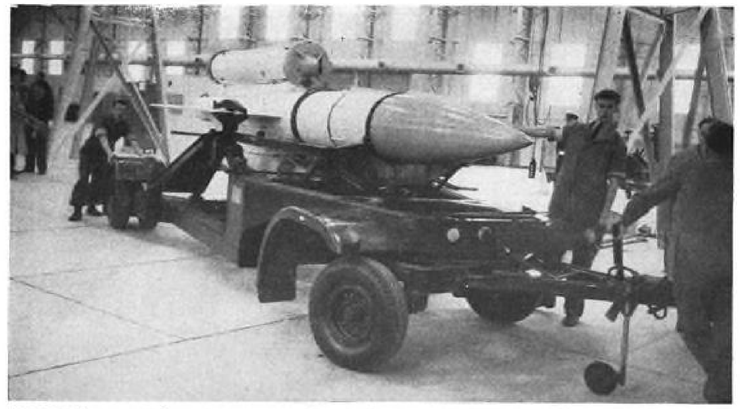
A data link connects the tactical control radar (TCR) with the precision-tracking target illuminating radar (TIR). The controller is also provided with a synthetic over-all radar picture of the presentations provided by early warning radar installations.

The TCR, which employs a volumetric scanner and is claimed to be of advanced design, was developed by the Royal Radar Establishment at Malvern and made by Metropolitan-Vickers Electrical Co., Ltd. It gives a tactical picture as well as automatically feeding positional data to the TIR through the data link. The TIR equipment was designed by British Thomson-Houston.

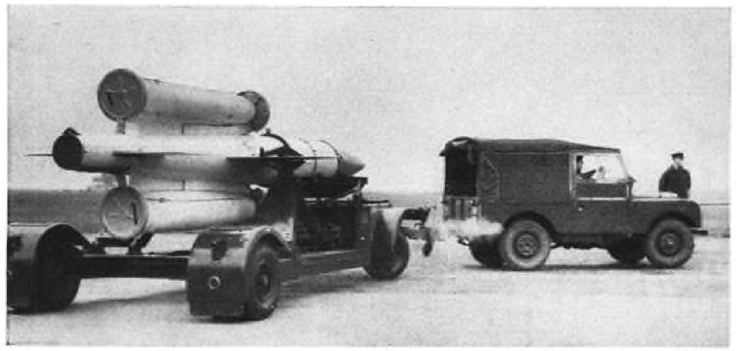
Flow Production

Assembly and servicing is based on flow production methods with rapid replacement and is carried out in an air-conditioned shop. Tests are carried out both before and after deployment on the launching pads.

Two principal rigs are for forebody and mainbody testing. The forebody includes the radar dish, electric power supply and computer. This rig, which includes a radar source to simulate target echoes, monitors the systems' responses.



MISSILE is mounted on transporter after static tests; hauled by truck to launch pad.



Tests are first carried out using an external electrical supply and are then switched to internals.

Mainbody includes the twin ramjets, hydraulic, nitrogen and electrical supplies. On the mainbody rig, air and fuel metering systems are checked, deviations are injected into the wing control system and its response monitored and all flow valves checked.

An over-all check follows mating of the two assemblies and the missile passes to fueling and storage stations, each leading directly from the concrete perimeter track. This track then proceeds into a security area, where the warhead and warhead initiators are fitted, and continues to the launching pads.

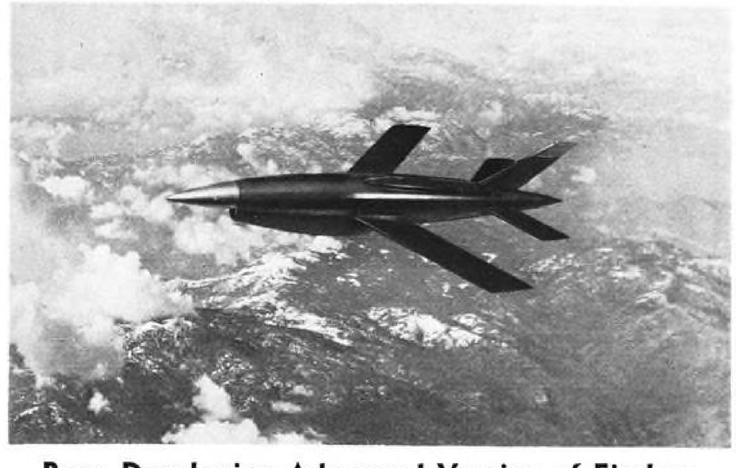
Launch Control

Launch control posts are situated close to the launching pads. A sequence of lights register on a console at the control post for automatic preparation and checking of each stage of the Bloodhound for flight.

The receiver inside the Bloodhound incorporates a gyro-stabilized aerial system which picks up the target reflections, thus observing the line of sight to the target. By a system of proportional navigation in three dimensions, the homing equipment computes the course for interception. The energy re-radiated from the target is converted through a series of servo motors to operate the flight controls and keep the missile on course for collision.

In an actual attack, early warning radar alerts the defensive system and allocates the target either to fighters or the tactical control radar at a missile base.

The tactical control radar secures the "blip" of the target reflection, and follows it. The information picked up by the tactical control radar is auto-



Ryan Developing Advanced Version of Firebee

Model of Ryan Aeronautical Co. Q-2C jet drone (AW Nov. 10, p. 37) is depicted in composite photo. Flight test of drone, an advanced version of the Q-2A Firebee, is scheduled for the end of the year. Nose is designed to house electronic miss-distance scoring system or radar augmentation to simulate a larger aircraft. Horizontal stabilizers on Q-2C will have greater span than Firebee, and leading edge on vertical fin will be thinner than on Firebee.

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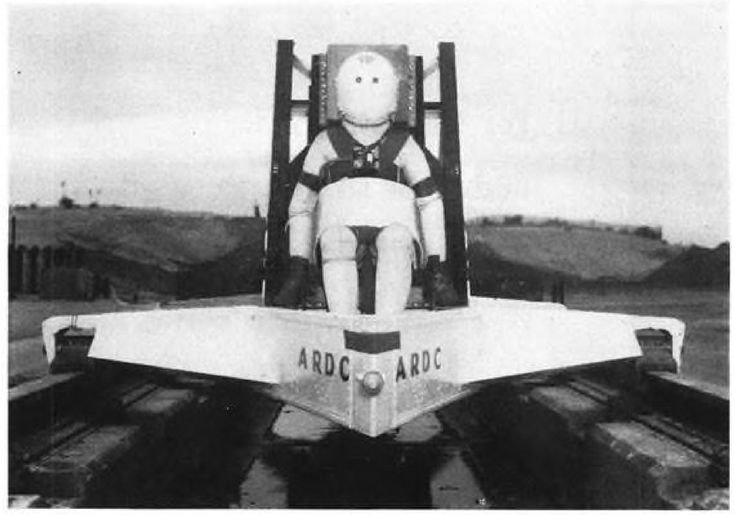

Dummy on Sled Tests Flight Suit

Sled and dummy recently were propelled 1,200 mph. on captive missile test track at Aero-Medical Field Laboratory, Air Force Missile Development Center, N. M. Purpose of test was to determine capabilities of flight suit built by Protection, Inc., under windblast conditions. Glass fiber helmet has smooth surface, except for half-inch apertures at eye level.

matically computed and fed into electronic stores.

Flashing colored lights and illuminated code letters on a tote board gives the tactical control officer an immediate picture of the developing battle situation.

Details of aircraft under surveillance, their identification, and the number of the electronic stores holding the data, are transmitted in the form of synthetic radar pictures to the console operators needing the information. The electronic store also passes the information to the TIR on the launching site. The TIR is an accurate precision tracking radar with a very narrow beam that holds and illuminates the target.

The TIR locks on to the target and the launchers swivel around in order to hold the same azimuth position.

Lockheed to Train Navy Polaris Teams

Los Angeles—Under contract with the Bureau of Naval Personnel, Lockheed's Missile Division is training—directly or through subcontractors—Navy specialist personnel in major phases of operating and maintaining the Polaris fleet ballistic missile weapon system.

Goal of the program is a nucleus of key trained officers and enlisted men to assume an active role in further development of the missile, particularly in the flight test program. Training is being conducted at Lockheed's Sunnyvale, Palo Alto and Santa Cruz Mountain facilities. Trainees are also receiving instruction in propulsion at Aerojet-General, Sacramento, in launching systems at Westinghouse Electric Corp., Sunnyvale, and in fire control and guidance at General Electric Co., Pittsfield, Mass.

Initial training program includes about 78 enlisted men and six officers and will train specialists in flight control, telemetering, structures handling, propulsion, guidance, fire control, launching and handling.

Trainees receive one week of formal classroom indoctrination by members of Lockheed's training and job analysis department, then begin on-the-job training conducted in production areas, shops, prototype laboratory and checkout areas.

Part of the trainee group will be transferred to Lockheed's Polaris test facility at Cape Canaveral, Fla., to continue training with Lockheed missile crews under supervision of Special Projects Office, Navy Bureau of Ordnance. Others will be assigned to USS Observation Island, a specially modified vessel for missile development work.

Ramo-Wooldridge Merger Results in Name Change

Thompson Ramo-Wooldridge Inc. is the name of the new firm formed through the recent merger of Ramo-Wooldridge Corp. with its parent company, Thompson Products Inc. Space Technology Laboratories, a division of Ramo-Wooldridge, has been split off as a separate corporation to be known as Space Technology Laboratories Inc.

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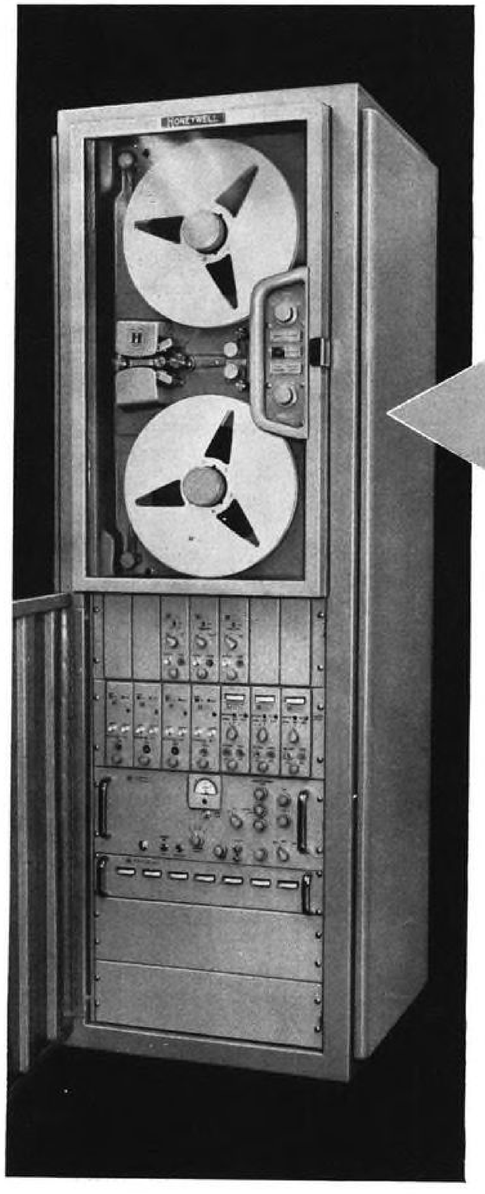

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USAF Contracts

Following is a list of unclassified contracts for $25,000 and over, as released by Air Force contracting offices:

HEADQUARTERS, WARNER ROBINS AMA, USAF, Robins AFB, Georgia.

M & F Manufacturing Co., Indianapolis, Ind., booth-paint spray, floor type, S/N 8100-117000, 11 ea., (IFB 58-382), $36,905.

M. L. Maxson Corp., New York City, spare parts applicable to B-57, A/C FCS, (RFP 59-1169), $37,263.

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., spare parts applicable to A/C FCS, (RFP 58-1174), $41,633.

Covel Manufacturing Co., Benton Harbor, Mich., grinder, surface, hyd. feed, horizontal, S/N 3415-223-6331, 42 ea., (IFB 58-310), $291,500.

Goodyear Aircraft Corp., Akron, Ohio, repair-modification of TM-76A weapon system, (letter proposal WR-9-Maint.-13), $444,936.

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., calibration and repair of fire control systems, (RFP 58-1178), $40,564.

Cox and Stevens Corp., Wallingford, Conn., repair of electric aircraft weighing kits, (Letter proposal WR-9-Maint.-34), $44,183.

Avco Manufacturing Corp., Cincinnati, Ohio, spare parts applicable to B-47 and B-66 A/C FCS, (Letter proposal WR-8-FSC10-2976), $98,260.

The Decker Corp., Philadelphia, Pa., repair/modification of gyroscopes, S/N 1270-216-6298, (Letter proposal WR-9-Maint.-20), $67,569.

Hughes Aircraft Co., Culver City, Calif., repair/modification of Hughes designed fire contol systems, (Letter proposal WR-9-Maint.-26 & 51), $15,669,812.

International Business Machines Corp., New York City, repair/modification of bombing navigation systems, (Letter proposal), $2,265,823.

The Decker Corp., Philadelphia, Pa., repair/modification of gyroscopes, S/N 1270-216-6297, 823 ea., (Letter proposal WR-9-Maint.-18), $164,869.

Aero Corp., Atlanta, Ga., repair/overhaul propeller assembly, two items, (IFB 58-406), $178,450.

Aircraft Engineering and Maintenance Co., Oakland, Calif., repair/overhaul of governor assemblies, (IFB 58-405), $36,143.

Federal Windows Manufacturing Co., Waukesha, Wisc., maintenance platforms, S/N 1730-390-5618, 3 ea., (RFP 58-1197), $532,648.

Avco Manufacturing Corp., Cincinnati, Ohio, spare parts applicable to B-66 and B-52 A/C FCS, (letter proposal WR-8-1270-510), $31,655.

Lucifer Furnace, Inc., Neshaminy, Pa., furnace, heat treating, electric, USAF FSC 3434-204-4915, 27 ea., (IFB 58-378), $49,-549.

Nobles Engineering and Manufacturing Co., St. Paul, Minn., modification kits applicable to MD 4 fire control system, (Letter proposal), $34,570.

The Decker Corp., Philadelphia, Pa., repair, overhaul and modification of FCS components, (Letter proposal WR-9-Maint.-22), $153,999.

Henry Spen & Co., Inc., Brooklyn, N. Y., truck assembly, nitrogen recharger, two-wheel, a cylinder cap, S/N 1730-534-0564, 162 ea., (IFB 59-501), $54,814.

The Martin Co., Baltimore, maintenance of Martin model 320 SAFE equipment installed in RB-57D-2 A/C, (Letter proposal WR-9-Maint.-72), $99,024.

Universal Services, Inc., Seattle, Wash., preparation of meals in base dining hall for troop feeding, (IFB 58-209), $129,432.

Boyle Construction Co., Sumter, S. C., construction of off-site support facilities for Capehart Housing Project, RAFB, Ga., (IFB 58-160), $247,450.

Pry Welding's Manufacturing Co., Modena, Pa., repair/modification of box, engine, USAF FSC 8115-390-5575, 662 ea.; box, engine, USAF FSC 8115-390-5576; box, engine, USAF FSC 8115-390-5578, 978 ea., (IFB 59-6), $216,720.

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At TAPCO, high-strength struts, control members and other structural components are produced by metal-gathering and the unique "Flotrusion" process.

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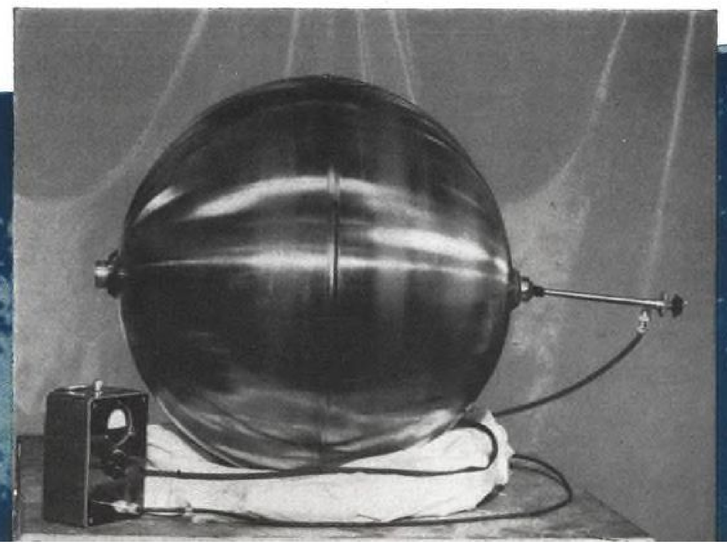
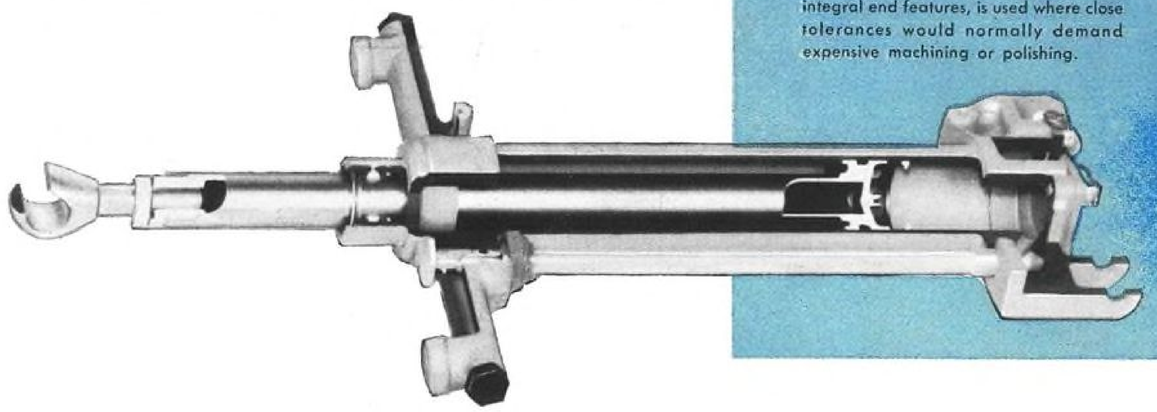
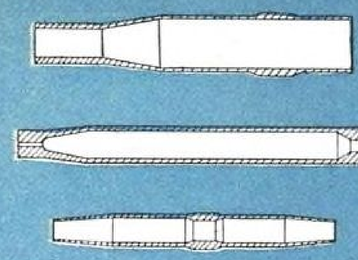
Precision missile pressure vessels of titanium are designed and fabricated at TAPCO. Many years of intensive research and development have resulted in unusual TAPCO GROUP techniques for working with such missile-age metals.



In many of the actuators produced by the TAPCO GROUP, the metal-gathering process is utilized to produce the piston head and shaft as one integral part, thus increasing strength and eliminating mechanical fastening or welding.





TAPCO's "Flotrusion" process, a unique method of redrawing steel tubing to obtain varying wall thicknesses and integral end features, is used where close tolerances would normally demand expensive machining or polishing.

A rocket engine case of an unusual alloy is welded by shielded arc method on giant TAPCO automatic welder.

Spinning a missile nose cone from super-alloy on a precision spinning lathe.

TAPCO GROUP
OF
Thompson Ramo Wooldridge Inc.
CLEVELAND 17, OHIO

OTHER INTEGRATED SERVICES FROM TAPCO INCLUDE DESIGN, DEVELOPMENT AND PRODUCTION IN THE FIELDS OF STRUCTURES, PROPULSION, ELECTRONICS, METALLURGY AND NUCLEAR POWER.

T/I 'electronic escorts' bring all-weather travelers safely home

Soon now, TI-built and TI-modernized airport surveillance radars will meet air travelers far outside congested airport areas and escort them electronically to an ideal approach fix. The Civil Aeronautics Administration has already ordered this potent safety factor for more than *seven dozen* major U. S. airports. Able to keep tabs on large numbers of aircraft operating in airport approaches (up to 60 miles distant), TI radars will log all aerial moving objects over video maps pinpointing navigational aids and hazards. In "ducks only" weather, the traffic controller can switch from linear to circular polarization for a clear look through clouds and precipitation.

Close kin to Texas Instruments military and industrial electronics, TI airways radar benefits from the most advanced technologies practiced today. Details on this new aspect of TI's 28-year-old capabilities may be obtained by writing to: Service Engineering Department . . .

apparatus division

systems management

systems — reconnaissance, airways control, anti-submarine warfare, anti-missile, countermeasures, airborne early warning, navigation, attack control, missile systems, engine control.

equipments — radar, infrared, sonar, magnetic detection, computers, timers, telemetering, intercom, microwave, optics, detector cells, engine instruments, transformers, time standards, and other precision devices.

research/design/development/manufacture

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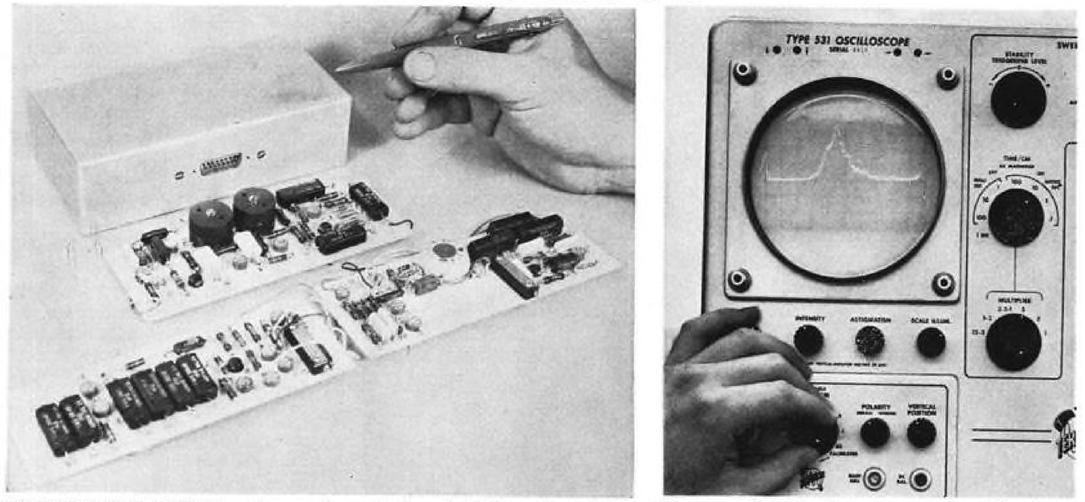


COMBINATION SPECTRUM analyzer and amplitude probability analyzer (left) which use statistical techniques to analyze vibration and other high frequency data in an aircraft or missile, reduce it to signals which can be telemetered over narrow-band channels. Oscilloscope (right) displays the typical power spectral density plot of a band-limited noise signal.

Technique Increases Telemetry Channels

By Philip J. Klass

Princeton, N. J.—A technique which reduces the bandwidth required to transmit vibration and other high frequency data by a factor of 100 to 1,000, providing more channels in the crowded telemetry spectrum as well as simplifying the data analysis problem on the ground, was demonstrated here recently before representatives of the military services and several aircraft-missile manufacturers.

Statistical data handling, as the new technique is called, is compatible with all existing telemetry systems without any modification, according to Applied Science Corp. of Princeton (ASCOP), which developed the technique. First prototype models will be delivered shortly to Army Ballistic Missile Agency for its evaluation.

The technique employs small, lightweight devices in aircraft or missiles which analyze on-the-spot the vibration or other high frequency data being measured to extract statistically significant information which can then be telemetered to earth using extremely narrow-band channels. This permits the telemetering of many more channels of information without additional transmitters or radio spectrum, or the same amount of information with fewer transmitters, according to ASCOP's Arthur Westneat, Jr.

Observers showed considerable interest in statistical data handling technique. Several commented to AVIATION WEEK that it appears to offer a basically new approach to obtaining flight test data and speeding its reduction for immediate use by interested aircraft-missile designers.

Behind the Concept

Nearly two years ago Applied Science Corp. began a basic study of the problem of telemetering data which pointed up the fact that roughly 10% of the channels required 90% of the total spectrum to transmit vibration and other rapidly changing data, while the remaining 10% of the spectrum accommodated 90% of the channels over which is transmitted slowly changing (narrow-band) data. This suggested that considerable economy in spectrum and equipment might be achieved if a technique could be devised to handle high frequency data in narrow-band form.

Company's study also pointed up the existing delays in transcribing quantities of telemetered data into useful visual form, after which it must be analyzed to extract the desired information.

Although a steep price is paid in

Transfer Function Computer

Useful new laboratory tool which can determine the cause-and-effect relationship between an output signal and any one of several input signals has been developed by Princeton University's James Forrestal Research Center and Applied Science Corp. of Princeton.

New transfer function computer can be used to determine, for example, which components of aircraft-missile motion result from displacements of its control surfaces, which are due to gusts. Device also could determine what portion of aircraft-missile vibration results from engine-induced excitation, what portion from control surface flutter.

If system under analysis has a non-linear transfer function, computer will come up with a linear transfer function which best fits system characteristics, according to Dr. E. J. Durbin, chief of flight research laboratory at Forrestal Research Center.

The computer consists essentially of three identical spectrum analyzers and analog computer circuitry. Outputs of the analyzers are manipulated by computer to produce expression which gives amplitude and phase relationship between two signals under analysis. Transfer function computer can analyze data from small fraction of a cycle per second to frequencies as high as 10,000 to 15,000 cps., permitting its use both for servo system and human response studies as well as for vibration analysis and other high frequency data, Durbin says.

A matter of family interest

Pratt & Whitney Aircraft has a "family interest" in what happens to its engines throughout their many years of operation.

When a Pratt & Whitney Aircraft engine leaves our plant it's as good as we can make it. It's built to stay that way if properly serviced, using replacement parts that are exactly the same as original parts.

We are concerned over recent reports of increased use of bogus* replacement parts and the potential hazard they present to the dependable and efficient operation of aircraft engines. Counterfeit parts are difficult to detect. They may look genuine but they could cause trouble.

As the booklet "The Problem of Bogus Parts", published by Flight Safety Foundation, Inc., points out, "Another reason for serious concern is that the airworthiness certificate of your aircraft may be suspended or revoked if bogus parts are used in its repair, overhaul or maintenance."

Protect yourself against the problem of bogus parts by specifying original manufacturer's parts, and by dealing with authorized distributors or reputable overhaul or maintenance agencies. Don't take chances by buying your spare parts from a source which doesn't have a family interest in your engine.

"The Problem of Bogus Parts," published by Flight Safety Foundation, Inc. A free copy of this informative booklet may be obtained by writing to Pratt & Whitney Aircraft, East Hartford 8, Connecticut, Attention: Service Manager.

PRATT & WHITNEY AIRCRAFT
East Hartford, Connecticut

CANADIAN PRATT & WHITNEY AIRCRAFT CO., LTD.
Longueuil, P.Q., Canada

terms of spectrum and airborne equipment weight to transmit back every single wiggle in the vibration measurements made aboard a vehicle to provide the engineer with a continuous time-history, the design engineer usually is interested in the data only during those intervals when a significant change is taking place. Even here, the engineer may have trouble determining exactly what is happening with a quick look at telemetered data and may have to subject it to extensive analysis first.

If this analysis could first be made aboard the vehicle and only the results telemetered down, the company reasoned, a considerable saving in spectrum and engineering analysis would result.

Airborne Analysis

On the assumption that high frequency data is a random function whose value is impossible to predict exactly at any future instant, Applied Science has turned to techniques used by statisticians to analyze and describe random functions and by physicists in analyzing Brownian motion, according to Westneat. Three such techniques which make it possible to describe most of the important characteristics of a high frequency random function in terms of a low-frequency (narrow-band) signal include:

• **Power spectral density** function. This is a measure of the average power available in the signal at each frequency present in the signal over a given interval of time (sufficient to obtain a representative sample). A plot of average power vs. frequency reveals the signal spectrum bandwidth, periodicities and their periods and the signal-to-noise ratios, according to Westneat.

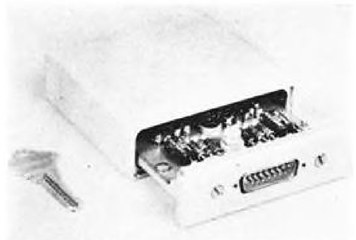
• **Amplitude probability distribution** function. This is a measure of the percentage of the total time that the signal can be expected to have any given value (amplitude). For different signal amplitude values plotted along the X-axis, the Y-axis plot shows the number of signals of each amplitude that occurred during sampled time interval.

• **Correlation function.** This is a measure of the randomness of the signal and can be used to derive the cause-and-effect relationship (transfer function) between two variables.

Hardware Developed

The company already has developed several of these airborne statistical analysis devices, and has others under development or planned. All of the units are miniaturized, and fully transistorized. Two of the devices which Applied Science plans to deliver soon to Army Ballistic Missile Agency are:

• **Spectrum analyzer,** weighing only 6 oz. and occupying 20 cu. in., obtains a power spectral density of vibration (or other high frequency) signal by examining the power intensity of the signal in small frequency increments over the entire range of frequencies encountered in signal. Unit going to ABMA will sweep over frequency range of 100 to 2,000 cps. in four seconds, transmitting to the ground a signal proportional to the power density at each frequency in increments of about 75 to 85 cps. This slowly varying signal can be transmitted over a bandwidth of less than 5 cps., according to ASCOP's Dr. A. G. Ratz. Company also has developed spectrum analyzers with frequency ranges of 180 to 10,000 cps. and 300 to 20,000 cps.



TIME-OF-OCCURRENCE marker identifies exact instant that transient occurs but requires narrow-band channels.

• **Amplitude analyzer** weighing only 2 oz. and occupying 6 cu. in., employs a signal amplitude gate which sweeps from any desired minimum to any desired maximum once every four seconds, effectively counting the number of wiggles in the high frequency signal at each amplitude level. Present unit has an amplitude resolution of about 2½% of full scale value, according to Dr. Ratz. Telemetry bandwidth required also is less than 5 cps.

The company also has developed a time-of-occurrence marker which can be set to be triggered whenever any specified transient occurs and to transmit back a series of pulses whose amplitudes can be used to establish the time-of-occurrence with an error of no more than 250 microseconds, using an extremely narrow-band telemetry channel. Unit weighs 3 oz., occupies only 3 cu. in.

Future Developments

Work on the third principal statistical analyzer, the function correlator, presently is in the stage of theoretical studies. The program is being sponsored by Army White Sands Missile Range. Equipment of this type should be useful in analyzing spectra with large noise peaks, coherent spectra, or relationships between two random variables, Dr. Ratz said.

Applied Science also plans to develop a number of other devices for analyzing raw airborne data, converting it into a form suitable for transmission over narrow bandwidth channels.

A new Signal Conditioning System by MRC

Versatile... Dependable... Adaptable

Now, Magnetic Research Corporation introduces a new Signal Conditioning System, originally designed for missile telemetering applications. In addition, the system performs to maximum efficiency in Research and Development of engines... in wind tunnels... aircraft... and on any additional applications where stability—simplicity—universatility—light weight are most important. These outstanding features have been achieved through unique modular construction which also enables complete interchangeability and electrical isolation of any of the various modules. Power input required consists of D-C. The Signal Conditioning System is available in complete packaging of as many modular channels as required. The following modules presently available:

- POWER SUPPLY REGULATOR
- VIBRATION AMPLIFIER
- CARRIER AMPLIFIER
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- D-C AMPLIFIER (0 to 100 cps band)

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Charlie Miller, Purchasing Agent, The American Welding and Manufacturing Co., Warren, Ohio, tells:

How a G-E vacuum-melted alloy helped solve the problem of fabricating super-hard jet engine rings

"At American Welding it's our business to make jet engine components to exacting specifications. Some of the materials we use are difficult to fabricate. René 41 is a case in point. We were getting many rejects on rings of this material, making it hard to meet delivery schedules.

"In looking for a solution to this problem, we placed an order with the Metallurgical Products Department of General Electric. We felt that G.E., with more than 10 years' experience in vacuum-melted alloys, could help us . . . and they did. They supplied us with vacuum-melted René 41 that met high physical and mechanical specifications. Fabrication problems were quickly solved by our metallurgical and production men with assistance from G-E metallurgical engineers.

"Now we are delivering these precision jet engine rings on schedule . . . and rejects have been practically eliminated."

Whatever vacuum-melted alloys your specifications call for, you too can profit from General Electric's leadership in this field. For facts about the complete G-E vacuum-melting service and facilities write: *Metallurgical Products Department of General Electric Company, 11107 E. 8 Mile Road, Detroit 32, Michigan.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

• **Axis-crossing counter,** a useful adjunct to the amplitude analyzer, will determine the average number of times per second that a signal crosses any selected voltage level.
• **Averaging device** for indicating average value of a raw signal over any desired interval.
• **Peak-recording device** capable of indicating peak value of transients.
• **Signal quantizer** which will transmit data only when amplitude of a signal changes by a pre-selected amount.

Company also is investigating a spectrum analyzer that uses comb-type filters instead of a frequency sweep to get around the possible errors that might be introduced if there is a basic change in the raw signal during the present 4 sec. sampling interval. Use of a comb filter may double the weight of the present unit, increase size by 15%, Dr. Ratz estimated.

Other long-range programs include investigations into possible bandwidth compression techniques for transmission of television and radar data as well as speech.

New Concept

Dr. Erwin Doneth, company vice president-engineering, emphasized that the whole concept of statistical telemetry is so new that its future development will require extremely close liaison between telemetry designers and the aircraft-missile designers.

"If aircraft-missile designers can tell us precisely what they are looking for, what is significant in the raw data, it should be possible to design airborne statistical devices to provide this information—with great saving in radio spectrum and in the time now required to reduce the data on the ground," Doneth said.

Westneat envisions a whole family of airborne transient statistical analyzers, each tailored to extract the specific type of information that the vehicle designer needs from any specific flight test.

Statistical data handling techniques should also find application in space vehicles, where equipment size, weight and electric power limitations will require use of narrow-band telemetering.

Spiral Antenna Suited for Guided Missile

Baltimore—Spiral antenna which can be electrically scanned over wide angles, making it suitable for a short-range missile with semi-active guidance, was reported here by W. S. Wheeler, Westinghouse Air Arm Division, during an East Coast Conference on Aeronautical and Navigational Electronics.

Spiral antennas can operate over an extremely wide range of frequencies, and have added advantages of small size and suitability for flush mounting. (AW July 14, p. 75.)

Wheeler described an antenna that uses four spiral arms, each of which is displaced 90 deg. (space quadrature) from adjoining arms. For ease of manufacture, the antenna uses arms of constant width, with dimension being small compared with operating wavelength in order to obtain performance comparable to a geometric spiral antenna whose arm width increases with spiral radius.

If four feed points are installed, one at the inner terminal of each spiral arm, and the phase of energy fed to one pair (180 deg. apart) is varied with respect to the energy fed to the other pair, the resultant beam position can be shifted to the left or to the right, producing beam scanning, Wheeler reported.

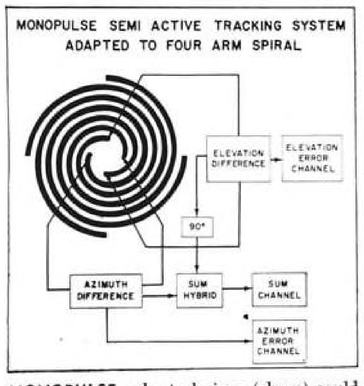
A small arithmetic spiral constructed by Westinghouse, incorporating a conic reflector on one face of the spiral to limit radiation to a single major lobe, produced a 73 deg. beamwidth and reference gain of 0 db. when both pairs of arms were excited in phase.

When energy fed to one pair of arms was shifted 90 deg. it produced a 30 deg. deflection of the antenna beam, decreased beamwidth to 60 deg. with a loss of 1½ db. in gain, Wheeler reported.

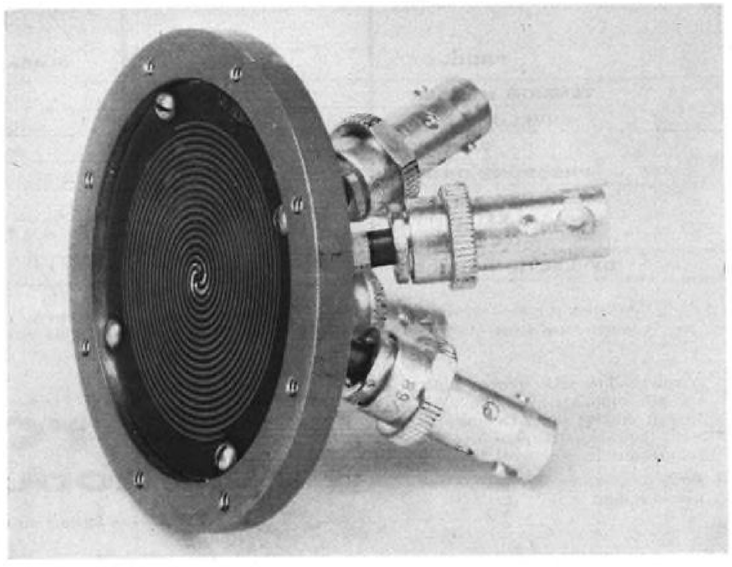
Cross polarization rose to within seven decibels of the normal polarization he noted.

Wheeler pointed out that the plane of beam deflection rotates with operating frequency, a characteristic of certain types of spiral antennas, which may or may not be a handicap, depending upon antenna application.

Small electrically scanned spiral antenna could be used as a fixed (non-gimbaled) antenna for certain types of short-range missiles employing semi-active guidance, Wheeler said. Its wide beamwidth would provide sufficient coverage to permit missile to acquire target after launching and to allow a



MONOPULSE radar technique (above) could be employed to obtain signals for missile guidance. Antenna was developed by Westinghouse Air Arm Division. Small spiral antenna (right), whose beam can be electrically scanned, can be used as a semi-active guidance antenna on a short-range guided missile.



3 ways to design flexibility into tension ducting systems

Arrowhead has concentrated on the development of all three types of stainless steel flexible bellows units. Each design has been refined to its ultimate in efficiency for its size and weight. Compare all three. They are Arrowhead's answers to your problems of flexibility in a tension ducting system.

Compare all these factors

PRODUCT	TIE-ROD	GIMBAL JOINT	PIN JOINT
TENSION MEMBER	Struts and linkage	Gimbal ring	Side pin hinge
ENVELOPE SIZE	Smallest	Largest	Medium
WEIGHT	Low	Heavier	Low
PRESSURE DROP	Approx. 7x△P St. Tube	Approx. 3x△P St. Tube	Approx. 2½x△P St. Tube
FLEXIBILITY	Angular movement in all directions.	Angular movement in all directions.	Movement in one plane only. Absorbs load on axis perpendicular to deflection.
DEFLECTION FORCE	Lowest	Low	Low

The relationships above will vary with combined factors of temperature, pressure and size.
A fourth tension device—Arrowhead braided bellows—was not compared because of the wide variation in its characteristics according to its length.

Arrowhead tie-rods, gimbal joints and pin joints are available in all aircraft ducting sizes. Designed to meet the most stringent aircraft requirements.

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useful lead angle during various homing modes.

A system similar to that used with monopulse radar antennas, with addition of phase shifter, could be used to obtain azimuth and elevation error signals for a missile guidance and control system. Voltage ratio of elevation difference signal to the sum channel would provide target elevation. Ratio of azimuth difference to sum channel would give target azimuth over solid angle of approximately one beamwidth, Wheeler reported.

USAF Evaluates Tacan in Alaska

Washington—Introduction of improved Tacan equipment in the Alaskan Air Command, coupled with increased maintenance personnel experience, has resulted in considerable improvement in the navigation aid's reliability and in pilot acceptance, according to a recent Air Force report.

The Alaska Tacan Report was prepared by a 10-man special ad hoc team which spent 10 days in Alaska earlier this year in order to determine what operational use was being made of Tacan, to obtain data on reliability and maintainability and its suitability for the Convair F-102 and other high performance aircraft.

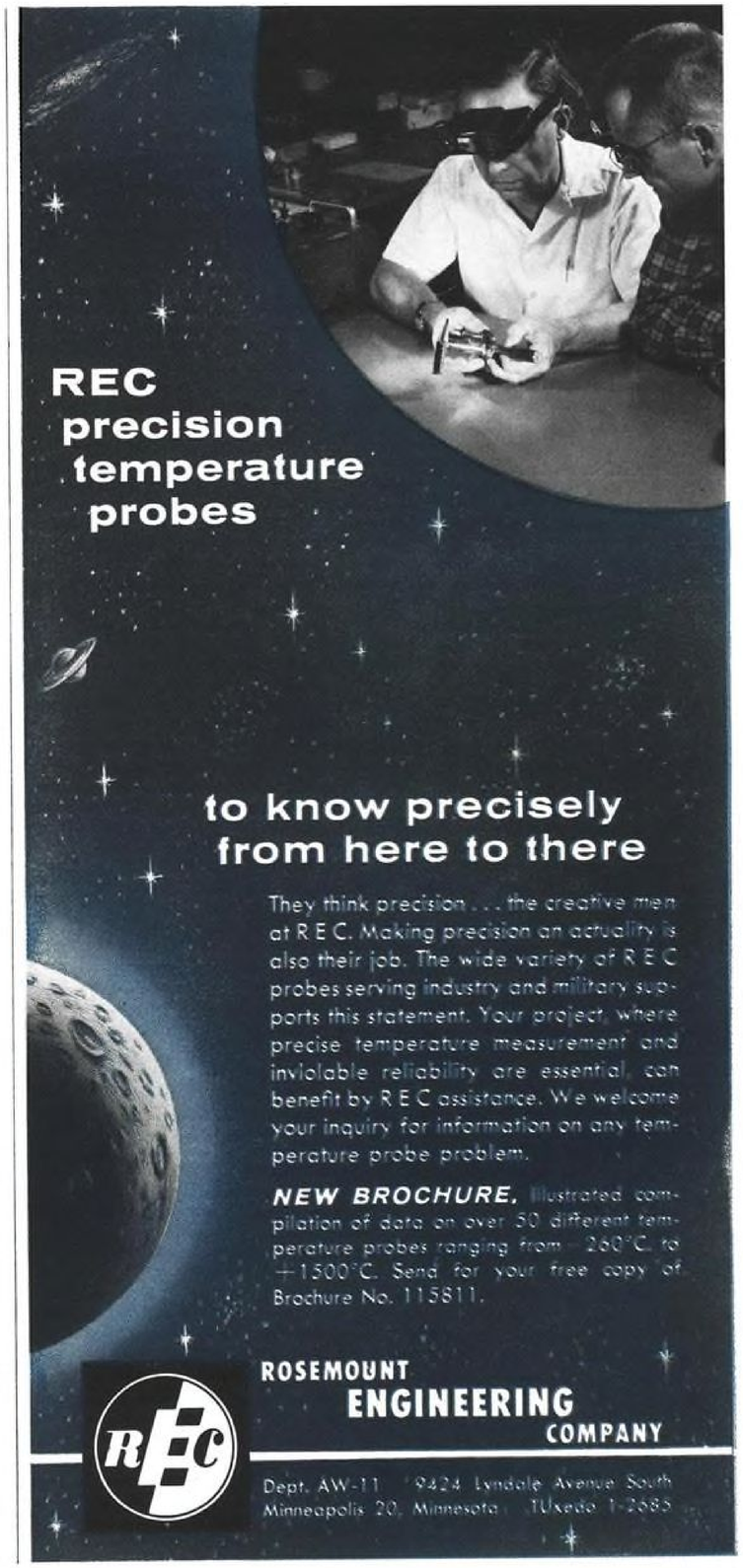
The report candidly admits that early Tacan equipments, constructed in 1954 and tested in 1955, did not rack up a good reliability record. This is blamed on unreliability of the equipment itself, inadequately trained maintenance personnel, lack of suitable test equipment and power supply problems. As a result, there was poor pilot acceptance of Tacan. Pilots preferred to use older low-frequency nav-aids and ground controlled (radar) intercept control.

In the summer of 1957, Alaska received new URN-3 Tacan ground stations with standby equipment which could be used in event of failure, improved versions of the airborne Tacan set, AN/ARN-21 Mod III or later, to replace earlier equipment. About the same time the Air Defense Command's F-102s arrived, equipped with late model Tacan sets and no other navigation aid. The result was an enormous change in pilot attitude toward Tacan, the report says.

As pilots began to use and rely upon Tacan to provide primary navigational guidance, there were three significant operational improvements:

- **Less diversion of radars** from their ground control intercept function.
- **Improved capability** in recovering tactical aircraft.
- **Decreased air-ground-air** communications congestion.

Here are high points of other find-



military electronics experience/on file at Motorola

ASW AND UNDERSEA WARFARE

- SE Submarine communications and detection.
- SE ASW data processing and display aids.
- PP ASW listening and retransmitting devices.

SPECIAL DEVICES

- SE Proximity warning.
- SE Long range electronic surveying equipment with airborne repeater.
- DS Electronic fusing.
- DS Electronic surveying equipment.
- DS Pulsed light range measurement equipments.
- PP Radiosonde transmitter and preamplifier.

MISSILE AND DRONE CONTROL

- SE Precision inertial-guidance system for short range air-to-surface missile.
- SE Bomber defense missile system.
- DS Homing guidance system for attack and reconnaissance drones.
- DS Air-to-air radar guidance system.
- DS Surface-to-surface radio inertial guidance system.
- DS Drone command guidance system.
- PP Data transmission and processing for surface-to-air missile guidance.
- PP Surface-to-air radar guidance system.

SENSORS

- SE Precision location of radars.
- SE High precision and high resolution forward-looking radar.
- DS VHF homing beacon for supply-drop aircraft.
- DS Anti-jam radar transmitter and receiver.
- DS Radar anti-clutter receiver.
- PP Beacons, C-band and X-band.
- PP Strategic bombing radars.

COMMUNICATIONS AND DATA TRANSFER

- SE Obstacle-gain data transmission.
- SE 18-Channel teletype.
- SE Noise-modulated data links.
- DS Integrated battlefield air mobile radio communication system.
- PP High-density FM voice multiplex.
- PP Integrated battlefield ground mobile radio communications system.
- PP High density UHF communication system for air defense.
- PP Coded secure communications.
- PP Pulse code modulated communication equipment.
- PP Multitone and digital selective calling equipment.
- PP Transportable and fixed-station microwave wide-band relay equipment.
- PP AM, FM and SSB voice and data communications equipment.
- PP I.F.F. equipment.
- PP Data link and logic for ground-to-air command guidance of aircraft and missiles.
- PP Miniaturized Transceivers.

Here is an unclassified look at representative Motorola military electronics programs...past and current. Necessarily incomplete, the listing includes only enough projects to demonstrate the breadth of experience at Motorola's Military Electronics Division. For detailed information on how Motorola's capabilities can be applied to your problem...or for data on engineering career opportunities...please write: Motorola, Inc., Military Electronics Division, 8201 East McDowell Road, Phoenix, Arizona.

KEY:

Program Status Coding (Reference MIL-E-5400B)

- SE *Study programs or programs resulting in experimental models.*
- DS *Programs resulting in developmental and/or service test models.*
- PP *Programs resulting in pre-production prototypes and/or production models.*

A-811-1

COMPONENTS

- PP Quartz crystal resonators and filters.
- PP Electrical wave filters.
- PP Electromechanical filters.
- PP Precision V.F.O.'s and B.F.O.'s
- PP Electromechanical reed filters and tone generators.
- PP Transistorized power converters.
- PP Transistorized voltage and current regulators.

NAVIGATION

- SE Doppler personnel navigator.
- SE Inertial sensors.
- SE Supersonic intercontinental bombing-navigation system.
- SE Hyperbolic battlefield navigation system for aircraft, land vehicles and man pack.
- DS Hyperbolic amphibious navigation system.
- PP Aircraft rendezvous and station-keeping systems.

DATA PROCESSING AND DISPLAY

- SE Automatic data processing for electronic countermeasures.
- SE Data processor for electromagnetic intercept.
- SE Threat evaluator for air defense.
- PP Shipborne electronic data system for air defense.
- PP Large-scope bombing radar indicator.

ELECTRONIC WARFARE

- DS Battlefield electronic warfare.
- DS False target generation system.
- DS Tracking jammer.
- PP Subminiature passive radar illumination detector.

GROUND SUPPORT AND TEST EQUIPMENT

- PP Phase-lock telemetry.
- PP Command destruct receivers.
- PP Guided missile test equipment.
- PP Programmed automatic test system.
- PP Aircraft test equipment.
- PP Militarized precision pulse circuit testers.

SOLID STATE MATERIALS AND DEVICES

- SE Ferro-electrics.
- SE Ceramics.
- SE Solid state devices.
- PP Ferrites.

COMBAT SURVEILLANCE

- SE Drone guidance, data sensor, and data transmission integrated reconnaissance system.
- SE Aircraft data sensor, and data transmission reconnaissance system.
- PP High resolution side-looking radars for aircraft and drones.

MOTOROLA

Military Electronics Division / CHICAGO • PHOENIX • RIVERSIDE

CHICAGO

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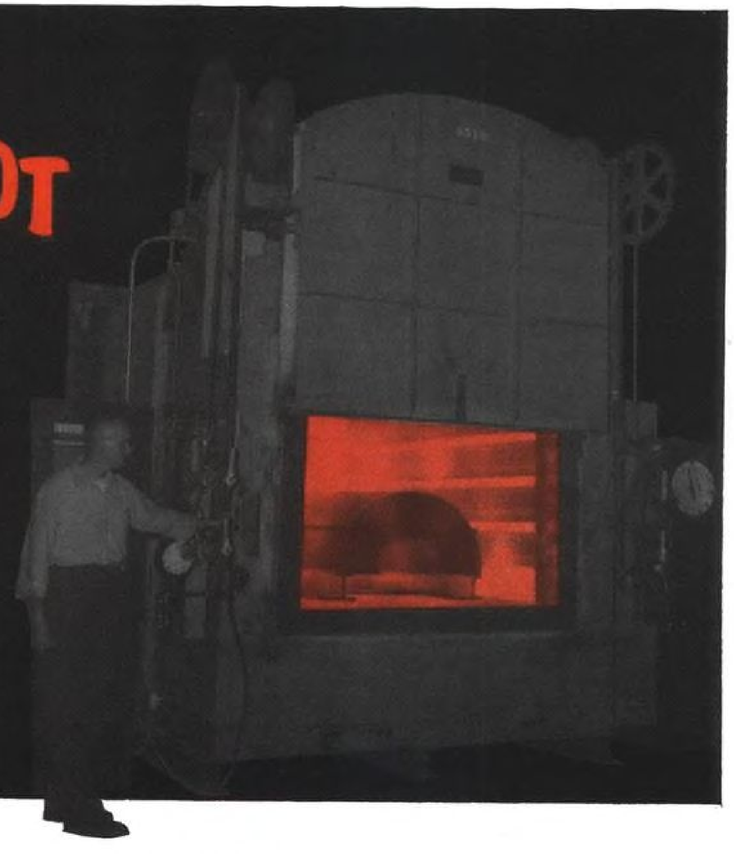
RIVERSIDE

Five Military Electronics Division plants in three locations. Over 500,000 square feet of engineering and production space, devoted exclusively to the design, development and manufacture of advanced military equipment.

RED HOT AND HONEYCOMB!

This missile component is typical of structures now in production.



AERONCA brazed stainless steel structures

Working with existing fully-integrated facilities, Aeronca is producing and delivering a variety of brazed honeycomb sandwich components for aircraft and missiles. Flat, wedged, conic, contoured and compound curved configurations are produced *daily* by specialists in high-temperature structures.

Aeronca . . . a pioneer in stainless steel honeycomb development . . . is capable of designing, developing and producing any major airframe or missile component involving honeycomb sandwiches.

A technical team is available, on written request, to make specific presentations on Aeronca's facilities for high-temperature air weapon structures. Write today for additional information.

AERONCA manufacturing corporation

1714 Germantown Road • Middletown, Ohio

Expansion of our operations has created openings for additional senior engineers. Write to Mr. L. C. Wolfe, Chief Engineer.

8261-AC

ings by the 10-man ad hoc team cited in the Tacan Alaska Report:

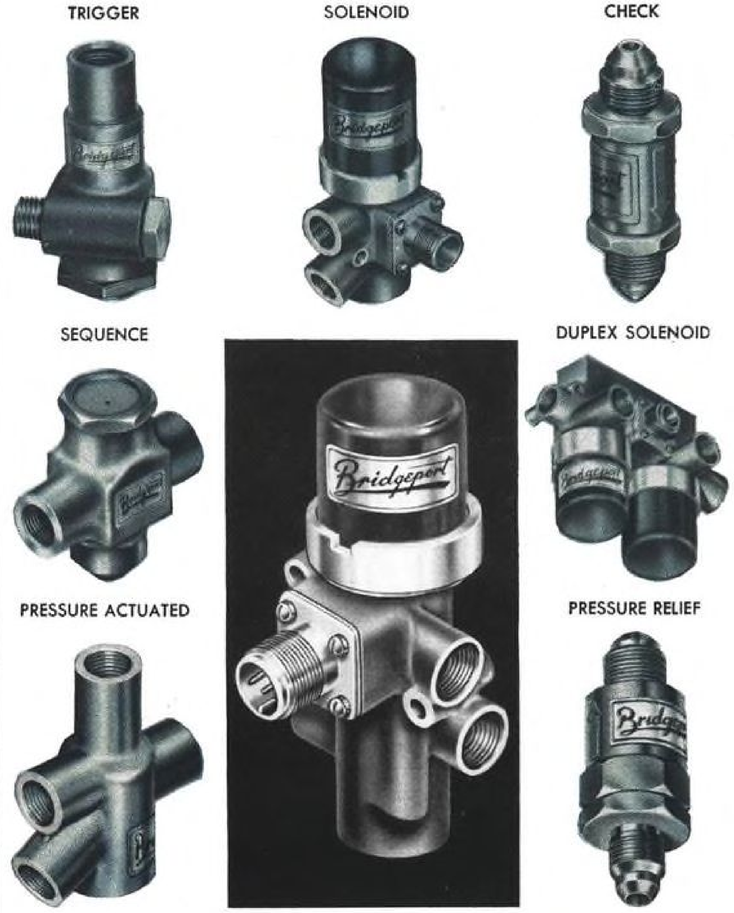
- **Average time** between failures of Tacan in F-102 is 90 hr., considerably better than the 22 to 35 hr. experience obtained with earlier equipments. (Figure is not high by airline standards, but military equipments are always considerably lower.)
- **Tacan is superior to VOR** (omnirange) for use in mountainous Alaskan terrain being less susceptible to course bends and scalloping. Once Tacan is properly aligned, there is no drift or course displacement, the report says.
- **Tacan accuracy,** coverage is well within design specifications. Maximum azimuth error is 1½ deg. and distance measuring error is within 0.2 naut. mi. Average range at 10,000 ft. altitude is 85 to 100 mi. on both azimuth and distance, depending upon terrain, with usable signals out to 140 mi. over fairly flat terrain.
- **100% "on-time"** can be expected from ground stations when dual (standby) equipment is used, providing automatic changeover provision is included.
- **Failures in recent-vintage** equipments are sufficiently random in nature to suggest there is no basic design deficiency in either airborne or ground equipment.
- **Report notes that there has not** been a single failure of SAL-39 Klystron tubes in the AN/URN-3 and AN/TRN-6 ground stations since they were commissioned.

Many of the early Tacan outages were not the fault of the equipment itself, the report says. For example, after many failure reports in Fairchild C-123 aircraft, it was discovered that the Tacan antenna cable was routed over a heating duct which caused the cable dielectric to melt, shorting the center conductor to its surrounding shield.

Locating the trouble was difficult because after the airplane had landed, the cable would cool off, correcting the trouble until the airplane again became airborne. In another case, the airplane's inverter was underpowered and unable to handle the Tacan receiver load. Installation of a larger inverter cured the trouble.

Some of the difficulties with early Tacan ground stations are attributed to poor construction of the buildings which housed the equipment. Buildings failed to provide sufficient warmth and protection from the elements, suffered cracking and heaving of the floor.

First military personnel available to maintain Tacan equipment had had only two weeks training on the equipment "in which they learned little more than how to turn equipment on and off," the report says. This problem has been largely eliminated, but the report points out that tuning of a



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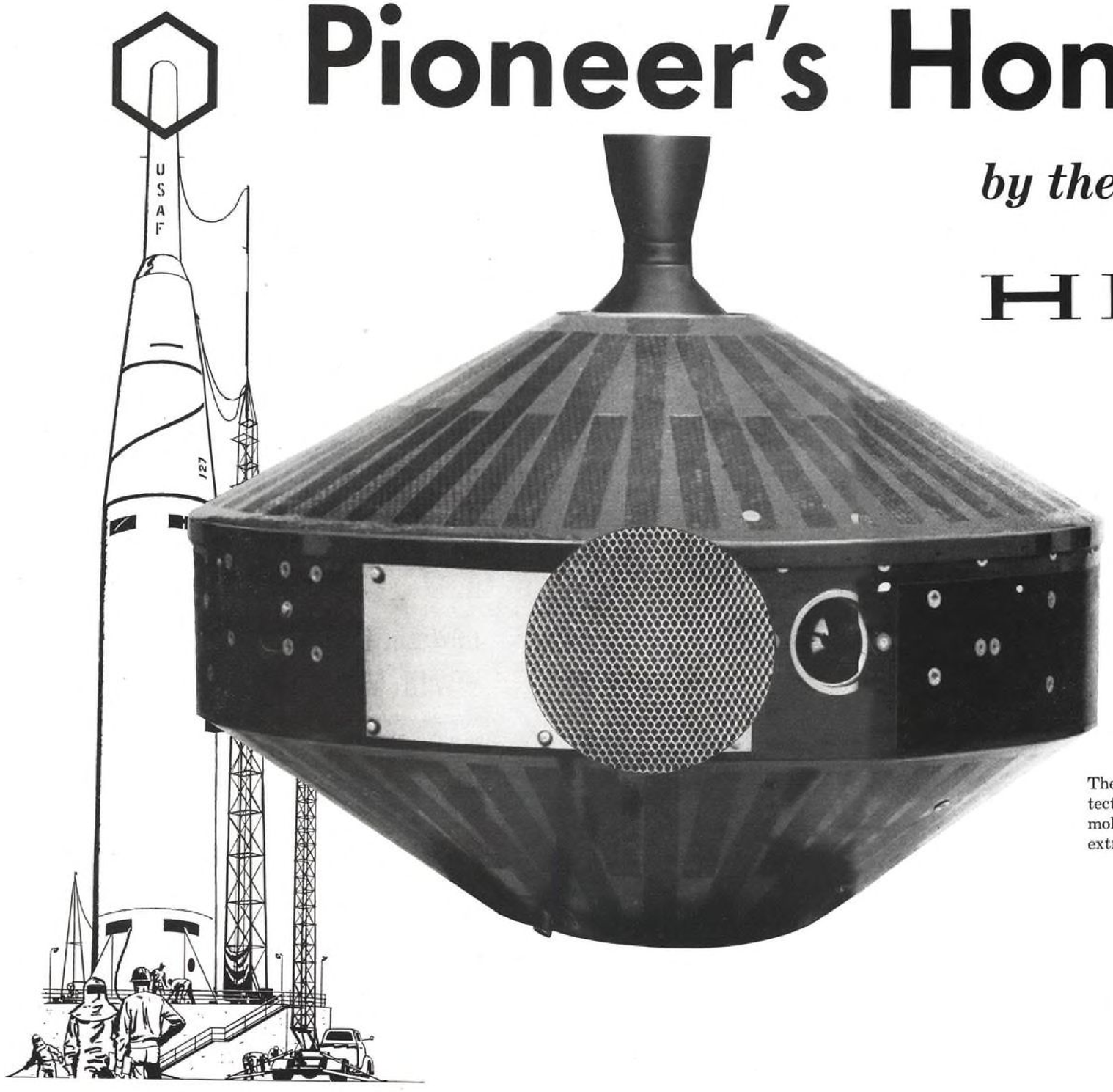

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Address all inquiries to:
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Scientific and Technical Relations,
Avco Research and Advanced Development Div.,
201 Lowell Street, Wilmington, Massachusetts

Research and Advanced Development division

Tacan transmitter is a critical adjustment and requires much experience.

The report concludes that the "Alaskan Tacan program has suffered with growing pains which caused skepticism among its users until modified production equipment, both airborne and ground, arrived in the theatre. With the arrival of this equipment, giving greatly increased performance, and with tactical pilots being forced to use and depend upon Tacan, the attitude toward Tacan in the Alaskan theatre has improved enormously. Greater confidence in the Tacan system has resulted."

Copies of the 55-page Alaska Tacan Report can be obtained by writing: Headquarters USAF, attention: AFOAC-E/N, Pentagon, Washington 25, D.C.

FILTER CENTER

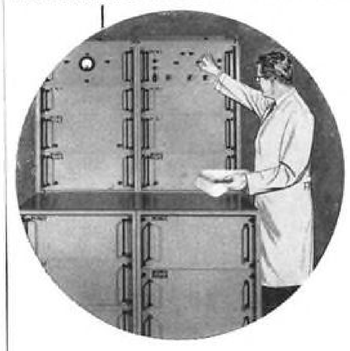
► **Radar Jamming Made Easier**—New 200-watt traveling wave tubes for all major radar bands, developed by Sperry Gyroscope Co. make it easier for electronic countermeasures equipment to jam powerful radars with their increased power, ability to shift frequency rapidly. Only two traveling wave tubes are required to boost jamming signal power level by factor of 100 million.

► **M-H Favored for F-108**—Self-adapting autopilot proposed by Minneapolis-Honeywell reportedly has won out for use on North American's supersonic F-108 interceptor and may also be selected for use on North American's B-70 supersonic bomber.

► **Big Push for Micro-Circuitry**—Number of major digital computer manufacturers have sizable programs aimed at micro-miniaturization of basic computer circuits. List is known to include Hughes Aircraft Co., International Business Machines Corp., Librascope, Inc., and Litton Industries. Observers expect IBM to announce a major breakthrough by next summer.

► **Transmitters for New Telemetry Band**—Philco Corp.'s Western Development Laboratory has delivered first of four transmitters designed to operate in new 1,435 to 1,535 mc. telemetry band (AW Sept. 29, p. 30) for use in RF link of pulse code modulation (PCM) data handling system being developed by Datalab Division of Consolidated Electrodynamics Corp. for Douglas Aircraft Co. System is designed to transmit at digital rate of 825,000 bits per second, provide information bandwidth of 400 kc. Ground receivers and data reduction gear will be housed in 33 ft. air conditioned trailer. Another

AUTOMATIC MISSILE CHECKOUT



Developed by Radiation, Inc., this system plays a vital role in the operational checkout of Bomarc missiles. The set provides simulated missile signals and automatically performs a sequence of tests to isolate any failures to specific sections of the missile package. Results are displayed in the form of GO/NO-GO indications. The unit also provides a self-test capable of isolating faults to a replaceable plug-in module.

This is typical of the advanced work being done by Radiation, Inc. in this field. One project presently underway will produce the most completely automatic universal checkout system in existence.

RADIATION INC.

AVIONICS • ASTRIONICS • INSTRUMENTATION
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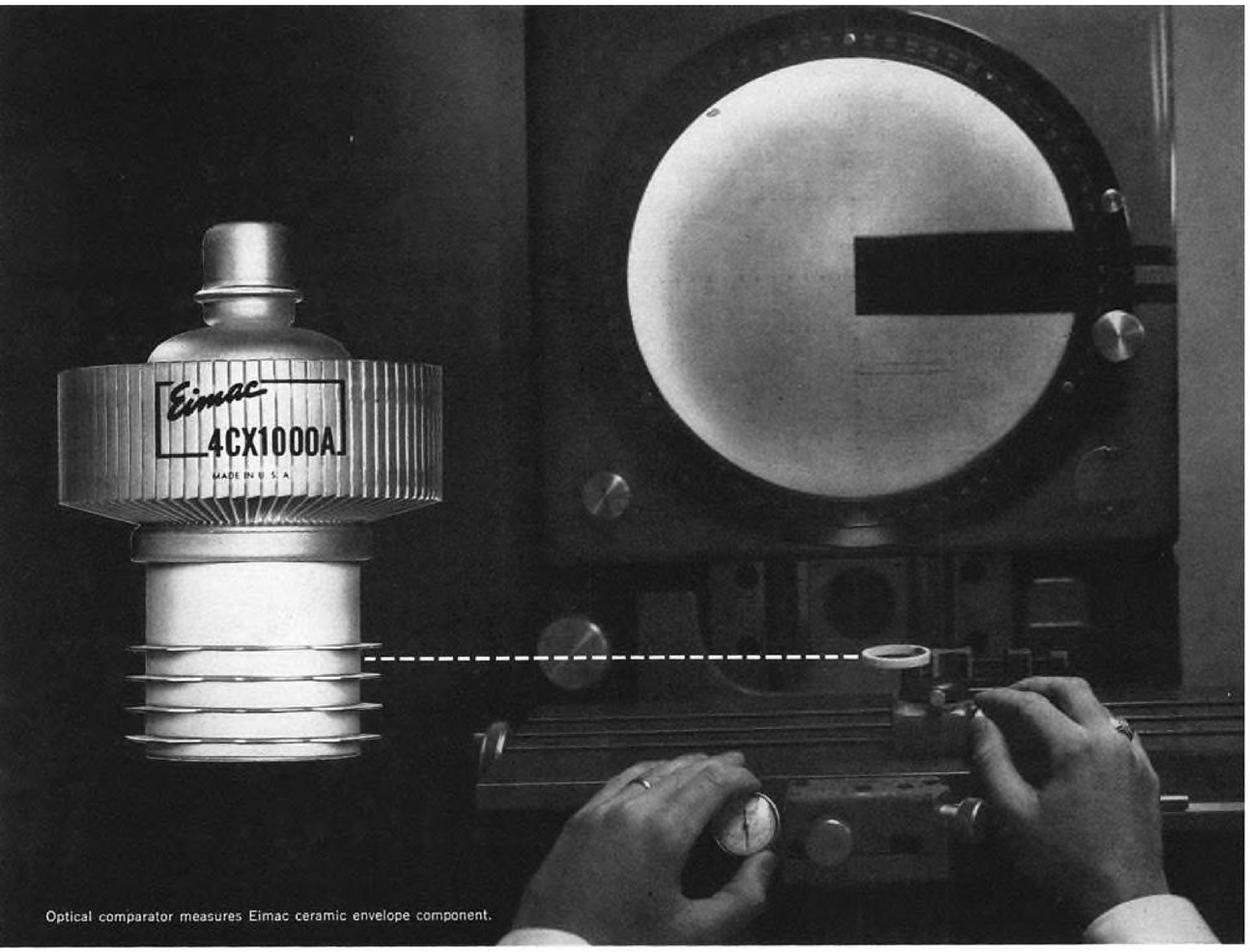

Optical comparator measures Eimac ceramic envelope component.

Exact Dimensional Uniformity...

Is an Eimac Ceramic Tube Extra

Sixth in a series describing the advantages of ceramics in electron tubes. Previously discussed: impact, heat, vibration, compactness, dielectric loss.

Electrode spacing is critical in modern high-performance vacuum tubes. Dimensional uniformity of the material used for the vacuum envelope has a direct effect on the accuracy of this spacing. The high alumina ceramic rings used in Eimac stacked-ceramic tubes can easily be held to tolerances of ± 50 millionths of an inch at production speeds. This degree of accuracy is not possible with glass techniques in high speed production.

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Background: You should be a graduate metallurgical, electrical, or mechanical engineer with three years of industrial or research experience. Experience in directing the research and development efforts of others is desirable.

Write to: Mr. A. L. Stevenson, Engineering Personnel, North American Aviation, Inc., Los Angeles 45, California.

THE LOS ANGELES DIVISION OF
NORTH AMERICAN AVIATION, INC.

trailer will carry remotely controlled tracking antenna.

► **Printed Board Research Facility**—Development of standardized, reproduceable method of testing surface resistance of printed wiring boards will be task of research facility being established at University of Delaware. Program is jointly sponsored by Electronic Industries Assn., National Electrical Manufacturers Assn. and American Society for Testing Material.

► **New Digital Data System**—Multichannel digital data transmission system, which reportedly requires less bandwidth and is less susceptible to noise interference than frequency shift keying (FSK) has been developed by Aeronautical & Instrument Division of Robertshaw-Fulton Controls Co. In new Phase-Multilock system, carrier is phase-shifted by predetermined amount under control of keying signal. Received carrier wave is compared to a reference wave and only those signals with correct amount of phase shift are used to operate receiving equipment, company says. Reference wave is derived directly from transmitted carrier in any of its selected phase shift positions and is accomplished through multiplication of portion of incoming signal by factor representing the number of permissable phase shift positions used in signaling system. Resultant signal is then divided down by same factor to provide stable phase reference. For more details, write the company at 401 No. Manchester, Anaheim, Calif.

► **Radiation Scare in Britain**—Permission to construct tropospheric forward-scatter communications station as part of NATO network has been suspended by Isle of Wight County Council, following reports in Britain's general press of the dangers of radiation from high power radio transmitters. British public, jittery over dangers of nuclear radiation, assumed that "radiation is radiation", no matter whether it is nuclear or radio. Both Supreme Allied Headquarters Europe and British Ministry of Defense called reports exaggerated and said all possible dangers were taken into account before selecting station.

► **Millimeter Waves Symposium**—Ninth international symposium sponsored by Polytechnic Institute of Brooklyn, Microwave Research Institute, to be held in New York Mar. 31 to April 2, will be devoted to subject of millimeter waves, including materials, solid-state amplifiers, electron tubes and components. Symposium is being co-sponsored by Air Force, Army, Navy and Institute of Radio Engineers. Papers and/or 100-word abstracts must be

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EACH SWITCH HAS "OFF" POSITION PLUS NUMBER OF POINTS LISTED.

Points	Size	Switch Part Numbers Thermocouple Type	*3 Wire Resistance-Thermometer Type
2	2"	11S2	36SR2
3	2"	11S3	36SR3
4	2"	11S4	36SR4
5	3"	10S5	37SR5
6	3"	10S6	37SR6
8	3"	10S8	37SR8
9	3"	10S9	37SR9
10	3"	10S10	37SR10
12	3"	10S12	37SR12
16	3"	10S16	37SR16
18	3"	10S18	37SR18
20	3"	10S20	37SR20
24	4"	27S24B2	38SR24
28	4"	27S28B4	38SR28
40	4"	38S2C	

*Resistance thermometer switches are provided with a safety resistor on off position.

2" SIZE

3" SIZE

4" SIZE

SPECIAL SWITCHES

No. 37S6C2, Four "4 Point and OFF" thermocouple switches combined in one 3" case.

No. 9S5, Single Pole, Four Point Instrument Switch in 1¼" round case.

No. 44S4, Six Pole, Double-throw Instrument Switch in 2½" round case, one hole mounting, ½-32 threaded bushing.

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Manufacturers of Complete Temperature Measuring Systems for Aircraft

submitted before Jan. 30 to: Prof. Herbert J. Carlin, Microwave Research Institute, 55 Johnson St., Brooklyn 1, N. Y.

► **Signed on Dotted Line**—Major contract awards recently announced by avionics manufacturers include:

• **United Electrodynamics,** Pasadena, Calif., $1 million prime production contract for transistorized telemetry systems, from Air Force Ballistic Missile Center (Air Materiel Command).

• **Electronic Engineering Co. of California,** Santa Ana, order from North American Aviation's Missile Division for a computer language translator system which permits rapid interchange of data between different types of computers and data processing equipment.

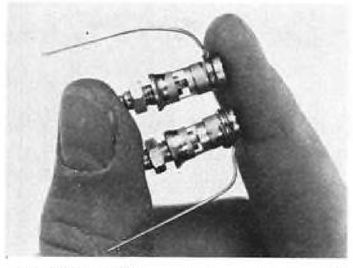
• **Summers Gyroscope Co.,** $540,000 Air Force contract for spare parts for gyro indicators and a $250,000 order from Douglas Aircraft Co. for flight control systems for use aboard a Navy fighter.

• **Interstate Electronics Corp.,** Anaheim, Calif., two Navy contracts totalling near $3 million for test and evaluation equipment for Polaris ballistic missile program.

• **National Research Corp.,** Cambridge, Mass., contracts totalling more than $230,000, for study to determine how missile components react upon re-entering earth's atmosphere and the behavior of materials under space high vacuum and temperature conditions.

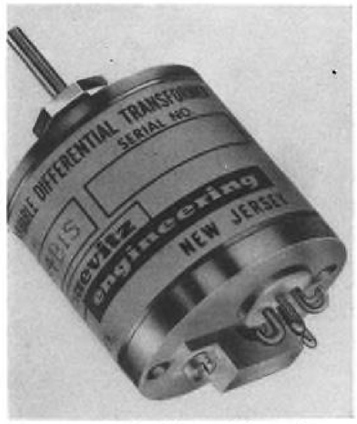
NEW AVIONIC PRODUCTS

• **Midget precision trimmer capacitor,** for operation at temperatures of −55C to 125C, with capacitance range of 1 to 8 mmfd., measures only 9/16 in. long behind chassis. Average "Q" is



over 800 at 50 mc., temperature coefficient is 50 ppm/deg. C. Dielectric strength is 1,000v. d.c. at 50% relative humidity. Corning Glass Works, Corning, N. Y.

• **Three inch storage tube,** Type WL-7225, used for storing information in computers, receives information in the form of electrical impulses which it stores and reads back on demand. Features are: 2.6 in. dia. useful target, improved resolution, electron gun beam focusing. Signal to be written is applied to gun control grid, usually clamped to the cut off, while the beam is scanned across the target. Erasure occurs simultaneously with the readout cycle. Electron Tube Division, Westinghouse Electric Corp., P.O. Box 284, Elmira, N. Y.



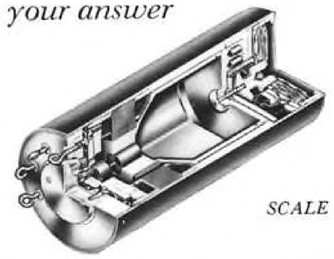
• **Linear variable differential transformer** (LVDT), Type 1000XS-KT, for operation over temperature range of −65F to 450F, has output voltage that is linear within 1% for core displacements of more than two inches. Unit has 5v. output for 6.3v., 400 cps. excitation. Schaevitz Engineering, P. O. Box 505, Camden 1, N. J.

• **Precision angular divider,** for indexing synchros and gimbal-mounted components with error less than 20 sec of arc, can be used by unskilled operator.

Repeatability is quoted at better than 10 sec. arc, range is 360 deg., with detent intervals of 5 deg. Theta Instrument Corp., 48 Pine St., East Paterson, N. J.

For the lightness you need and the accuracy you've been seeking

The constant-damped AP-S1 pendulous accelerometer may be your answer



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Only three ounces in weight, this rugged, spring-restrained accelerometer has 0.05% linearity to half-range, 1% to full range. Full scale ranges from 2 g's to 100 g's. Compensated damping 0.5±0.1 from −40°F to +200°F. Full scale output 7v at 400 cps excitation. Resolution 0.04% of full scale.

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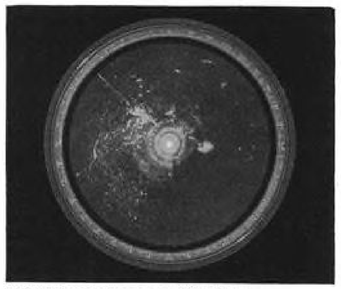

Conventional radar scope "blip" image.

New Philco high resolution radar picture.

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From the wonder-world of advanced electronics comes this Space Age "all-seeing eye." Compact enough to be used in a wide variety of advanced operational vehicles, Philco high resolution radar is especially well suited to air and space navigation, reconnaissance and combat area surveillance.

Philco, in conjunction with the USAF Air Research and Development Command, has perfected new techniques in radar signal processing. Called REDAP*, this new system produces clear, detailed pictures of any area in topographic relief, from behind the protective cover of cloud screens, midnight fog or extremely high altitudes.

At Philco, human resources, plus ultra-modern facilities add up to amazing versatility and gigantic capacity. Current activities include research and development in such fields as missiles and guidance, weapons systems, electronic computers, infra-red, communications and navigational systems, as well as advanced radar techniques.

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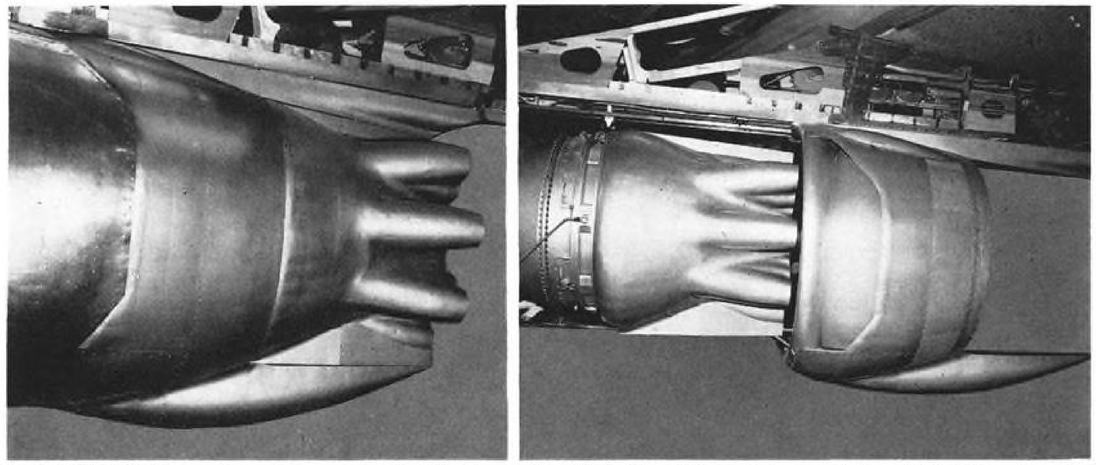


DOUGLAS DC-8 jet transport sound suppressor mates tail pipe nozzles with device called an ejector, a cylinder extended beyond nozzles during takeoff. Engineers say the device decreased sound and still increased takeoff thrust enough to offset the loss caused by nozzles. Ejector fairs into pod during flight (left) and is shown in mockup form in extended position (right). Oval indentation near ejector tip is one of two doors which close to form a thrust brake to reduce landing roll; doors turn thrust forward for reversing action.

Douglas Develops Retractable Reverser

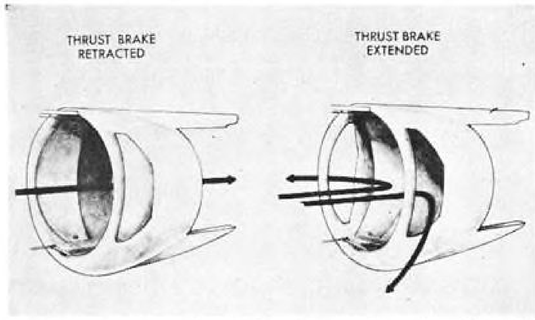
Los Angeles—Retractable reverser and jet engine suppressor which cuts the Douglas DC-8 jet transport noise level from 9-12 db, and provides at least 40% reverse thrust has been developed by Douglas Aircraft Co. engineers after a three year test program.

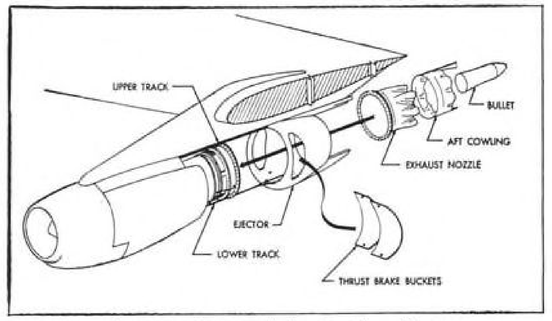
A combined corrugated nozzle system and retractable ejector, the device utilizes clamshell doors to turn the thrust forward for braking action, according to a report to the Society of Automotive Engineers by L. R. Jordan and C. M. Auble, of Douglas Aircraft Co.

Suppressor nozzle was designed for negligible distortion due to temperature and pressure under operating conditions. This was accomplished through:

• **"Triple bubble" design** incorporating

CONVAIR 880 jet transport reverser diverts thrust forward through cascades on pod sides.





THRUST reverser doors close (left) to divert engine exhaust forward for reversing action, open for normal thrust action. Suppressor-reverser exploded view is at right.

A giant step has been taken in the U.S. military development program with contracts for the creation of an unprecedented primary strategic weapon system. It is the Air Force DYNA-SOAR, now in Phase-I design stage by a six-company project team under Martin direction.

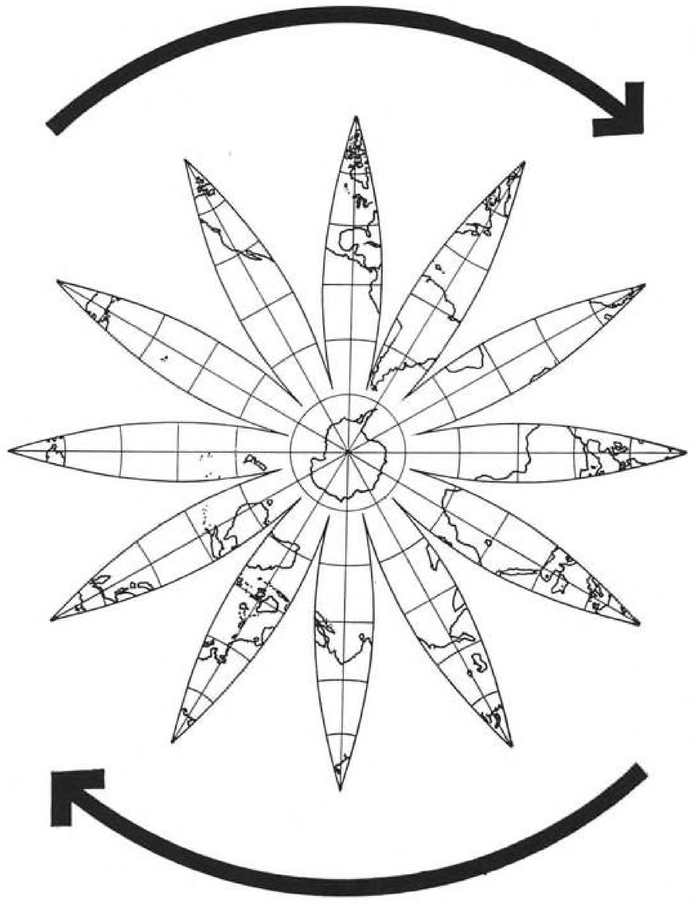
DYNA-SOAR—the most advanced military weapon system now in development—is a pilot-controlled bomber-reconnaissance space vehicle, its mission being to circle the earth at orbital velocity, with controlled aircraft landing capabilities. It will be propelled by several stages of rocket boosters, enabling it to operate from ground level to the ionosphere at hypersonic speeds.

In an entirely new and advanced concept of integrated industry coordination, the six companies teamed in this No. 1 military program constitute top capabilities in the basic areas of airframe, propulsion and radar guidance system development.

Bell, a pioneer in the boost-glide field, will design and build the airframe of the vehicle ...Bendix will develop communication, telemetry, hydraulic and electrical power conversion systems...Goodyear will produce the crew-escape capsule and the radar systems ...Minneapolis-Honeywell will be responsible for guidance and navigation to keep DYNA-SOAR on course and supply position and velocity information to the crew. American Machine & Foundry's responsibility is an advanced system of ground handling and launching equipment...And Martin will establish the configuration and design of the rocket boosters, carry out an experimental aerodynamic program for the complete vehicle, and assemble a full-scale mockup of the system.

Because of the challenging technical problems involved, the presidents of the six companies – aggregating assets of over $2 billion – comprise an active advisory panel, with their top engineering teams participating.

Never before in military history has so formidable a task force of specialized industrial capabilities been applied against such an advanced concept.



MARTIN
BALTIMORE·DENVER·ORLANDO

internal vanes and radial struts to place stress-carrying material in tension.

- **Use of welded** 19-9 DL stainless steel, with fairly light sheet steel used for outer portion of each lobe.

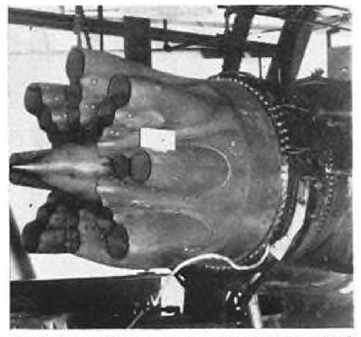
After exhaustive testing, engineers decided that for optimum sound reduction, using corrugated nozzles, the suppressor should have:

- **As large an outer diameter** as possible at the exit plane.
- **Lobes which increase** in cross sectional area at the exit plane with radial distance from the thrust axis, and no fewer than eight lobes.
- **Relatively small** center body, or bullet.
- **At least** 90% of the exhaust area distributed in the lobes, i.e., less than 10% of the exhaust area should be located in the annular passage near the bullet.

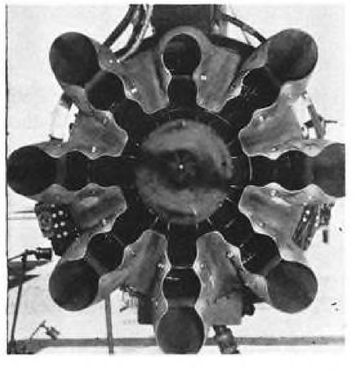
To reduce thrust loss to a minimum, the engineers said the nozzle should have a cross sectional flow area that is constant or slightly converging over most of its length, with convergence to final flow area taking place rapidly in the final few inches of gas travel.

Thrust loss, they discovered, dropped in proportion to the number of lobes, and the center body size had little effect on nozzle static thrust.

In considering thrust reversal for



THRUST mixing nozzles mix Douglas DC-8 jet engine exhaust with cold outside air to cut noise. Engineering goal was 9-12 sound decibel reduction; company says the nozzles "meet or exceed" the goal. Ejector was not fitted for either of these suppressor views.



American industry teams up to build the B-70 and the F-108

AMERICAN INDUSTRY faces a job that is big, demanding, urgent.

The F-108 and the B-70 will be the first of the new generation of manned weapon systems. No military airplane in the world today even approaches their performance.

They represent such a sharp break with the past that almost everything that goes into them — aerodynamic design, structure, propulsion, electronic and hydromechanical systems—will require giant forward strides in engineering.

The need for these radically advanced manned weapons is very great. Yet the scope and complexity of the systems engineering involved presents problems so formidable that it will challenge the most creative minds in America.

There is only one way to handle projects of this size: dividing each project into major systems and assigning each of these systems to a major contractor. In this way, America's outstanding scientists and engineers can begin work *simultaneously* on each of the separate systems (15 for the F-108, 16 for the B-70).

Each major contractor will be responsible to the Weapon System Manager for *everything* about his system, from engineering through construction. In every case he will sublet contracts for engineering and components to other companies, large and small. He will deliver his system to the prime contractor, North American Aviation, who in turn will deliver the complete weapon system to the Air Force.

This is the Weapon System Manager concept. This is the way American industry shelves self-interest and shares secrets to make the nation strong. This is the way that free men can meet the threat of tyranny.

The Los Angeles Division of

North American Aviation, Inc.

braking, the engineers concentrated on an unusual external target type of thrust brake in which two brake buckets, or clamshells, rotate to close off a moveable "ejector" in braking configuration.

The ejector moves fore and aft and is actuated by two overhead switches in the DC-8 cockpit. Switches energize solenoid valves which port hydraulic fluid to the actuating cylinders; cockpit lights indicate full extension. System operates the buckets in one or two seconds.

Brake operation is controlled from the pilot's pedestal by thrust brake throttles which are pivoted from the main throttles; operation is possible only when the main throttles are in idle position. Thrust braking selection directs engine bleed air to the actuating cylinder, utilizing an engine-mounted pilot valve which takes its signal from a cam on the engine throttle shaft. Engine operation is not necessary for ground checks, since both thrust brake and ejector are operable from normal ground power supply plugs.

Air used for actuation is taken from either the aircraft's pneumatic manifold or the engine high pressure bleed system. In case of pneumatic system failure, the thrust brake will either retract automatically due to the pressure loading on the bucket, or may be opened by retracting the ejector.

Piston-Operated

Ejector is piston-operated; it can extend in 3 sec. and retract in 6 sec. Device is held in fore or aft position by locking hydraulic fluid in the cylinder. Two bayonet type disconnect valves are fitted in the aft slide assembly; in fully extended position, these connect with valves in the pylon at the ejector track rear, thus supplying air for the thrust brake actuator. Latches on the pylon track prevent inadvertent extension in flight.

In the forward thrust position, the brake bucket surfaces form the inner line of the forward ejector wall. Two buckets rotate to close off the ejector completely in the full braking configuration.

In testing this design, engineers found:

- **Moderate aft sweep** of 9-11 deg. angle on buckets in the braking position had little effect on the reverse thrust. Aft sweep was found to be desirable to stabilize gas flow during the operation.
- **Unblocked area of 1%** in the ejector resulted in about 2% loss in braking thrust.
- **Length of aft lip extension** which turns the gas flow forward had a relatively small effect on performance; optimum length was found to be about one-third of the reference nozzle diameter.

The engineers also noted that the

How to avoid false test results due to "ground loop" voltages

With the increasing need for greater accuracy in shock and vibration measurement, extreme care should be taken to avoid the introduction of spurious voltages.

Circulating ground currents, generated by electrical devices external to the measuring system, generate voltages that can lead to completely false results.

GROUNDING USUALLY AT FAULT

Ground loops may come from various extraneous sources.

Figure 1 shows how circulating ground currents in a structure can induce electrical voltages in a typical shock and vibration measuring system. In this example, the accelerometer, amplifier and data handling or recording equipment are placed at three separate locations. Each instrument has its electrical circuitry grounded to the housing, and each housing is connected electrically to the structure at points A, B and C.

Voltages E, produced in the structure by the circulating currents, are introduced into the measuring system between points A&B and B&C.

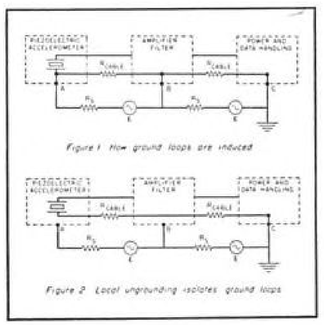


Figure 1. How ground loops are induced

Figure 2. Local ungrounding isolates ground loops

SOLUTION TO THE PROBLEM

First, all electrical apparatus capable of generating currents should be ungrounded and a *single heavy point ground* employed.

Second, all measuring instruments should be ungrounded at local points and the entire system grounded at the single point.

Anthony W. Orlacchio
Chief Engineer
Gulton Instrumentation Division

Figure 2 illustrates a recommended technique for ungrounding the system described in Figure 1. By removing the internal circuit grounds from structural points A and B, ground loop voltages are isolated from the measuring system.

UNGROUNDED INSTRUMENTS THE ANSWER

Today, a new series of Gulton accelerometers and associated electronic equipment is available with *internal ungrounding*.

Accelerometers contain sensitive seismic elements insulated from mounting studs by rugged ceramic insulation.

Filter and amplifier circuitry, as well as connectors, are electrically insulated from the housing which can then "float" at the local ground potential of the mount with no effect upon the measuring signal.

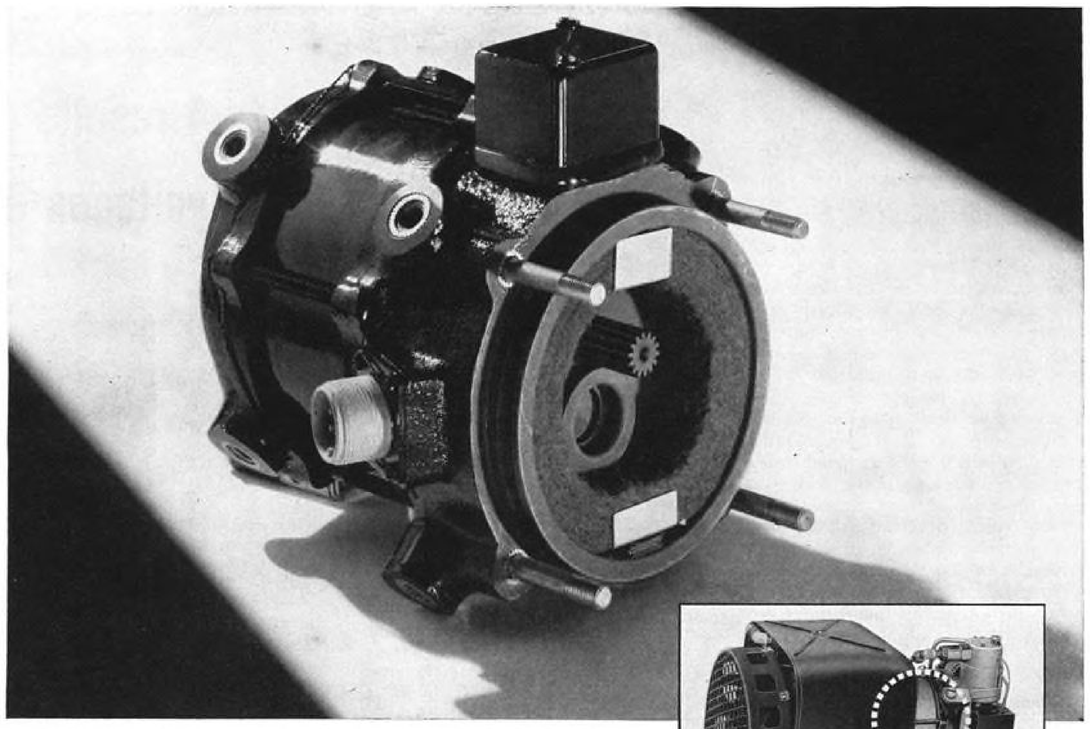
SEND FOR TECHNICAL DATA

For more complete information on Gulton ungrounded instrumentation systems, contact your local Gulton representative or write us direct.

FREE TECHNICAL SERVICE OFFERED BY GULTON

A Gulton Instrumentation Engineer will gladly call at your request to help you with instrumentation problems. You are invited to put his extensive experience in shock and vibration measurement to work for you.

GULTON INSTRUMENTATION DIVISION
Gulton Industries, Inc.
Metuchen, New Jersey



Model E6440-1 exemplifies Airborne capabilities in the design and development of large special motors. Inset shows application on Walter Kidde & Company lightweight compressor package (2.4 scfm, 3000 psi) used for auxiliary pneumatic power on jet tanker.

AIRBORNE CAN HELP YOU WITH LARGE SPECIAL-DESIGN MOTORS

Photo courtesy Walter Kidde & Company, Inc.

Airborne can design and develop almost any type of large special motor you need and supply it in any quantity you require. Evidence of this capability is found not only in current projects, but also in the many different motors developed over the years for use on our own actuators and electromechanical systems.

Typical of the large special motors designed and produced by Airborne is the one above developed for Walter Kidde & Company to power one of its outstanding lightweight compressor packages. Special features include magnesium castings for weight savings; modified high-temperature insulation and lubricants; and a special thermal overload protector (Type C protection) to prevent winding damage at temperatures above 400°F.

Whatever your particular requirements in large special-design motors, it will pay you to consult Airborne. Chances are we can solve your problem in good time and at reasonable cost. Write, phone or wire for more information.

GENERAL ENGINEERING DATA

Airborne Special Design
Motor E6440-1

1. 115/200 v a-c, 400 cycle, 3 phase (conforming to MIL-M-7969A)
2. Rated 1.7 hp at 10,900 rpm—10 in-lb full load torque; 25 in-lb starting torque
3. Duty cycle: 30 min. on at full load/30 min. off
4. Ambient temperature: −65 to +165°F
5. Altitude: to 50,000 ft
6. Weight: 8.8 lb

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thrust brake has "neglible effect" on engine operation over the whole operating range.

Sound suppressor and reverser, designated daisy-ejector type, has been installed on General Electric CJ805-3 turbojet engines which will power the Convair 880 jet transport.

Suppressor comprises a daisy petal design which Convair says provides a total perimeter larger than that of the conventional circular tail pipe, thus increasing the shear area where high thrust exhaust creates friction with ambient air, producing high noise levels.

Device utilizes an ejector to pump air through the forward portion of the engine pod, aft of the firewall, for cooling.

The cooler air also provides a blanket of what Convair terms "secondary air" which is ejected around the perimeter of the daisy-petal-shaped tailpipe where it mixes with the exhaust, reducing the sound level.

Thrust reversing is obtained by use of clamshell doors which close to block the normal exhaust channel, deflecting the exhaust forward through cascades located on both sides of the engine pod. Cascades extend 60 deg. above and below a horizontal line on each side, for a total of 240 deg. Reverser is hydraulic-powered. A separate pump is provided for each engine.

ARMY aluminum air-drop personnel carrier built by Food Machinery & Chemical Corp.

Air-Drop Vehicles Designed for Army

New York—Food Machinery & Chemical Corp. is developing a family of air transportable vehicles under Army contract which includes transporter-erectors for at least two missiles —Pershing and Little John.

J. M. Hait, executive vice president of the corporation and manager of its Ordnance Division, told the New York Society of Security Analysts last week that the vehicles are identical in basic machinery but use different hulls for widely varying tasks.

Besides the missile equipment, the family includes the air droppable M59 troop carrier, the first of which has just been completed by the division as first in the line, command post vehicles, and a command center vehicle. Ten to 15 types of vehicles are contemplated.

Some are designed for transport by helicopter. Others would require a Lockheed C-130 or Douglas C-133 for airlift.

If the development is successful, Hait said, the total program might dwarf the company's current $60 million defense volume.

Other projects in which the company is engaged:

• **Nike Zeus** sustainer engine development. This is a project of Grand Central Rocket Co., half owned by Food Machinery through its 50% holding with Tennessee Gas Transmission Corp. of Petrotex.

• **Bomarc erector-launcher** and power pack, Thor erector-transporter and Hawk erector-transporter. All these are in production.

Volume of the corporation's defense divisions next year is expected at least to equal this year, which was a record year for the company, the analysts were told.

NOW DC-6B SERVICE FROM FRANKFURT TO ALL EAST AFRICA

NEW GATEWAY TO AFRICA—FRANKFURT! From the center of Europe you can now fly overnight to leading East African cities on luxurious new DC-6B's of Ethiopian Airlines. An incomparable first class and tourist class service. Ethiopia offers a unique vacation experience. Cool always. Modern hotels. THE LAND OF THE QUEEN OF SHEBA IS ADVENTURE LAND!

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ETHIOPIAN AIRLINES

THE WONDERLAND ROUTE

General Agents in United States and Europe **TWA**

28 volts powers this transistorized vibration amplifier

Consuming only a fraction of the power required by tube type units, taking ⅓ the space, and operating directly from a 28 volt battery, this GLENNITE transistorized amplifier fills all requirements for airborne application.

Unique design and rugged construction assure extremely low microphonics, provide high input impedance for direct use with piezoelectric accelerometers.

A companion light weight, 3-channel battery pack is available. This unit contains a rechargeable, sealed nickel cadmium battery capable of powering 3 transistorized amplifiers for 16 hours.

Like more data on these units? Contact your local Gulton representative, or write us direct.

SPECIFICATIONS

Gain: Continuously variable from 10 to 100
Input impedance: 30 megohms minimum
Power input: 28 v dc at less than 3 ma
Frequency range: 10 cps to 20 KC
Temperature range: up to 200° F

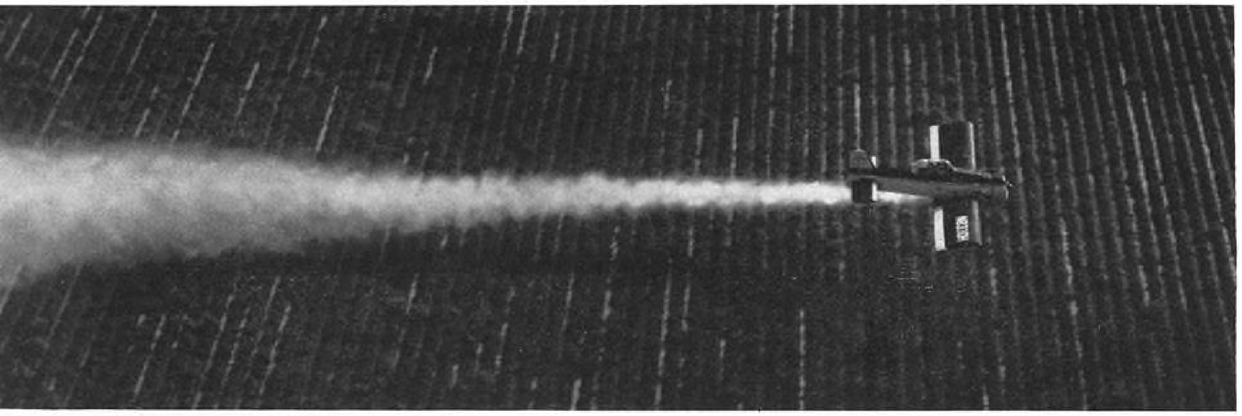
Call in Gulton

Whether you need a single instrument or a complete system, Gulton is capable of meeting all your needs in shock and vibration measurement from transducer to readout equipment. Call in a Gulton Instrumentation Engineer on your next assignment — or on your present one if you have a problem.

GULTON INSTRUMENTATION DIVISION

Gulton Industries, Inc.

Metuchen, New Jersey

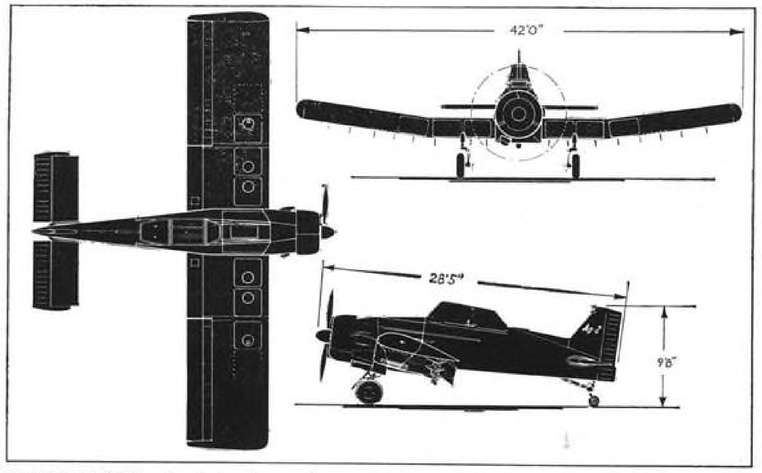


PROTOTYPE Transland AG-2 can carry 3,500 lb. payload on spray jobs; engineers plan to test aircraft for solids dispensing.

Aviation Week Pilot Report

AG-2 Features Low-Speed Controllability

By Richard Sweeney



THICK, high-lift wing is dominant characteristic; note nose slant for good visibility.

AG-2 Performance Specifications

Airspeed Limits (true indicated airspeed):

Never exceed	165 mph.
Max. structural cruising	131 mph.
Maneuvering	129 mph.
Flaps extended	106 mph.

Stalling Speeds (mph.) Power Off:

Angle of bank	0°	20°	40°	60°
Flaps up	84	86.7	96.1	118.8
Flaps down	67	69.1	76.6	94.7

Flight Load Factors:

Max. positive load factor	3.6 with flaps @ 0°
	2.0 " " @ 20°
Max. negative load factor	1.4
Maximum weight	6,000 lb.

Torrance, Calif.—Transland Aircraft's AG-2 spray and dusting airplane, designed for a high degree of operational efficiency, emphasizes qualities which include excellent visibility, good flight characteristics and a cockpit engineered for maximum protection in case of an accident.

AG-2 basic design stems from AG-1, exclusively agricultural airplane built at Texas A & M College under supervision of Fred E. Weick, and sponsored by the Civil Aeronautics Administration, U. S. Department of Agriculture and the National Flying Farmers Assn.

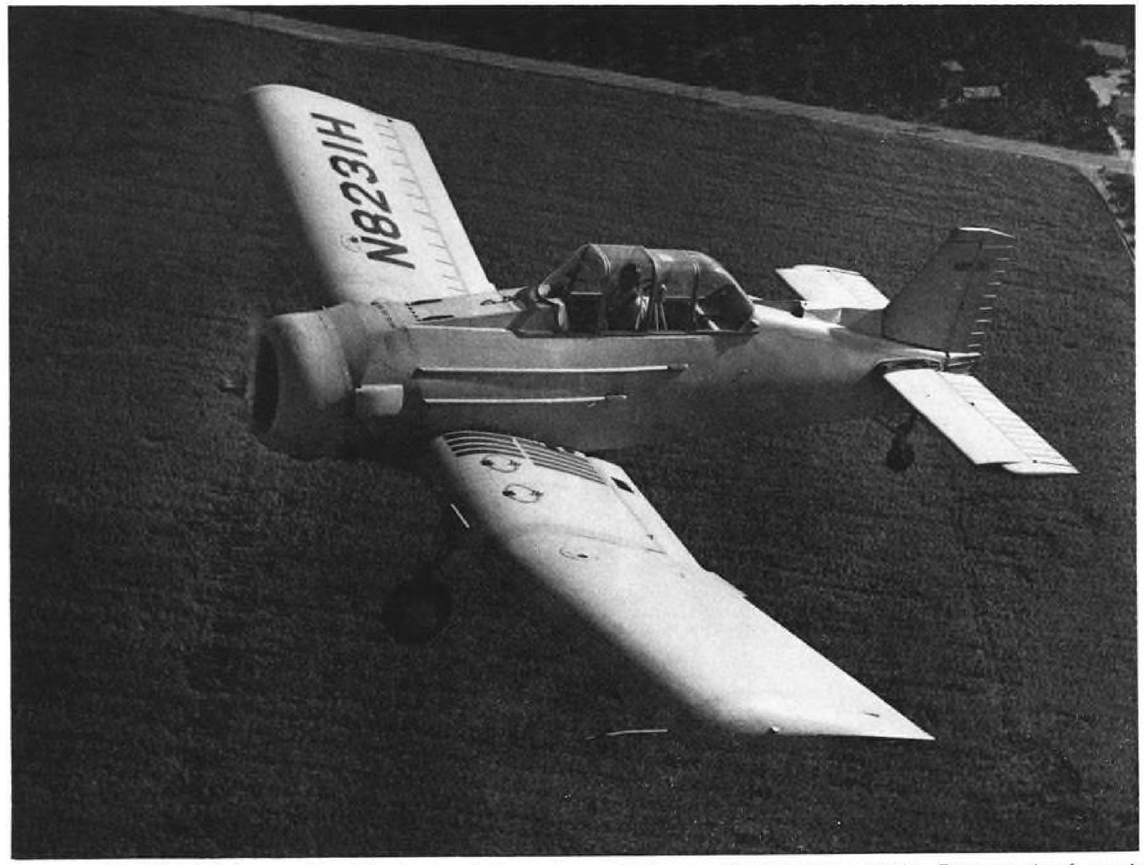
Following the crash of the AG-1, George S. Wing, Transland president, bought the wreckage and plans, studied test reports, recommendations and opinions of the many pilots who had flown it, and refined the design to produce the AG-2.

Transland has two airplanes currently flying: the prototype, N8330H (AW Jan. 28, 1957, p. 93) and N8331H, first production configuration airplane. Both were flown for varying periods in Aviation Week flight evaluation.

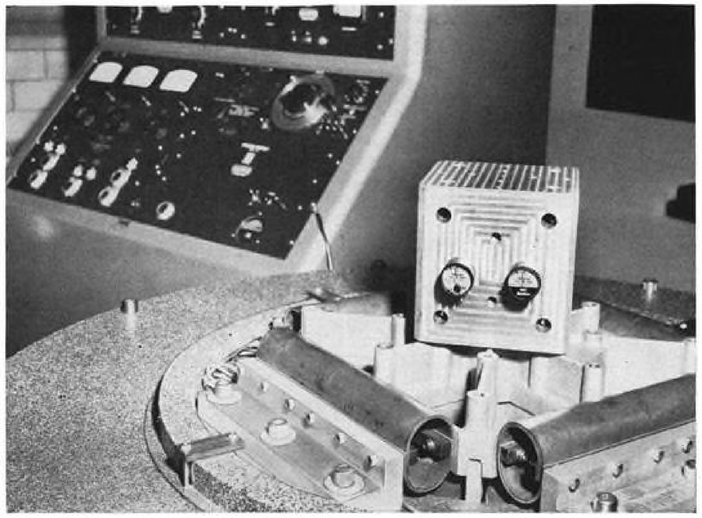
AG-2 flight characteristics are complementary to the primary mission of the airplane. An aerial applicating airplane is meant to have as high utilization as possible since it is making money for the operator and pilot only when it is dispensing a payload of some type. One of the best assets a plane of this type can have is an ability to work for hours at a time with minimum strain on the pilot, while operating at maximum loads.

With its design for lifting high loads,

TRANSLAND AG-2 features slot-lip ailerons and aileron flaps, called flaperons. Cockpit is sealed to prevent entry of toxic fumes; ram air intake scoop delivers air to cockpit area for pilot protection from spray or dust fumes. Aircraft demonstrated no tendency to snap in turns during pilot evaluation of a typical spray mission. Aircraft remained fully controllable at slow flight of 50 mph.



PRODUCTION AG-2 includes second seat in closed cockpit area to carry loader or mechanic to operations site. Prototype aircraft now is being converted to open cockpit airplanes with second seat enclosed by hatch when not in use.

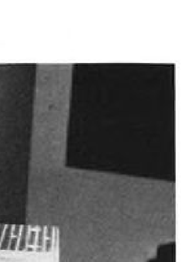


RMC-LINDSAY ONLY GAUGE TO STAND THIS TEST — This photograph shows vibration testing of RMC-Lindsay pressure gauges on the 3200 force pounds Calidyne Vibrator to 50 G output, amplitude .010 to .20. Cycling frequencies to 2,000 cps. The test is conducted so as to parallel actual installation conditions, with gauges subjected to 350°F under operating pressures. Complete test reports are available on request.

THE RMC-LINDSAY GAUGE IS RADICALLY DIFFERENT

from ordinary high pressure gauges

HERE'S WHY...



1. **The RMC-Lindsay gauge is a multiple coil, helical bourdon tube type, *restricted for overpressure.***
2. **The pointer is attached directly to the end of the coil, with no linkages or pivots to be affected by vibration.**
3. **Superior techniques in coiling, heat treatment, calibration, and material specification are *new* and *exclusive* with RMC.**
4. **No other gauge can match RMC-Lindsay specifications:**

PRESSURE RANGE: Pressures in ranges 0 to 1,000 p.s.i. up to 15,000 p.s.i. with retard scales available. OVERLOAD PRESSURE: Nominal overload pressure factor of 2.0 times the maximum dial reading (higher factors available). BURST PRESSURE: Normally 3.0 times the maximum dial reading. TEMPERATURE: Not affected by temperatures up to 350°F. VIBRATION: Qualification test report available on pressure tests showing cycling, vibration, to 2,000 cps. at 25 G's, and resonant frequency vibration tests at 25 G's. SHOCK: Data available on MIL-E-5272 shock test. PULSATION: Practically unaffected by line pulsations of 3% of the full dial reading. ENDURANCE: To 250,000 cycles or higher depending on application. ACCURACY: Hysteresis friction and backlash are below readable limits. Absolute gauge accuracy to extremely low limits as required.

Whatever your high pressure gauge problems may be, why not let RMC engineering skill provide the answers. Write, wire or phone either of the addresses below.

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ROCHESTER MANUFACTURING CO., INC.
221 Rockwood Street, Rochester 10, N.Y.

RMC
LINDSAY PRESSURE GAUGES

good controllability at the speeds where most of the pertinent flight work is accomplished, the AG-2 seems to meet its mission well, according to experienced agricultural pilots who have flown the airplane.

In many cases, flight characteristics of airplanes used for aerial applicating are allowed to become less than desirable, while still sufficient to do the job. Design of the AG-2 is such as to be able to do the job and still maintain higher standards of controllability than heretofore obtainable with aircraft reworked to the agricultural and forestry mission, according to company engineers.

First Flights

First flights were made in the prototype airplane and included a general sampling of the aircraft's characteristics at medium and low altitudes, and a sample aerial applicating mission near Oxnard, Calif.

A later series of flights were made in the production airplane and included flight evaluation at high and low altitudes and simulated dusting operations in an overwater flight test area near Los Angeles.

Walkaround inspection of the AG-2 is simple. The primary concern outside of general airframe, powerplant, propeller conditions, is to see that all filler necks for liquid spray tanks and hopper are fastened solidly. Liquid dump valves also are checked for security.

Flights were conducted from Torrance Municipal Airport on the Transland plant side of the field. No taxiways paralleling the runway are available, offering a good assessment of the plane's taxi characteristics on rough fields. The airplane proved to have excellent taxi abilities both with tail wheel locked and unlocked. Wide gear tread, plus load location low to ground, enhanced stability in taxi with the tailwheel unlocked.

Engine runup and check is standard. Normal takeoff is without flaps, and unless the pilot is thoroughly familiarized with the airplane's configuration and attitude relationship to the ground, a takeoff in three point attitude is usual. Wing has a 4 deg. angle of incidence which, when coupled with the aircraft's three point attitude, helps generate takeoff lift before the pilot is aware of it.

Gross weight on first flight with N8330H approximated 4,500 lb. on the prototype, including partial fuel load. At the lower gross weight, with a power setting of 30 in. hg. and 2,100 rpm., a sustained 1,000 fpm. rate of climb was held to 4,500 ft. where 110 mph. indicated air speed was calculated to a true air speed of 121 mph.

In trimming out the AG-2 for level flight, a definite appearance of nose down attitude is obtained when the

Flight Comfort
FOR MODERNS

In an age of jets, passengers demand the ultimate in comfort. Enterprising seat manufacturers are provided a wide latitude in materials with which to fulfill these requirements of style and comfort.

Aerotherm, the name on the finest aircraft seats in the world, adds another requirement to the art . . . Energy Absorption. Studies in this field point the way to the further delethalization of aircraft seats . . . the ultimate in a trend toward greater safety and "flight comfort for moderns".

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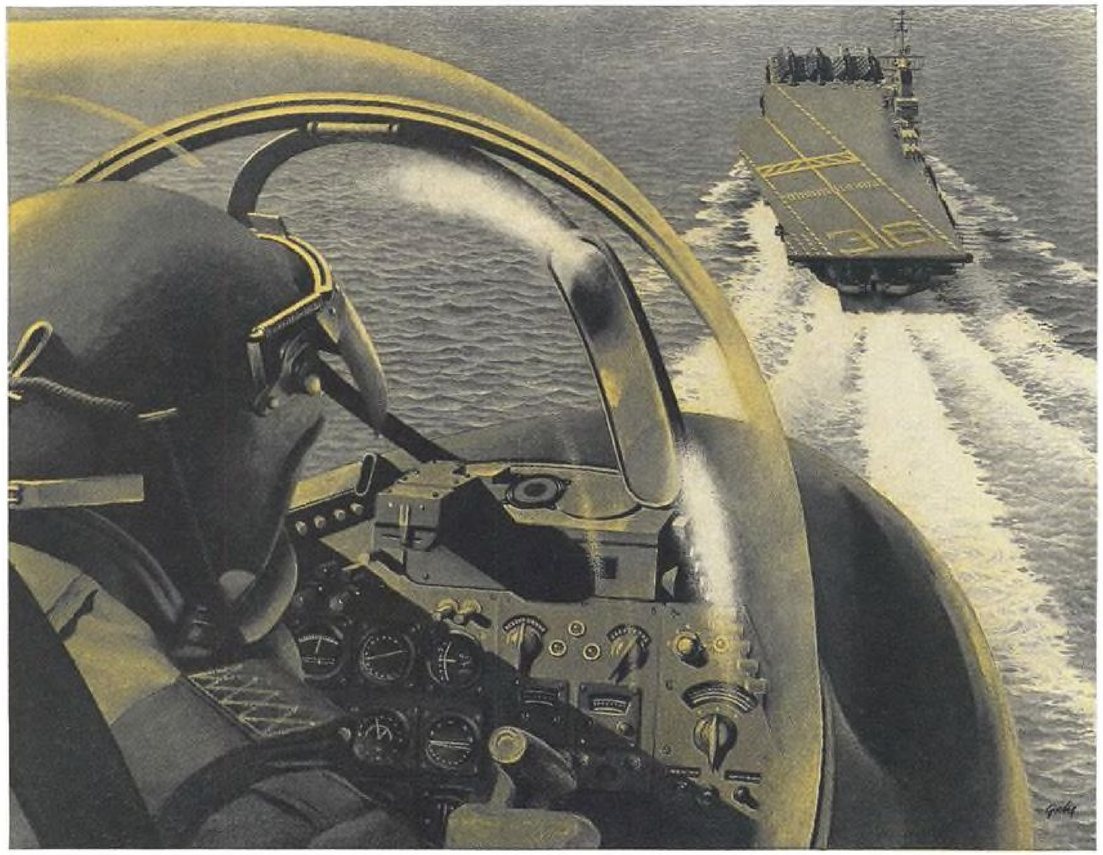

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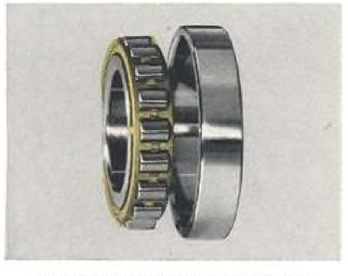

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As part of our expanding organization, you'll perform research and experimentation to determine the geometry, materials, and lubricants for bearings for high loads and temperatures up to 1000°F.

You may qualify for one of these long-range careers, if you have a ME or Chemical Engineering degree.

Write to: Mr. A. L. Stevenson, Engineering Personnel, North American Aviation, Inc., Los Angeles 45, California.

THE LOS ANGELES DIVISION OF
NORTH AMERICAN AVIATION, INC.

AG-2 Earnings Breakdown

Swath in feet	225
Speed, mph.	117
Specific fuel consumption	.495
Gal. spray/load	250
Boom time	9.4
Acres/load . . 500 ÷ Acre/min . .	250
Turning time allowance	2.8
Ferry time	12.3
Flying time/trip	24.5
Boom time	9.4
Turning time allowance	2.8
Ferry time	12.3
Loading time @ 100 gal./min	2.5
Taxi time	1.5
Trip cycle time	28.5
Flying time/trip	24.5
Loading time	2.5
Taxi time	1.5
Trips/hr.	2.1
Gal./hr.	525
Gross/hr.	$199.00
Gross/mo. @ 55 hr./mo.	$10,945

Application—½ gal./acre (forest or range spraying)
Rate of pay—38 cents/gal. for 12 mi. ferry

plane's rate of climb is settled on zero, with the combination of forward sloping hopper top and relatively large angle of incidence contributing.

Stalls, power off, straight ahead and in turns, indicated good characteristics, with no tendency to snap in turns. Accelerated stalls were incurred at higher airspeeds as the angle increased, and while the margin between buffet and break closed, there still was an ample speed warning spread between the two values.

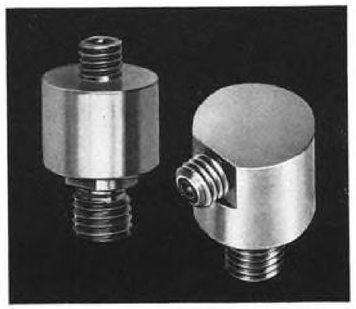
Attitude perspective again plays a vital part in stall recovery with the AG-2. If the nose is allowed to drop and airspeed build up without power, accelerated stall can be induced or a follow-on stall can occur if an extra margin of airspeed is not allowed or if the nose is pulled up too quickly. Power recovery technique is very effective, from stalls ahead, or turning.

Dusting Mission

Simulated dusting mission (carrying no payload) with N8330H was flown over Oxnard farm, with aircraft at gross weight approximating 4,300 lb. Following turnaround procedure of a climbing 45 deg. turn and a reverse turn, the off-field to on-field time approximated 20 sec. at best with pilot allowance for proximity of a mountain at one end of the flight path, and relative unfamiliarity with this particular airplane.

Later flight evaluation work with the production airplane N8331H and comparison of characteristics in several flight regimes convinced the AVIATION WEEK

Avoid false test results with GLENNITE internally ungrounded accelerometers



Now you can avoid one of the major causes of false test results — spurious "ground loop" voltages — by using *internally ungrounded* GLENNITE accelerometers.

These units contain sensitive seismic elements *internally* insulated from the mounting stud by rugged ceramic insulation. You can employ a *single point ground* at the data handling or recording equipment by using a combination of these accelerometers with ungrounded GLENNITE amplifiers and filters.

GLENNITE accelerometers are available in uni- and triaxial models — wide acceleration and temperature ranges.

A complete line of associated ungrounded electronic equipment includes filters, amplifiers, connectors and other related units.

For complete data on Gulton instrumentation systems — grounded or ungrounded — contact your local Gulton representative or write us direct.

Call in Gulton

From transducer to readout, Gulton is capable of meeting all your instrumentation needs. If you have a measurement problem, why not call in a Gulton Instrumentation Engineer. His broad experience in shock and vibration measurement can prove invaluable to you.

GULTON INSTRUMENTATION DIVISION

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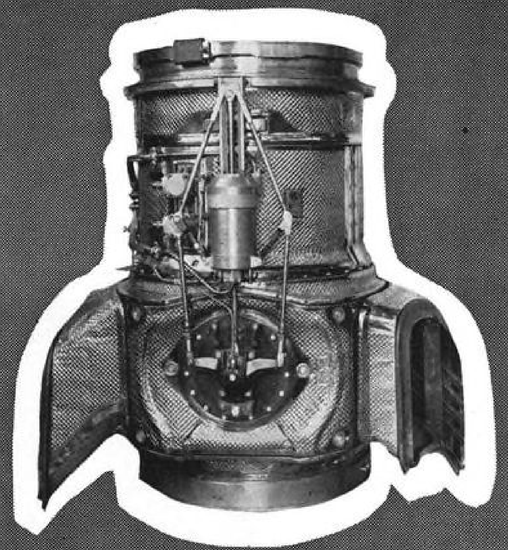
Metuchen, New Jersey



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are now being made by Delaney Gallay Ltd. at lower prices than ever before

What's more, we don't jib at complicated shapes and fittings, as this blanket fitted to the Rolls-Royce thrust reverser for the D.H. Comet proves.

Our wide experience has enabled us to develop a revolutionary and exclusive method of manufacture that we sincerely believe will enable us to tackle anything.

WE ALSO DESIGN AND MANUFACTURE

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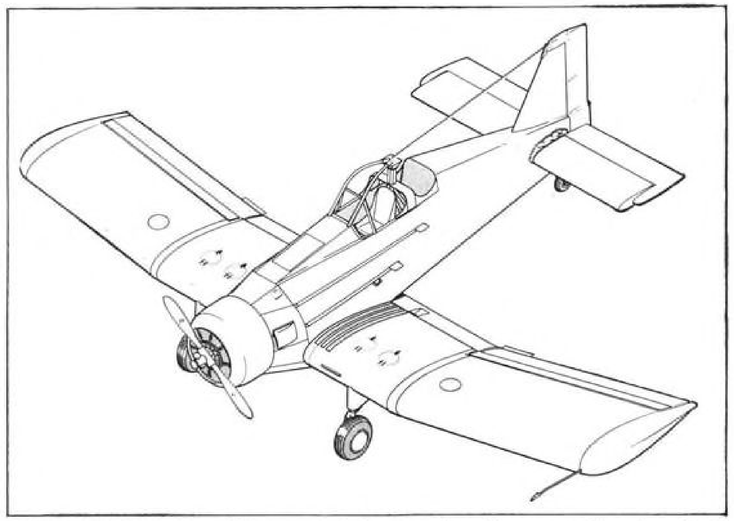

OPEN cockpit design has cable to vertical fin as guard to lift a power line clear of tail.

pilot that the prototype aircraft may have been slightly out of rig following a heavy flight test schedule, in that the production plane's control forces, trim-out and handling in dusting passes were much better.

First evaluation flight with N8331H was conducted at a gross weight approximating 4,400 lb., 2,600 lb. under maximum certificated gross weight. Climb-out at this weight was made at 30 in. hg. and 1,900 rpm. at an indicated airspeed of 85 mph., yielding a climb rate averaging better than 1,000 fpm.

Level flight at 7,500 ft. using 25 in. hg. and 1,800 rpm. yielded 106 mph. IAS. The airplane was not equipped with a free air temperature gage, thus precluding a true airspeed calculation. Airplane trimmed out well in this condition.

Slow flight with flaps extended to full 20 deg. travel resulted in a 50 mph. IAS, at which the airplane remained fully controllable although slightly mushy, using a power setting of 30 in. hg. and 2,150 rpm.

Sample altitude climb from 6,600 ft. to 7,700 ft. was accomplished in 1 min., using the same power setting, with flaps retracted, 80 mph.

At 8,800 ft., 22 in. hg., and 1,450 rpm. produced 85 mph. IAS in cruise trim. The aircraft remained stable in hands-off flight, although the rudder-aileron interconnect required precision rudder work to avoid over-control. Standard maneuvering at this condition

AG-2 Specifications

Powerplant	**Pratt & Whitney R-1340, S3H1 or AN-1, 600 hp. nine-cylinder radial aircooled engines.**
Propeller	**Hamilton Standard 108 in. dia., 6101A blade section, two-blade constant speed, Hamilton Standard Constant Speed Hub 12D40.**
Weight empty	**3,400 lb.**
Useful load	**2,600 lb.**
Gross weight	**6,000 lb.**
Payload	**2,000 lb.**
Tread landing gear	**10 ft. 10 in.**
Tire size, main gear	**27 SC Type 1.**
Tail wheel (500-5) Type 3	**14.5 in.**
Hopper volume	**53 cu. ft.**
Liquid tank capacity	**250 U. S. gal.**
Fuel tank capacity	**125 U. S. gal.**
Oil tank capacity	**10 U. S. gal.**
Power loading	**10 lb. per hp.**
Wing area	**321 sq. ft.**
Wing loading	**18.6 pounds/sq. ft.**
Aspect ratio	**5.49.**

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indicated the high lift wing can enter an accelerated stall if control movements are not careful.

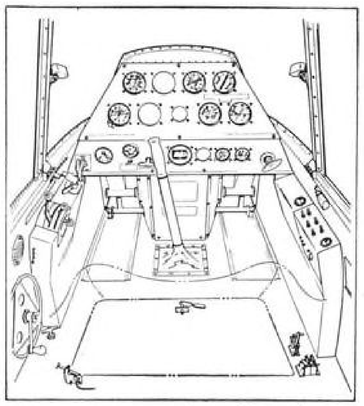
One maneuver performed with the aircraft was a full stall descent from 5,000 ft. to 3,000 ft. above water in the flight test area.

Airplane was pulled into a normal power-off stall at 5,000 ft., and remained laterally stable throughout the entire descent with no tendency to fall off or snap. Full back stick was held against normal trim and this required a fair amount of force. The airplane shuddered considerably, strong horizontal tail buffeting was felt, but yaw control remained highly effective throughout descent. The airplane proved rather noisy in the descent.

Control Pressures

Low altitude maneuvers sampling N8331H characteristics again indicated that careful control pressures are required for maximum performance maneuvers, both to get the most out of the airplane as well as to avoid going into an accelerated stall or other less-than-desired conditions.

Evaluation of N8331H at its maximum certificated gross weight included a maximum performance takeoff. The takeoff was uneventful, except for an impression of slight left wing heaviness. The airplane displayed no tendency to slew despite asymmetric loading, and during a short flight, the airplane was fully controllable and maneuverable, although considerable arm tiredness was experienced.



COCKPIT has room for radio equipment.

After reloading both tanks to capacity, a second high performance takeoff was affected, with the AG-2 airborne after a 500 ft., 18 sec. roll. Temperature was 22C and altimeter setting 30.02 in. hg. This takeoff was made without flaps, and level flight attitude was assumed prior to leaving the runway.

Climbing at 6,000 lb. gross weight, 85 mph. IAS yielded a 1,000 fpm. climb rate, using 2,150 rpm and 32 in. hg.

Using 30 in. hg. and 1,950 rpm., the airplane registered 116 IAS cruise at 2,500 ft.

Accelerated stall characteristics were investigated at 4,500 ft., using 85 mph. IAS, up to 65 deg. bank angles, with the aircraft showing increased stall speeds with one bank angle in normal increase rate. However, at the slightly less than maximum gross weight (due to fuel burnout in climb), stall speeds proved slightly less than placarded values, with care in control handling.

Stall investigation conducted at 5,000 ft., demonstrated the airplane's ample warning period between initial tail buffet and break, with straight ahead values being 78 mph., buffet, to 70 mph. break. Considerable pilot work was required to pull the aircraft through the last 3 mph. with normal flight trim condition.

Simulated dusting passes, accomplished at the overwater test area at working altitudes which would prevail over any surface being dusted, indicated that smooth control handling resulted in stall speed values better than placarded; short time turns were possible despite the load.

Consideration was given to the fact

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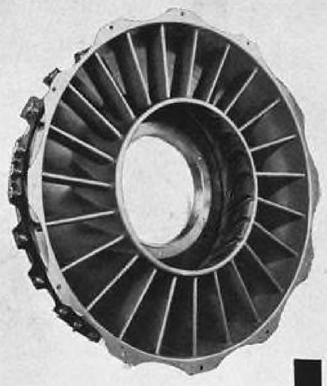

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that for many applicating projects, the airplane would be flown with less fuel aboard than was carried on this flight, but that initial takeoff weight would be on the order of 7,700 lb., under Civil Air Regulations Part 8 operation or in foreign work. Also, the initial pass would be at the highest weight, with the load decreasing according to the amount of spray or dust applied per acre.

Turnaround times varied, with 30 sec. being the longest period at the all-up weight. Other conditions were the 45 deg. pulloff, 85 mph. IAS in turn at a 70 deg. bank, 400 ft. maximum altitude, 2,100 rpm. and variable manifold pressures according to requirements. Minimum turnaround time was on the order of 18-19 sec.

Some investigation of maneuvering with high load and flaps down was conducted, with the airplane still exhibiting stability, but with attendant normal increase in control sensitivity due to lowered indicated airspeeds.

Dump times for liquid loads proved within placarded time limits, i.e., about 15 sec. with equal dumping rates prevailing from each side. Little change occurs in the airplane's longitudinal trim with disposal of loads. Either partial disposal as would obtain in applicating passes, or in dumping, is testimony to good a load disposition in the center of gravity area, both vertically and longitudinally.

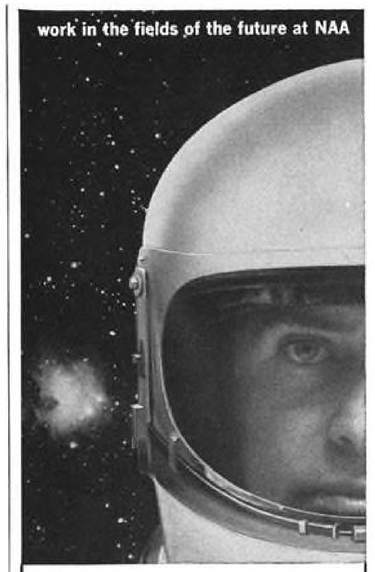
Stable and Sensitive

Slow flight investigation showed the airplane to be stable, although sensitive. Slowest condition was with full flaps, 1,500 rpm., 23 in. hg., and indicated airspeed of 53 mph., at which turns could still be made without altitude loss at both single and double needle width, 90 deg. turn. At this condition, the airplane is still flying, but marginally. Increase in airspeed to 55 mph. IAS restored control to a more acceptable level. At higher airspeed values, the control characteristics such as roll and turn rate, climb and dive, were more than adequate.

In all conditions and regimes investigated, if proper perspective is kept on airplane's design mission, characteristics are very good. Normal operational regimes are considerably better than other airplanes which have been converted to aerial applicating from other basic design missions.

Landing investigations showed the airplane frequently is landed tailwheel first until the pilot is familiarized with attitude. However, the airplane can be very well wheel-landed or on three points.

One landing was made with the tail wheel unlocked in a cross wind. The airplane was allowed to deviate from its normal path as far as possible before



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recovery was made with slight brake application, a testimony to excellent ground stability. No tail wheel chatter was experienced in the free roll and landing was in the three point condition, with flaps extended, to check the worst possible conditions. Gusts averaged 12 mph. from about 30 deg. left off the nose.

Following the landing, a high performance takeoff was made, again with the tailwheel unlocked, with wind in a steadier state but approximating the same magnitude and direction, and again no chatter was experienced. Transland designers have suppressed shimmy with a heavy spring which is not intended to make the tailwheel free from its locked regime, rather to increase stability of movement during unlocked condition maneuvering on the ground.

Initial Torque

The airplane remains steady with more than adequate control available with rudder. Initial torque, while significant, is not of sufficient magnitude to cause a problem, and while some brake application to correct is required in first few feet of ground roll, aerodynamic damping by rudder becomes effective very quickly.

Takeoff for high performance were made without flaps as well as with flaps, both from level attitude and from a three point attitude, and in all conditions, the airplane became airborne at least at placarded values, or slightly less.

Using full flaps, takeoff power applied with brakes held three point attitude, airplane was airborne in slightly more than 10 sec., distance approximating 480 ft.

Maximum performance landing resulted in having the airplane stopped and turned off the active runway approximately 400 ft. from the touchdown point, indicating a very good performance from less than optimum airports.

Design Features

Among design features which have been incorporated in the AG-2 are such things as a sealed cockpit, i.e., a cockpit in which fumes from toxic loads cannot penetrate, a structure which has been designed to minimize penetration of dust and spray while the payload is being dispensed.

Company President George Wing points out that while the AG-2 is larger and heavier than most current airplanes, over-all cost of about $28,500 is not out of line with airplanes now being used for agricultural and other aerial applicating work. His market forecasts are partly predicated on the yearly attrition rate which is using up the supply of planes which have most readily been converted to applicating work.

In addition, Wing cites the earning capacity which has been built into the AG-2, in its load carrying capacity, its interchangeability between types of work without down time for changeover of equipment. This also eliminates necessity of having airplanes which are rigged for solids, additional airplanes which are rigged for spray, and one set not working.

Foreign markets are excellent for AG-2, Wing found out on a recent trip throughout the world, with the surface barely scratched in the kind and the amount of work which can be accomplished. Best sales aspect of the AG-2, according to Wing, is its complete design for this work, and thorough research background which has contributed to the design.

Although primarily an agricultural airplane, the AG-2 can be used for such missions as aerial supply drops, using standard bomb racks under wing joints and fuselage, also for such purposes as carrying fuel to remote locations using liquid tight hopper, all tanks, and draining off all but sufficient fuel for the return trip. An inflatable rubber storage tank can be carried in the hopper on the first trip, along with extra fuel supplies.

Transland, a division of Hi-Shear Rivet Tool Co., started as a sheet metal structures subcontractor, branched into design and manufacture of aerial appli-

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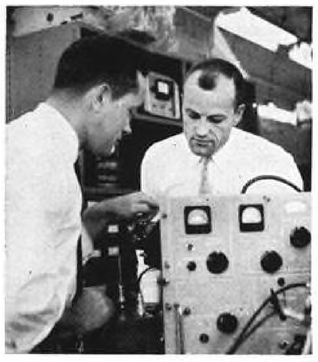

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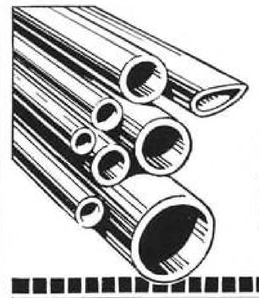

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cating equipment; follow-on to design and production of an agricultural airplane was a natural consequence.

Present plans call for manufacture and sale of an airplane which comes with standard built-in equipment enabling the airplane to switch between applying liquids and solids (dust or pellets) between missions, without turning off the engine.

Solids provisons are a 53 cu. ft. hopper which dispenses out through the fuselage bottom via a spreader (exact type and configuration is not yet decided).

Liquids are carried usually in two 63.5 gal. tanks (62.5 gal. usable), in each wing, a total of 250 gal. capacity, plus spray boom built in, attached to rear side of aft spar, discharging into airflow ahead of flaps and ailerons.

In addition, the hopper can be liquid-sealed and has lines for gravity flow into tanks, enabling liquid loads to be carried up to maximum gross weight.

The AG-2 is certificated as a CAR Part 3 airplane in expectation of export. However, Part 8 certification carries the airplane further in useful areas of operation at weights much greater than the standard Part 3 certificated figure.

The airplane is a low wing configuration using National Advisory Committee for Aeronautics 64021 airfoil section, modified. It has slot-lip ailerons and aileron-flaps (termed "flaperons"). The only trim provision is pitch, obtained with an all moving stabilizer. Flight controls have a spring-cable interconnect between rudder and aileron.

AG-2 Powerplant

Power plant is 600 hp. Pratt & Whitney R-1340, which gives aircraft good performance for its purpose. Originally, the airplane was equipped with an R-985, but a decision was made to change to a larger engine primarily due to lower cost of engines (R-1340 is not in as tight supply as R-985), and the gain in performance was considered a bonus by Transland. Hamilton Standard constant speed propeller is used.

While the AG-2 has coventional landing gear geometry, the pilot impression is almost that of tricycle configuration, due to forward slope of nose. When the airplane attains flight altitude, the nose slope is pronounced, and visual altitude cue is different from either conventional or three-point airplane.

Cockpit layout is simple and uncluttered. Space for the pilot to move around in is ample and controls locations are excellent.

Standard instruments include airspeed, altimeter, engine gage, tachometer, manifold pressure, cylinder head temperature, carburetor air temperature, fuel quantity, magnetic compass,

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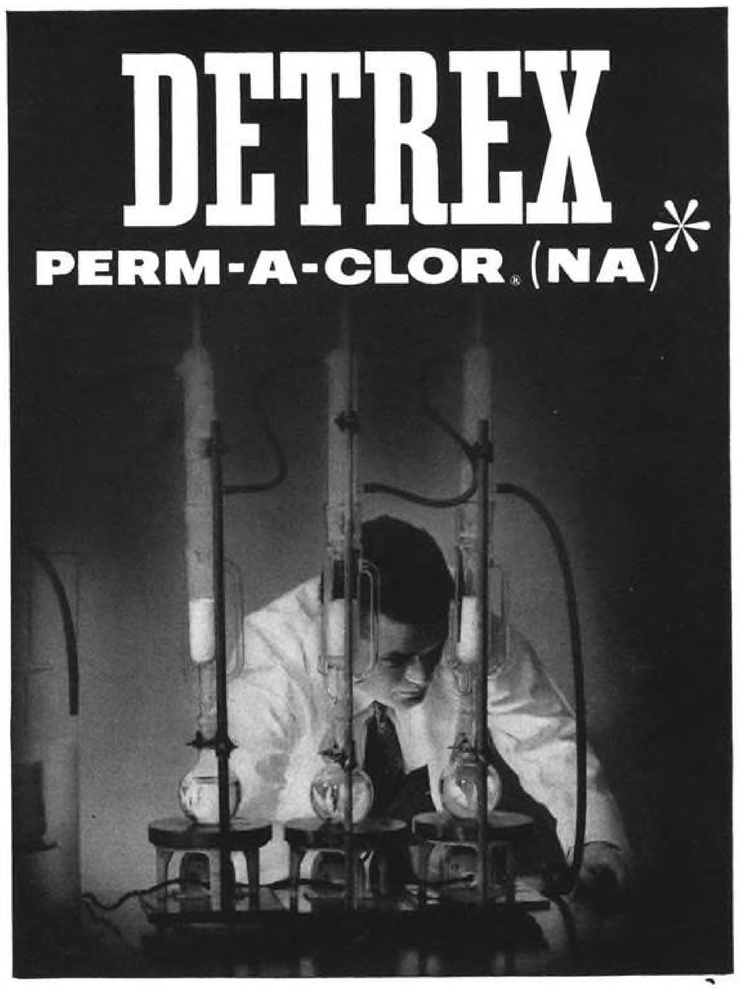

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MICRO-BEARING ABSTRACTS

by A. N. DANIELS, *President*
New Hampshire Ball Bearings, Inc.

BEARING FITS AND FITTING PRACTICES

As shown in *Fig. 1*, the fitting of Micro-Bearings, like the fitting of larger ball bearings, chiefly involves the clearances between the inside diameter of the housing and the outside diameter of the bearing; the bore of the bearing and the shaft diameter.

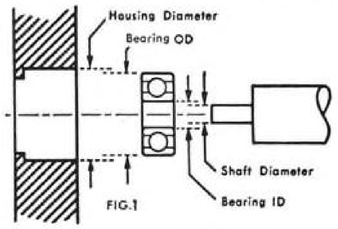

FIG.1

The achievement of the desired fit by dimensioning is illustrated in *Fig. 2*. The bearing ID is represented by the top blocks and the shaft OD is represented by the lower blocks. Such a block diagram could also be applied to housings and bearing outside diameters. In this block diagram, it will be noted, the bearing ID is represented by a .00015 tolerance with a similar tolerance for the shaft. A resulting fit of line to line to .0003 loose is shown.

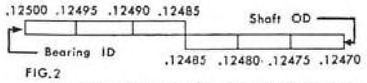

FIG.2

An interference fit not tighter than line to line is suggested for the following reasons:

1. *Difficulty in assembly.*
2. *Difficulty in disassembly. This is often more hazardous than the assembly operation and may result in total bearing destruction.*
3. *Reduction in radial play.*
4. *Danger of bearing ring conforming to possible poor geometry of mating shaft or housing.*

TOLERANCE DISTRIBUTION

The maximum .0003 loose condition shown in *Fig. 2* may be excessive in some applications. The fitting problem then resolves itself to reducing this extreme, and yet maintain the maximum tight fit of line to line. The looseness may be reduced by redimensioning the shaft to .12490/.12475 as shown in the block diagram, *Fig. 3.*

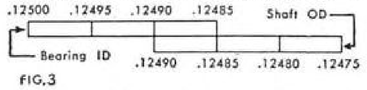

FIG.3

If the frequency distributions of shaft and bearing ID sizes were statistically normal, the modal fit of all parts would be 0.0001 loose. Accordingly, an insignificant percentage of parts would be mated to the extreme values, and for practical purposes could be ignored.

With regard to bearings' outside diameters and bores, however, normality of the distribution curve cannot be assumed. During the grinding operation, the "most metal tendency" tends to skew the frequency distributions for bearing ID's and OD's in the direction of most metal.

In grinding and finishing shafts and housings, similarly skewed distributions occur.

Operating on a modified probability distribution of tolerance is possible if the volume of parts is sizeable. But the approximate distribution of shaft and housing sizes must be verified if this method is to be used.

MATERIALS and SURFACE FINISHES

The ease of assembly is also affected by materials and finishes. The following factors must be considered:

1. *The galling characteristics, hardness and ductility of the materials involved.*
2. *Finish lay patterns produced by various tools and techniques used.*
3. *R M S surface finish values achieved.*
4. *Geometry of shafts and housings as regards out-of-roundness, taper, etc.*

The possible combinations of these elements in any single application are so numerous that their gross effect can only be ascertained by trial and error, or by a detailed study of operations on individual applications. A more complete discussion of fitting practices, including sizing methods and coding, is found in our design handbook.

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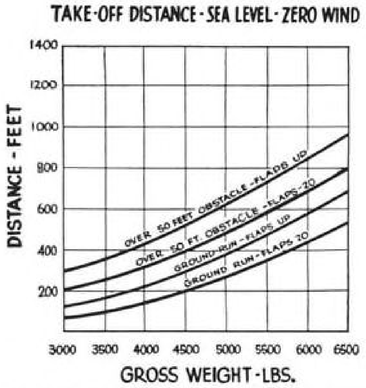

LOADED AG-2 can clear a 50 ft. obstacle in 800 ft., using 20 deg. flap.

trim position indicator and ammeter. Optional instrumentation includes turn and bank, stall warning indicator; optional equipment includes landing lights and external power receptacle.

The electrical system includes a direct cranking starter, generator, navigation and instrument panel lights.

Cockpit Layout

Cockpit layout has trim wheel and flap hand crank on the left side, beside the pilot seat, with throttle quadrant in conventional position ahead of this.

Ahead of the quadrant is a fuel selector, while the fuel wobble pump is above the selector and moves for and aft in a slot just under the windshield.

Right hand console has an ammeter, electrical system switches and trim position indicator, while on one side of the console are the circuit breakers.

Main instrument panel has two rows of gages, four on top and five on bottom.

Top row contains airspeed, (left) to right) blank (for optional needleball), manifold pressure and tachometer. Second row contains altimeter, blank (for optional rate of climb), small blank space (for clock or other similar instrument), engine gage and cylinder head temperature. Below the main panel is a line of controls and gages, carburetor heat, ignition switch, single fuel gage for both tanks with selector switch below, liquid load dump valve T handle, magnetic compass, small blank space, engine oil filter pressure gage carburetor air temperature gage and primer.

Controls on the floor are minimized, with fuel on-off T-handle on left floor just behind console, while on right, beside pilot's seat, are tail wheel lock and parking brake controls. Pilot's seat adjusts fore and aft.

Second seat is provided, in small compartment aft of pilot with seat being a fixed bench installation. Provision of the seat makes it possible for the AG-2 to carry a loader, flagman or mechanic to the site of remote operations.

Should tools or parts be required, the hopper space can be utilized.

Although CAA requirements for drainage holes and ventilation preclude an actual complete seal at the moment, the possibility is that a type of flapper valve over holes which would be closed by aerodynamic pressures during flight may be incorporated.

Air Intake

In the cockpit area, a ram air intake scoop has been mounted on an extended dorsal fin which delivers air into the cockpit area. Since a low pressure area due to the airflow exists around exterior of the cockpit, and higher pressure obtains inside from ram intake, constant flow to the outside prevails, giving additional fumes and dust protection on top of the relatively tight cockpit.

Additionally, for those desiring an open cockpit airplane, such a version now is entering flight test stage, with prototype N8330H being converted. The open version retains the two cockpit feature, with the second seat closed by a sheet metal hatch when not in use. A windscreen is provided, and turnover bar structure extends from cowl in front of cockpit over the pilot's head to the main turnover structure located behind pilot's head, in front of the rear seat.

The AG-2 was never tested in a wind tunnel. Resulting airplane's aerodynamic characteristics show no lack of basic required qualities, although some refinements would quite possibly have been made. Additionally, this a reflected in the airplane's cost, reducing development expenditures which otherwise would have been reflected in the airplane's price.

AG-2 Structure

Structure is conventional built-up sheet metal, Alclad throughout. A few extrusions are used in the wing. No forgings are used so far and their use for production purposes appears debatable, company engineers say.

In addition to Alclad material, all interior surfaces are anodized and primed with a catalyst-setting primer. Additionally, exterior surfaces are given a coat of catalyst-setting type enamel as a further corrosion resistance move.

Slot-lip ailerons are drooped 12 deg. and their downward travel when acting as flaps is proportional to that of the main flap.

Units are mechanically bussed together.

Location of the spray boom behind the rear (false) spar serves a dual purpose of dispensing the load downward aft of the main structure, taking advan-

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tage of downwash from the high lift airfoil section to get better penetration characteristics.

In the cockpit, a master pilot control system for the dispensing equipment is to be used, with all possible variations in load and type of application able to be used without changes beyond adjustment of the pilot's controls.

Although the airplane currently has no specific dispensing system for solids, it is to be tested with a number of possible equipments. Additionally, it is possible that airplane will incorporate Sellers Swathmaster dispensing equipment as part of standard equipment and included in the over-all package price, but a decision has not yet been reached on this.

The airplane is billed currently as carrying a 3,500 lb. payload, which would bring the gross weight up to that of the 1,700 lb. which is the heaviest weight yet used in the flight test program.

Radio equipment is not considered standard in the AG-2, but since numerous aerial application contractors currently are finding radio communications profitable to their operations, provisions are made for carrying such equipment. No specific equipment is recommended, the choice being left to the operator for that which best suits his individual situation.

Beech Testing Larger Twin-Bonanza

Wichita, Kan.—New version of Beech Twin-Bonanza light twin engine aircraft, featuring a redesigned, larger fuselage providing for an airstair-type entrance door in the left side to ease passenger entrance and exit, is undergoing flight tests prior to evaluation by the U. S. Army. Airplane, designated L-23F, is one of three prototypes being built by Beech Aircraft Corp. under an amended L-23D contract.

Company partially lifted the wraps on its new model during the annual meeting of Association of the U. S. Army in Washington, D. C., but Beech representatives said that it will be several months before full details can be discussed. Development is significant in that it could presage a new civilian product for the company's current business aircraft line. In addition, indications are that the L-23F could be developed further to take turboprop powerplants and pressurized cabin.

Enlarged fuselage provides for separation of passengers from crew. In earlier Twin-Bonanzas, crew and passengers enter the airplane by stepping onto the wing and then into the cabin and are in close proximity. Installation of a retractable door in the side of the fuselage of the L-23F considerably simplifies loading the airplane. Length of the L-23F is 33 ft. 2 in. compared to 31 ft. 6 in. for the earlier L-23D and its F-50 civilian counterpart. Airplane stands 14 ft. 2 in. high.

L-23F is powered by new fuel-injection 345-hp. geared and supercharged Lycoming IGSO-480-A1A6 engines, which eliminate conventional carburetion system and attendant icing problems. With these engines, the L-23F has an estimated top speed of 209 kt. at 9,000 ft. and cruise speed of 177 kt. of 10,000 ft. at 65% power.

Prototype L-23F has a gross weight of 7,638 lb., an increase of 368 lb. over the L-23D and weighs under 5,000 lb. empty. Six-place version provides for two crew, four passengers and a lavatory; seven-place model would eliminate the latter equipment.

North Dallas Airport Undergoes Expansion

Dallas—Brown Aero Corp. and the Airpark Co. are building new hangar and office facilities at Addison Airport, business flying field north of Dallas.

Brown Aero will move its Aero Commander distributorship from present quarters at Dallas' Love Field. At Addison, the company plans a 9,600 sq. ft. hangar and 1,500 sq. ft. of office space for its sales and service operations.

Airpark Co. is building a hangar for use as storage for multi-engine aircraft, including Douglas DC-3s. Airpark facility will have 13,000 sq. ft. of hangar area and 3,000 sq. ft. of office space.

Opened a year ago, Addison is now handling about 5,400 landings and takeoffs a month and expects to sell more than 750,000 gal. of fuel this year. The airport has a TVOR and recently applied to the Civil Aeronautics Administration for installation of a control tower. Field operates 24 hr. a day and has a rotating beacon, night lights and other navigational aids. Instrument arrivals and departures are controlled by Dallas approach control through the Addison TVOR.

PRIVATE LINES

Beech contract for some 600 KDB-1 propeller-driven target drones, expected to be announced soon, is being placed by Navy, not U. S. Army, as inadvertently reported by AVIATION WEEK (Oct. 27, p. 23). Army also is interested in the Beech drone, which attained altitude of 43,500 ft. in tests at Pt. Mugu, Calif.

Deposits for delivery of two Grumman Tradewind turboprop executive transports have been placed by Canadian corporations for mid-1959 delivery with Timmins Aviation, Ltd., Montreal, Grumman distributor.

Additional 28 hinged radomes for Douglas DC-3s have been ordered by Civil Aeronautics Administration from Remmert-Werner, Lambert Field, St. Louis, Mo. Domes, with swingaway scanner mounts, will be similar to 22 units purchased by CAA last year.

Noland Co., Newport News, Va., has purchased an executive Fairchild F-27 turboprop and has assigned interior design to Davis Ellies Industrial Design, Inc., Columbus, Ohio.

First transpacific delivery of a Beech Travel Air light twin was made by Skyways Aircraft Ferrying Service President Jack Ford who flew the plane from Wichita, Kan., to the Philippines with stops at Van Nuys, Calif., where auxiliary fuel tanks were fitted to bring capacity to 300 gal., Honolulu, Wake, Guam and Manila. . . . Socony Mobil Oil Co. purchased a Travel Air executive transport. . . . Convair awarded Beech a follow-on production contract exceeding $7 million to furnish additional aft fuselage sections and other major assemblies for F-106A and F-106B Delta Dart interceptors. Deliveries of these assemblies begin in April, 1959.

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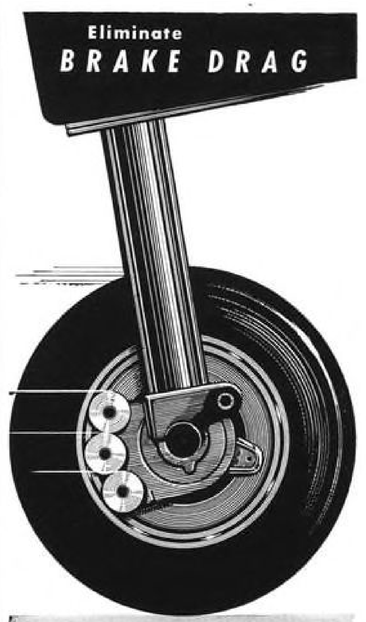

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Trans-Texas Airways Modifies DC-3 Fleet

Houston—Trans-Texas Airways is operating a fleet of modernized Douglas DC-3s which allow the local service carrier to fly schedules competitive with Convair 340 and Douglas DC-6 operations on routes in the Southwest.

Called Super Starliners, the airline's DC-3s are getting increased performance from a modification program which included installation of the AiResearch maximizer kit. All 20 of Trans-Texas' DC-3s have the maximizer kit installed, and the cost ran about $16,450 per airplane.

Maximizer modification of the Trans-Texas DC-3s includes tighter cylinder baffles which make possible a redesigned cowl, reducing frontal area and profile drag and improving airflow through the nacelle area. Installation also includes wheel well doors, a new Siamese stack arrangement, a redesigned oil cooler fairing and a fairing which streamlines the tail wheel area.

In addition to its own fleet, Trans-Texas has modified some executive aircraft with this kit, and the airline offers the conversion for $21,400 or a parts-only kit for $14,875.

AiResearch kit was supposed to increase speed on the DC-3s by 20 mph. But Trans-Texas said the increase may run as high as 30 mph. because of other modifications which have cut drag and weight. The airline said flying times were reduced 10-12% when new schedules based on the converted DC-3s were published last summer.

In a computation based on July operating figures, Trans-Texas' average block speed was 164.2 mph., the highest among the local airlines. Average length of hop was 79.1 mi. DC-3 average block speed for all local airline DC-3 operators was 147.9 mph. and the average hop was 82.8 mi.

In addition to the AiResearch kit, Trans-Texas has engineered a number of its own modifications over the years. These include conversion to a 24-volt system, installation of an electric propeller feathering system, a dual hydraulic system and standardization of engines to the Pratt & Whitney R1830.

In the cockpit, the airline has installed a standard instrument panel which can be removed from the inside for rapid maintenance and has put in a one-piece windshield. New radio navigation-communications equipment includes three VOR receivers which are interchangeable.

In the passenger area, the Super Starliners have an integral step door, special buffets designed for local service operation, Janitrol cabin heaters, an enlarged waist-level cargo door and a high density 23 passenger interior.

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FIELD ENGINEER GIVES PILOT PRE-FLIGHT BRIEFING

WHO'S WHERE

(*Continued from page 23*)

Honors and Elections

Glenn B. Warren, vice president and consulting engineer of General Electric's Turbine Division, has been elected president of The American Society of Mechanical Engineers.

John G. Brooks, president of the Siegler Corp., has been named to the board of directors of the Electronic Industries Assn., Washington, D. C.

Renato Contini, of New York University College of Engineering's Research Division, has been elected the first president of the Human Factors Society of America.

Dr. Malcolm R. Currie, co-head of the electron dynamics department of Hughes Aircraft Co., has been named the outstanding young electrical engineer of 1958 by Eta Kappa Nu, national honor society, for his technical contributions in the field of low noise electron guns and backward wave oscillator development.

Edgar H. Dix, Jr., retired assistant director of research of the Aluminum Co. of America, has received the U. S. Navy's Distinguished Public Service Award for ". . . the development of high strength, corrosion resistant aluminum alloys which constitute the basic construction material in modern, high performance naval aircraft. . . ."

Changes

H. Don Reynolds, assistant vice president, American Airlines, Inc.

C. E. Mahoney and **J. L. Richardson,** assistant secretaries, Electronics Division, Ryan Aeronautical Co., San Diego, Calif.

Rear Adm. Jack S. Dorsey, USN, Deputy Director for Communications-Electronics, Joint Staff, Joint Chiefs of Staff, Washington, D. C.

J. Paul Jordan, assistant to the president Gulton Industries, Inc., Metuchen, N. J.

Walter F. Ring, president, and **Robert O. Zecca,** vice president, Silence, Inc., Farmingdale, N. Y.

Arthur J. Fallon and **Thomas M. Sullivan,** Deputy Directors of Aviation, The Port of New York Authority, New York, N. Y.

Rear Adm. Edward A. Hannegan, Commander, Naval Air Test Center, Patuxent River, Md. **Rear Adm. Robert J. Stroh** replaces Adm. Hannegan as Commander, Carrier Division 14.

Robert C. Ward, Washington, D. C., representative, Propeller Division, Curtiss-Wright Corp., Caldwell, N. J.

Arthur G. Woodside, manager-newly formed aircraft instrument product section, General Electric's Instrument Department, West Lynn, Mass.

Clarence A. Wetherill, chief engineer, Stromberg-Carlson, a division of General Dynamics Corp., San Diego, Calif.

Wesley C. Bonn, assistant to the president in charge of customer relations and advertising, Kollsman Instrument Corp., Elmhurst, N. Y. Also: **Henry N. Droge,** general sales manager.

George P. Smith, director-sales service

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department, Minneapolis-Honeywell's Aeronautical Division, Minneapolis, Minn.

Ronald J. R. Kallman, Western regional manager-Transac computer systems, Philco Corp.'s Government and Industrial Division. Mr. Kallman's headquarters will be at Philco's Western Development Laboratory, Palo Alto, Calif.

Kenneth Morris succeeds **S. O. Svendsen** as factory manager, Seattle Division, Boeing Airplane Co., Seattle, Wash. Mr. Svendsen is now assistant manufacturing manager, Transport Division, Renton, Wash. **Robert Barker** succeeds Mr. Morris as manager of Boeing's Moses Lake, Wash., Flight Center. Also: **T. E. Gamlen,** assistant general manager-operations, Transport Division, and **Harold Abling,** assistant manufacturing manager-factory and preflight operations.

Albert E. Beckers, director of engineering, Tube Operations, Allen B. DuMont Laboratories, Inc., Clifton, N. J.

Douglas Aircraft Company, Inc., Santa Monica, has announced the following appointments to the Nike missile engineering project. **Paul C. Swan,** manager-newly created Nike Weapons System office; **W. W. Bendow,** chief project engineer, and **N. T. Weiler,** assistant chief project engineer-Nike series; **S. L. McCroskey,** project engineer-Nike Hercules. Also: **W. T. Dickinson,** assistant chief engineer, and **Marshall Nesbitt,** executive engineer, Aircraft Engineering Department.

Herbert L. Karsch, planning director-missiles systems, Allison Division of General Motors Corp., Indianapolis, Ind.

Jack Rosenberg, manager of engineering, Electronic Control Systems, the Los Angeles facility of the Electronics Division of Stromberg-Carlson, Rochester, N. Y.

Charles F. Merrigan, manager of scatter and special systems engineering, General Electric Co., Technical Products Department, Syracuse, N. Y.

Carl R. Malmstrom, manager of research and development and engineering, Defense and Technical Products Division, Rheem Manufacturing Co., Downey, Calif.

Armin F. Raebel, chief experiment engineer, Solar Aircraft Co., San Diego, Calif.

Harry W. Swanson, works manager, Sumners Gyroscope Co., Santa Monica, Calif.

Dr. Ernest A. Keller, staff scientist, Chicago Military Electronic Center of Motorola, Inc., Chicago, Ill.

D. E. Zesiger, assistant manager of customer relations, Western Division, Goodyear Aircraft Corp., Litchfield Park, Ariz.

W. H. Seibert, manager-newly created support services department, The Garrett Corp.'s AiResearch Manufacturing Division, Los Angeles, Calif.

Wyandotte Chemicals Corp., Wyandotte, Mich., has reorganized its Research and Engineering Division into two new staff divisions and announced the following appointments: **Dr. J. William Zabor,** director-Research Division, and **John H. Reifel,** director-Engineering and Development.

Ray Destabelle, chief engineer, Transducer Division, Technology Instrument Corp., Santa Monica, Calif.

M. S. Griffin, staff director-advertising, Thompson Products Divisions, Thompson Ramo Wooldridge, Inc., Cleveland, Ohio. Mr. Griffin succeeds **Fred R. Witt,** retired.

Dan M. Tenenbaum, head of all rocket testing, Aerojet-General Corp., Sacramento, Calif.

U.S. Exports of Aircraft, Parts, and Accessories

(Money figures in thousands of dollars)

Item	July 1958		Cumulative totals January-July 1958		Cumulative totals January-July 1957	
	Number	Value	Number	Value	Number	Value
Aircraft, parts, and accessories, total	.....	$114,059	.....	$621,519	.....	$649,642
Commercial and civilian aircraft, total	149	$20,096	1,082	$136,053	1,233	$138,493
Aircraft 3,000 lb. and over empty airframe weight:						
Cargo transports, commercial, new	.....	.....	.....	.....	1	$1,400
Passenger transports, commercial, new:						
3,000-14,999 lb. empty airframe weight	.....	.....	23	$1,232	64	$5,135
15,000-29,000 lb. empty airframe weight	2	$1,521	2	$1,521	2	$1,480
30,000 lb. and over empty airframe weight	9	$13,582	57	$97,401	61	$94,933
Rotary wing aircraft, commercial, new	2	$528	25	$6,119	32	$5,527
Commercial and civilian aircraft, used and rebuilt, including converted	9	$2,938	87	$19,107	105	$19,487
Aircraft under 3,000 lb. empty airframe weight						
Utility, commercial and civilian, new:						
3 places and under	21	$155	162	$1,349	211	$1,429
4 places and over	57	$1,009	415	$6,959	478	$6,728
Rotary wing, commercial, new	2	$75	21	$778	25	$915
Commercial and civilian aircraft, used and rebuilt, including converted	46	$278	288	$1,487	254	$1,459
Commercial and civilian aircraft, new, n.e.c. (all empty airframe weights)	1	$10	2	$100	.....	.....
Aircraft engines, reciprocating, new air-cooled under 400 hp[1]	97	$306	937	$2,782	850	$2,016
Aircraft, components, parts, and accessories, n.e.c.[2]	.....	$93,657	.....	$482,684	.....	$509,133

SOURCE: Foreign Trade Division, Bureau of the Census.

[1]Aircooled reciprocating engines, new, 400 hp. and over are included in "Other aircraft, parts, accessories."
[2]Includes military aircraft.

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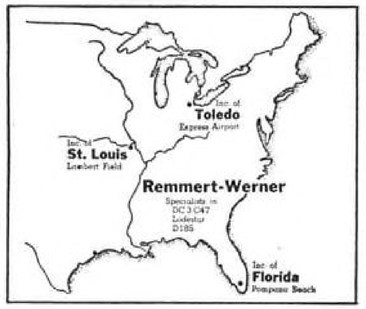

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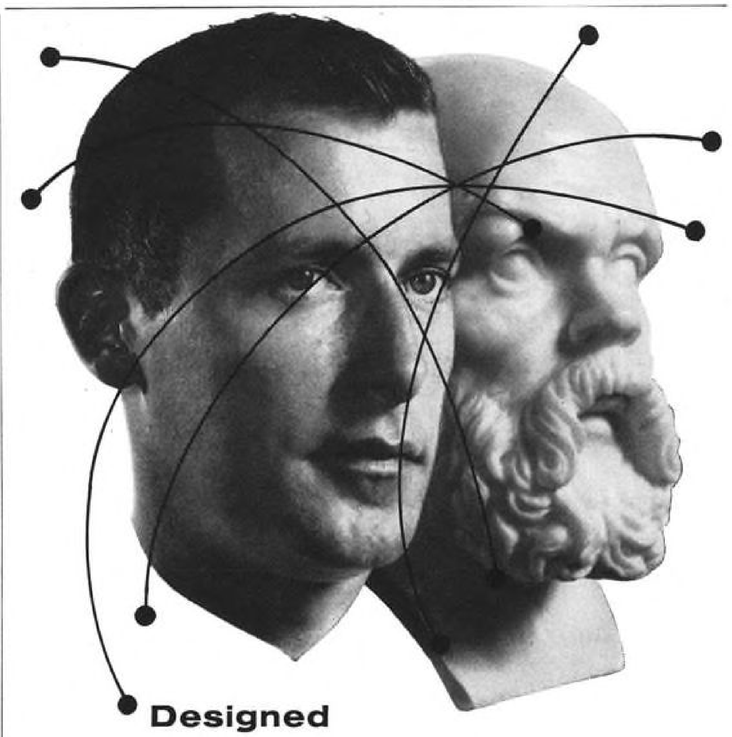

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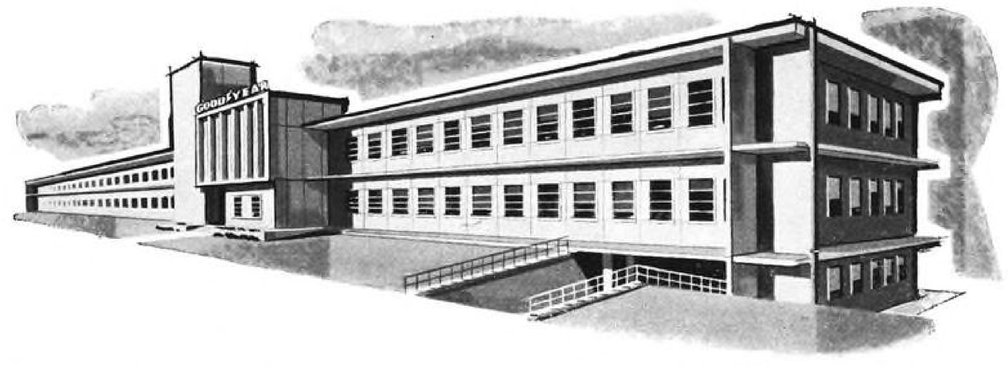

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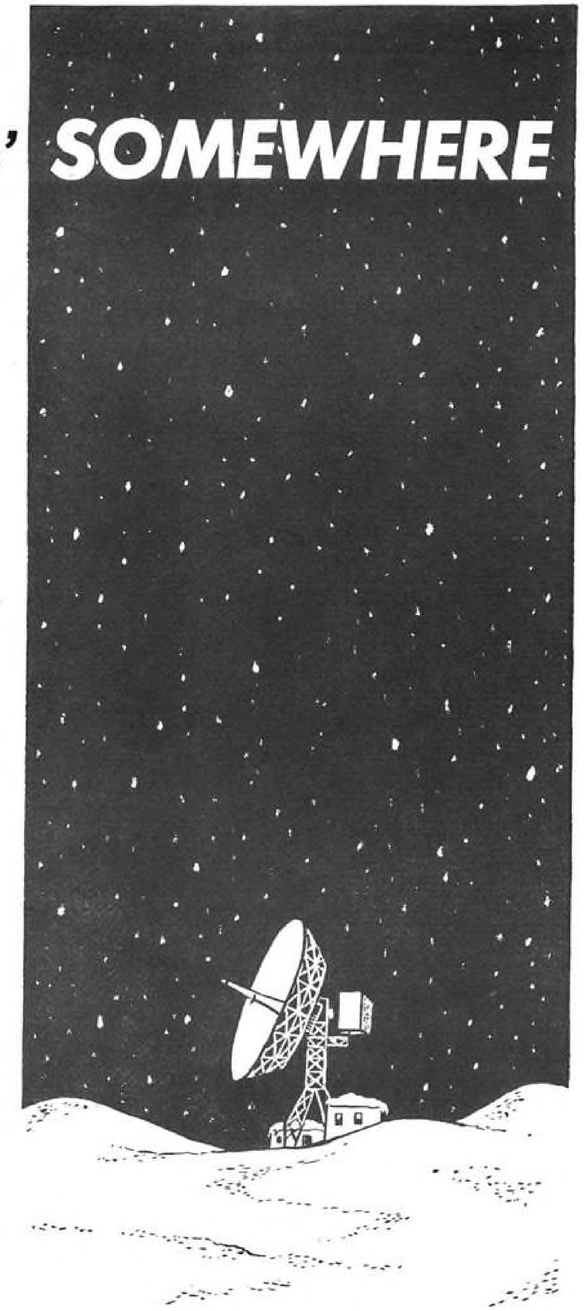

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LETTERS

707 Designation

I should very much like to suggest that in your articles mentioning the Boeing 707 you always indicate the series number, e.g. 120, 220, etc.

As you know, 707 for Boeing has no more significance than DC for Douglas, and this leaves me a little at a loss to identify any particular airplane.

As always, many thanks for your excellent publication.

A. A. Prevost
International General Electric Co.
150 East 42nd Street
New York, N. Y.

(Thanks to reader Prevost for a good idea. It will be done.—Ed.)

Radiation Dosage

On p. 30 of the Oct. 20 issue of Aviation Week there is an article describing some of the information gathered by the Pioneer. The radiation levels are given in the article as ". . . four roentgens at 5,000 mi., three roentgens at 10,000 mi., two roentgens at 17,000 mi. and one-half roentgen at 60,000 mi." A great deal more information would be available if the time as well as the dosage (in other words, the dose rate) were specified. One might assume, since the usual manner of reporting dose rates is in terms of roentgens per hour, that the above-quoted dose levels are meant to be roentgens per hour also. Would you please tell me whether this assumption is correct?

Further along in the same article the statement is made that "The one-half roentgen measured at 60,000 mi. is about twice the maximum safe weekly dosage recommended by Atomic Energy Commission." Since only the dose and not the dose rate is given, it is a trifle difficult to determine whether twice the maximum safe weekly dosage would be received in one hour at 60,000 mi., or in one day, or in one week. It is suggested that, if possible, in future articles containing radiation information, the dose rate instead of only the dose be given for a more complete bit of information.

A. N. Tschaeche
Dosimetry Supervisor
Reynolds Electric Co.
Rad Tech Department
Las Vegas, Nev.

(Omission of the words "per hour" following the number of roentgens was an error. Precise times for the readings are not available. In addition, some of these "quick-look" figures have been rendered suspect by further study of the telemetry data. For details, see Aviation Week for Nov. 3, p. 28. —Ed.).

Union Leadership

The pilots as individuals might well ask what the leadership of their union is doing to them and the airline industry. There was a time when the airline pilots were looked up to and admired. Under present ALPA leadership their stature is diminishing rapidly. Why has this situation come about and what are the ramifications?

Aviation Week welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

It has come about because those who presently lead ALPA have taken the pilots down a road towards an industry dictatorship. It is a known fact that no dictatorship can tolerate criticism. Not long ago a Naval Lieutenant (AW Aug. 18, p. 118) made critical comments regarding the practices of some airline captains. He was subsequently condemned to the "shoe store" by a captain who signed not only his name but ALPA council number (AW Sept. 8, p. 118). The Lieutenant was upbraided by another follower of the ALPA "line" for withholding his name (AW Sept. 15, p. 134).

Were these bold condemnations? Not particularly. It takes no courage or even originality to spout the "party line" of a strong organization. The truth of the matter is the Naval Lieutenant is not the only one who apparently realized and fears the far-reaching dictatorial powers of ALPA. Its own members have reason to be fearful if they speak up against ALPA policy.

At least two captains have been held up to their membership recently as horrible examples. Their crime: writing letters contrary to this policy. Those who filed charges against them made it clear they advocated the stiffest penalties their union could impose. The notifications that went with these charges to the membership at large should have served the dual purpose of punishing the "defectors" and preventing any further "defection."

A Western Air Lines captain (name withheld) spoke out against this policy during the Western strike this year (AW April 14, p. 118). He, too, was berated for remaining anonymous (AW May 12, p. 146); it was obvious that had he signed his name he would have faced very strong reprisals.

More recently Flight Safety Foundation printed a pamphlet titled "The Growing Problem of Midair Collision" by Captain Anonymous. (The pamphlet bore out the criticism the Naval Lieutenant had leveled at some airline pilots.) Why "Captain Anonymous" in this case? The same fear of reprisals?

Apparently ALPA's leadership policy is to destroy or belittle any and all who dare speak against it, and this does not exclude other unions, i.e., Mechanics, Flight Engineers, Stewards and Stewardesses, etc., or government regulatory agencies such as the CAA and CAB. All must conform if the policy is fully implemented. This is the familiar format of all dictatorships past and present. It does not add to the stature of a profession that until lately had every right to be proud. This program can lead to distrust and hate within the ranks of the pilots and among the other employes of the industry who have worked with them through the years.

At this stage the pilots as individuals still have the opportunity to change the direction the present leadership is pursuing. Surely there are many fine potential leaders within the ranks of the pilot's union who could restore the prestige and integrity of their union; the prestige that rightfully should be growing rather than diminishing.

C. A. Wayne
Amityville, N. Y.

Windshift in Descent

Letter writers Weir and Thomson (AW Oct. 6, p. 114) ignore all but the obvious effects of penetrating a horizontal windshift during descent from an overriding tail wind into a surface headwind. The obvious effect is as Thomson says, to reduce angle of attack.

But, "strange to relate and wonderfully true even shadows have their shadows, too." Your aeronautically sophisticated readers may appreciate a glimpse of the "shadows" unseen by Messrs. Weir and Thomson:

1. Turbulence at the shear level. At the discontinuity surface between two opposing windstreams, friction causes turbulent mixing. At various points along a horizontal shear surface, strong vertical wind currents—with perhaps no horizontal component—circulate locally. Thus the wing could hit a sharp updraft as it penetrated the shear layer. Add a perfectly plausible downdraft on the tail at the same instant, if you wish. Acting directly to increase angle of attack, these side-effects of the windshift penetration could be much stronger than the relatively puny reducing effect on angle of attack resulting from Mr. Thomson's vectorial addition, which considers only the horizontal components. There could be a large net increase in an already high angle of attack.

2. Dynamic unbalance in pitch attitude. With nose-up "rotation" (and the descent had been unusually steep) the elevators were quite sharply deflected—more than necessary to merely maintain the angle of attack that had been reached. The sudden headwind would sharply increase elevator action, rotating the nose faster, and higher than planned.

The severity—and sequence—of impact of the wheels suggested a complete and sudden stall near the ground. (Both engines were knocked clean off the airplane.)

Such a drastic result—unforeseen by the seasoned pilot—can be explained with the effects indicated above, particularly if they all acted in concert. Hence, my original statement that the overriding wind should have been regarded as something more than merely "a factual observation and not as a factor in the hard landing . . ." as the accident report put it.

If there is something wrong with my reasoning, I hope Mr. Thomson, who makes his point constructively, will straighten me out.

As for critic Weir: shadow-boxing's an art. With insight blinded by ire, his preachments aren't worth a farthing!

Allen W. Hayes, Owner
Chartair
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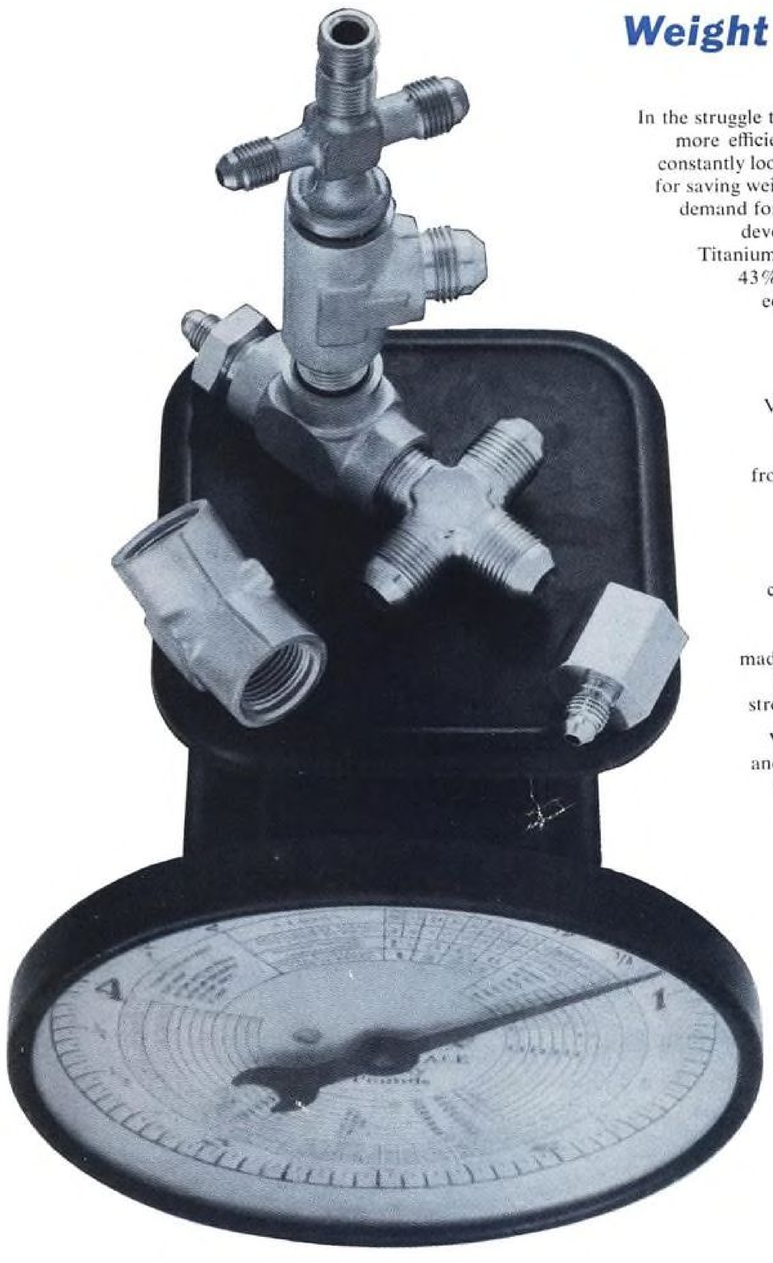

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