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Including Space Technology

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August 11, 1958

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Douglas DC-8 Jet Transport

NASA Details Space Program Contracts

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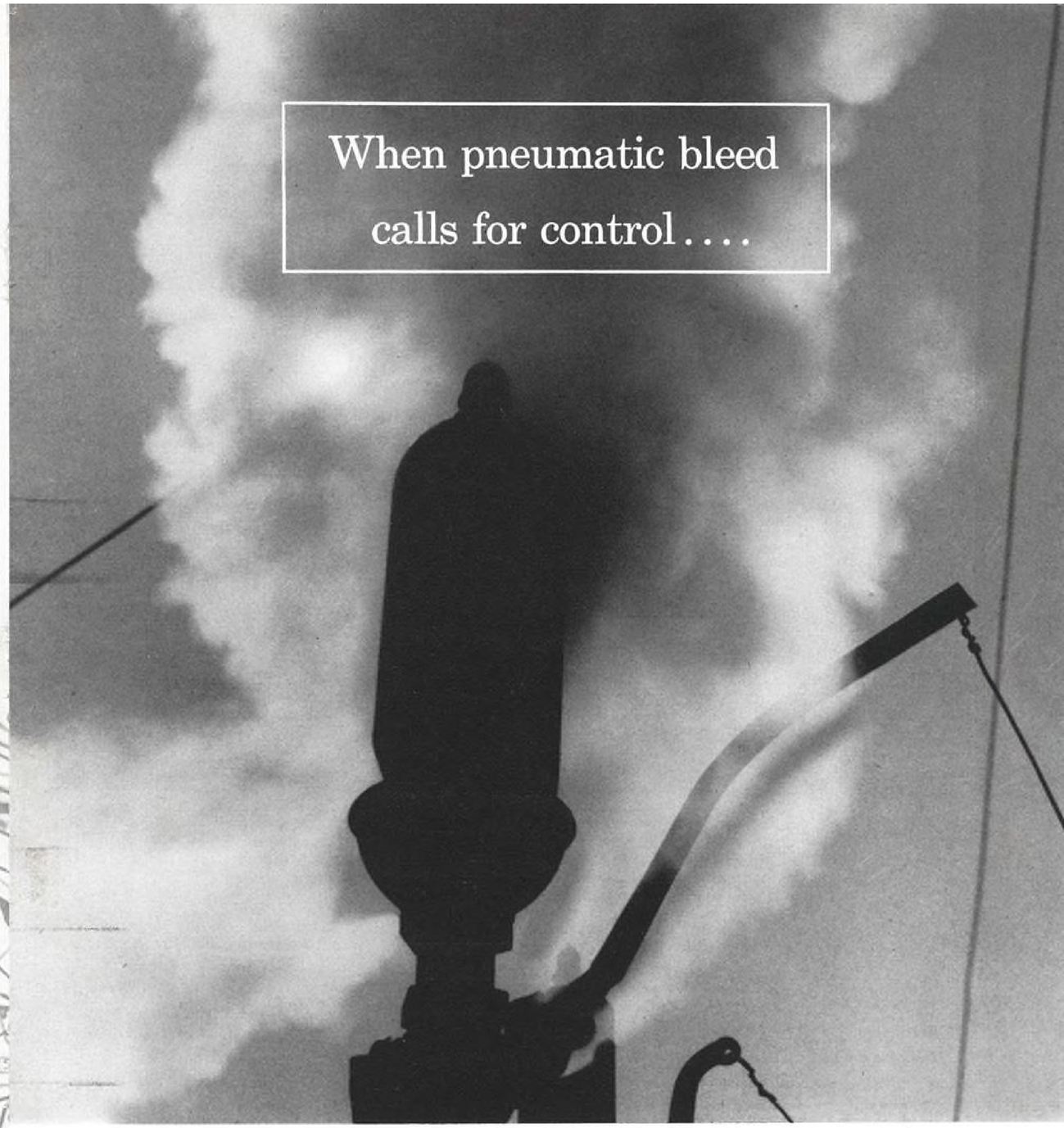

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AVIATION CALENDAR

Aug. 18-19—Annual Western Regional Meeting, American Astronautical Society, Dinkelspeil Auditorium, Stanford University, Palo Alto, Calif.

Aug. 19-22—Pacific General Meeting, American Institute of Electrical Engineers, Hotel Senator, Sacramento, Calif.

Aug. 19-22—Western Electronic Show & Convention, Institute of Radio Engineers, Ambassador Hotel, Los Angeles, Calif.

Aug. 25-27—Third Annual Convention, National Flying Club Assn., Hollywood Roosevelt Hotel, Hollywood, Calif.

Aug. 25-29—Second Symposium on Naval Hydrodynamics, Washington, D. C.

Aug. 25-30—Ninth Annual Congress, International Astronautical Federation, Amsterdam, Holland.

Aug. 25-31—1958 Texas and Southwestern Soaring Contest, Grand Prairie, Tex.

Aug. 30-Sept. 1—Annual One-Design Sailplane Regatta, Harris Hill, Elmira, N. Y.

Aug. 31-Sept. 1—Air Race, Professional Race Pilots Assn., Ft. Wayne, Ind. For details: Don Berliner, 18 Hudson Ave., Athens, Ohio.

Sept. 1-7—1958 Farnborough Flying Display and Exhibition, Society of British Aircraft Constructors, Farnborough, Eng.

Sept. 2-12—Problems of High-Powered Radar Design, Summer Program, Massachusetts Institute of Technology, Cambridge, Mass. (Security clearance required.)

Sept. 3-5—1958 Cryogenic Engineering Conference, Massachusetts Institute of Technology, Cambridge, Mass.

Sept. 4-6—AGARD Avionics Panel Meeting, Cambridge University, Cambridge, England.

Sept. 8-13—First International Congress of the Aeronautical Sciences, Palace Hotel, Madrid, Spain.

Sept. 9-11—Second National Conference on Applied Meteorology: Engineering, Ann

(*Continued on page 6*)

AVIATION WEEK Including Space Technology

August 11, 1958
Vol. 69, No. 6

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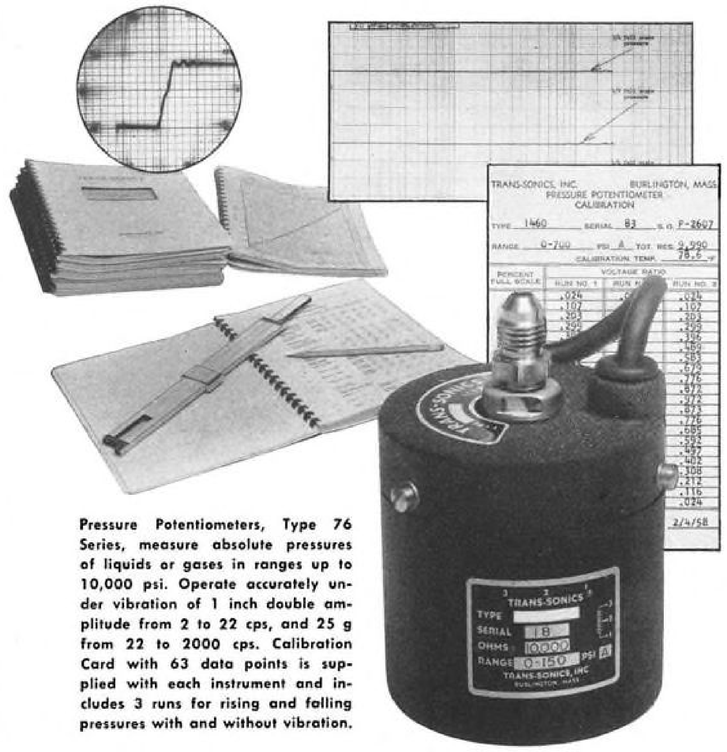

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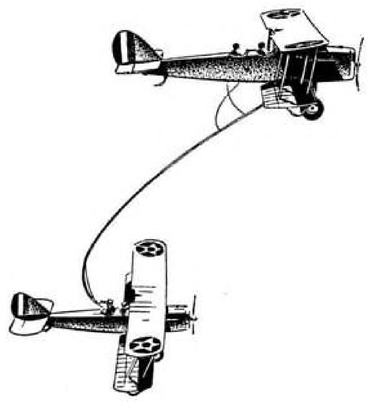

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AVIATION CALENDAR

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Arbor, Mich. Program Chairman; Dr. D. J. Portman, 5500 East Engineering Bldg., University of Michigan, Ann Arbor, Mich.

Sept. 11-12—Annual Business Meeting and Conference, Northeast Chapter, American Assn. of Airport Executives, Municipal Airport, Worcester, Mass.

Sept. 15-18—Fall Meeting, American Rocket Society, Inc., Hotel Statler, Detroit.

Sept. 15-19—Annual Instrument-Automation Conference & Exhibit (International), Instrument Society of America, Philadelphia Convention Hall, Philadelphia, Pa.

Sept. 22-24—1958 Meeting, Professional Group on Telemetry and Remote Control, Americana Hotel, Bal Harbor, Miami Beach, Fla.

Sept. 22-24—1958 Convention of the National Business Aircraft Assn., Bellevue Stratford Hotel, Philadelphia, Pa.

Sept. 25-27—Fifth Annual National Western Forum, American Helicopter Society, Ambassador Hotel, Los Angeles, Calif.

Sept. 25-28—Air Force Assn. Annual Convention and Airpower Panorama, Dallas.

Sept. 29-Oct. 3—National Aeronautical Meeting, Society of Automotive Engineers, Inc., the Ambassador, Los Angeles.

Sept. 29-Oct. 3—Semi-Annual Meeting and Western Tool Show, American Society of Tool Engineers, Shrine Exposition Hall, Los Angeles, Calif.

Oct. 1-2—Conference on Radio Interference Reduction, sponsored by Armour Research Foundation and U. S. Army Signal Engineering Laboratories, Museum of Science and Industry, Chicago, Ill.

Oct. 1-3—National Airports Conference, University of Oklahoma, Norman, Okla. Co-sponsored by American Assn. of Airport Executives and the CAA.

Oct. 6-7—National Symposium on Extended Range and Space Transmission, sponsored by Institute of Radio Engineers and George Washington University, Lisner Auditorium, Washington, D. C.

Oct. 6-7—Champion Spark Plug Co.'s Distributor and Business Aircraft Operators Clinic, Secor Hotel, Toledo, Ohio.

Oct. 7-8—1958 Joint Meeting, Institute of the Aeronautical Sciences and Canadian Aeronautical Institute, Chateau Laurier, Ottawa, Canada.

Oct. 7-12—Sixth International Communications Convention, Genoa, Italy.

Oct. 8-10—14th Annual Aviation Spark Plug and Ignition Conference, Champion Spark Plug Co., Secor Hotel, Toledo.

Oct. 9-10—Ninth Annual National Noise Abatement Symposium, sponsored by Armour Research Foundation, Hotel Sherman, Chicago, Ill.

Oct. 13-15—14th Annual National Electronics Conference, Hotel Sherman, Chicago, Ill.

Oct. 15-17—Twelfth Annual Meeting, Southeastern Airport Managers' Assn., The Palm Beach Terrace, Palm Beach.

Oct. 22-24—Fifth National Vacuum Symposium, Sir Francis Drake Hotel, San Francisco, Calif.

Oct. 27-28—East Coast Conference on Aeronautical & Navigational Electronics, Institute of Radio Engineers, Lord Baltimore Hotel, Baltimore, Md.

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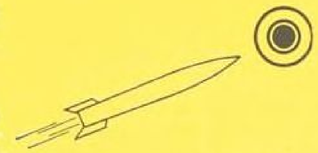

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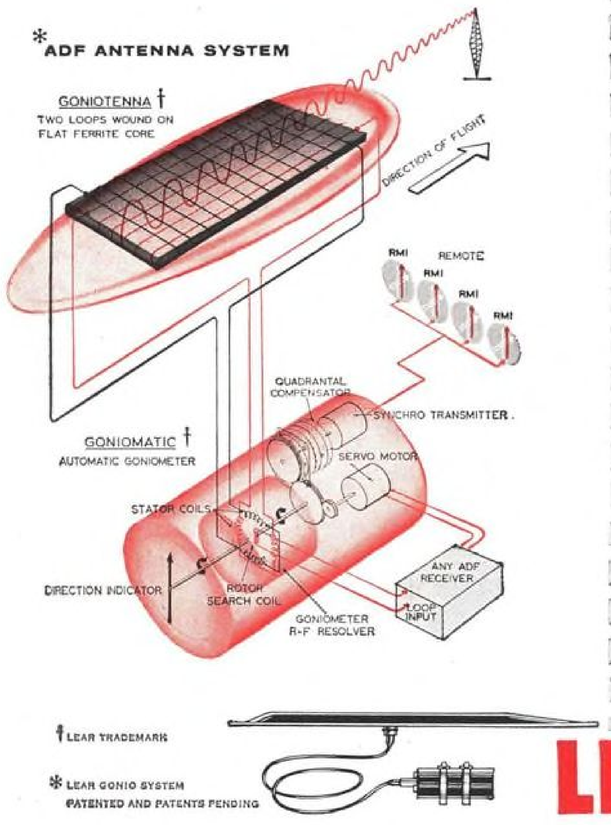

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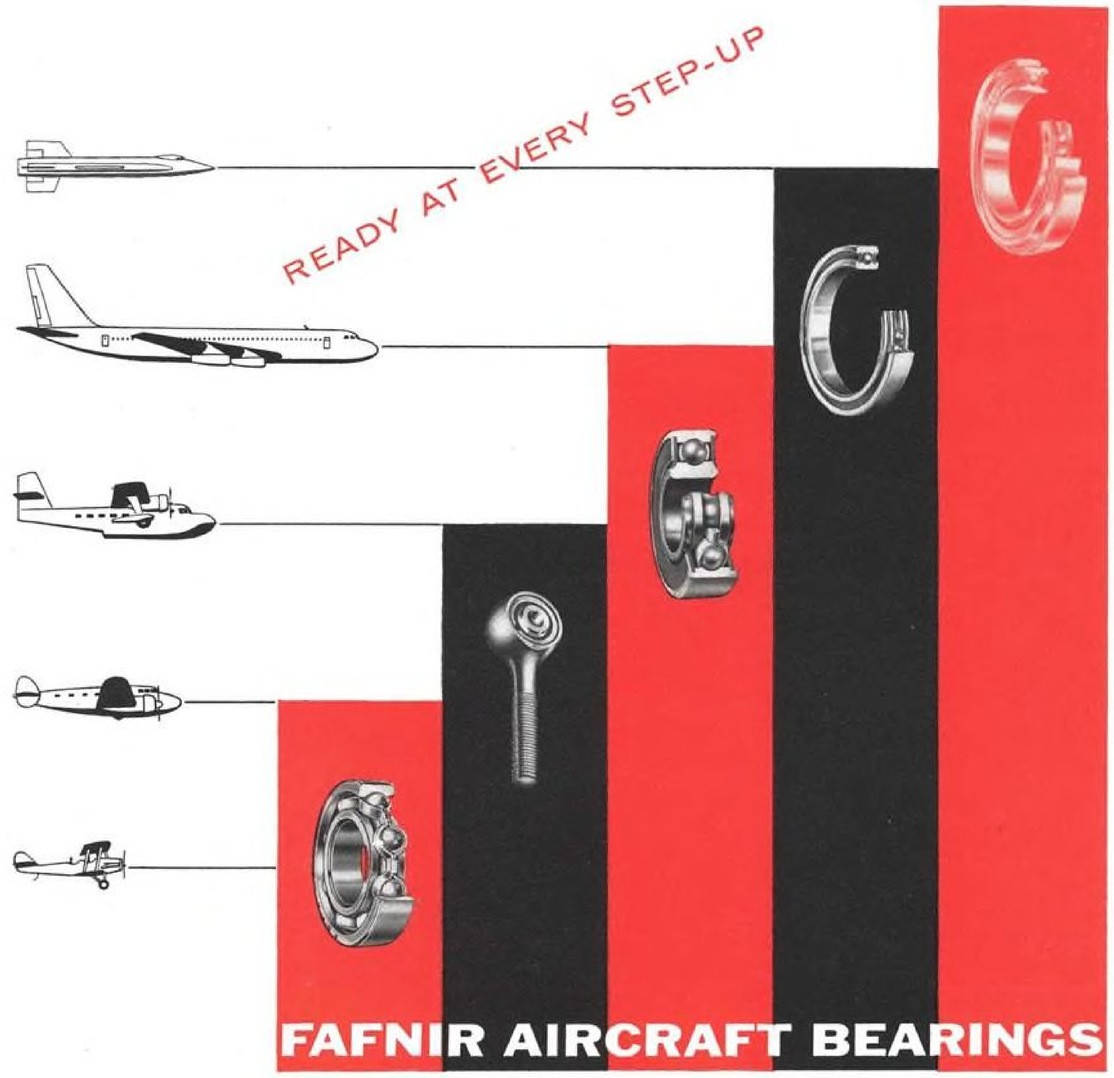

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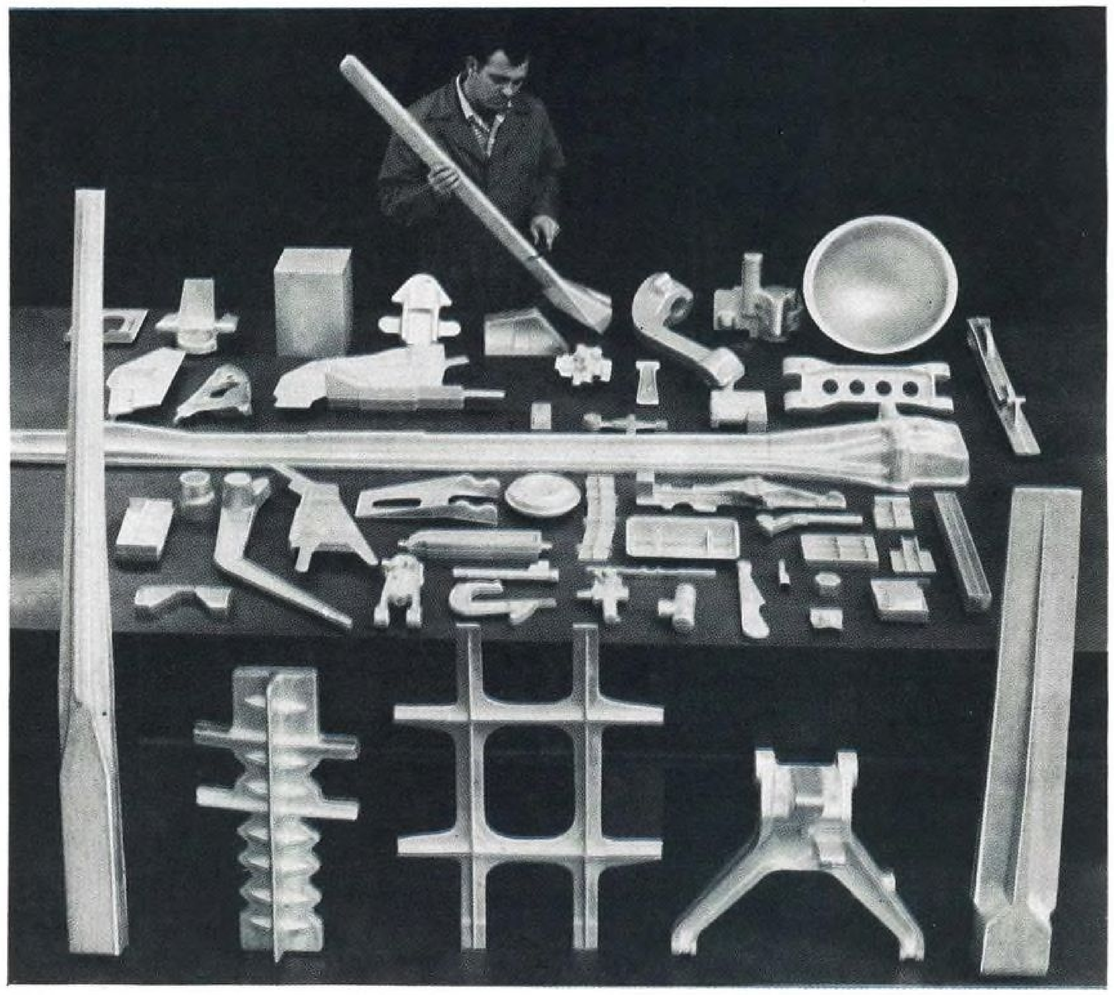

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COVER: First Douglas DC-8, now well into company flight test program, crosses California coastal mountain range returning to Edwards AFB where most of flight testing is being done. Airplane has logged approximately 60 hr. since first flight. Program is progressing through system checks and step-by-step exploration of performance extremes. Speeds have reached Mach .85 and 505 kt. Takeoffs have been made at gross weights up to 225,000 lb. Design maximum takeoff gross weight is 265,000 lb. Highest altitude attained so far is 36,000 ft. The second DC-8 is expected to enter the test program shortly.

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BOMARC	Erector-launcher and Decontamination system
NAVAHO	Transporter-erector and vertical access tower

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EDITORIAL

AVIATION'S ECONOMIC PROBLEMS

The eagerly-awaited Cherington report (see page 28) which was distributed to Congress and appropriate federal agencies last week provides a sharp focus on the economic problems facing the aviation industry and a keen analysis of this industry's growing role as a significant force in the national economy. The Cherington report is the first comprehensive look at the role of civil aviation in the national economy since the Finletter Commission report a decade ago.

This intervening decade has been marked by major economic and technical growth trends that have radically altered the role of aviation in the over-all economy. Dr. Paul W. Cherington of Harvard University, who prepared the report, and Elwood R. "Pete" Quesada, the President's special assistant on aviation policy who commissioned Dr. Cherington to do the job, both deserve the industry's commendation for the manner in which this job was done.

Possible Benefits

There is an opportunity for the report to serve two useful purposes:

• **To serve as a lubricant to ease friction between** some segments of the industry and some agencies of the government which has been an effective deterrent to constructive progress. The report makes it abundantly clear that the economic problems now facing the industry are not the result of imprudent planning or action by any particular group but rather result from a combination of interlocking circumstances for which almost everybody in industry and government must shoulder some responsibility.

• **To serve as a catalyst in stimulating** a coordinated plan of action aimed at solving these problems by all the government agencies involved and both the air transport and manufacturing portions of the industry. The report does not offer any ready-made panacea for all of the economic problems looming on the near horizon, but it does suggest several broad avenues down which a well coordinated industry-government program could move successfully.

There are already indications that action is stirring in some areas cited by the report. The complex relationship of the Military Air Transport Service and the commercial airlines is already being re-evaluated at the Department of Defense level and the Air Coordinating Committee is exploring avenues of financing the large scale sales of piston-powered transports that are a necessary corollary to the U.S. airlines shift to gas turbine power plants.

Where Initiative Lies

There is no question that much of the initiative in moving toward solution of these economic problems must come from the federal regulatory and financial agencies involved in the many facets of civil aviation. But it would be a tragic mistake by the aviation industry to lean heavily on government action alone. Government action such as repeal of the transportation tax, liberal government financing policies on second-hand equipment for the export market, new look at the airline fare structure by the Civil Aeronautics Board and a larger share of MATS non-combat traffic to commercial carriers can only provide the industry with more capital resources and more operational latitude to solve its own problems.

The major impetus toward genuine and lasting solutions to these economic problems must come from industry itself. It will require extremely vigorous, intelligent and farsighted leadership by the management of each individual airline and manufacturer involved to permanently shuck the financial problems of the jet age.

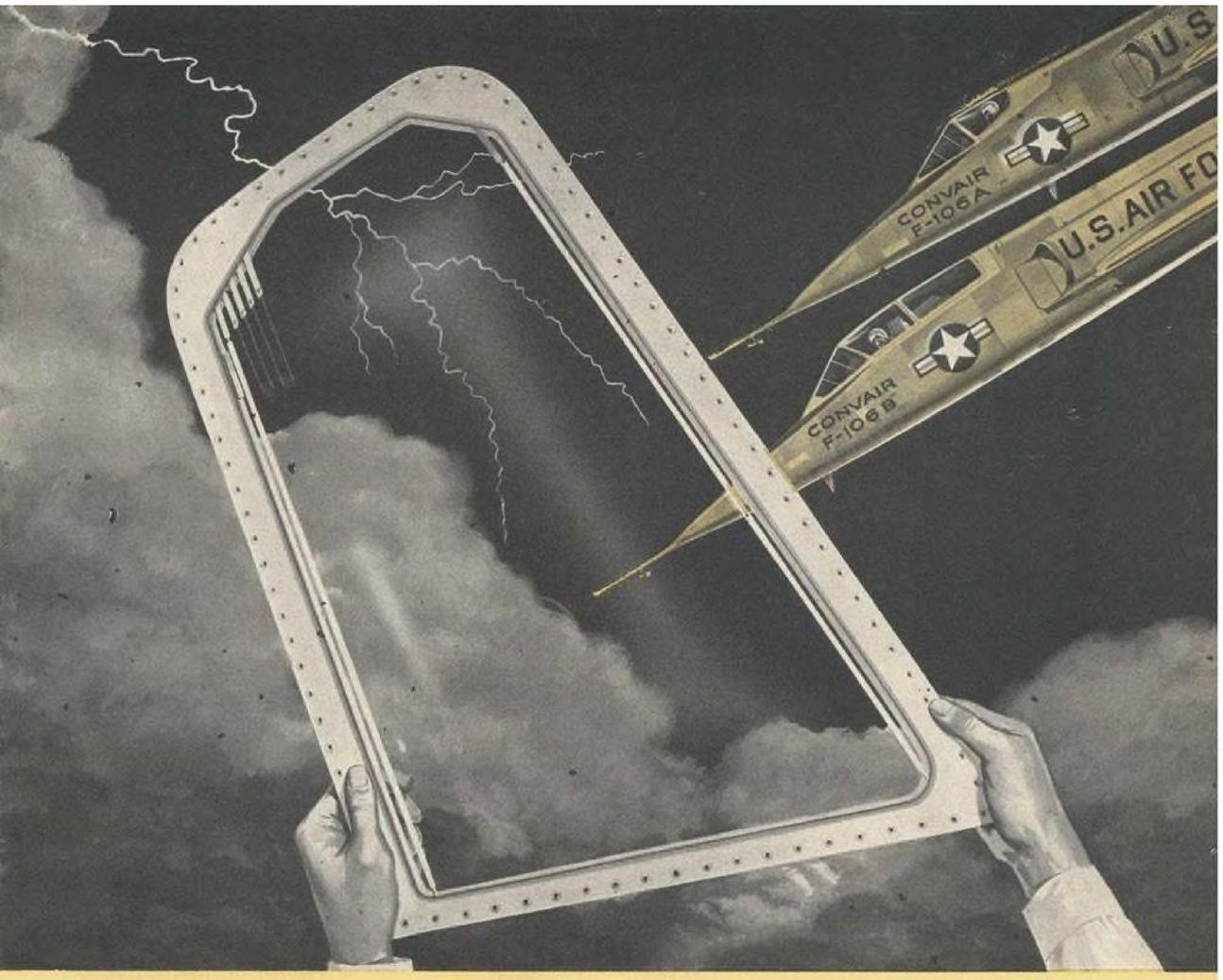
Air transport has become so vital and integral a part of the American economy that it would be unthinkable to have it collapse from economic strain. The life net of government subsidy is still spread to prevent this. But it would be a tragic retrogression if the airline industry, which in recent years has risen almost completely off federal subsidy and added a dynamic positive contribution to the nation's economy, were now to fall back on this device and again become a direct drain on the taxpayers.

Top-Level Attention

It should be a source of great encouragement to the aviation industry in its efforts to achieve long-term solutions to the current crop of economic problems to note the consistent and vigorous attention that has been devoted to this area by the highest levels of the government during the past few years. Beginning with the Harding report, which laid bare the impending crisis in air traffic control, continuing with the monumental Curtis report that spawned the new Federal Aviation Agency and now punctuated by the Cherington report on economic problems of the jet age, the executive branch of the government has developed an effective modern approach to the most dynamic aspect of our expanding economy. It has recruited able men to tackle these jobs and, with solid congressional support, has translated their recommendations into action. As we pointed out last week, the record of solid achievement during the current session of Congress has been truly remarkable.

With the new Federal Aviation Agency ready to emerge soon as reality and the prospect of getting vigorous leadership for it from Mr. Quesada as its initial head and with James Pyle, current Civil Aeronautics Administrator, as his deputy and eventual successor, the outlook for civil aviation is brightening despite the scattered economic thunder showers on the immediate horizon.

—Robert Hotz



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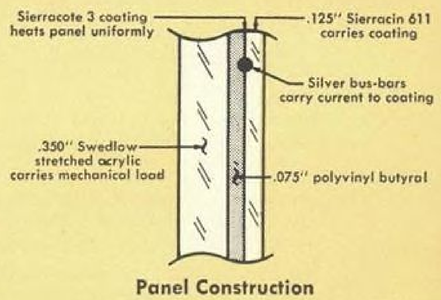

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Please refer to Dept. 10

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WHO'S WHERE

In the Front Office

Morris M. Townsend, president, Resort Airlines, Inc.

Machlin B. Laddon, president, Langley Corp., San Diego, Calif., succeeding **I. M. Laddon** who remains as board chairman.

A. C. Ducati, vice president in charge of development engineering, Giannini Plasmadyne Corp., Santa Ana, Calif.

The Industrial Products Group of Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., has announced the following appointments: **George M. Muschamp,** group vice president-engineering; **O. B. Wilson,** group vice president-marketing; **John M. Wilson,** director of engineering; **R. L. Mallory,** sales manager.

Warren B. Hayes, vice president, Pacific Semiconductors, Inc., Culver City, Calif.

Chester A. Hill, vice president-assistant treasurer, Aerojet-General Corp., Azusa, Calif., succeeding **Tracy S. Clark,** retired.

Sam F. Arn, vice president-sales, Pac-Aero Engineering Corp., Santa Monica, Calif.

J. Justin Basch, vice president-marketing, Oakite Products, Inc., New York, N. Y.

Charles Theodore, vice president-sales, Ling Electronics, Inc., Culver City, Calif.

The Sheffield Corp., subsidiary of Bendix Aviation Corp., Dayton, Ohio, has announced the following appointments: **Jack T. Welch,** vice president-field sales; **William I. Wilt,** vice president-gage and instruments division; **Victor J. Boll,** assistant vice president-contract manufacturing division; **Thomas W. Clark,** assistant vice president-service facilities division.

Maj. Gen. Harold E. Watson, Deputy Assistant Chief of Staff for Intelligence, USAF Headquarters, Washington, D. C.

Howard M. McCoy, assistant to the executive vice president, Marquardt Aircraft Co., Van Nuys, Calif.

Honors and Elections

Dr. Mervin J. Kelly, president of Bell Telephone Laboratories, has been named 1959 recipient of the John Fritz Medal for "his achievements in electronics, leadership . . . and contributions to the defense of the country. . . ."

Dr. Robert J. Jeffries, president of Data-Control Systems, Inc., has been appointed a member of the National Research Council to represent the Instrument Society of America in the Division of Engineering and Industrial Research for a period of three years.

Dr. George S. Crampton, Professor Emeritus of Ophthalmology at the University of Pennsylvania Medical School, will receive an Edward Longstreth Medal from the Franklin Institute "For his development of the Borescope, a specialized periscope for the internal inspection of turbine shafts, rotors. . . ."

Martin M. Decker, president of the Decker Corp., has been elected vice president of the National Aeronautic Association of the United States, Washington, D. C.

(*Continued on p. 93*)

INDUSTRY OBSERVER

► Nike Zeus anti-ICBM missile will carry small Doppler radar developed by Ryan Aeronautical Co., which is either intended for homing on enemy nose cone or for enabling Nike Zeus to discriminate between fast-moving nose cone and slower-moving decoys.

► **Initial attempt already has been made to air-launch a lightweight Naval Ordnance Test Station satellite and other satellites are about ready for launching.**

► Titan intercontinental ballistic missile will have an aluminum skin as opposed to the stainless steel airframe of the Atlas.

► **Report to Defense Department on recommendations for research with beryllium to promote its use in aircraft and missile structures is being submitted by a panel of National Academy of Sciences' Materials Advisory Board. Panel members include representatives from Beryllium Corp. of America, Brush Beryllium Co., Martin, General Electric, Atomic Energy Commission and Nuclear Materials Inc.**

► Titanium Metals Corp. of America is shipping its first sheets of new heat treatable titanium alloy TI-4A1-3MO-1V to North American Aviation and Chance Vought. Biggest, and most hoped for market at present is North American's B-70 Mach 3 bomber (AW July 14, p. 26).

► **De Havilland has developed a new version of the Gyron Junior jet engine. Designation is Mark 10. Although the new engine's power is still secret, de Havilland says the 7,000 lb. thrust of the earlier Mark I is "greatly enhanced."**

► Soviet Union is putting 10 times the effort into geological research, particularly discovery of mineral deposits, as the U. S. is, according to information recently obtained by U. S. Geological Survey. Soviet effort, plus the ever-increasing demand for solid fuel propellants and heat and pressure resistant alloys and compounds generated by missiles and high speed aircraft, have prompted the United States Geological Survey to ask Congress for an immediate $3 million increase in this country's current geological research program.

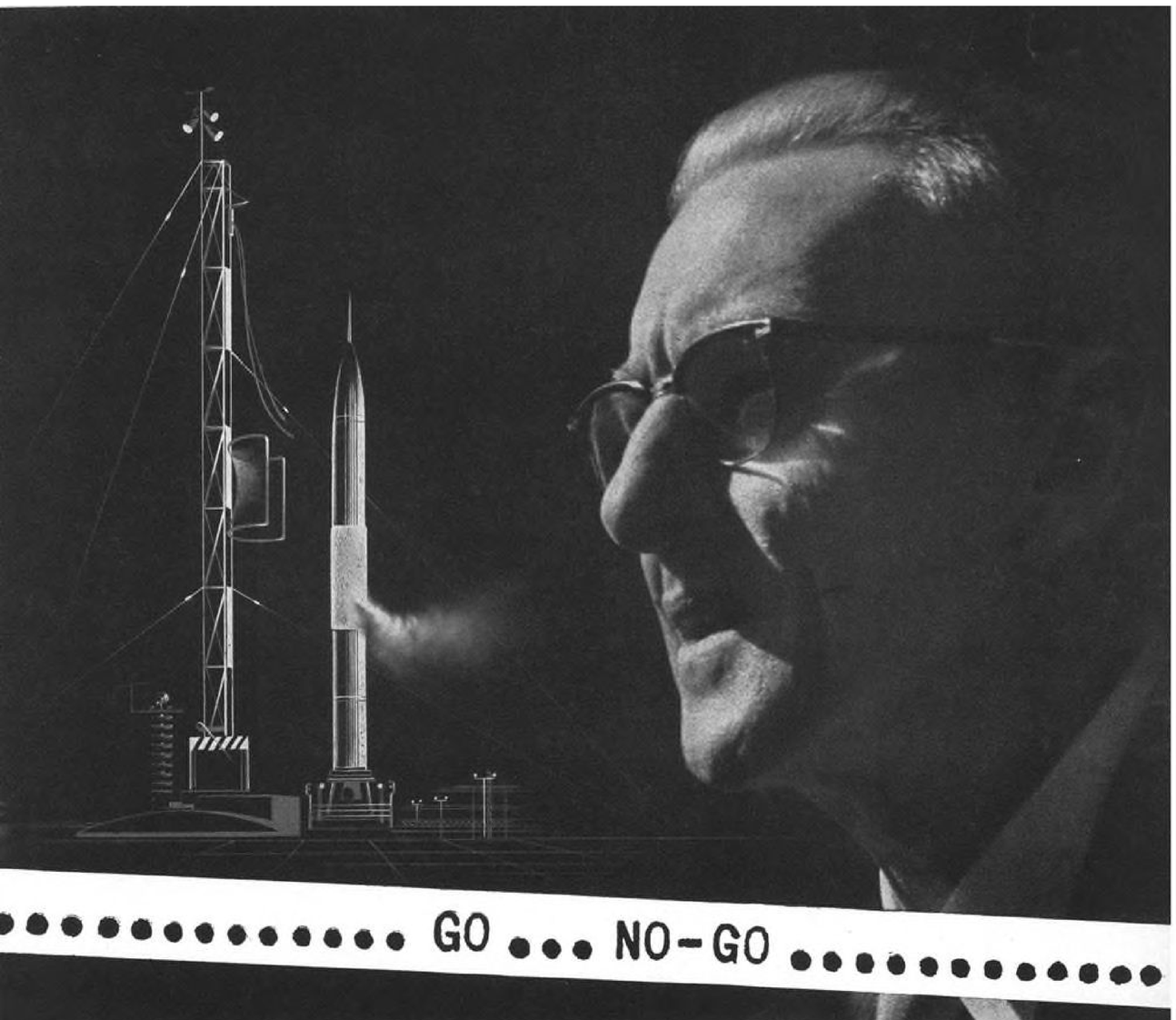
► **Tests at Wright Air Development Center have shown that a man in street clothes can withstand temperatures of 300F for 10 min., while a man in flying gear can stay in 240F heat for 15 min.**

► Czechoslovakia's three- to five-place L-34 helicopter now under development reportedly will have a maximum speed of about 102 mph. and a ceiling of 14,765 ft. The all-metal, single rotor craft is intended for passenger transportation, pilot training, aerial ambulance work and observation. It will carry a three-hour fuel supply.

► **Special Projects Office of Guy B. Panero Engineers, New York City consulting engineers with heavy experience in underground installations, is conducting a study on tunnels, shaft closures and ventilation for the Martin Titan intercontinental ballistic missile weapon system under a $15,500 contract from Air Research and Development Command's Ballistic Missile Division. Findings could result in "hard" launching sites that would be quite capable of withstanding even direct hits by megaton warheads (AW July 21, p. 15).**

► Failure of latest Vanguard satellite launching vehicle last June 26 occurred when Aerojet second stage engine cut off prematurely due to low chamber pressure.

► **Initial small quantities of nitrogen textroxide ordered by North American's Rocketdyne Division and Aerojet-General for evaluation are being followed up with orders for 10-ton test lots. Long storage life makes the oxidizer a promising substitute for the considerably more powerful, but less stable, liquid oxygen.**



Automatic checkout equipment is a project of J. G. Ferguson, Senior Staff Engineer, Stavid Engineering, Inc.

Mr. Ferguson has specialized in the development of frequency standards for Loran and other navigation systems, field transmission measuring apparatus, cathode ray tube displays, and many other test and measuring devices for electronic equipment. His current work at Stavid is to develop equipment for reliability studies and automatic testing of electronic systems. Mr. Ferguson is one of a team of Stavid scientists and engineers who are applying their knowledge ... from concept through production ... to projects of major importance to the defense and progress of our country.

In Stavid's objective engineering atmosphere, scientific, development and manufacturing teams are producing a wide range of electronic systems for all branches of the military. A typical project is the development of an Airborne Search, Bombing and Terrain Clearance Radar System.

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Washington Roundup

Security Veil Tightened

White House, concerned with the Middle East situation and angered by what it believes to be attempts of the individual services to overly push their own cases, is applying its policy of "no news is good news" with renewed vigor.

One service public information official in the Pentagon complained last week that "Russia can now put out more information than we can." Another said, "All we can handle here are minor releases."

Information going beyond the routine release of promotion, etc. must pass through the office of Murray Snyder, Assistant Secretary of Defense for Public Affairs and former aide to presidential press secretary James Hagerty, where it is graded for "policy" and "timeliness" as well as for actual security which often plays a poor third to the first two. Additional veto power over the services was recently granted Snyder in a move to prevent the individual services from releasing information that might remotely be interpreted as promoting interservice rivalry or of flaunting the party line as laid down by the Administration.

Federal Aviation Agency

Chances are good that the proposed bill to create a new Federal Aviation Agency will be approved by Congress and sent to the White House this week. Conferees were meeting late last week to work out differences between the House and Senate approved version. House amendments to the Senate bill were mostly technical.

Capital Gains Ruling

Airlines cannot keep capital gains from the sale of flight equipment without deducting the amounts from their subsidy payments, Civil Aeronautics Board ruled last week. In a decision in the Capital Gains Proceeding, CAB told carriers it has no legal right to authorize such action but can legally issue refunds to carriers in annual lump sum payments if airlines comply with regulations showing they intend to use the gain for new equipment purchases.

Attempt for Perspective

Top Pentagon officials also are going out of their way to try and avert any repetition of the public criticism touched off last December by Navy's first, and abortive, attempt to launch a Vanguard satellite. Widespread criticism and disappointment at the Vanguard failure stemmed primarily from advance press billing that the small satellite would effectively answer the Soviet Union's large Sputniks I and II and prove that the U.S. had not lost its technical superiority.

Last week, in a press briefing on the Air Force lunar probe planned for later this month (AW Aug. 4, p. 26), Advanced Research Project Agency Director Roy W. Johnson carefully explained that there "is only a slight possibility" of success and that "attaining a lunar orbit is not anticipated." Johnson, prodded into speaking by articles detailing the lunar plans which Defense Department feared might re-create the pre-Vanguard atmosphere, added:

"The complete success of these first experimental flights depend on the perfect functioning of more than 300,000 complex and interdependent parts, the failure of any one of which could nullify the complete success of the flight. Certainly the chances of success are no better than one in 10."

Concurrently, a brief Air Force statement confirming the first successful firing of an Atlas intercontinental ballistic missile with all three engines ignited cautioned against any thoughts that the launch meant the U.S. had an operational ICBM capability. The release quoted Air Force Secretary James H. Douglas as warning that "in the furtherance of the Atlas test program some failures must still be expected when flight testing such highly complex weapons systems."

Restricted Flight Area

Strategic Air Command plan to conduct simulated bombing missions maneuvers over the Great Lakes region has resulted in a Civil Aeronautics Administration directive requiring all civilian flights to obtain special CAA air traffic control approval for operations in the designated North Central Restricted Area during specified dates during August, September and October.

The military exercise will be conducted between the hours of 1 a.m. and 4 a.m. (CDT) at mixed altitudes up to 40,000 ft. Area involved is roughly bounded by Dayton, Springfield, Saginaw and Ironwood, Mich., in a rectangular form extending to the Canadian border. Effective dates of restrictions are Aug. 20, 21, 22, 27, 28, 29; Sept. 3, 4, 5, 10, 11, 12, 17, 18, 19, 30; Oct. 1, 2, 3, 14, 15, 16, 17. Area will be used only one of three nights listed per week in first two months and four nights per listed week in October. Air Route Traffic control facilities will have information 12 hours in advance.

Dallas to West Case

Civil Aeronautics Board last week voted to consolidate undecided portions of the Dallas to the West Service Case with the Southern Transcontinental Service Case. First route awards in Dallas to the West Case were made earlier when Continental Airlines and Trans Texas Airways received tentative Board approval for nonstop service in the case (AW July 28, p. 33).

Scope of the consolidated proceeding will cover the need for single carrier service from the Florida cities of Miami, Orlando, Jacksonville, and Tampa/St. Petersburg/Clearwater along with Atlanta and Birmingham to San Diego, Los Angeles and San Francisco/Oakland. The Case also includes the need for such service connecting Houston with the three California cities. Intermediate stops proposed on the routes involved are New Orleans, Houston, San Antonio, El Paso, Dallas, Ft. Worth, Albuquerque, Tucson, Phoenix and Las Vegas.

ATA Appeal

Air Transport Assn. is asking the Civil Aeronautics Board to reconsider its order of July 15 denying the airline group permission to hold industry-wide joint fare discussions. ATA said the existing complexity of various fare discounts, which it termed a "20 year encrustation" of individual carrier tariff filings, has greatly hampered industry efforts to accelerate the sale of tickets. It added that more than 42 possible fare combinations are possible between New York and Miami.

—Washington staff

Space Technology

NASA Details Plans for Space Challenge

Nation's new space agency asks for $343 million to begin drive to cut Soviet technological lead.

By Ford Eastman

Washington—Detailed plans by which the U.S. hopes to challenge Soviet advances in space technology at an initial cost of $343.1 million have been revealed to Congress by the newly created National Aeronautics and Space Administration.

To lay the groundwork for a long-range civilian space exploration program and continue or expand projects already under way, Congress has been asked to approve new appropriations of $125 million for Fiscal 1959. The remainder of the $343.1 million would be acquired through transfer of $117 million from defense department accounts, most of it from the Advanced Research Projects Agency currently conducting civilian projects and $101.1 million from the National Advisory Committee for Aeronautics, which is to be absorbed by NASA.

Total amount needed for Fiscal 1959 represents only a fraction of the funds that will be required in future years, Dr. Hugh Dryden, NACA director, told Congress. When projects now in research and development reach the production state the costs will skyrocket to many times the current fund request.

Fund Division

Of the new money asked, $7 million is for salaries and expenses, $70.2 million for research and development and $47.8 million for new construction and equipment. This, along with the money to be transferred, will give NASA a total of $85.1 million for salaries and expenses, $187.2 million for research and development and $70.8 million for construction and equipment.

The $7 million sought for salaries and expenses will provide for 800 additional positions in the new NASA over and above the 8,000 now employed by NACA. Salaries of the new positions will range from about $4,000 a year in the lower grades up to a maximum of $21,000 annually in the top administrative, scientific and engineering grades.

The $47.8 million asked for new construction includes $24.5 million for expansion of NACA facilities at Wallops Island, Va., $3.75 million for construction of a new space projects center at Beltsville, Md., and $19.55 million for equipment and instrumentation at various locations.

The $70.2 million additional requested for research and development will be used to broaden the current space program and add new projects to cover a wide field ranging from lunar and interplanetary probes to manned space flight and development of million-pound thrust rocket engines. This supplements the $117 million for programs either started or planned by ARPA which are civilian in nature.

Construction Plans

Funds for construction have been requested in two separate appropriations; $23 million to carry on current functions of NACA in support of both aeronautics and space and $47.8 million to provide the necessary facilities required for expanded space operations.

Under the statutes, NACA did not require prior congressional authorization for construction. Under the new Space Act, however, appropriation requests exceeding $250,000 must have prior authorization. To eliminate any confusion, Congress quickly authorized not only NASA requests but the NACA request as well and is currently considering appropriating the funds.

A breakdown of planned construction, expansion and instrumentation covered by both NACA and NASA budget requests follows:

Wallops Island, Va.—NACA, $130,000, NASA, $24.5 million. Total—$24.63 million. This is requested to provide for additional launching facilities, land acquisition, construction, instrumentation and other facilities required for launching of solid and liquid fuel rockets.

Land acquisition and construction of mainland facilities are estimated at $6,782,500. Construction includes an administrative and range control building, model assembly and reliability check laboratory, technical service shop, causeway and other supporting facilities.

The $130,000 asked by NACA is for erosion control.

Island facilities will total $4,680,000 and include launching pads costing $85,500; launching site control station, $646,000; vehicle and rocket launching facilities, $3,112,500.

Instrumentation systems totaling $12.5 million at Wallops are:

- **Space vehicles ascent and** insertion guidance and tracking system, $3,480,000.
- **Long-range radar tracking** system, $2,200,000.
- **Radar spare parts and** test equipment, $750,000.
- **Tracking data handling** equipment, $900,000. Total electronic tracking system, $7,330,000.
- **Satellite and missile cameras,** $350,000.
- **Long focal-length tracking telescope,** $450,000. Total photographic and optical systems, $800,000.
- **High-gain telemetry receiving** antenna systems, $1,150,000.
- **Standard telemetry receiving** and recording systems, $400,000.
- **Special narrow-band, long-range** telemetry system, $300,000. Total telemetry data receiving and recording system, $1,850,000.
- **Launch area programming and** control system, $850,000.
- **Range safety and destruction** system, $800,000.
- **Computation system,** $600,000.
- **Meteorological instrument devices,** $270,000. Total range operation and control system, $2,520,000.

Space Projects Center

Space Projects Center at Beltsville, Md.—$3,750,000. The construction of two buildings, a research projects laboratory and a space projects building, along with supporting facilities, is proposed.

The space projects building, to be constructed at an estimated cost of $2,020,000, will serve as the initial headquarters for the center in which offices for the director and his staff and the technical and contracting staff will be located.

One wing in the basement will house computer equipment, the other wing a cafeteria.

The projects laboratory will provide space for engineering personnel, electronics work and control and guidance instrumentation. The basement will house instrument and electronics shop equipment and personnel. Cost is estimated at $1,045,000.

Equipment and instrumentation at various locations, NASA, $19,550,000.

One of the first tasks to be taken over by NASA is the general tracking of satellites. For this purpose, Dryden told the House Space Committee, NASA will begin by taking over the present network of the International Geophysical Year. In addition, NASA will take over the Vanguard Computing Center in Washington and add to that as well as make use of optical stations operated under contract by the Smithsonian Institution and the military operated stations.

Here is a breakdown of the instrumentation systems and the estimated costs:

- **Improvement of existing Minitrack** stations, $4,160,000.
- **Provision of equipment and facilities:** for two additional Minitrack stations, $2,600,000.
- **Improvement of capabilities** of existing optical tracking stations, $250,000.
- **Provision of long-range telemeter** data acquisition systems, $2,570,000. Total for extension of Minitrack and optical network capabilities, $9,580,000.
- **Precision range and velocity** measuring system, $1,930,000.
- **Telemeter reception equipment,** $1,800,000.
- **Data handling and transmission** system, $750,000. Total downrange data acquisition station, $4,480,000.
- **Terminal data transmission** equipment, $250,000.
- **Tracking system,** $2,825,000.
- **Computing system,** $750,000.
- **Command-control system,** $175,000. Total re-entry command-control system, $4,000,000.
- **Portable launching and** instrumentation systems, $1,490,000.

Langley Aeronautical Laboratory, Langley, Va., NACA budget, $11,350,000.

This has been requested for the construction of a high-temperature structural dynamics facility and a 110-kilavolt cable tie between east and west areas.

Lewis Laboratory

Lewis Flight Propulsion Laboratory, Cleveland, Ohio, NACA, $7,800,000. The program at Lewis includes installation of an air heater in the unitary wind tunnel, modification of the altitude tunnel rocket research, retubing propulsion system laboratory tunnel, hypersonic missile propulsion facility, modification of the materials research laboratory and a high-energy rocket engine research facility.

Ames Aeronautical Laboratories, Moffet Field, Calif., NACA, $3,720,000.

Included in this request are funds for a 12 by 12 in. hypersonic helium tunnel, hypervelocity research laboratory and modification of the flight research laboratory.

Under the space act, the administrator was given a certain amount of leeway in appointing personnel and fixing salaries for a limited number of key positions.

For top scientist, engineering and administrative personnel, the administrator was authorized to appoint a maximum of 260 persons at a top limit of $19,000 annually, 10 of which could exceed that up to a $21,000 a year limit. In addition, the administrator, if he found it necessary, could establish the entrance grade for scientific and engineering personnel without previous government experience at two grades higher than that provided under the Classification Act of 1949—to Grade 7 rather than Grade 5.

Under the organization plan presented to Congress, NASA has asked for a total of 57 special positions which will be determined by the administrator at rates equal to or in excess of $12,770 annual salary.

Space Technology

NASA Drafts Broad Research Program

By Evert Clark

Washington—Nation's new civilian space agency plans to take over support of a million-pound thrust rocket engine, Air Force portion of the Rover nuclear rocket project and a man in space project as it moves into a broad, $187.2 million research and development program for Fiscal 1959.

The research funds requested by the National Aeronautics and Space Administration for its first year include $155 million in industry and university contracts and $32.2 million for work in government laboratories. A complete list of projects begins on page 36.

Highlights of the program are:

- **Million-pound rocket booster** that could be used with high-energy fuel upper stages to put 40,000 lb. in a 300-mi. orbit; put 10,000 lb. around the moon and return it to earth orbit; or land 10,000 lb. on the moon and send a 400 lb. payload back into an earth orbit. By clustering three boosters, using high-energy fuels for these and the upper stages and using atmospheric braking instead of retro-rockets for re-entry, more than 10,000 lb. could be returned from the moon, NASA scientists believe. This engine is the Rocketdyne project now supported by USAF under ARPA's direction. NASA budget calls for $10 million for this development. The engine is expected to produce 1.5 million lb. thrust and is at least three to four years away.
- **High-energy rocket motors.** This $6.9 million budget item includes development contracts for a 12,000 lb. thrust fluorine-hydrazine engine at a cost of $2.32 million; an 80,000 lb. thrust engine using the same propellants, $3.58 million, and a 100,000 lb. thrust hydrogen-oxygen engine, $1 million. In addition, $1.7 million was asked for design work and adaptation of a Thor or Jupiter intermediate range ballistic missile for engine flight tests.
- **Launching of lunar and interplanetary** probes and vertical probes and geophysical, astronomical and communications satellites from 100 lb. to 2,000 lb. with vehicles ranging from Jasons and Aerobees to Atlas and Titan.
- **Manned space capsules** that would wait for the Atlas intercontinental ballistic missiles to reach a stage of reliability that the capsule could be sent into an orbit at some 120 nautical miles. Full-scale mockup of the capsule with a man in it already has undergone some ground tests, including all-axis motion simulation, at NASA's Langley Laboratory. Scale models have been fired upstream in a hypersonic

Budget Estimates

National Aeronautics and Space Administration Fiscal 1959 supplemental estimates for research and development (in millions) are:

Program	Contracted Work* Govt.	Contracted Work* Non-Govt.	Supplies and Materials	Equipment	Total
Space Science	$17.15	$18.28	$27.42	$1.85	$64.7
Space Technology	12.95	46.80	17.30	4.95	82.0
Meteorology and Communications	0.1	4.22	5.70	.48	10.5
Technology of Manned Space Flight Vehicles	2.0	6.50	21.50	....	30.0
Totals	$32.2	$75.80	$71.92	$7.28	$187.2

* Contractual research, development, operations, technical services, repairs, alterations and minor construction.

R & D Activities

Washington—National Aeronautics and Space Administration divides its research and development program into four types of activities:

- **Space science—Studies of physical characteristics of space with vertical probes and satellites; lunar probe experiments; planning studies for interplanetary probes; developmental effort on an astronomical satellite.**
- **Space technology—Research and development on high-energy rocket engines and a one-million lb. thrust engine; support of nuclear propulsion studies and development of solid propellant rockets. Extensive research on vehicular subsystems and instrumentation. Experimental test flights in systems test vehicles to determine functional performance of equipment developed.**
- **Meterology and communications—Development of meteorological observation satellites, with initial effort on additional infra-red and heat-balance measurements and development of television-type cloud cover satellite unit. Investigation of utility of reflector and relay satellites for communications.**
- **Technology of manned space flight vehicles—Studies toward design of manned space capsules and integration with booster rocket system. Experiments to verify predicted performance in flight and on re-entry.**

wind tunnel at Ames Laboratory to determine heat input and stability.

Capsule would be cone-shaped and seven ft. in diameter at the base. It would weigh some 2,100 or 2,200 lb. and would employ retro-rockets deployed laterally and firing through a central nozzle and attitude jets. Man would recline on a couch at the base of the cone. Whether he would be assigned any tasks in initial shots still is being debated. Capsule could be jettisoned from the launching vehicle any time short of orbiting. First flights would call only for a few passes around the earth. At 25,000 ft. and low subsonic speeds, a large parachute would be deployed for the re-entry. Deceleration would be 10G.

Cost of eight test capsules is listed as $4.8 million and cost of four test capsule subsystems at $3.0 million. Five Thor-Able missiles or the equivalent would be used for instrumented and small-animal flights at a cost of $8.4 million, and two Atlas or equivalent vehicles would be used for two full-scale capsule test flights at a cost of $5.3 million. Over-all cost of the development is estimated by NASA as $30 million.

- **Rover nuclear rocket development.** NASA would assume only the Air Force support of the project—work on the vehicle—and Atomic Energy Commission would continue reactor development support leading to proof of feasibility (AW July 28, p. 26).
- **Communications satellite.** Primarily design studies, but this includes launching of 100-ft. sphere into orbit by late 1959 or early 1960 as a first step.

'Reasonable First Step'

NASA's program, which National Advisory Committee for Aeronautics Director Dr. Hugh Dryden called "a reasonable first step" toward a national space program, relies on big missile boosters for the next four to five years.

Further development of liquid, solid, nuclear and electric propulsion engines are provided for in the budget, and NASA hopes that specific impulses at least as high as 800 to 900 sec. can be achieved with the nuclear engine. Limiting factor will be the melting point of the fuel elements.

Specific impulse of 360 sec. was achieved recently with high-energy fuels at the Lewis Flight Propulsion Laboratory, compared to about 250 for current engines. NASA scientists did not specify what propellants were used to obtain this, but they said hydrogen-oxygen and hydrogen-fluorine showed the most promise.

Program proposed by NASA also encompasses a number of subsystem projects ranging across auxiliary power supplies; personnel equipment; launching, midcourse and terminal guidance; landing control, vehicle and ground computers, stabilization systems and subsystems, etc.

In addition to design and development studies in these areas, program calls for procurement of 72 to 74 boosters and upper stages for satellite launchings, test vehicles, etc. They are:

- **Thirty Jasons or Aerobees** for vertical probes to measure temperature, density, etc. Cost under the supplies and materials part of the budget is listed as $3 million. Another $2.95 million would go into design, development, instrumentation, tracking, etc.
- **Six or eight modified Jupiter** and/or Thors for geophysical satellites to measure infra-red radiation, cosmic rays, meteorites, X-radiation, magnetic fields, etc., at a cost of $8.8 million.
- **Eight modified Vanguard or Sergeant** systems as upper stages for geophysical satellites, cost $6.5 million.
- **Two Thor and/or Jupiters** for lunar probes at $2.3 million and another $1.4 million for upper stages and assemblies.
- **Two units of Sergeants and systems** for test vehicles for high-energy fuel systems, $2.3 million.
- **Two Thor and/or Jupiters** plus retro-rockets for recovering payloads from material test satellites, $3.5 million.
- **Five Sergeants or equivalent as** test vehicles for specific solid rockets that are to be developed, $2.5 million.
- **One Thor-Able and payload recovery** system for a meteorological satellite, $3.2 million.
- **One Thor or Jupiter** and vehicle for initial communications services satellite, $2 million.
- **Seven Thor-Ables and Atlases** mentioned above for manned capsule tests, $13.7 million.

Interplanetary probes for shots to Mars and Venus are in early planning stages. Total of $2 million is included, $400,000 of it for design studies and $1.6 million for initial studies of trajectories, missions and vehicle design.

Among the earliest programs to get under way will be 100 to 700 lb. satellites. Earlier satellites, up to about 120 lb., will be spin stabilized as are the Vanguard and Explorers.

Stabilization systems probably will divide into one for the 100 lb. to 300 lb. workhorse satellites and one for satellites greater than 2,000 lb., including the astronomical satellite which will require extreme precision.

One early project may be television camera satellite to picture cloud cover on the illuminated side of the earth. Infra-red sensors later will relay data on cloud covers even at night.

Space Radiation Levels

Iowa City, Iowa—Deadly radiation approximately 150 times more intense than estimated from Explorer III data has been reported by recently launched Explorer IV. Telemetered data from two Geiger counters, one of them shielded with 1/16 in. of lead, and two scintillation counters aboard Explorer IV indicates that high intensity radiation begins at an altitude of about 250 mi., not 600 mi. as earlier believed, and doubles in intensity roughly every 60 mi. away from the earth.

Lead shielded Geiger counter experienced 60% as many impacts as the unshielded counter, striking hard at earlier hopes that light shielding might be sufficient to protect space travelers. At an altitude of 1,200 mi., present data indicates that unshielded space traveler would receive the maximum safe weekly dosage in about two minutes, according to University of Iowa scientists who are supervising the experiment.

Data from scintillation counters mounted on the surface of Explorer IV's shell has forced scientists to revise an earlier theory that intense radiation which swamped the Geiger counter mounted inside Explorer III might be X-rays generated by electrons striking its external shell. If space radiation proves to be electrons, its energy level is estimated at six million electron-volts; 40 million electron-volts if radiation stems from protons.

USAF, Army Clash on Air Defense Role

Washington—Showdown battle on air defense is rapidly being forced on Defense Department by Congress. Fight will center around a choice between Air Force's Bomarc interceptor missile and Army's Nike Hercules anti-aircraft missile, but far broader implications include the possibility that USAF might be taken out of air defense completely, and the possibility that the F-108 and future manned interceptors might have to be abandoned in favor of missiles, even if USAF retains a defense role.

Cost of supporting partially overlapping systems is the key to the entire controversy. Congress has made it clear in words and by legislation that the nation will not support SAGE early-warning system, the Bomarc, current and planned interceptors and the Nike Ajax, Nike Hercules and their complementary low-level defense missile, the Hawk.

Although Nike Hercules and Bomarc are neither competitive nor even directly comparable on the basis of range, over-all protection, kill probability, rate of fire, cost, manpower requirements and many other factors, most Pentagon observers agree that Defense Secretary Neil McElroy is being forced into a position where he will have to choose one or the other.

Congress' attitude was made clear in a bill authorizing military construction for Fiscal 1959. It cuts 20% from Nike and Bomarc construction funds and directed Secretary McElroy to "determine with respect to each defended area, which missile or combination of missiles will be employed in that area."

Re-evaluations of both systems are currently under way at Defense Department level, but there has not yet been a really competitive comparison by anyone other than the two services involved in the controversy. Apparently none is planned, and the choice may be made without a complete competitive study being made.

The pending choice presents USAF with these difficult decisions:

- **Whether to bow out of the defense** role entirely in order to concentrate effort and budget on its strategic missions.
- **Whether to stay in air defense and** throw all-out support behind Bomarc at the risk of helping to kill off manned interceptors.
- **Whether to attempt to keep a mix** of manned and unmanned interceptors —a choice which might be a double-or-nothing gamble and could cost USAF its role in air defense.

Army's stake in the battle is more than its growing responsibility in anti-aircraft defense. Riding on the Nike Hercules project, many Army observers feel, is its whole role in anti-missile defense, particularly since Nike Zeus—the anti-missile project behind which the nation is putting almost all its effort in the field—is considered another step, although a major one, in the growth of the Nike family. Army feels it vitally needs the experience with the Hercules in preparing for its role with the Zeus, which was chosen over Air Force's competing Wizard systems because Zeus was further along in development.

Some of the arguments on both sides are:

- **USAF's Bomarc** supporters feel it is so far superior to Hercules as a defensive weapon that they would rather see Army get the whole air defense mission and the Bomarc itself than to see Bomarc killed in favor of Hercules. This, however, is not an over-all Air Force view.

Even USAF's strongest Bomarc adherents believe manned interceptors are essential, with their flexibility and independence of ground radar, in order to range 1,000 mi. or more from shorelines and kill enemy aircraft outside the continent. This is part of USAF's concept of trying to kill the enemy first at his own fields and always as far away as possible from U.S. targets. Army's concept, based on shorter range missiles and no manned aircraft, by necessity depends on kills close to the target.

- **Army concedes that its defense is** a "step defense," depending on Hawk at low levels, Nike Ajax for shorter ranges and Nike Hercules for longer ranges, but it argues that it has experience, trained crews, Ajax complacements in being that can be modified to take Hercules, and a missile that is becoming operational right now.
- **Both services appear to feel** that a compromise which included a mix of both missiles would only create a temporary solution.

Other pertinent points are:

- **Bomarc IM-99 has a range of** approximately 200 mi. It is controlled by SAGE until its homing radar sees the target and takes over. Low-level capability is limited. IM-99B, which is expected to go into the ninth of 15 approved Bomarc sites late in 1960, will have a solid-rocket sustainer instead of liquid. Range will increase to about 400 mi., and it will have low-level capability. All sites are programmed to be ready shortly after the nearest SAGE installation is ready.
- **Nike Hercules has a range between 75** and 100 mi. Although it will receive its early warning from USAF systems, its radars also must acquire the target themselves close to the point being defended. Using three radars, it is more susceptible to jamming and decoys.
- **USAF wanted about 40 Bomarc sites** with 120 missiles per site for optimum air defense. Cost, including five years of operation, would have been approximately $6 billion. It has been cut down to 30 sites, with 60 missiles at the first two and 30 missiles at the remaining sites. Cost is under $2 billion.
- **Army wanted some 160 battalions** for optimum coverage at a cost of about $11 billion. Battalions would range from close to a dozen around some targets to one or two per site. Some would be exclusively Nike Hercules, some would include Nike Ajax. Ajax sites now number less than half the total bases Army desired.
- **Army agrees that the optimum** number of Bomarc sites cover more total area than an optimum number of Nikes but says much of the land "protected" is wasteland that needs no protection, whereas Nikes protect specific targets.
- **Manpower requirements differ widely.** One claim is that the optimum Nike plan requires seven times the number of men that the optimum Bomarc plan does.
- **Studies of the nation's entire defense** forces—all types of missiles plus interceptors—for the current and near future credit a very high percentage of the kills to Bomarc, rating it well ahead even of interceptors.
- **Acreage required favors Bomarc.** Army claims that Nike Hercules needs some 200 acres per battalion if there are four batteries to a battalion. USAF says the actual figure is much higher. Bomarc requires 80 acres, whether it is a full or half-strength squadron.
- **Lethality of warheads** also favors Bomarc. Both it and Hercules use a variety of heads, including high explosive for lower-level shots, but most powerful Bomarc head virtually ensures not only aircraft kill but also kill of the aircraft's weapon.
- **Nike Hercules made six kills out** of six shots in recent tests at Eglin AFB, Fla., against QF-80 drones. In one shot, Hercules selected and "killed" lead drone of a three-drone formation. Exercise demonstrated mobility of Hercules teams by bringing in elements from three different locations. Army cites mobility and field emplacement capability as advantages over Bomarc. Shots included a kill at 7,000 ft. altitude and 50,000 yards slant range and a kill at 30,000 ft. and 40 nautical mi. range.
- **Bomarc tests have demonstrated a** kill probability of 80% in last five and about half that in the last 10 tests. Drones in all tests have been B-17s and QF-80s.

Airframe Industry Earnings Rise; Companies Forecast More Orders

New York—Sales and earnings for three major airframe manufacturers have shown increases and one manufacturer, McDonnell Aircraft, last week said future sales should exceed $400 million if there is no downward trend in contracts through government termination, reduction or stretchout.

McDonnell had sales of $442,408,483 and earnings of $10,028,577 for its fiscal year ended June 30. Sales were up $107,120,719 over last year, and earnings rose $356,923. McDonnell's backlog is $505,724,030.

At Temco Aircraft Corp., sales for the first six months of 1958 nearly equalled the record first half of 1957 for a total of $61,519,718 compared with the record high of $61,640,181 a year ago. Earnings this year increased to $1,177,438, or 69 cents per share, against 1957 earnings of $1,017,758, for 60 cents per share. Company now has a backlog of $124,000,000.

J. S. McDonnell, president of McDonnell Aircraft, last week told stockholders the company will complete a $5,137,000 polysonic wind tunnel next spring, for testing speeds up to Mach 6.

McDonnell last week received an Air Force order of $5,794,904 for production of GAM-72 Quail missiles. Missile is air-launched decoy to distract enemy radar, fighter planes and anti-aircraft missiles from the main target.

Aeronca Manufacturing Corp., which makes airframe assemblies and components, said its earnings for the first half of 1958 rose to $12,175,077, as compared to $10,754,515 for the same period a year ago. Net earnings were $353,472, or 58 cents a share, against $338,057, or 52 cents a share a year ago, according to John A. Lawler, president.

Lawler said Aeronca's backlog is $30,478,000, as compared to $36,300,000 last Dec. 31. He said the company's Baltimore Division now is concentrating on electronic digital computers and missile ground support and control systems and has achieved "favorable recognition," in forecasting an increase in orders for the second half.

In the electronics field, Westinghouse Electric Corp. reported second quarter net income of $17,070,000, a 4% hike over the $16,417,000 earned in that period last year. Second quarter sales reached $474,632,000, a 6.4% drop under last year's second quarter record sales of $507,253,000.

Westinghouse Electric first half sales this year totalled $923,961,000, a decline of 6% from the first half of 1957, when sales hit a record high of $982,939,000. However, Gwilym A. Price, board chairman, said new orders booked in June were the highest this year and unfilled orders for defense products are higher than a year ago.

Other financial developments:

• **Consolidated Electrodynamics Corp.** reported first half sales of $15,382,136, up slightly from the record $15,198,161 set in that period last year. Earnings, however, dropped sharply to $30,292 this year, as compared to $911,235 a year ago. Philip S. Fogg, president, said the drop was reflected in a production rate cutback to reduce inventories but added that it was "impossible to reduce manufacturing overhead costs proportionately." He forecast an increased production rate in the second half of 1958. Company has a $17.8 million backlog.

• **Westinghouse Air Brake Co.** net income for the second quarter of 1958 rose to $2,611,134 from first quarter earnings of $2,301,276. Earnings in the first six months dropped to $4,912,410 from last year's $6,640,686, and six-months sales were $113,282,858, as compared to $123,794,437 last year. A. King McCord, president, predicted second half sales and profits will be "reasonably good."

• **Jack & Heintz Inc.** said its sales of $10,513,000 in the first half of 1958 produced net income of $525,000, a slump from the $178,000 net income of the corresponding 1957 period. Company's backlog is about $12 million and President Frank R. Kohnstamm said management looks for a "modest improvement" in second half sales.

• **Thiokol Chemical Corp.** net sales for 1958's first half reached $32,278,284, an increase of $6,610,547 over that period last year. Net income was $865,756 as compared with $838,493 in 1957. Figures include those of Reaction Motors and National Electronics Laboratories, Inc.

• **Aeroquip Corp.** said its net earnings for the nine months period ended June 30 were $493,138, a substantial drop from the $2,021,412 earned in that period a year ago. Net sales were $25,877,333 this year, against $32,132,988 last year. An upturn in business is forecast by Peter F. Hurst, president, who noted present operations are showing signs of improvement.

• **Menasco Manufacturing Co.**, annual sales reached a record high of more than $25,000,000 according to Henry P. Nelson, president. He said the company's backlog is about $27,000,000, an increase from last year.

• **Standard Coil Products Co.** reported second quarter sales and net earnings were well up from the same period in 1957. Quarter sales reached $16,347,671, compared with last year's $13,427,473 to produce earnings of $291,352, or $252,786 better than a year ago. James O. Burke, president, forecast 1958 sales will be "substantially better" than 1957's. Company's Kollsman Instrument Corp. produces aircraft and missile navigational instruments.

• **Lear Inc.** reports that it attained the highest backlog of orders in its history —$67,900,000—during the six month period ending June 30. Lear's consolidated net earnings also were up for the period, totaling $630,000, or 27 cents per share, as compared with 14 cents a share for the first six months of 1957. Record backlog was obtained by orders which exceeded shipments by approximately $3 million during the six months. Shipments for the first half totaled $29,238,000 as compared with $34,366,000 for the first half of 1957 and $64,693,000 for the 12 months ending Dec. 31. Consolidated net earnings for all of 1957 totaled $859,000, or 36 cents per share.

Renegotiation Compromise

Washington—House Ways and Means Committee last week approved a six-months extension of the renegotiation law to Dec. 31 and announced that it will undertake a "broad review of the entire subject" early next year. The President had requested a two-year extension. Two amendments to the act provide:

• That decisions on renegotiation determinations by the U. S. Tax Court may be appealed to the U. S. Court of Appeals. This was urged by Aircraft Industries Assn. (AW Aug. 4, p. 27).

• That contracts of the new National Aeronautics and Space Administration be subject to renegotiation.

In a letter to Committee Chairman Wilbur Mills (D.-Ark.), AIA President Orval Cook called the committee action "very fair." He added:

"In particular, we were pleased to learn that the Congress will undertake a thorough examination of the renegotiation process during the next session. We are confident that this story will result in a new approach to the problem of renegotiation which will help our government obtain superior weapons in shorter periods of time and at less cost."

House Unit Urges R&D Emphasis

By Katherine Johnsen

Washington — House Government Operations Committee urged Defense Department to encourage "competition along parallel avenues of endeavor" in research and development in a comprehensive report released today. The report was based on hearings held over the past seven months. It declared:

"If development is limited to a narrow range of weapons we are precluded from the best choices in the procurement stage."

"There has been for too long a tendency in military research to be restrictive because the future is uncertain." There should be a "clear understanding," the report said, "that the multiple approaches to research problems, carried on so well in the competitive civilian economy, be utilized in the military program."

Such an approach, it was emphasized, dictates "strong discipline" in decision-making as to whether a research project should be continued into the development stage and again at the point where the weapon is ready to move into production. The Secretary of Defense was called on to "demarcate" the stages of research, development and production through which a weapons system passes and to establish the responsibility for the making of decisions to proceed from one stage to the next.

The committee also directed the General Accounting Office to work out, in cooperation with Defense Department, separate accounting classifications for research, development and procurement so that it will be clearly shown what funds are financing what.

Since the cost of closing some of the contracts "was equal to what the normal completion would have entailed" and since the funds taken from research and development were turned over to procurement of other items, the committee declared that the economies achieved are "unclear" and "perhaps nonexistent."

The report also suggested that the debt ceiling was only used as "an excuse" to reduce the research and development program. "Research and development appropriations are 'no-year' appropriations and do not have to be expended immediately,' it was noted.

Other points and recommendations made by the committee headed by Rep. William Dawson (D.-Ill.) included:

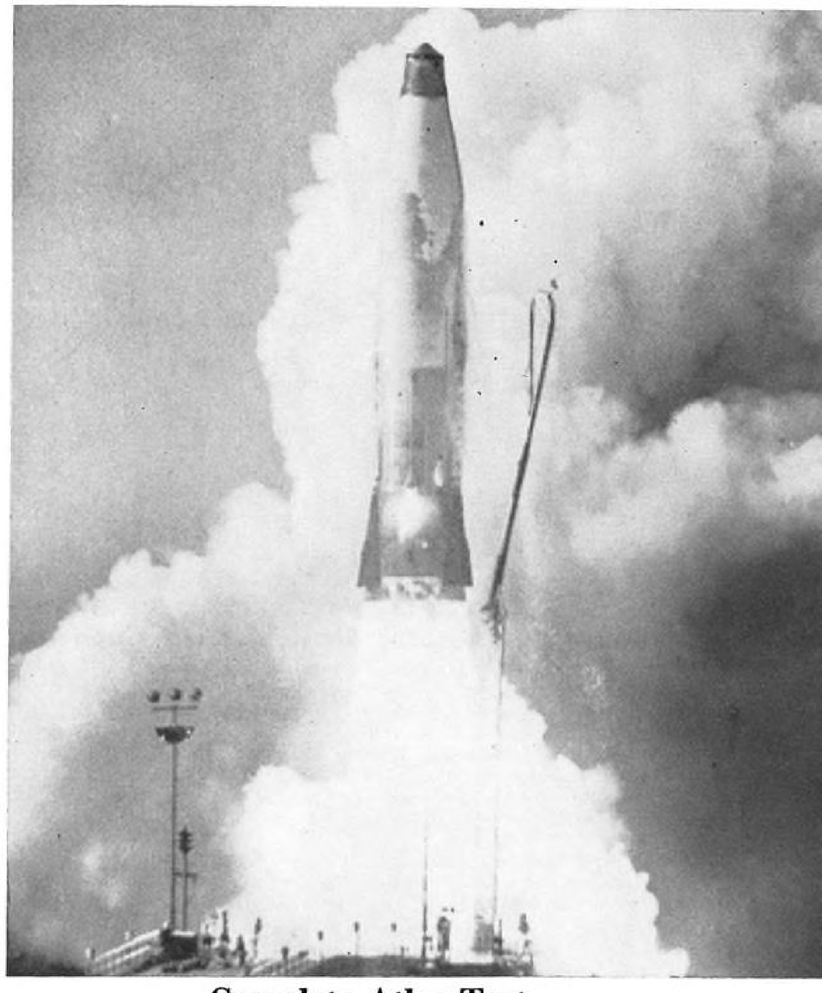
• **"Strenuous efforts must be made** by the Secretary of Defense to eliminate layers of review and minimize detailed reviews of project operations." The report complained that "the Office of the Assistant Secretary of Defense for Research and Engineering has joined with the Office of the Assistant Secretary of Defense, Comptroller, to exercise a

Pershing Contractors

Washington—Four major subcontractors have been selected by the Martin Co. for Army's Pershing solid propellant two-stage ballistic missile system.

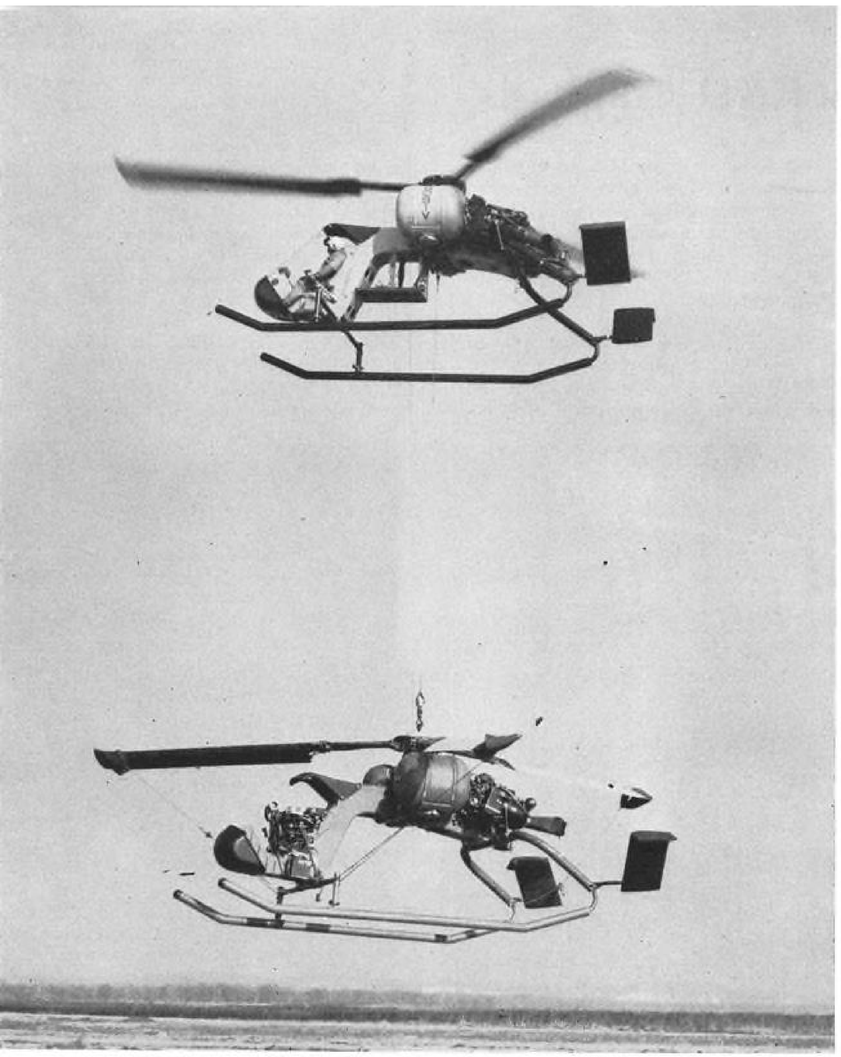
The four contractors are Bendix Eclipse-Pioneer Division, Teterboro, N. J.; Bulova Watch Co., Long Island, N. Y.; Thiokol Chemical Corp., Huntsville, Ala., and Thompson Products Accessories Division, Cleveland.

Bendix will develop the inertial guidance system, Bulova the fusing and arming system, Thiokol the propulsion system and Thompson Products has the contract for a transport-erector-launcher which will allow the Pershing to be transported to an unprepared site and there erected and fired in a "matter of minutes." Army announcement of the subcontractor selection by Martin termed the missile a "selective-range" system.



Complete Atlas Test

Test firing of the Convair Atlas ICBM from Cape Canaveral, Fla., shown above marked the first successful operation of the complete Atlas system in flight testing. Test utilized all three Rocketdyne rocket engines with full power obtained from the sustainer during entire portion of flight programmed; good separation of two booster engines after burnout and separation of the nose cone with simulated warhead with satisfactory re-entry and impact in a pre-selected target area. Missile flight control system including vernier engines functioned satisfactorily for the duration of the 2,500 mi. flight. Convair and USAF officials feel this successful Atlas test is the most significant milestone passed so far in the development test program for this first U. S. ICBM.



McDonnell Helicopter Shows Lifting Capacity

McDonnell Model 120 turbine helicopter is powered by three AiResearch GTC-85-35 gas turbine compressors; compressed air is ducted through the rotor hub and rotor blade to pressure jet burners, mounted on each of the three rotor blade tips, where fuel is injected and burning occurs. Rotor system, originally developed by McDonnell for its XV-1 Convertiplane (AW June 24, 1957, p. 23), eliminates power shafting, gear box, clutch and tail rotor. Helicopter, which has empty weight of 2,400 lb., is designed to maintain level flight at maximum gross weight with one gas turbine compressor inoperative. Maximum takeoff weight is 6,300 lb. Cargo hook is pilot-controlled.

great deal of negative-type control over military research and development through the budgeting and expenditure processes."

It said that "it is quite possible" for a project to be subjected to as many as seven lengthy reviews at the level of the Secretary of Defense.

• **"Fiscal operations should be geared** to promote research and development, not hamper it." The committee said that numerous projects "are still suffering under the yoke of unwarranted rejustifications and other fiscal limitation. . . ." Defense Department was directed to review its various budgetary procedures and submit a report to the committee by next January.

• **"A policy should be developed** with the aim of preventing the sudden termination of research projects that have been approved and are making good progress. Research should be advancing rather than remaining static or going backward."

Nuclear Propulsion Safety Evaluated

Ft. Worth—Controlled fission product field tests are being conducted by the Nuclear Laboratories of Convair's Ft. Worth plant as part of a joint Air Force-Atomic Energy Commission nuclear propulsion safety program.

Tests are conducted at the National Reactor Testing Station in Idaho and are sequels to controlled burning experiments done last year at the Idaho facility. Purpose is to maintain maximum safety of reactor operations by improving predictability of the behavior of fission products when they are released in the atmosphere at low levels.

Elaborate sampling network extends 3,200 yd. from the release point, and it will be used to monitor the effects of various weather conditions on downwind airborne radioactivity and ground contamination.

Air Force Special Weapon Center of Air Research and Development Command is managing the experiment, and participants include the Atomic Energy Commission's Idaho Operations Office, Aircraft Nuclear Propulsion Department of General Electric and Atomic Energy Project of the University of Rochester.

Scientists Report Space Flight Gains

San Diego—Technical advances indicating promising lines of attack on problems attendant to space flight were outlined in papers delivered here last week to sessions of Space Exploration Meeting sponsored jointly by Air Research and Development Command, American Rocket Society and Institute of Aeronautical sciences.

Regional meeting was attended by some 450 registrants, had a classified session on space research programs, also open sessions on environment and life, as well as technology. A panel on economics and sociology of space exploration was conducted, with Theodore von Karman, H. J. Steward of Cal Tech., Morton Alpherin of USAF Office of Scientific Research Directorate of Advanced Studies, D. N. Michael, Dunlap & Associates, A. C. Hall, Martin Co. Denver Division, all participating.

Research efforts in materials have brought forth results which tend to show strength levels approaching those of atomic cohesion may be possible, according to one paper, while another dealt with proper mating of propulsion system, type of gas accelerator to produce efficiency for space travel.

Details of development of Navy's centrifuge at Naval Air Development Center were presented, as was a compilation of state-of-the-air in closed ecological systems, along with radiation study results and other human factors aspects of space flight.

Communications, power supplies, trajectory accuracy requirements were treated in papers, with a status report given on attitude control for satellites.

Beirut Tests One-Manager Airlift Concept

By Robert E. Farrell

Evreux, France—Impressive airlift job performed by USAFE's 322nd Air Division during Lebanese crisis clearly demonstrated efficiency of a "single manager" system for operating an airlift task force.

The 322nd Air Divisiou, headquartered at Evreux, carried out the bulk of the Air Force transport effort during the Lebanese "crisis period" July 15-25—without a hitch. Some 418 sorties were flown by 322nd aircraft which shuttled around-the-clock between European and Near East points.

Nearly eight million pounds of cargo were hauled during the 11-day period. More than 5,000 men were carried, including 3,500 fully-equipped U.S. Army combat troops.

The 322nd's aircraft also airlifted fuel into Jordan to support British paratroop operations in that country.

Airlift task force commander for the operation was Col. Clyde Box, 322nd Air Division Commander. Col. Box reported directly to Gen. Frank F. Everest, Commander in Chief, USAFE.

C-130 Field Capability

The Lebanese airlift also pointed out the field capability of the Lockheed C-130 Hercules turboprop transport. 322nd Air Division crews had just completed transitional training on the Hercules when the Lebanese job came up. Grinding pace of the airlift meant that most of the division's C-130s were flown past their inspection periods, yet no serious breakdowns resulted.

Co-star of the Lebanese show, according to 322nd's officers, was Douglas' C-124 Globemaster transport. Both 322nd's C-130s and C-124s were the backbone of the airlift while many of the division's Fairchild C-119 Flying Boxcars lent a hand. Its Fairchild C-123 Providers played a supporting role to the main lift effort.

To date, little information has been released by USAF on the role of the 322nd Air Division in the Lebanese affair. Throughout the airlift a top secret label was slapped on all 322nd operations. AVIATION WEEK, by interviewing 322nd officers and air crews here at Evreux, has pieced together the following account of how the USAFE Lebanese airlift was carried out between July 15-25.

Within hours after the July 14 Iraqi revolution broke out, all USAFE units were put on the alert. Operation "Bluebat," code name for the Near East airlift, began July 15. The big NATO airbase at Adana, Turkey, was selected as the advance staging area for U.S. landing operations in the Near East. While Sixth Fleet Marines were landing at Beirut early in the afternoon on July 15, on the same day 322nd aircraft began to airlift U. S. Army paratroops from Germany into Adana.

IRONIC sign on Beirut Airport terminal building greets Douglas C-124C Globemaster.

As Operation Bluebat unfolded, Airlift Task Force Commander Col. Box had available 48 C-130 transports from the division's 317th Troop Carrier Wing stationed at Evreux, 12 C-124 Globemaster transports from the division's Third Troop Carrier Squadron based at Rhein/Main, Germany, and about 50 C-119s from the division's 60th Troop Carrier Wing based at Dreux, France. These aircraft, plus 36 C-124s turned over to the 322nd by MATS Eastern Air Transport Force, formed the main airlift effort into the Near East.

Flight of 41 C-130s from Sewart AFB, Tenn., and Ardmore AFB, Okla., flew a tactical support mission from the United States directly to the Adana staging area, but these aircraft reportedly were immediately deadheaded back to the U.S. after unloading.

Munich to Adana

Within the 24-hr. period during July 15-16, 322nd aircraft airlifted "Alpha Force" from Furstenfeldbruck, near Munich, to Adana. The lift was carried out in 72 sorties by 34 C-130s, 16 C-124s and 22 C-119s. Alpha Force consisted of 1,749 paratroopers of the 24th Infantry Division, a unit of the U.S. 7th Army, plus 9,900 lb. of combat cargo to keep the paratroops supplied for five days.

Aircraft carrying Alpha Force took off from Furstenfeldbruck at 10-min. intervals. Initial C-130 units flew over the Alps and crossed Greece to reach Adana, a flight of 1,800 mi. by this route. Almost immediately, however, continued air passage was refused by Switzerland, Austria and Greece. As a result 322nd C-130s were leaving their home base at Evreux, flying to Furstenfeldbruck to pick up loads, then backtracking around the Alps to Marseille, where they landed to refuel. Final leg was a flight eastward down the Mediterranean slot to Adana. Thus instead of 1,800 mi. the C-130 airlift route was stretched over 2,300 mi.

Slower C-119 and C-124 aircraft were routed through Cappodichino Airport at Naples, Italy.

Alpha Force was to be followed immediately at Bravo Force, a similar paratroop airlift. But by July 17 it was apparent the Lebanese situation would remain fairly quiet, so Bravo Force was

Mikoyan Emphasizes Manned Aircraft Need

Moscow—Russian designer A. I. Mikoyan agrees with Red Air Force planners that manned aircraft will not be overshadowed by unmanned missiles for long.

Mikoyan, interviewed by "Komsomolskaya Pravda," declared that the substantial difference in speed and altitude of flight now existing between unmanned ballistic missiles and piloted airplanes is temporary. "In the future," he said, "these two types of flying apparatus will merge into one. . . .

"Obviously the first manned Sputnik will be essentially a super-speed airplane hurled into the upper layers of the atmosphere by a multi-stage rocket."

Mikoyan predicted that mother planes will be be built to carry smaller aircraft into the upper atmosphere for launching to greater heights.

Defense Appropriations Agreement

Washington—Senate-House conferees last week agreed upon a $39.6 billion appropriations bill to meet the nation's defense requirements for Fiscal 1959. Quick approval by both the House and Senate was expected. Included were provisions for $815,857,000 more for missiles, aircraft and manpower than the Administration has requested.

Of the total amount approved by conferees, Air Force will receive $17.8 billion, a large portion of which will be for the procurement of missiles and aircraft. Navy received $11,359,427,000; Army $8,992,859,000.

In arriving at a compromise, conferees took the following action:

- **Added $140 million for additional long-range transport aircraft for Army airlift.**
- **Provided $51.6 million for the procurement of 15 additional Boeing KC-135 jet tankers but dropped a Senate amendment for the purchase of 13 additional Boeing B-52G bombers.**
- **Provided a total of approximately $314 million for Military Air Transport Service transport activities and directed that $80 million of this must be used only for the procurement of commercial air transport service from both scheduled and independent carriers.**
- **Eliminated $18 million for purchase of 30 Fairchild F-27 turboprop transports but restored funds for jet training aircraft. A total of $21.8 million was asked for this purpose.**

Appropriations approved by the conference committee was $1.1 billion more than voted by the House and $440.1 million less than that originally approved by the Senate. The Air Force appropriations approved by the committee was $224.7 million higher than that asked by the President.

kept at our bases in Germany.

Instead of lifting Bravo Force, 322nd aircraft on July 17 began airlifting Charley Force into Adana. Charley Force, a support group rather than a strike force, was lifted in 177 sorties between July 17-25. About 2,000 fully-equipped soldiers were hauled along with 4,580,000 lb. of support cargo.

Beirut Landings

Until Saturday, July 19, the 322nd operated from European points to Adana only. But at 0930 hours on Saturday, July 19, 322nd aircraft began landing at Beirut as well as Adana. After unloading at Beirut, C-130 aircraft flew to Adana or Tripoli, Libya, for refueling and then nonstop back to Evreux.

In addition to airlifting Alpha and Charley Forces, 322nd aircraft during the July 15-25 period performed a variety of airlift tasks to support Air Force and Army Near East operations.

At Landstuhl, Germany, 322nd aircraft loaded in a matter of hours the entire logistic equipment and supplies needed to support the USAFE 86th Tactical Fighter Wing, which had shifted into the Near East region.

At Toul Air Base, France, 322nd aircraft loaded and flew to the Near East an Army engineer company which specializes in repairing bomb-damaged runways and improving water and sanitation facilities.

At Hahn Air Base, Germany, three C-124s loaded and carried to Adana a complete communications unit so that liaison could be more easily maintained between the staging area and European headquarters.

From somewhere in Germany, 14 C-124s airlifted to Adana a complete 100-bed Army field hospital weighing 384,301 lb. along with 179 medical technicians. The entire mission was accomplished in 12 hr.

From Evreux, 322nd Air Division's 2nd Aeromedical Evacuation Group rushed to Adana a C-54 evacuation aircraft with medical crew. The later remained at Adana throughout the 11-day airlift period without relief.

Special airlift requests cropped up throughout the July 15-25 period. For examples, as the Adana build-up mushroomed it soon became apparent that the Turkish base's water facilities were inadequate. Col. Box had 10 of his C-130s pick up in Europe 224,000 lb. of iron pipe and pipe fittings and airlifted the load to Adana. Army engineers already lifted into the staging area, then built a 12-mi. water pipeline from Adana to the nearest water source.

Another special airlift request came from oil-short British paratroop forces in Jordan. To handle the request, Col. Box set up an oil shuttle between Beirut and Amman using 10 C-124s and 13 C-130s.

Throughout the 11-day airlift operation, which tied up the 322nd Air Division's C-130s and C-124s, the division's normal mission of providing Air Logistics System (ALS) service to tactical units throughout USAFE theater, a region five times larger than the United States, was handled by 322nd C-119s and C-123s.

The entire 11-day airlift involved movement of 7,912,371 lb. of cargo and 5,870 personnel. Food, ammunition, weapons, tanks, bulldozers, jeeps, half-tracks and general logistic-type material were airlifted in 418 sorties by 322nd aircraft without an accident or major incident.

Hectic page of the Lebanese airlift put considerable strain on air crews and ground personnel. 322nd Deputy Commander-Operations, Lt. Col. John Van Dynn, estimated that roundtrip missions between Evreux and Near East terminal points took about 24.5 hr., including stops at on-loading points in France and Germany. Most 322nd air crews flew four missions. Fifteen-hour crew rest between missions was established. Flight surgeons met crews on the line after each mission; few crew members were grounded.

Many 322nd Air Division headquarters officers, including Col. Box and Lt. Col. Van Dynn, flew at least one C-130 airlift mission to the Near East.

Riding herd on the over-all operation, Col. Box told AVIATION WEEK that the Lebanese airlift "confirms again the need for centralized control of air transport on a theater-wide basis."

Cargo and troop loading and off-loading were handled with a minimum of delay as a result of 322nd special Combat Airlift Support Units (CALSU) which directed handling operation at terminal points. At Furstenfeldbruck, where Alpha Force was embarked, 322nd Deputy Commander Col. Tarleton H. Watkins headed up the CALSU mission and worked with U. S. Army Brig. Gen. C. A. Speidel of the 24th Infantry Division.

Airlifting the 24th Infantry Division by 322nd aircraft was made easy by the fact that 322nd units often are involved in joint airborne exercises with 7th Army units. Last year 322nd aircraft dropped 100,000 Army paratroopers in exercise games.

Alpha Force went into the Near East rigged for paradrop, in case the air head wasn't secure upon arrival.

Average C-130 load ran about 22,000 lb., according to 322nd Deputy Commander/Traffic, Lt. Col. Otis E. Winn. Later loads, where drop gear wasn't required, ran higher. Loaded C-130s generally were turned around in 25 min. Unloading Alpha Force C-130s took longer than this, however, mainly because loads were rigged for paradropping.

Airlifting Alpha Force with C-130s, Col. Winn said, proved that an airborne unit with its transport is "one of our finest weapons." In 3½ hr., "you can go down the road 1,000 mi. and dump a formidable strike force."

One problem pointed up by the Lebanese airlift was the lack of an efficient communications system. With several hundred aircraft flying an airlift on top of a regular commercial air operation in Europe, control over 322nd aircraft was often a touch-and-go affair. U. S. officers wonder if there exists a peacetime answer to the communications problem, though some seem to feel a single sideband radio transmitting and receiving system, though costly, might do the trick.

Ground communications between 322nd headquarters and other European points also leaves much to be desired. Calls are made via leased wires from national governments, a system which often operates in an erratic fashion. One 322nd communications officer remarked he was "running a multi-million dollar transport service with a two-bit communications system."

On the maintenance side, 322nd Deputy Commander-Materiel, Lt. Col. Joe D. Miles, told AVIATION WEEK that during the Lebanese operation his C-130s "did much better than we anticipated." Mobile maintenance crews sent out from Evreux kept 42 of the Division's 48 C-130s available.

"We did overfly some inspections out of sheer necessity," Col. Miles said. On several 322nd C-130s, overflight time ran as high as 80 hr.

Division's 48 C-130As are normally operated on a 40-hr. monthly basis per aircraft. Hercules aircraft were phased into the 322nd operation last fall. The unit is not slated to receive the Hercules B model which can claim among other performance increases, to be a quieter airplane than the A model.

Noise factor on 322nd Hercules transports should be lessened as a result of a reduction gear box fix that is planned. Beginning in November, 24 of the Division's 48 C-130s will begin rotating back to the United States for reduction gear box changes. Gear ratio will be altered to slow down propeller blade tip speed, thus reducing both pilot and metal fatigue.

The T56 engine proper presents no major problem, Col. Miles said. He has just received approval to hike the engine change requirement to 750 hr. from 350 hr.

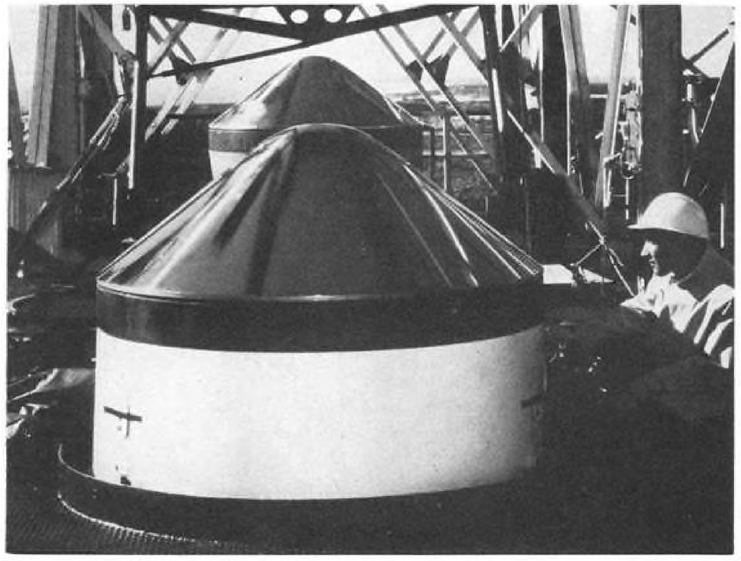
The 322nd's main role of cargo transport is now being re-emphasized by the fact that the division's only assault transports, some 118 C-123 Providers, are being returned to the United States. Providers came into the 322nd set-up in June, 1956, and immediately were put to work as cargo carriers. Since then the 322nd has never received a single U.S. Army request to carry out an assault type mission.

As a cargo transport, the C-123 has never quite fit into the 322nd operation. Its range and all-weather capability were restricting factors. Also its metal fuselage floors were badly cut up under daily cargo handling until a ¾ in. plywood flooring was installed.

The C-123s actually were on the way home when the Lebanese crisis broke. Division officers now expect all their C-123s will be retired by next September. The C-123s fate in the USAFE theater, incidentally, was predicted in AVIATION WEEK about the same time the C-123 first appeared in 322nd Air Division colors (AW June 11, 1956, p. 32).

ASW Group Formed

Dallas—Chance Vought Aircraft is launching a concentrated research and development program in the field of anti-submarine warfare with the formation of an ASW group under Vice Adm. Harry Sanders, (USN. Ret.). Chance Vought group will explore all aspects of the ASW problem, including aircraft, missile, detection and fire control equipment. As Director of Advanced ASW Engineering, Sanders will draw personnel from various sections of the company's engineering organization as the need arises. Navy has asked industry aid in gaining breakthroughs in underwater detection and classification (AW July 14, p. 32).



Nose Cone Fitted

Highly polished copper nose cone is secured to Thor intermediate range ballistic missile prior to recent firing from Cape Canaveral, Fla. First official Air Force photo shows heat sink, production model cone developed by General Electric Co., that will be used on both Thor and Atlas until more pointed, ablative cone is perfected.

Correction

Because of a typographical error in the Aug. 4 issue of Aviation Week (p. 37), a report on three firms entering into a working agreement to jointly develop advanced devices for guided missiles and space travel did not fully designate the companies involved. They were General Motors Corp., Callery Chemical Co. and Thiokol Chemical Corp.

News Digest

First flight of twin-engine de Havilland Caribou was made July 30 at Toronto after taxi tests. Flight lasted about 1 hr.; prototype will be delivered to Canadian Army for evaluation. U.S. Army has ordered five Caribous for evaluation, powered by Pratt & Whitney R2000-4 producing 1,450 hp. each (AW June 9, p. 67).

Trans World Airlines last week reported a net loss of $11,931,000 for the first six months of this year as compared with a $1,114,000 loss for the first half of 1957. The airline, however, realized a net profit of $2,163,000 in June from $29,078,000 in revenues. The June total is 10% above that for the same month of 1957 last year reported a net income after taxes totaled $1,877,000. Second quarter figures showed improvement over the first with net losses, before taxes, of $864,000 compared with $10,167,000 for the first three months of this year.

Lockheed Aircraft Corp. will build 26 more P2V-7 patrol planes under $22 million BuAer contract. Order, extending production through September, 1960, probably will be the last for the aircraft, due to be replaced by the P3V-1, anti-submarine version of the Lockheed Electra.

President Receives Airline Aid Proposals

Program to help lines meet equipment obligations sent to Eisenhower by Special Assistant Quesada.

By Robert H. Cook

Washington—Proposals to help the airline industry meet its $2.8 billion equipment program were presented President Eisenhower last week by Elwood Quesada, his special assistant for aviation.

Along with the proposals, Quesada sent a letter to the White House in which he warned that inability of the carriers to complete their financing programs would pose a threat to the national economy, signal a return to subsidy by some airlines and touch off strong pressure by aircraft manufacturers for government purchase of unsold aircraft as a means of regaining development costs.

The results of an economic analysis of the situation prepared for Quesada by Dr. Paul Cherington of Harvard University and submitted to the President contained these major recommendations:

- **Passenger fare adjustments,** increases in some areas, decreases in others, are needed to improve earning levels and restore confidence of investors.
- **Carriers should study methods of** improving the traffic base in order to recapture growth rates experienced during the last decade.
- **Studies should be made of the effect** of increased certificated competition along with the costs and practicality of present route patterns for jet operations.
- **Air Coordinating Committee** or Operations Coordinating Committee should explore methods of aiding in the sale of older U. S. aircraft to foreign countries.
- **Defense Department** should immediately adopt a resolution to resolve the allocation of traffic controlled by Military Air Transport Service between military and commercial carriers. Congress last week ruled that MATS must allocate at least $80 million of its Fiscal 1959 traffic to commercial carriers.
- **Secretary of Treasury should consider** the relief to carriers afforded by repeal or reduction of transportation excise taxes, if the tax policy question arises.

Expressing concern over the difficulty many carriers are having in obtaining financing for their jet equipment, the report added that it was questionable as to whether many of the carriers would be able to make full economic use of the new equipment without first embarking on extensive new marketing efforts. It also noted that, despite large airline contracts, no U. S. manufacturer has yet received enough orders to reach the break-even point with its jet transports.

Tracing the background of the airline's economic problems, Cherington predicted that the declining rate of net profits, which last year amounted to only 4.8% return on investment or 1.9% margin on sales, will eliminate all profits by the end of this year. He said that, despite impressive revenue and traffic figures, the airline market is limited to three to six million "repeat travelers" who account for the bulk of air travel and added that the rate of traffic growth has been declining gradually since 1955 with this year's volume at or below 1957 levels. The market must be expanded to yield a rate of 11% to 13% a year in order to finance the equipment program, the report said.

Cherington added that extensive use of coach service and family-plan discounts, while aiding in traffic gains, has caused progressively lower yields per passenger mile with average trunk revenues dropping from 5.75 cents per passenger mile in 1948 to 5.25 cents in 1957. Coach, tourist and other discount service accounts for 65% of international and overseas travel but, despite a fare increase of 24% in transatlantic fares, passenger yields have declined from eight cents per passenger mile in 1948 to 6.6 cents in 1957, the report said.

Increased Competition

Competition through new Civil Aeronautics Board route awards has increased to a point where 87% of the markets have competitive service with 12 major markets having five or more carriers. While such CAB action has aided medium size carrier expansion, Cherington said, it also has presented the problem of re-equipping if they are to compete effectively with their larger competitors. He also noted the percentage decline of passengers carried by U. S. international airlines as a result of post World War II bilateral agreements (see page 31).

Speed and capacity of the new equipment should make possible in 1962 a total capacity of 83-92 billion seat miles after retirement of a major portion of the present piston engine fleet, Cherington said. He added that present traffic forecasts indicate a level of only 49 billion passenger miles by 1962. With a majority of deliveries scheduled for the next three years at a rate faster than the traffic buildup, the situation probably will result in a temporary surplus of capacity, which could possibly be absorbed by expected lower operating costs of the new equipment along with accelerated retirement of piston engine aircraft, the economist said.

Of the total $2.6 billion needed for equipment, carriers are still short by $760 million for which no financing has been arranged, the report said. Medium-sized carriers, it said, are having difficulty in obtaining needed long-term loans except in limited amounts at high interest rates approaching 6%. The financing problem is further intensified by the insistence of banks on short-term loans not to exceed 10 years which, Cherington said, will impose a heavy repayment burden on the carriers.

Financing requirements are so large in relation to present capitalization that the debt ratios will exceed the limitations considered acceptable by lending institutions, thus requiring more equity financing as a condition precedent to the granting of further loans.

Equity market for most of the medium carriers is not favorable since the issuance of more stock by any carrier whose stock is selling below book value would involve a heavy loss in equity on the part of present stockholders. The outlook is dim for further issues unless earnings improve enough to restore the confidence of investors, according to the report.

Cherington placed much of the blame for the present situation on a drop in traffic growth because of the economic recession and the action of many carriers in inaugurating new service over new competitive routes. He said the resultant depression in load factors and earnings has caused many cutbacks and cancelations in orders for aircraft, with more expected to follow if the decline continues.

Cherington was mildly critical of CAB's policy of determining fare needs only on the basis of a long-term study, pointing out that the Board should take into consideration the financial needs of the carriers during a period of major equipment transition. He also criticized the actions of carriers which added capacity despite stable or even declining traffic volume. Continuation of the practice, he said, would largely nullify the benefits of any fare increase.

Observing that there is room for doubt that the necessary traffic can be generated to make the enlarged capacity economically sound, the report questioned the value of carrier traffic forecasts which fail to identify the new class of customers they claim will almost double the present traffic volume. Such forecasts can only be realized by increased airline efforts to research and develop new markets, it said.

In part much of the new airline traffic will have to be diverted from automobiles and the balance in newly generated travel, the report stated.

Proposed Action

Government action to aid a traffic buildup for the next five years he said could be accomplished by the following:

- **Repeal of the 10% transportation tax.** Cherington, however, noted that the tax repeal might bring heavy pressure on Congress from the automotive industry for similar relief. He added that, should the tax question be reopened by Congress, the Secretary of the Treasury might want to consider how much assistance a tax repeal would be to the airlines.
- **Allocation of more MATS traffic** to commercial carriers. Regarding the MATS issue as "extremely complicated," the report said the Air Force "unjustifiably" discounts the national defense value of the airline industry because it is not under direct military control and recommends that it be resolved "if at all possible" at Defense Department level. President Eisenhower, in recent discussions with Defense Secretary Neil McElroy, has already requested a complete analysis and review of the role of MATS in peace and war.
- **Amendment of the Guaranteed Loan** Act to include the larger carriers with a maximum loan well beyond the present $5 million limit if the carriers cannot increase their earnings level or find sufficient conventional financing.
- **Federal loans to foreign countries for** the purchase of second-hand aircraft being disposed of by U. S. carriers in their re-equipment programs.
- **Civil Aeronautics Board review of** depreciation policies, particularly in the event piston aircraft now being delivered must be retired on a declining second-hand market before the expiration of the normal seven-year depreciation period.

The Board has indicated it may review this matter as part of the General Passenger Fare Investigation.

Quesada, as chairman of the Air Coordinating Committee, also has initiated a review on the matter of loans to foreign countries as federal assistance in the disposition of used aircraft.

Lack of Cooperation

Among other cost and financial problems facing the industry, Dr. Cherington discussed a reported lack of cooperation between individual air carriers and among airlines and airport officials on the problems of handling jets on the ground. He suggested that further efforts on the part of airlines might result in substantial savings in ground operations.

As to the concern voiced by a number of carriers, investors and some segments of the CAB staff that increased route awards during the past three and a half years are diluting traffic densities, Cherington said the Board's actions were too limited to form any definite conclusions.

He expressed concern, however, that neither the CAB nor any other government agency was conducting a study of the economics of jet operations and the present and future route structure.

Airline financing difficulties also have placed aircraft manufacturers in a precarious position, Cherington said, as carriers continue to press for more liberal credit assistance and downpayments.

As a competitive measure, many manufacturers have offered trade-in agreements, thereby assuming any risk that surplus aircraft might not be sold at trade-in prices. Lack of ready cash from airlines, coupled with drastic cutbacks in pre-payments and progress payments, places manufacturers in a serious working capital squeeze, which they feel can only be solved by increased borrowing, he said.

Government Support

A static or declining level of commercial orders probably would result in increased efforts by manufacturers to have the government buy these transports, the report said, adding that there are already some sales of this nature in negotiation.

Statehood for Alaska Presents Commercial Aviation Problems

Washington—Control of commercial aviation in Alaska promises to pose one of the most complex legal questions facing the territory's transition to statehood.

On the effective date of statehood, Civil Aeronautics Board control of the territorial aviation will come to an end—with the major exception of jurisdiction over the eight scheduled airlines classified as engaged in inter-state transportation.

As interpreted under present law, the balance of Alaska's airline industry will become intra-state transportation legally removed from CAB authority and free to operate at its own discretion until laws governing its operation are passed by the new state.

Major Concern

Major concern is not a question of federal or state control but how long it may take before the Alaskan government can settle other pressing statehood problems and exercise its authority over intra-state transportation, which the scheduled operators fear may become a powerful competitive force in the interim.

Also of concern is the question of percentage distribution of Federal Airport Aid funds, which last year totaled $1.3 million under a 75% formula for the territory as compared with an average of 50% for states, with a maximum allowable grant of 61% to states having large areas of federal land.

It is believed likely that Alaska as a state may be allowed funds equal to about 8% of the total appropriations for airports in the states. Based upon 1957 figures, the new state would stand to collect an estimated $2.4 million in federal aid or the maximum percentage allowed because of its vast areas of government-owned land. The territory presently has 164 airports in public use which could possibly qualify for such aid. A total of 48 airport aid projects are now in progress.

While it appears that the new state will receive increased funds of this type, Alaska also may find the increased percentage of contributions that they must provide a financial handicap.

Legal counsel for both the federal government and the Alaskan airlines recognize these problems and are conducting studies of the possible interpretations involved in the change to statehood. But no official or public recommendations have been made.

It is generally agreed that 112 registered Alaskan pilot-owners, who operate as intra-territory carriers, would make up a majority of the intra-state category, with CAB power remaining only over certificated carriers, routes connecting two intra-state points but flying over a point outside Alaska, such as the Gulf of Alaska or the sounds of the Bering

Sea, and intra-state routes which pick up passengers from an interstate flight.

Airline Fears

Scheduled carriers fear that they may be faced with unrestricted competition from the intra-state carriers on flights within Alaska. Pending CAB action favors the Alaskan pilot-owners in the Intra-Alaska Case.

Pilot-owners had asked authority for the hiring of additional pilots, plus regular schedules for passenger transportation. On the basis of a report by examiner Herbert K. Bryan, the Board is now engaged in a rule making procedure which will allow these operators to be classified as Alaska air taxi operators controlled by an individual, partners or a corporation. In addition, the examiner recommended they be permitted to hire five pilots and operate without route limitations except where scheduled airlines have two trips a week. The proposed rule change would be limited to a two year experiment.

Certificated carriers also contend that a lack of authority over intra-state aviation might open the door for outside carriers to move in and tap the lucrative summer traffic of Alaska, leaving the state during the winter months.

It is possible that the new regulation could go into effect before the territory officially assumes statehood and in ample time for these air taxi operators to strengthen their competitive position and later increase their route systems in direct competition with the scheduled carriers without any federal restrictions except CAB safety rules.

A much favored solution to the possible intra-state problem is the hope that Alaska will form a commission to control this segment of the industry.

One such proposal is for the formation of an Alaska Civil Aeronautics Board under an Alaska Air Commerce Act which would take effect upon expiration of territorial status. As suggested by airline attorneys, the Board would have five members with authority similar to that of the CAB. The Alaskan Board appointed by the governor also would have the right to question the setting of fares or selection of carriers under the CAB's administration of inter-state carriage.

CAB power over carriers now operating between Alaska and the U. S. would be strengthened since the Board would be empowered to set exact air fares for routes as opposed to the present minimum and maximum range.

Some observers feel a clause of the statehood bill answers any doubts of aviation control since it provides that Congress has the power to continue existing laws until the new state takes action of its own.

Airlines to Buy Doppler on Gamble

Washington – Major international airlines, several domestic carriers and three avionics manufacturers intend to proceed with their plans to buy and build 8,800 mc. Doppler radar on a calculated-risk basis as result of recent Federal Communications Commission compromise move (AW Aug. 4, p. 25).

Although the commission denied an airline petition to revoke its earlier action to move civil Doppler radars out of 8,800 mc. band to 13,000 mc. band, FCC indicated its willingness to grant regular licenses, normally for five years, for 8,800 mc. airline radars and to attempt to provide reasonable amortization period for such equipment.

Despite qualifications and ambiguities in FCC's recent statement, international and several domestic carriers appear ready to gamble on a reasonable lifetime for the 8,800 mc. equipment. On this basis, Bendix Radio, Collins Radio and General Precision Laboratory intend to proceed with design and manufacture of 8,800 mc. equipments. Radio Corp. of America, which had suspended its 8,800 mc. Doppler program in June, is now reconsidering.

Aeronautical Radio Inc., and Air Transport Assn. will neither encourage nor discourage airlines from proceeding with 8,800 mc. but will urge carriers to make individual evaluation.

Current thinking at ATA and Arinc is that the two airline industry groups plus several avionics manufacturers probably will file suit in Federal Court of Appeals, claiming that FCC's April 16 action exceeded its statutory authority by repudiating the International Radio Treaty of 1947 to which U. S. is a signatory, as predicted by AVIATION WEEK (June 30, p. 28.)

Three Carriers Win New Southern Stops

Washington—Eastern, National and Southern airlines last week received tentative Civil Aeronautics Board approval for new services in an expedited portion of the South East Local Service Case (AW April 21, p. 37).

CAB vote would allow Southern to serve Huntsville and Anniston, Ala., in addition to Eglin AFB, Fla., between New Orleans and Panama City, Fla.

Eastern would serve Melbourne, Fla., on its Miami-Midwest route.

National also would serve Melbourne on its Florida-Houston route along with exemption authority to provide one daily roundtrip to Orlando on the airline's interchange service with Delta and American between Miami and points west of Dallas.

Vickers Explains Viscount Controls

The following communication has been received from Vickers-Armstrongs Aircraft Ltd., Weybridge, England, in reference to the letter "Viscount Controls" written by John S. Hahn, liaison engineer, Rohr Aircraft Co., Chula Vista, Calif., and published on page 110 of AVIATION WEEK's Aug. 4 issue:

"With reference to the letter concerning Viscount controls published in your August 4th issue, we wish to state that, although the Manchester accident investigation itself concerned only aileron locks, a complete investigation was naturally made by Vickers of all the other control lock systems.

"It is completely impossible for any stray object or even for unlashed freight to operate these locks. Major structural failure would be necessary first. Nevertheless, further safeguards have been introduced. The suggestion that such things have not been considered is a pointless insult to the integrity of the British industry and of the relevant government agencies. The suggestion that the locks should be on the cockpit controls ignores the point of the locks which is to prevent gusts, etc., loading the control system when the aircraft is on the ground. If the locks are at the cockpit end of the system, then the gust reversals are fed right along the controls to the cockpit before being resisted. Many reversals are, therefore, applied which cannot be statistically evaluated for fatigue calculations. This is elementary design knowledge. The suggestion of spring loading the cables into locked position thus requiring tension on the cable for unlocking is by definition a fail dangerous concept should the cable break. We also point out that the ailerons are interconnected so that to lock one is to lock both.

"The last two paragraphs of the letter are further gratuitous insults to the official court of investigation which had the benefit of top engineering and scientific evidence from Farnborough, A.R.B., BEA and Vickers. This evidence followed months of most careful and thorough accident investigation.

"The writer of that letter, by implication, admits he has not read the evidence or even a full report of the inquiry and it is difficult to understand why he sets his views above those of highly qualified and independent engineers of world repute who spent months on the case.

"It is a fact, furthermore, that the Viscount has a safety record much better than world average, even including a mid-air collision, and that over 320 of these aircraft are now in daily service all over the world with a reputation in all aspects which is second to none."

U. S. Carriers Gird for Bilateral Battle

By L. L. Doty

Washington—France's denunciation of its bilateral air pact with the U.S. last month (AW July 28, p. 30) is stiffening domestic trunkline resistance against any further route grants to foreign flag carriers within the U.S.

Most U.S. airlines, particularly the transcontinental carriers, look upon the French move as a tactical maneuver designed to pressure the State Department into a more generous attitude toward the French. These carriers are worried that during the next 12 months —the period of grace before the agreement is actually terminated—the State Department will concede to at least some of France's demands.

Both international and domestic airlines will fight any action that will increase competition. But the concern of domestic airlines is more deep-seated since they already have seen a significant amount of traffic diverted from domestic routes to the newly established polar routes between the West Coast and Europe.

France is definitely seeking a polar route between the West Coast and Paris to match those operated by TWA and Pan American. During the final moments of the latest bilateral negotiations between France and the U.S., a polar route was offered Air France by the State Department, but it was rejected as not enough.

France wants a far broader concept of a route exchange between the two countries than is now contained in the bilateral agreement. In effect, the foreign carrier is asking that it be permitted to serve every U.S. gateway city in America now served by U.S. international airlines operating into Paris. This means Air France wants to duplicate TWA domestic routes.

The polar route request was enough to evoke protests from transcontinental domestic airlines. But any move to ease Air France's routes into domestic territory would draw opposition.

Already, these airlines have declared that the grant of traffic privileges between San Francisco and New York being sought indirectly by Qantas Empire Airways (AW May 19, p. 38) would set a dangerous precedent. And, they add, any precedent established by surrendering to Air France's demands would open the floodgates of U.S. traffic to any foreign carrier.

The State Department is giving no clue as to its position on the issue except to say that the U.S. is ready to resume negotiations whenever France is ready. One State Department official was at pains to make it clear that the renunciation of the bilateral did not spell a finish to air service between France and the U.S.

He went one step further and expressed confidence that the service would continue even after the bilateral was terminated, explaining that termination of the agreement did not automatically stop foreign carrier permits.

He did admit that, after the 12 month grace period, the two countries could "agree to disagree" and drop the service but evidenced hope that settlement would be reached before then. He confessed that the State Department feels Air France has "a good thing."

In any bargaining on routes, France has two points against her from the start. In the first place, approximately 26% of all Air France's international traffic is U.S. traffic. Secondly, the country has nothing to offer the U.S. in additional routes in exchange for those it seeks.

Threat Debated

Whether Air France will be willing to sacrifice so large a share of its total traffic by carrying out the threat to terminate the bilateral agreement remains to be seen. Some observers believe that France is serious in its warning and that it feels U.S. carriers will be unwilling to bypass so important a tourist area as France, even though the percentage of such traffic to all U.S. international traffic is only 8%.

Privately, some observers feel that France is betting that the two U.S. carriers involved, Pan American and TWA, will never agree to serve Brussels jointly instead of Paris in the event of a breakdown in the agreement and that this difference will leave the State Department no alternative than to concede to Air France's wishes.

On the point of route exchanges, France contends that reciprocity was the intent of the 1946 agreement. At the time of the agreement, neither nation visualized the technical advances in aircraft that would permit polar and other nonstop operations.

The agreement now grants American flag carriers the right to operate from anywhere in the U.S. to Paris and Nice. It allows Air France to operate from anywhere in France to Boston, New York, Chicago and Houston.

Domestic airlines argue that this is a fair exchange of cities with Air France having the better of the deal. The French government argues that it is unreasonable to prohibit Air France from competing with U.S. carriers in the U.S. while the latter can compete with Air France in France.

Crux of the issue on the bargaining table is that France has nothing to offer the U. S. that U. S. carriers really want.

The French threat to withdraw from the bilateral agreement began about a year ago after the Civil Aeronautics Board granted TWA and Pan American the right to fly the polar route from the West Coast to London and Paris. Early this year, the French intensified the threat to scrap the pact as negotiations, which resumed last October, began to flag (AW March 3, p. 125).

The French government emphasizes that there are no political connotations in the denunciation of the agreement and that the action was based on commercial reasons only. Attempts to pin the denunciation on the new de Gaulle government are discounted by the State Department on grounds that the move began long before Gen. Charles de Gaulle acceded to power.

The international controversy underscores the stake nations throughout the world feel they have in the expansion of their airlines for national prestige and as a means of strengthening national economy. This factor is apparent in the operating policy of smaller airlines as well as the larger carriers.

For example, unnoticed behind Air France's fight for U.S. traffic privileges, is a bid by the privately-owned French carrier, TAI, for an extension of its routes from Australia to the West Coast via Honolulu. Although the French government is not pressing this request at present, it is not, by any means, being shelved.

Foreign airlines are naturally eager to capture as large a share of the lucrative American tourist market as they can and are seeking a wider range of U.S. gateways as a means of attaining that end. Domestic carriers are urging that the moves be arrested immediately since competition within the U.S. is already so keen that load factors generally are tumbling downward month after month (AW July 21, p. 33).

According to the Air Transport Assn., 75% of all traffic between the U.S. and other countries was carried on U.S. airlines in 1949 and 22 foreign airlines were sharing the U.S. market.

By 1957, the number of foreign carriers operating into U.S. markets had grown to 39, and only 63% of the total traffic flew under the U.S. flag.

Behind the controversy is a growing fear among both international and domestic carriers that the Soviet Union's Aeroflot state-owned airline may eventually gain a strong foothold in U.S. markets as a result of the precedents that have already been established in bilaterals with other countries.

AIR FRANCE

This Skipper Flies the "Seven Skies"

Sea captains of the 1800's took years to sail the "seven seas"! Now modern skippers like Air France Captain André Chatel fly the "seven skies" in a matter of days. His swift Super Starliner spans the Atlantic overnight! Continuous ground-to-air radio contact keeps him in constant touch with weather and spotting stations around the world. Captain Chatel flys more thousands of miles in a year than his salty counterpart logged in a lifetime! And even with this proud record, he is typical of all Air France pilots. Fly with him soon across the "seven skies" to Europe, The Middle East, Far East, Africa and Mexico on Air France—the world's largest airline!

Every 3 minutes an Air France airliner arrives or departs somewhere in the world!

WORLD'S LARGEST AIRLINE / WORLD'S MOST PERSONAL SERVICE

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SHORTLINES

► **Alaska Airlines** has begun a new luxury service between Portland and Seattle and Fairbanks and Anchorage using custom built Douglas DC-6C aircraft. The airline is scheduling daily nonstop flights, except Saturday, from Seattle to Fairbanks with an extra over-night nonstop flight scheduled from Seattle to Fairbanks on Friday. Departures are scheduled from Portland Tuesday, Thursday and Friday.

► **Braniff International Airways** reports a 44.7% increase in its air express ton miles for the first five months of 1958—686,608 express ton miles as compared with 474,133 express ton miles for the same period of 1957. Braniff flew 2,338,673 freight ton miles in the first five months of this year, a 26.6% increase against 1,846,673 freight ton miles in the first five months of 1957.

► **Bristol Aeroplane Co.** has sold a Britannia 307 airliner to Air Charter Ltd., an independent British operator, for use as a troop carrier and general charter operations. The aircraft will be fitted to transport more than 100 passengers or fully equipped troops. Orders for 23 Britannias in a special 250-series troop and cargo version are now being readied for Britain's Ministry of Supply and RAF Transport Command.

► **Emery Air Freight Corp.** reports a second quarter 1958 net income of $87,318, a 7.2% increase over first quarter net income of $81,450.

► **International Air Transport Assn.** has announced REAL-Aerovias Nacional, a Brazilian international carrier, as IATA's 86th member company.

► **Mohawk Airlines** is replacing its male flight agents with female stewardesses on all its flights. From 1947 through 1949, Mohawk employed only hostesses. As of Jan. 1, 1950, the transition to male flight agents was completed. Then, on July 1, 1955, the airline again began using hostesses. Transition will be completed by next April 30.

► **Northwest Airlines'** operating revenues for the first six months of 1958 totaled $44,106,208, an increase of 15% over the same period of last year. Net income for the first half of 1958 was $521,713, including $429,479 obtained by property disposal. Comparable 1957 figure totaled $908,545, made possible by income of $1,095,052 from disposal of flight equipment. The airline's total June, 1958, operating revenues were $9,960,275, up 20% from June, 1957.

AIRLINE OBSERVER

► Battle between flight engineers' and pilots' unions has become intensified as a result of conflicting reports by two emergency boards (AW Aug. 4, p. 41 and AW July 28, p. 32). Both unions are determined to stand firm in their opposition to one another that, for the present at least, a series of strikes against carriers introducing jet transports this year and early next year may be in the offing. Flight Engineers' International Assn. resumed negotiations last week with Eastern Air Lines after a ringing denunciation of presidential fact finding board which earlier recommended that the airline require third crew members to be pilot-qualified.

► **Watch for Canadian government to quash any competitive threats against Trans-Canada Airlines on the airline's transcontinental monopoly as a result of a recent report by a British aviation consultant who suggested only token competition on domestic inter-city routes for TCA for some years in the future. Heavy traffic routes between Montreal, Toronto, Winnipeg and Vancouver are expected to be protected for the government-owned airline. Other carriers, using multi- and twin-engine aircraft, will continue under the present strict regulation. Report also urges that operators of single engine aircraft and helicopters be allowed freedom to operate wherever they can find business . . . a suggestion opposed by most Canadian aviation organizations who feel such competition may result in a price war.**

► English firm of International Aeradio Ltd. will supply ground ILS equipment to Hungarian civil aviation authorities and airborne ILS units to MALEV, the Hungarian airline. Contract agreement calls for installation of PTC 1100 ground ILS equipment at Frehigey, the Budapest airport, by winter. Aircraft will be equipped with STC units for which a limited number of licenses have been issued following a delay in negotiations held up by an export embargo on the airborne equipment.

► **Noise level of Lockheed Electra will be "substantially lower" than that of present four engine propeller aircraft, according to recent study conducted for the Port of New York Authority. The Port Authority said it expects no problems in handling the turboprop plane which is quieter, 1.47 mi. from start of takeoff, than present airlines are at a point 2.2 mi. away. Tests were made at indicated air speeds from 130 to 180 kt. to simulate typical airliner climb-outs.**

► Noise level of the Soviet Tu-104 has forced it to use Le Bourget terminal instead of Orly Field on the Paris-Moscow route. Paris Airport Authority reports the Aeroflot jet was shifted to the less densely populated area because of the "excessive noise of the reactors."

► **Japan Air Lines plans to issue an additional 1,433,200 shares of stock. The shares, with a face value of nearly $2 million, will increase JAL capital from $19.9 million to $21.9 million. Stocks will be allotted to stockholders at the rate of one share per 10 holding stocks.**

► Ansett-ANA of Australia has placed orders for additional turboprop equipment, including six Fokker Friendships, two Viscount 832s and two more Lockheed Electras. Canberra government has not approved additional Electra purchase but is expected to do so. Ansett plans turboprop service on all its main routes by early next year and is scheduled to take delivery of its first Electra by March, with Viscount deliveries beginning in January.

► **Flight Engineers International Assn. has signed new contracts with the Flying Tiger Line and Seaboard & Western Air Lines. The two-year contracts involve about 147 flight engineers. Third-man-in-cockpit qualification issue did not arise in the negotiations because neither of the cargo airlines has ordered jets or turboprops.**

► Eastern Air Lines has extended its contract with the CE-BE Chemical Co. Inc., Downey, Calif., for de-sealing, repair, rework and resealing of integral fuel tanks on the airline's Constellation fleet. Contract covers work on 18L-749 type, 12 L-1049s and option on 16 additional 049s at the company's Long Beach Airport facility.

Airline Income & Expenses—May, 1958

(IN DOLLARS)

	Passenger Revenue	U. S. Mail	Express	Freight	Charter	Total Operating Revenue	Total Operating Expenses	Net Income Before Taxes
DOMESTIC TRUNK								
American	23,455,026	595,026	2,087,148†	.....	95,719	26,320,890	24,448,046	2,521,474
Braniff	4,607,734	135,898	46,900	159,047	4,078	5,035,699	4,624,583	355,682
Capital	8,229,970	212,202	104,676	127,896	29,507	8,799,856	8,672,251	127,605
Continental	1,874,823	48,743	22,799	58,994	1,604	2,066,882	2,153,219	−86,336
Delta	6,428,117	161,251	75,255	258,192	67,312	7,133,903	6,807,510	236,199
Eastern	18,064,481	335,139	755,397†	.....	4,695	19,356,858	18,500,345	785,023
National	3,458,385	82,722	14,901	141,049	79,737	3,982,624	4,162,234	−28,112
Northeast	8,864,522	158,946	68,467	175,597	83,698	9,542,470	12,038,421	−2,719,836
Northwest	4,665,062	175,026	355,547†	.....	21,595	5,233,195	5,439,191	−205,995
Trans World	16,397,513	399,859	865,970†	.....	30,421	17,797,146	18,158,669	−560,395
United	22,592,392	825,758	1,727,230†	.....	128,455	25,455,758	23,505,008	1,718,409
Western**	.....	.....	.....	.....	3,623	23,704	796,786	−455,313
INTERNATIONAL								
American	343,098	3,142	72,664†	.....	.....	427,344	537,401	−103,254
Braniff	498,718	7,120	.....	27,331	.....	550,275	723,479	−181,841
Caribbean-Atlantic	139,043	2,598	5,625†	.....	3,471	159,416	173,287	−14,364
Delta	444,406	5,150	.....	13,442	60	481,926	519,148	−43,535
Eastern	1,587,427	36,792	56,583†	.....	80,640	1,762,137	1,717,324	38,295
Mackey	82,734	.....	.....	944	.....	91,075	108,175	−17,100
National	206,109	3,618	1,617	10,600	.....	227,787	298,896	−72,360
Northwest	1,781,844	531,684	326,376†	.....	38,400	2,768,536	2,243,141	525,394
Pan American								
Alaska*	.....	.....	.....	.....	.....	.....	.....	.....
Atlantic	10,364,000	647,000	889,000†	.....	522,000	12,854,000	11,817,000	1,059,000
Latin America	5,053,000	167,000	1,074,000†	.....	182,000	6,784,000	8,083,000	−1,321,000
Pacific	4,402,000	487,000	565,000†	156,000	433,000	6,174,000	5,841,000	348,000
Panagra	1,052,000	45,000	.....	.....	153,000	1,635,000	1,673,000	−32,000
Resort	.....	.....	.....	.....	.....	538,106	494,217	43,889
Trans-Caribbean	.....	.....	.....	.....	.....	359,658	255,095	67,676
Trans World	5,725,582	515,403	345,363†	.....	242,215	7,061,729	7,577,857	−588,880
UMCA***	4,436	.....	1,153†	.....	.....	5,589	7,319	−1,730
United	1,046,687	45,733	24,735†	.....	.....	1,128,769	1,069,765	48,416
Western**	.....	.....	.....	.....	19,748	20,920	69,677	53,291
LOCAL SERVICE								
Allegheny	489,549	11,183	3,934	10,986	919	744,622	774,876	−30,254
Bonanza	232,365	3,680	1,859	3,163	4,978	385,003	370,443	12,922
Central	142,287	4,164	1,069	4,510	1,613	361,500	374,821	−13,320
Frontier	381,407	200,151‡	3,232	23,620	2,024	619,134	597,726	19,253
Lake Central	164,617	4,065	6,687†	.....	.....	327,938	315,376	12,563
Mohawk	545,037	5,659	6,557	8,274	11,493	699,340	744,657	−45,317
North Central	701,318	217,616‡	11,500	.....	30,806	969,440	1,016,431	−51,190
Ozark	434,094	233,709‡	5,497	9,867	4,006	693,184	643,988	44,468
Pacific	394,516	10,772	3,171	3,644	13,021	577,858	588,107	−17,816
Piedmont	491,184	9,989	3,956	6,874	16,806	758,315	737,074	18,786
Southern	221,706	8,016	2,995	3,960	63	406,986	424,448	−19,361
Trans-Texas	295,032	10,089	3,110	11,091	15,937	591,513	589,082	2,539
West Coast	247,049	4,559	2,124	4,692	5,150	385,559	402,907	−17,348
HAWAIIAN								
Hawaiian	356,322	4,573	.....	61,317	17,049	445,972	466,119	−27,826
Trans-Pacific	168,319	606	.....	6,408	7,306	213,879	194,564	19,315
CARGO LINES								
AAXICO	.....	1,543	2,588	39,541	517,125	560,862	600,094	−39,232
Aerovias Sud Americana	.....	.....	.....	110,498	20,602	132,296	157,043	−26,484
Flying Tiger	.....	9,656	937,478†	.....	1,879,998	3,509,410	2,548,983	892,437
Riddle	.....	6,525	247,896†	.....	479,025	908,094	972,783	−646,689
Seaboard & Western	.....	.....	.....	.....	.....	7,174,448	8,752,074	−1,577,626
Slick	.....	.....	.....	.....	450,328	692,255	825,808	−170,102
HELICOPTER LINES								
Chicago Helicopter	58,053	104,901‡	.....	.....	.....	163,916	151,753	−12,163
Los Angeles Airways	15,937	11,543	3,406	.....	1,055	113,161	110,952	4,499
New York Airways	50,010	3,664	886	2,741	.....	199,793	212,821	−14,351
ALASKA LINES								
Alaska Airlines	177,275	46,822	793	41,033	79,523	507,304	514,160	−13,501
Alaska Coastal	73,385	9,603	.....	8,615	3,944	133,079	126,520	6,560
Cordova*	.....	.....	.....	.....	.....	.....	.....	.....
Ellis	.....	.....	.....	.....	.....	89,643	82,871	6,771
Northern Consolidated	65,572	33,918	.....	26,733	6,687	159,198	201,566	−42,368
Pacific Northern	538,138	63,591	82,093†	.....	574	832,603	829,987	−10,697
Reeve Aleutian*	.....	.....	.....	.....	.....	.....	.....	.....
Wien Alaska	68,817	46,734	.....	20,722	104,036	343,042	296,275	46,767

* Not available. ** Western strike 2/21/58 to 6/1/58. *** Uraba, Medelin & Central Airways.
† Property figure. ‡ Includes federal subsidy.

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

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NASA Details Space Contracts Program

Washington—Proposals for a $145 million contracting program with industry for space research and development was included in the supplemental budget request presented Congress by the new National Aeronautics and Space Administration.

It is complemented by a $32.2 million NASA research and development program with other government agencies, such as USAF's Ballistic Missiles Division. Of the total $187.2 million requested for research and development, $117 million will be transferred to NASA from Defense Department accounts.

AVIATION WEEK is presenting below a detailed breakdown of the proposed industry contracting program as a service to its readers. For a report on the over-all NASA budget request, including the construction and equipment program and salaries and expenses, see story on page 18.

General

Space Science $18,280,000

Design and development of vertical probe rocket vehicles		$500,000
Research and development on scientific instrumentation for vertical probes such as temperature, density and spectrographic devices		700,000
Services for launching, tracking, data reduction and analysis for vertical probes		1,750,000
Research and development on scientific instrumentation packages for satellites. Infrared radiation, cosmic rays, meteorites, X-ray radiation, magnetic fields and other geophysical phenomena will be investigated		3,000,000
Services for tracking and telemetering operations, and data reduction and analysis for satellite experiments		3,250,000
Development of lunar probe instruments, including surface scanner and specialized data playback and display instruments		700,000
Initial study of techniques for effecting landings of instrument packages on the moon.		200,000
Studies on long-range telemetering systems particularly adapted to lunar probes		80,000
Initial studies of trajectories, missions and vehicle design for interplanetary probes		1,600,000
Study of the performance requirements of satellite-borne astronomical telescopes		100,000
Prototype satellite-borne astronomical telescope development		1,200,000
Command control and data handling and transmission for specific application to satellite-borne astronomical telescopes		1,200,000
Vehicle design and construction for astronomical satellites		800,000
Design studies on satellite booster vehicles		1,000,000
Design studies on upper-stage rocket assemblies for satellites		700,000
Analyses and studies on vehicle-borne sensing devices to be used in probes and satellites.		500,000
Studies of data handling devices of the type used in processing recorded experimental data		100,000
Studies relating to the development of telemetering receivers of the type used in the satellite program		200,000
Studies of precision requirements and system arrangements for range and range-rate systems		200,000
Design studies for interplanetary probes		400,000
Miscellaneous repairs, alterations and minor construction		100,000

Space Technology $46,800,000

Initial development contract for a million-lb. thrust rocket motor		$10,000,000
Development contracts for high-energy rocket motors		6,900,000
12,000-lb. thrust fluorine-hydrazine motor	2,320,000	
80,000-lb. thrust fluorine-hydrazine motor	3,580,000	
100,000-lb. thrust hydrogen-oxygen motor	1,000,000	
Solid propellant rocket motor development contract		1,700,000
Studies of electric propulsion for space vehicles		200,000
Research and development on improved auxiliary power supplies		2,200,000
Design of specific power units	800,000	
Investigations of energy sources	600,000	
Development of generators, regulators and controls	800,000	
Investigation of reaction controls for space vehicles		700,000
Investigation of angular momentum controls for space vehicles		950,000
Retro-rocket systems including investigations of rocket types, thrust programming and controls		500,000
Studies on gravity stabilization techniques for altitude control		700,000
Studies and prototype equipment development for the following phases of data handling and data transmission		2,500,000
Information coding and processing	800,000	
Receiving components and systems	400,000	
Transmitting components and systems	400,000	
Erectable antennas for space vehicles and orientation devices	600,000	
General studies, such as the multi-purpose use of transponders, the improvement of analog-digital converters and the development of data recording and retrieval techniques	300,000	
Studies of the task requirements for space vehicles using manual controls		300,000
Studies of navigational and mapping display devices for use in space vehicles		450,000
Design studies for prototype control consoles		250,000
Development of personnel equipment including air supply and renewal, waste disposal, emergency protection, and food supply		1,000,000
Research and development on guidance systems for space vehicles, including efforts on sensors such as gyroscopes and star trackers; servomechanisms; systems analyses for specific missions; and construction of experimental units		4,300,000
Launching guidance	1,500,000	
Midcourse guidance	1,200,000	
Terminal guidance	1,200,000	
Landing control systems	400,000	
Research and development on computers for vehicle-borne systems and for the improvement of ground-based computers used to derive detailed orbital or flight path constants of space vehicles		3,700,000
Solid state components	800,000	
Mechanical design and packaging	900,000	
Logical design	700,000	
Input-output devices	1,100,000	
Reliability analyses	200,000	
Instrumentation research and development to improve the sensitivity, range and reliability of existing devices and techniques and to bring to an acceptable point of development those techniques and instruments which are required for scientific studies in space, but which have not yet been reduced in size and/or weight to acceptable values		3,450,000
Sensing devices for field, particle and radiation measurements	1,200,000	
Sensing devices for biological and medical measurements	300,000	
Sensing devices for determining the performance of the vehicle and its booster rocket	550,000	
Data switching and internal storage devices, such as magnetic or electrostatic tapes	550,000	
Studies on methods and equipment for the measurement of vehicle position and velocity	850,000	
Development of stabilization system for a 100-400 lb. payload		1,000,000
Development of stabilization system for a large capacity (more than 2,000 lb.) payload		800,000
Development of subsystem units for stabilized platform application		1,100,000
Design work and adaptation of an IRBM booster for flight testing of high-energy motor		1,700,000
Design studies and development of a materials test satellite		1,300,000
Development of a solid fuel booster motor		300,000
Investigations of energy sources for use as auxiliary power supplies in space vehicles		200,000
Physiological and human engineering studies of the tasks involved in space vehicle operations		150,000
Studies in logical design for computers		100,000
Reliability analyses for computer systems		100,000
Design studies on switching and data storage		200,000
Systems analyses on position and velocity measurement techniques		50,000

Meteorology and Communications . $4,220,000

Development of meteorological satellite payloads		$2,200,000
Heat balance and infrared spectrum units	400,000	
Television-type cloud-cover units		1,600,000
Studies on advanced experiments	200,000	
Communications service developments		2,020,000
Analysis of reflector sphere experiments	100,000	
Studies of channel requirements	120,000	
Studies of passive reflectors	200,000	
Studies of active relays	150,000	
Studies of electromagnetic propagation	50,000	
Design of a communications relay satellite	1,400,000	

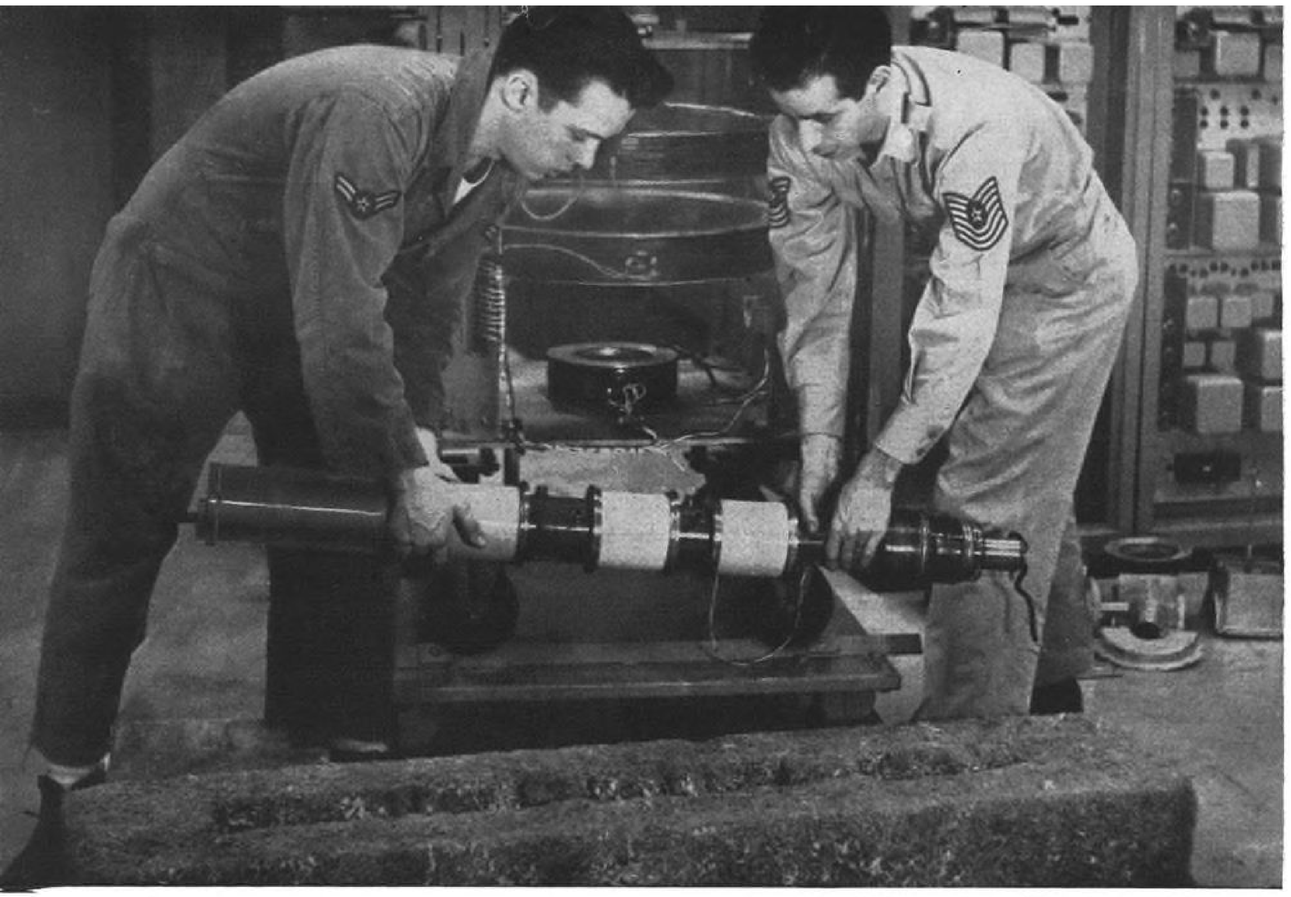
Technology of Manned Space Flight Vehicles $6,500,000

Design and development of capsule units for manned space flight	$1,700,000
Design and development of electronics units and instrumentation for manned flight capsules	1,000,000
Development and adaptation of booster units for small-scale and full-scale flight experiments	3,800,000
Total	$75,800,000

R&D—Supplies and Materials

Space Science $27,420,000

Rockets used as vehicle propulsion units for vertical probes (approximately 30 vehicles—Jasons and Aerobees)	$3,000,000
Components and materials used in the assembly and test of the scientific payloads of the vertical probes	750,000
Booster rockets for geophysical satellite projects. These are modified IRBM units (six or eight units of Jupiter and/or Thor type)	8,800,000
Upper stage rocket systems for geophysical satellite projects (eight modified Vanguard or Sergeant systems)	6,500,000
Vehicle-borne sensing devices for use in the geophysical satellite projects. This will include units used in monitoring the performance of the propulsion stages and items within the payload	2,000,000
Material used in the assembly of test fixtures, calibration jigs and the like	300,000
Supplies used in assembling test bench versions of data handling devices	100,000
Components and materials used in the assembly of experimental and prototype telemetering transmitters. Includes units to be tested for environmental performance which will be expended in testing	700,000



U. S. Air Force personnel remove 25,137 hour klystron from advanced Pole Vault base. Department of Defense Photograph.

Eimac Klystrons Going Strong

after 25,000 Hours in Pole Vault Tropo-Scatter Service

After 25,137 hours on the air, and still in perfect operating condition, this Eimac 3K50,000LF UHF klystron has been acquired through the cooperation of the U.S. Air Force and Canadian Marconi, Ltd. This klystron was one of the original tubes installed in Project Pole Vault, the first tropo-scatter communications line ever established. The tube is just one of a number of Eimac klystrons that have exceeded 25,000 hours of reliable on-the-air time in this system. Eimac klystrons are used as final amplifiers in the Pole Vault 10 kilowatt transmitters that handle multiple-channel voice and teletype communications. Experience with this first system in our early warning defense network confirmed klystron-powered tropospheric scatter as an outstandingly dependable system of long distance communication.

The exceptional performance of these tubes under the difficult logistical and environmental conditions of the far north is indicative of the reliability and conservative rating of performance-proved Eimac external-cavity klystrons. Eimac amplifier klystrons are now being used extensively for tropo-scatter communications throughout the United States, Canada and other regions of the world. Eimac klystrons for communications and pulse applications are now available covering frequencies from VHF to SHF and to multi-megawatt output powers.

For further information, write for a copy of the 24-page booklet "Klystron Facts Case Five."

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Ceramic Receiving Tubes	Vacuum Pumps

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Components and materials for the development of telemeter receivers and receiving systems	400,000
Components and materials for the development of range and range-rate measuring systems	370,000
Booster rocket systems for lunar probes (two units of Thor and/or Jupiter type)	2,300,000
Upper stage rockets and assemblies for lunar probes	1,400,000
Materials and components for the development work on the lunar probe payload	200,000
Materials used in initial investigations of the lunar landing problem	100,000
Optical, mechanical and electrical components used in developing a prototype satellite-borne astronomical telescope	200,000
Materials and components for the development of a command orientation control, data handling and transmission system for the astronomical telescope	200,000
Materials used in the development of a prototype satellite vehicle carrying an astronomical telescope	100,000

Space Technology $17,300,000

Experimental units to be tested in the development of solid propellant rocket motors (new development)		2,000,000
Components and materials to be used in the development of electric propulsion systems for space vehicles		100,000
Components and materials used in the development of auxiliary power supplies. To be used in the following areas:		
Specific package designs	100,000	
Energy source development	100,000	
Development of generators, regulators and power supply controls	300,000	
Components and materials used in space vehicle and rocket control system development as follows:		
Reaction control systems	200,000	
Angular momentum control	400,000	
Retro-rocket systems	200,000	
Components and materials used in development of data handling and data transmission systems for space vehicles. As follows:		
Coding and processing studies	200,000	
Receiving components research	200,000	
Transmitting components research	200,000	
Erectable antennas research	100,000	
Other areas such as transponder, converters and recorders	200,000	
Components and materials used in research and development on displays and control consoles for space vehicles:		
For materials used in task studies	50,000	
For mapping system studies	200,000	
For prototype and/or mockup consoles	400,000	
Components and materials used in development of personnel equipment		100,000
Components and materials used in studies of guidance systems, as follows:		
For launching guidance	400,000	
For midcourse guidance	300,000	
For terminal guidance	300,000	
For landing control systems		100,000
Components and materials used in computer research and development, as follows:		
Research on solid state components	200,000	
Studies of packaging techniques	200,000	
Research on logical design	100,000	
Development of input-output devices	200,000	
Components and materials used in instrumentation research and development, as follows:		
For development of field, particle, and radiation measurement devices	200,000	
For biological and medical instruments	100,000	
For vehicle performance measurements	150,000	
For data switching and storage devices	300,000	
For transmitting components for range and velocity systems	100,000	
For receiving components for range and velocity systems	100,000	
For transponder development	100,000	
Components and materials used in research on stabilized-platform systems:		
For light-load platforms	300,000	
For heavy-load platforms	300,000	
For stabilization subsystem development	500,000	
Booster rocket systems for high-energy fuels system test vehicles two units of Sergeant and systems		2,300,000
Booster rocket systems and payload recovery systems for material test satellite (two units of Thor and/or Jupiter rocket systems and retro-rockets)		3,500,000
Test vehicles for solid-fuel rocket development (five Sergeants or equivalent)		2,500,000

Meteorology and Communications. $5,700,000

Components and materials for development of infrared and heat balance instrumentation	200,000
Components and materials for use in developmental work on the television-type cloud cover satellite equipment	200,000
Booster (one Thor-Able) vehicle, and payload-recovery system for a meteorological satellite	3,200,000
Materials for studies of passive reflectors for communications services	50,000
Components and materials for research on active relays	50,000
Booster (one Thor or Jupiter) and vehicle for initial communications services satellite	2,000,000

Technology of Manned Space Flight Vehicles $21,500,000

Prototype test space capsule systems (eight test capsules to be expended in test)	4,800,000
Prototype capsule electronics and instrumentation (subsystems for eight capsules to be expended in test)	3,000,000
Booster systems for small-scale flight tests (eight Thor-Able or equivalent units)	8,400,000

for missile and rocket telemetry recording
...the **Honeywell 3170**
precision tape transport

a rack-mounted unit designed by the largest manufacturer of instruments and controls —to meet the most demanding requirements of analog magnetic tape instrumentation.

Examine these brief specifications on the Honeywell 3170 high-performance tape transport—designed to provide unparalleled flexibility and performance in accordance with IRIG specifications. Complete mechanical and electronic data are available on request—including application engineering assistance.

Performance

Extremely low "wow and flutter."

Tape speeds available from 60 to 1½ ips . . . selected by switch, without belt changes.

Less than 2 seconds start time and 1 second stop time at 60 ips, with 14" reels.

Fast forward and rewind.

Flexibility

Up to 14" reels with NARTB hubs standard.

Plug-in, interchangeable, record and playback heads.

In-field changeover for tape widths of ¼" to 2".

Search and control capstan, optional.

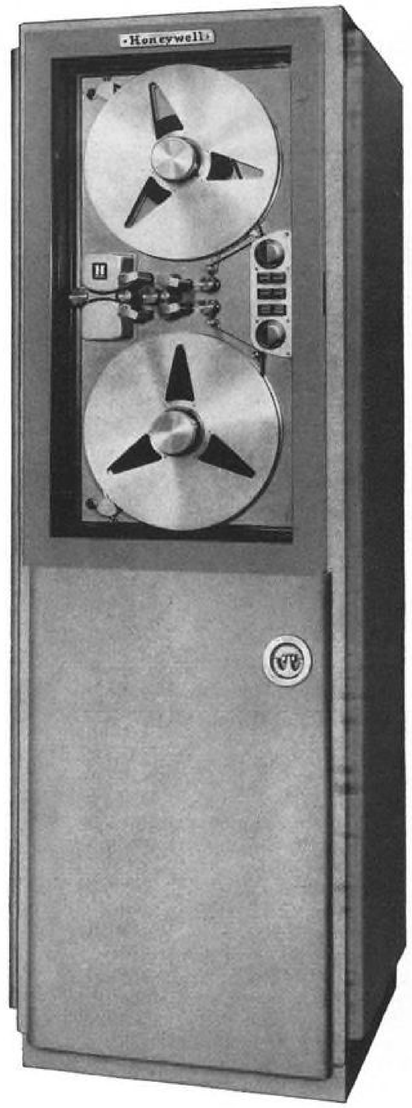
Features

Precision-ground mounting plates assure perpendicular head mounting on change of head stacks.

Precision capstan drive assembly with multiple-speed hysteresis synchronous motor, operated from line, speed control servo, or precision-frequency power generator.

Closed-loop isolation of tape path, with precision, non-mechanical tape tension control of both supply and take-up reels.

Honeywell multi-track heads—record and playback—conform with IRIG specifications.



The complete Honeywell data acquisition system features direct, wide-band FM, multiplexed FM, or PDM data recording by means of plug-in amplifiers. Electronic components have low zero and gain drift with temperature and voltage changes. Signal-to-noise ratio exceeds IRIG specifications.

For detailed information, call your local Honeywell field engineer . . . he's as near as your phone. MINNEAPOLIS-HONEYWELL, 10721 Hanna Street, Beltsville, Maryland.

Honeywell

First in Controls

Booster systems for full-scale flight test (two Atlas or equivalent units)		5,300,000
Total		$71,920,000

R&D—Equipment

Space Science		**$1,850,000**
Equipment items for research and development studies on vehicle-borne sensors		500,000
Calibration and performance test equipment for use in the development of vehicle-borne space science instruments		700,000
Data handling equipment such as magnetic tape drives and code correctors		150,000
Experimental telemeter receiver systems for laboratory use in developing instrumentation techniques		100,000
Experimental laboratory equipment for work on range and range-rate measuring system		100,000
Test equipment for experimental investigations of lunar landing techniques		100,000
Equipment for experimental tests of command control and data handling and transmission as applied to astronomical satellites		100,000
Equipment for use in mockups of astronomical satellites		100,000
Space Technology		**$4,590,000**
Research and development test equipment for work on auxiliary power supplies		400,000
Investigations of systems	100,000	
Energy source studies	100,000	
Studies of generators and controls	200,000	
Research and development test equipment for use in projects on vehicle control		350,000
Reaction controls	100,000	
Angular momentum controls	150,000	
Retro-rocket systems	100,000	
Research and development test equipment for use in projects relating to data handling and transmission		600,000
Receiving systems studies	200,000	
Transmitting systems studies	200,000	
Erectable antenna studies	200,000	
Research and development test equipment for use in studies of navigational and mapping systems		100,000
Equipment for use in setting up prototype control consoles		100,000
Equipment for research and development tests of personal equipment		100,000
Research and development test equipment for use in projects developing guidance units		600,000
Equipment for use in the development of lunar landing units		100,000
Research and development test equipment for computer studies		600,000
Solid state components	100,000	
Computer packaging	200,000	
Logical design	100,000	
Input-output devices	200,000	
Research test equipment for use in the development of instrumentation		1,100,000
Field, particle and radiation measurements	200,000	
Biological and medical measurements	100,000	
Vehicle performance measurements	200,000	
Data switching and storage devices	300,000	
Position and velocity measurement systems	300,000	
Equipment for testing stable platform development articles		500,000
Light payloads	200,000	
Heavy payloads	200,000	
Subsystems tests	100,000	
Equipment items for use in setting up systems test vehicles and materials test satellites		400,000
Meteorology and Communications		**$480,000**
Test equipment for television type meteorological satellite payload		$200,000
Test equipment for studies of passive reflectors		50,000
Test equipment for studies of active relay satellite components		50,000
Test equipment for use with the advanced communications satellite		180,000
Total		$7,280,000

Company Keys Space Data to Civil Uses

Glendale, Calif.—Space Electronics Corp., Glendale, has been formed for development of ground and airborne electronic equipment for missiles and space vehicles. One of the major objectives of the company, a subsidiary of Pacific Automation Products, Inc., will be to apply knowledge gained in the U.S. missile and space program to commercial and civilian fields.

These projected fields include use of relay satellites to interchange live television programs and other communications, development of electronic satellites as world-wide navigational aids, and meteorological surveillance stations for observation of long-range weather conditions.

Principals of the new corporation include Dr. J. C. Fletcher, president, and F. W. Lehan, vice president. Fletcher previously was director of Electronics Laboratory, Ramo-Wooldridge Corp., with responsibility for development of guidance and control systems for missiles in USAF ballistic missile program.

Lehan was associated with Ramo-Wooldridge as associate director of Electronics Laboratory, responsible for the development of concepts, system engineering and technical direction of ICBM and IRBM guidance systems, as well as project engineer for the Minuteman solid propellant ICBM.

Ramo-Wooldridge Plans Research Unit

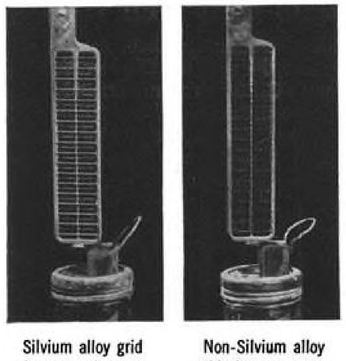
Ramo-Wooldridge Corp. plans to buy a 90-acre site near the Chatsworth Reservoir in California's San Fernando Valley for construction of a multi-million dollar research and development facility. First units of the new center will provide space for some 2,000 scientists, engineers and administrative personnel in approximately 150,000 sq. ft.

Advanced electronic research and development operations will be transferred to the new facility upon completion and space vacated at Ramo-Wooldridge's present location will be used for space technical laboratories.

An Exide battery gives you a feeling of confidence

. . . confidence that you'll be able to take off on schedule

SILVIUM RESISTS CORROSION



Silvium alloy grid after corrosion test.

Non-Silvium alloy grid after same test.

The one time when you can least afford a battery failure is during takeoff. But when you have Exide aircraft batteries in commercial planes, you have dependable protection against the major cause of sudden battery failure.

In place of ordinary positive plate grid alloys, Exide uses Silvium,* a new, patented alloy that resists corrosion up to 100% longer. While in other batteries corrosion often causes sudden failure, Silvium grids normally outlast the battery. In addition, experience proves Silvium stretches battery life, giving you more value for your dollar.

Eliminate this needless threat of takeoff delay from your operations. Install Exide Batteries. For information, call your nearby Exide sales office. Or write Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 2, Pa.

*U.S. Patent

Exide®

Research and Development Decline

Department of Defense has adjusted funds obligated for research and development to the 1947-49 level of purchasing power of the dollar in the three columns to the right. They show that, in actual purchasing power, the research and development effort of the three military services has declined from a peak of $1,179 million in Fiscal 1952 during the Korean war to $910 million in Fiscal 1958.

	Obligations (Actual) (000,000 Omitted)			Obligations (Adjusted to 1947-49 Price Index) (000,000 Omitted)		
	For Missile Programs	For R & D Programs	Total R & D	For Missile Programs	For R & D Programs	Total R & D
1950 Fiscal Year						
Army	23	100	123	22	95.8	117.8
Navy	49	151	200	47	114.6	191.6
Air Force	31	171	202	29.7	163.8	193.5
Total	103	422	525	98.7	404.2	502.9
1951 Fiscal Year						
Army	45.7	238.3	2f4	40.6	212.8	252.4
Navy	61	376	437	54.2	334.2	388.4
Air Force	52.1	277.9	330	46.3	247	293.3
Total	158.8	892.2	1,051	141.1	793	934.1
1952 Fiscal Year						
Army	78.8	351.2	430	64.2	290	354.2
Navy	74.9	468.1	543	60.8	386.5	447.3
Air Force	100.9	358.1	459	82.4	295.7	378.1
Total	254.6	1,177.4	1,432	207.4	972.2	1,179.6
1953 Fiscal Year						
Army	74.6	326.4	401	58.2	254.8	313
Navy	78.1	411.9	490	61	321.5	382.5
Air Force	121.9	371.1	493	95.2	289.7	384.9
Total	274.6	1,109.4	1,384	214.4	866	1,080.4
1954 Fiscal Year						
Army	63.8	281.2	345	49	215.8	264.8
Navy	55.1	360.9	416	42.3	277	319.3
Air Force	69.8	334.2	404	53.6	256	310.1
Total	188.7	976.3	1,165	144.9	749	894.2
1955 Fiscal Year						
Army	75.9	249.1	325	54.8	179.7	243.5
Navy	59.6	298.4	358	43	215.3	258.3
Air Force	64.7	395.3	460	46	285.2	331.9
Total	200.2	942.8	1,143	144.5	680.2	824.7
1956 Fiscal Year						
Army	112.5	264.5	377	73.4	172.4	245.8
Navy	76.5	394.5	471	49.8	257.2	307
Air Force	45	457	502	29.3	297.9	327.2
Total	234	1,116	1,350	152.5	727.5	880
1957 Fiscal Year						
Army	109	283	392	68.2	177.1	245.3
Navy	146.2	378.8	525	91.5	237	328.5
Air Force	91.3	432.7	524	57.1	270.8	327.9
Total	346.5	1,094.5	1,441	216.8	684.9	901.7
1958 Fiscal Year						
Army	159.6	364.1	423.7	99.7	165.1	264.8
Navy	195.5	329.3	524.8	122.2	205.8	328
Air Force	104.1	404.4	508.5	65	252.8	317.8
Total	459.2	997.8	1,457	286.9	623.7	910.6

Roylyn GROUND SUPPORT EQUIPMENT

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STOW-ABLE DUCT

AIRATERRA . . . foremost designer and marketer of ground support equipment . . . offers the finest in woven-type DACRON and SILICONE DUCT . . . FIELD TESTED!

Every section of AIRATERRA or ROYLYN DUCT is so marked . . . and FULLY GUARANTEED.

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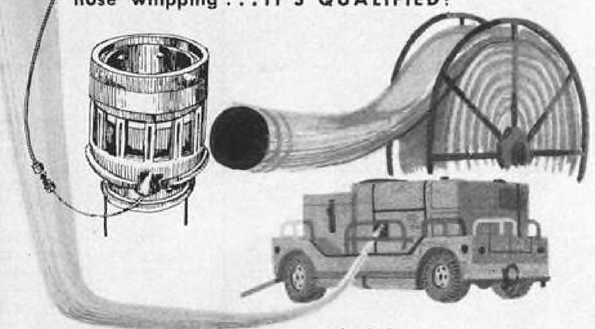
- GUARANTEED ROYLYN QUALITY

USE WITH ROYLYN 7643-48 AIR-START COUPLING with butterfly valve to prevent hose whipping . . . IT'S QUALIFIED!



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Increase the life of this duct even further with the replaceable Roylyn scuff jacket.

Write direct to AIRATERRA for technical information and prices.

The Best Connections in the World

DESIGNED • MARKETED BY AIRATERRA

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USAF Contracts

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

HEADQUARTERS, AIR FORCE OFFICE OF SCIENTIFIC RESEARCH, Air Research and Development Command, Washington 25, D. C.

Regents of the University of California, Berkeley, Calif., research on "Theoretical Physics of Elementary Particles," (AF 49 (638)-327), $39,600.

Regents of the University of Michigan, Ann Arbor, Mich., research and reports concerning "Study of Selective Factors in Cognition," (AF 49(638)-367), $79,337.

Northwestern University, Evanston, Ill., research on "Kinetics of Metal Oxide Reactions," (AF 48(638)-436), $88,582.

Institute for Advanced Study, Princeton, N. J., studies in mathematical analysis, (AF 49(638)-253), $88,000.

Regents of the University of Wisconsin, Madison, Wis., research on "Studies on the Complex Precursors of Induced Enzymes in Yeast," (AF 49(638)-314), $29,604.

Princeton University, Princeton, N. J., "Applications of the Methods of Modern Topology," (AF 49(638)-431), $76,506.

State Board of Control, acting for and on behalf of Florida State University, Tallahassee, Fla., low energy (1-10 Mev.) nuclear research, (AF 49(638)-427), $217,260.

University of Rochester, Rochester, N. Y., "Theoretical Investigations of the Effects of Imperfections on the Optical Properties of Solids," (AF 49(648)-432), $74,678.

AIR FORCE CAMBRIDGE RESEARCH CENTER, ARDC, Hanscomb Field, Mass.

Williamson Development Co., Inc., West Concord, Mass., research directed toward the development of instrumentation and techniques for the study of transient optical phenomena associated with hydromagnetic experiments, (RFP-04578), AF 19(604)-4091, $29,737.

Regents of the University of New Mexico, Albuquerque, N. M., research directed toward the study of radio frequency emissions, (RFP-633308), AF 19(604)-2436), $30,182.

University of Chicago, Chicago, Ill., research concerning infrared atmospheric transmissions under haze conditions, (RFP-06137), AF 19(604)-3909, $32,185.

Polytechnic Institute of Brooklyn, Brooklyn, N. Y., theoretical and exploratory experimental research in electro-magnetics networks and related solid state and plasma topics, (RFP 04533 and 04533A), AF19-(604)-4143, $225,000.

International Business Machines Corp., Poughkeepsie, N. Y., design and analysis of high-speed computer circuits, (RFP 04504), AF19(604)-4152, $186,000.

General Electric Co., Syracuse, N. Y., feasibility study of the use of phase reversal keying, (RFP 25640), AF19(604)-4077, $47,953; services and facilities for tracking satellites, (RFP 25030 and 25030A), AF19(604)-4087), $26,993.

Lockheed Aircraft Corp., Palo Alto, Calif., research for the study of the absorption coefficients of hot gases for the analysis of nuclear fire balls and other high temperature sources, (RFP 25486), AF19(604)-3893, $37,988.

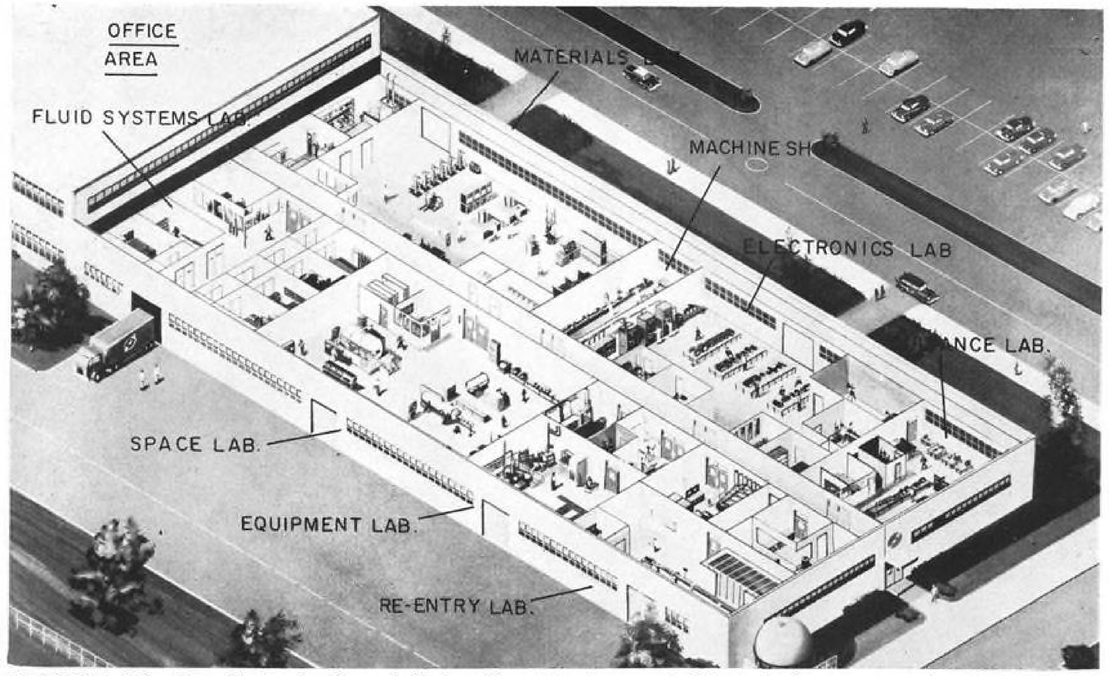
Coughlan Construction Co., Inc., Boston, Mass., construction of telephone duct facility and rock excavation, (RFP IFB no. 19-604-58-148), AF19(604)-4413, $27,046.

Northeastern Construction Co., Inc., Framingham, Mass., repair of airfield paving facilities, areas 1 through 6 and 8 and rock excavation, (IFB no. 19-604 58-98), AF19(604)-4412, $46,193.

Stanford Research Institute, Menlo Park, Calif., research on radiation effects in magnetics and dieletrics, (RFP 25571), AF19-(604)-4141, $114,000.

Stavid Engineering, Inc., Plainfield, N. J., research directed toward the installation, testing and development of BADGE experimental equipment, (RFP 632185), $200,883.

Melpar, Inc., Boston, Mass., research on anti-jam communications systems using redundant transmission, (RFP 27757 and 27757A), AF19(604)-4064, $41,760.



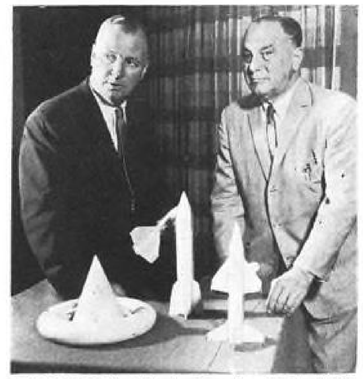
REPUBLIC Aviation Corp. Engineering Research Center will contain nine separate laboratories for space research projects.

Republic Launches Space Program

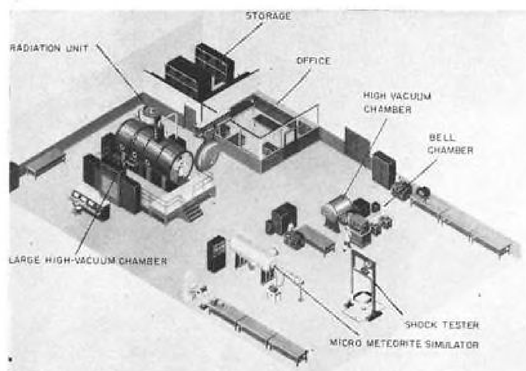
Farmingdale, N. Y.—Republic Aviation Corp. is now working with architects on the plans for its recently proposed $14 million Engineering Research Center (AW Aug. 4, p. 33) and expects to begin construction sometime this fall, probably in October.

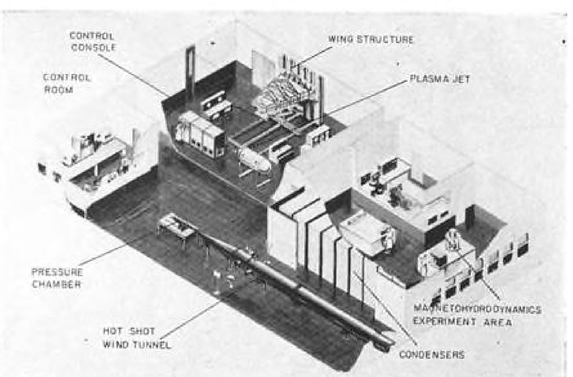
Part of the company's four-year $35 million program of research and development, which is aimed at getting Republic established in the missile and space field, the new facility will house nine laboratories—six for research and development and three for the study of materials and processes.

Space Environmental Development Laboratory and Re-entry Simulation and Aerodynamic Laboratory (see below) will be two of the more important units and will contain elaborate and expensive simulation equipment. One of the major pieces of equipment, for example, will be a high altitude test chamber large enough to accommodate a man. Republic is conferring with Litton Industries, which has built a large high-vacuum chamber capable of pressures down to 10^{-6} mm. mercury; and, according to Republic, Litton is confident that its engineers will be able to construct a chamber capable of evacuation down to 10^{-8} mm. Hg.

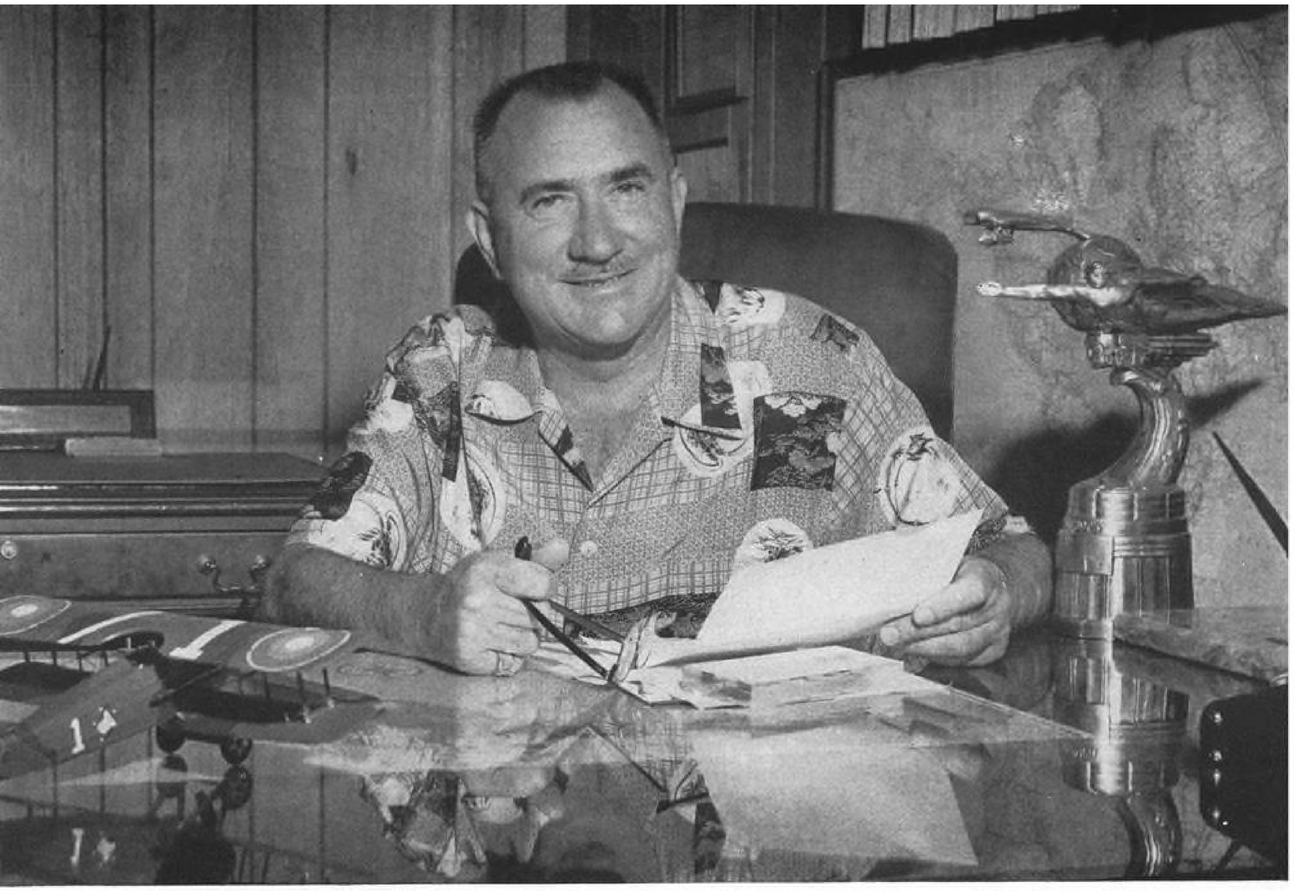


REPUBLIC President Mundy Peale (left) and Vice President-Research and Development Alexander Kartveli (right).





SPACE facility (left) will have a shaped-charge micrometeorite simulator. Re-entry unit (right) will have Mach 20 wind tunnel.



Paul Mantz, Hollywood's top aerial film director and crack-up artist. Champion-equipped, he's made $12 million mocking death.

Another in a series on unusual aircraft operations—and why the world's top pilots, like all the world's major airlines, use CHAMPION SPARK PLUGS.

Noted aviation authority reports on

The Mantz World

by HERB FISHER

Mr. Fisher
International aviation authority, veteran test pilot, author

Mantz crash-lands B-17 for "Twelve O'Clock High"... only man ever to fly a 10-crew Flying Fortress alone. "They didn't want to risk hurting anyone else," he says. He manipulated co-pilot controls via steel welding rods attached.

"Our relics aren't flown for months at a time—yet, with Champions, they're always ready to take off," Jim Thompson, chief pilot, tells Mantz (l) and Elmer Sasse (r) of Sky Store, Champion representative.

Paul Mantz' world has been one of full-throttle scramble to do everything from the incredible to the sublime for the movie industry—often at the ends of the earth.

He's been acclaimed as Hollywood's "most nearly indispensable man." He's been hailed as one of aviation's most singular "greats." Film colony old-timers say the fact that he's alive at 54 makes him an oddity. The precision master (aviation's greybeards still call him "king of stunt men") has made his name and fortune outwitting personal disaster for 32 years.

Today Mantz is Hollywood's top aerial film director. A flamboyant personality in a habitat where flamboyance is the norm, Mantz remains the film capital's undisputed ace plane-crasher, museum-piece restorer, relic "stunt" flyer, aerial photographer—and is still introduced as the one-time personal owner of the world's seventh largest air force (485 war surplus planes he bought in 1947).

He pilots the Paul Mantz Air Service from Orange County Airport, Santa Ana, Calif. Company motto: "We charter anything, any time, any place." Off-beat service includes an airborne ambulance operation, a "Honeymoon Express" for Nevada-bound stars, and a global shuttle service for magnates. Rebuilding and maintenance of his 50-plane fleet—World War I relics to jets—goes on in three hangars covering 3½ acres.

"Spare" time, Mantz breaks international records. He's the only flyer to win the Bendix Trophy three times in a row. He holds several transcontinental speed records, plus the world's record for 46 consecutive outside loops in a stock plane—set 27 years ago.

In other "spare" time, Mantz borate-bombs the Forest Service's most unruly fires . . . runs the Flying Yachtsman restaurant on Catalina Island . . . and relaxes with wife and son at home—"home" being an ultra-swank ocean-going yacht equipped with radar, loran gear, automatic pilot and radio direction finders. (Mantz was one of the first instrument flyers, has lived by electronics since.)

The Mantz world—from the incredible to the sublime . . .

The sublime: Consider the Mantz-directed aerial photography in such Cinerama extravaganzas as "Seven Wonders of the World" (a 5-month, 72,000-mile zigzag grind around the globe), "America the Beautiful," Zanuck's new "Deluxe Tour" . . . film spectaculars that made people the world over catch their breaths.

The flying: "Hair-raising, at times," Mantz tells me . . .

Or those air thrillers like "Strategic Air Command." For many grueling weeks Mantz chased behemoth USAF B-36's in his B-25 camera plane to record this monumental sky drama. (During the war, Colonel Mantz trained and supervised combat camera crews in world-wide filming operations.)

The incredible: Those World War I

Mantz pilots sister ship to Rickenbacker's famed World War I Spad. All Mantz' famous vintage aircraft are Champion-fired, for dependability.

Jerry and Yank aeroplanes seen first in "Men with Wings" and several times since—they're Mantz-built or restored relics, and Mantz-flown. The Spirit of St. Louis in the recent Lindbergh movie by that name—a Mantz plane, flyable and authentic down to the last nut and bolt. The B-17 that cracked up in "Twelve O'Clock High." Mantz.

In directing "Spirit of St. Louis" aerial sequences, incidentally, Mantz had to labor along in a B-25 camera plane with landing gear down, flaps fully extended and prop in low pitch.

Remember the older films. The time Mantz brought movie-goers to their feet by diving a biplane into a hangar doorway and out the other side. Or the one where the goggled aviator bounced his aeroplane off a hangar roof. (Mantz lost his wheels on that one.) And those spectacular crashes into bunches of trees—Mantz losing his wings and nearly his tail. No trick shots in those days: When plot called for a crash or worse, Mantz stood in for the stars.

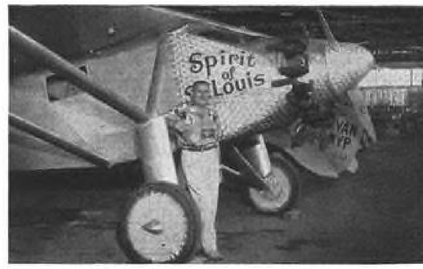
"For recreation, Herb? Well, I used to knock navigation lights off my buddies' wingtips with my own wingtips. I never knew why I got such a kick out of that—I was paying for the lights."

Though he's leaped from burning planes, had overzealous movie "powder men" set off dynamite too soon in "bombing" sequences, and had his relics knocked apart in the air, this "living legend" has been injured but *once*. A broken collar-bone. And this on the ground, when a crash-landed plane turned on him as he was running from it.

"That's why I prefer 'precision pilot' to 'stunt man,'" Mantz says. "It takes a hell of a lot more than guts or craziness to fly the impossible assignments the script-writers dream up—or to film what the money says to film. It takes calculation, thinking, along with skill, sure—and *it takes the world's best in parts and equipment and ground maintenance.* I've swallowed a lot of raw heart up there, Herb, hoping my planes would make it.

"I've flown on Champion Spark Plugs (I use this as a prime example, since the ignition system is *vital* to the life and reliability of the engine) for 32 years.

"Champions have proved their dependability for me *all over the world, under all kinds of operating conditions, and in a truly unique variety of planes* . . . every-



"Lindbergh was astounded when he saw our replica of the Spirit of St. Louis," says Mantz, who directed aerial filming of the movie. "We used Champions on the entire Lindbergh flight—never changed a one. Hit severe weather over the Bay of Fundy and were mighty thankful for no ignition trouble."

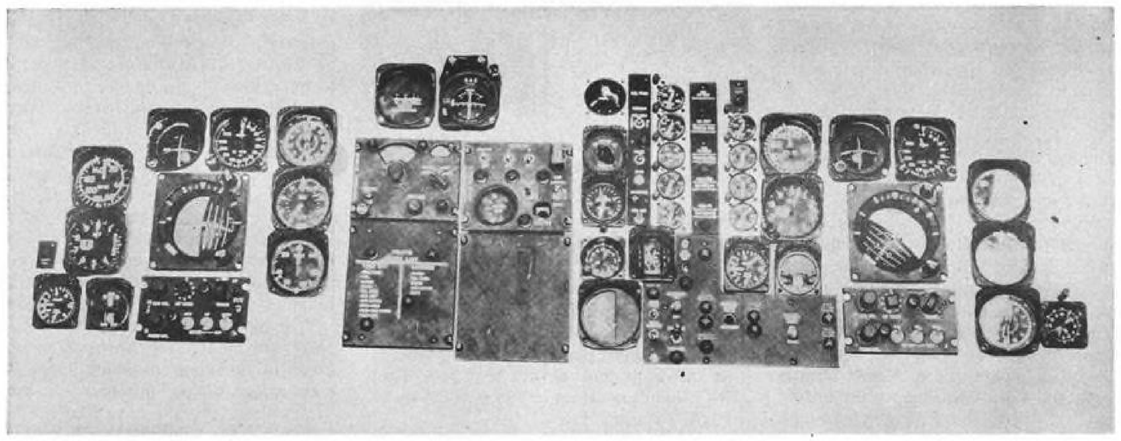
thing from my fleets of antiques to my camera planes. I *know why* all the world's major airlines fly with Champions."

When man tries a first landing on the moon, Mantz will probably photograph it from a camera ship parked nearby.

CHAMPION SPARK PLUG CO.
TOLEDO 1, OHIO

A Mantz world, conquered. Mantz shows Fisher where B-25 camera plane filmed wonders of world. Mantz has directed aerial sequences in major flying pictures for 20 years, supplied crews, support aircraft and vehicles, camera ships and vintage planes.

Mantz roars in between two trees, losing wings and nearly tail, in filming of "When Willie Comes Marching Home."



INSTRUMENT panel installed in anti-submarine warfare helicopter looks conventional, yet is coupled with a unique automatic flight control arrangement and instrument information presentation derived under ANIP philosophy specifically for anti-submarine warfare mission.

Navy Adapts Cockpit Display Knowledge

By Richard Sweeney

Johnsville, Pa.—While long range objectives of highly integrated pilot displays are pursued in the Army-Navy Instrument Program (ANIP), Navy seeks to use knowledge gained in the program to put interim advanced displays into operational production aircraft as soon as possible.

Aeronautical Instruments Laboratory of Naval Air Development Center here has the task of readying these displays, and can follow three main paths to accomplish its mission:

- **Use knowledge from ANIP** long range research which can be translated into production hardware within the time span allotted to develop a system for a particular forthcoming aircraft.
- **Initiate research efforts** on its own in specific areas where effort may well lead to hardware for which laboratory sees a need.
- **Direct development efforts** of the many contractors involved toward one particular system which is aimed at a particular aircraft.

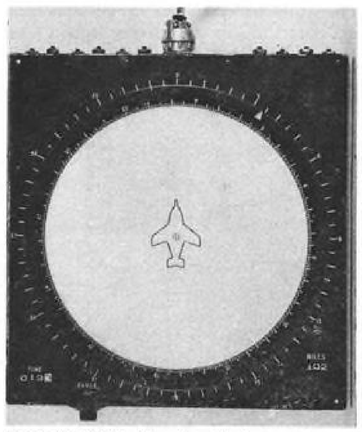
Over-all ANIP efforts are in three areas—research, development and application. Defining the terms and correlating them as they apply to this program could yield this description—"Diligent inquiry in seeking facts, truths and principles about man's requirements in an aircraft environment, which can be mechanized and exhibited in a series of progressive steps, as systems, for employment in specific aircraft."

In the effort, prime research work is directed by Douglas Aircraft El Segundo Division in fixed wing aircraft, by Bell Helicopter Corp. in rotary wing aircraft, and is monitored by Office of Naval Research.

Development work is monitored and funded by Bureau of Aeronautics through its field activity—Aeronautical Instruments Laboratory of NADC.

Applications effort, also monitored and funded by BuAer, works through specific airframe contractors.

ANIP concept calls for showing pilot an analogy to visual (contact) flight to answer the prime questions: "What am I doing?" "How am I doing?" "What should I be doing?"



HORIZONTAL situation display portion of DV-4 panel has airplane reference in center, illuminated pointer above and to right of airplane, giving aircraft position relative to destination.

Vertical, flat transparent cathode ray tube in front of pilot presents analogy to what he would see looking out windscreen while flying contact. Another cathode ray tube presentation on horizontal plane in front of pilot makes use of small airplane symbol and map to give analogy to what would be seen looking out bottom of plane at ground. These elements are to answer what and how pilot is doing.

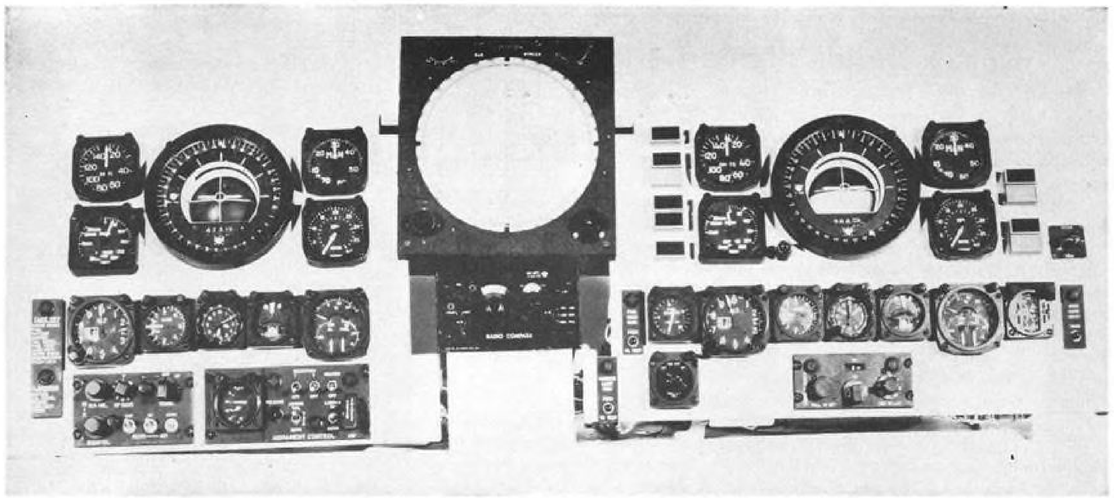
Answer to what he should be doing is to be provided by a "pathway in the sky" to be presented on vertical tube. Pilot flies to the path.

Data for the over-all presentation is to be gathered by various sensors aboard the aircraft, and information from these sensors is passed along to a central data computer in the aircraft. Computer results go to an electronic signal generator which changes computer output into proper signals to generate the desired indication on the proper indicator. Knotty problem in the program has been the signal generator.

Electronic Signal Generator

In April, Office of Naval Research announced existence of an electronic signal generator developed by Kaiser Aircraft & Electronics Division of Kaiser Corp., which will electronically present the pathway in the sky concept (AW April 28, p. 83). Development of this generator has been termed a significant step toward ANIP final goal.

Kaiser developed the unit with company funds, under no contract, as a proprietary item. While the unit is very new, apparent capabilities indicate it may have an effect on several pilot



FIRST rotary wing development phase panel, DH-2, shows pilot displays basically similar to conventional panels, but sensing and information presented is different. The DH-2 rotary wing effort has yielded operational equipment in the Sikorsky HSS-1N (AW June 23, p. 54).

To Aircraft

display projects now in stages varying from proposal to flight test developmental hardware fabrication.

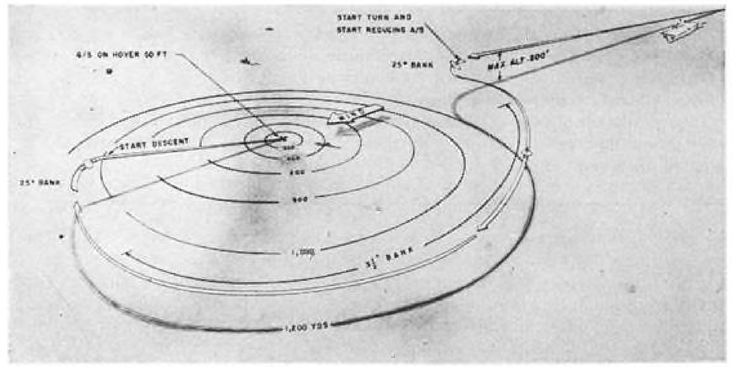
Since ANIP work manifests itself in many areas, a method of identifying work progress has been devised, which uses three symbols, two letters and a dash number. First letter is either "R" or "D" denoting research or development. Second letter is either "V" or "H" for fixed wing or rotary wing respectively. Dash number identifies the phase, with Army using odd numbers, Navy even. Thus, RV-1 would identify research, fixed wing, Army, first phase; DH-6 would specify development, rotary wing, Navy third phase.

Current Efforts

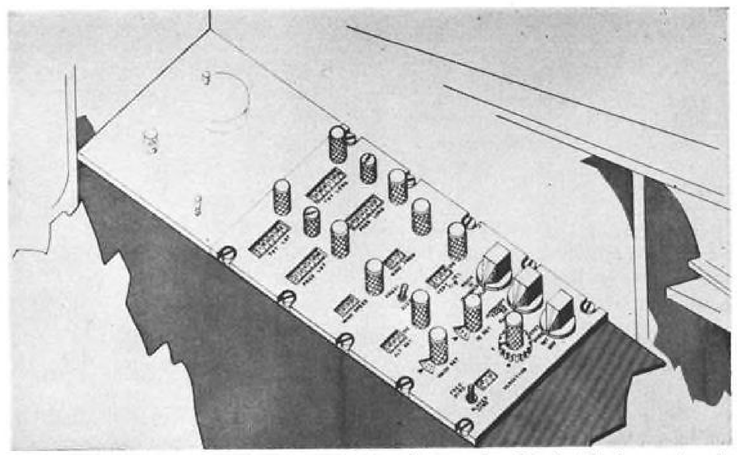
Current efforts in development area, including delineation of equipments representing three different phases which either are now or soon will be undergoing flight tests, were outlined in a paper by Louis Guarino, superintendent, Design and Stabilization Division, Aeronautical Instruments Laboratory.

Paper originally was delivered during closed session of ANIP symposium in Los Angeles last October (AW Oct. 21, p. 34), and recently has been declassified. Equipments described by Guarino are Aeronautical Instruments Laboratory developmental units, unrelated directly to flat tube equipment in flight test at Douglas El Segundo, which is actually a research tool.

Two fixed and one rotary wing efforts—DV-2, DV-4 and DH-2—were described in the paper. Another project touched on lightly was DV-10. The



PROGRAMMED anti-submarine warfare maneuver could be performed by the Sikorsky HSS-1N helicopter with instrumentation which is a product of the DH-2 phase of the Army-Navy Instrument Program. Maneuver calls for hovering motionless over water while headed into wind, dunking sonar, proceeding to next point to repeat operation.



DRAWING shows controls for the DV-4 installation. In this installation, automatic preprogramming for all flight modes is replaced by pilot manual inputs. The greatest apparent difference between the DV-2 and DV-4 units is in attitude display.

Kaiser Builds Signal Generator

Oakland, Calif.—Recently announced electronic signal generator developed by Kaiser Aircraft & Electronics Division of Kaiser Corp. today exists as one prototype model. However, company says, design is such that unit's capabilities can be expanded to meet any presently envisioned requirement, given proper funding and support.

Company has this to say about the generator which, although it was developed as a proprietary item, supplies the previously missing link in Army-Navy Instrument Program system chain of sensors—computer—signal generator—pilot display:

It will provide simplified, absolute spatial orientation to pilots under any weather conditions. It is flexible, adaptable to all types of aircraft. It can provide both immediate and short term (5 sec. to 1 min.) information which pilot needs. It provides for forward, backward (as in helicopter flight), lateral and vertical motion. It can accept inputs in form of voltage or shaft rotation, from any computer which presently is indicated in ANIP effort, and will be able to process any data these computers might furnish.

It can accept inputs from today's navigation aids such as VOR, ILS, even low frequency beams, with proper adaptation. It can accept inputs from today's vertical and directional gyros as well as from reference gyro systems, inertial stable platforms. It has flexibility in the type of illustration it can present to represent earth, sky, other data which would be shown in this display.

Kaiser says that within one year's time, again given proper funding and support, generator's status would be:

- Completely transistorized unit.
- Package of less than 1,000 cu. in., a 50% reduction from current size.
- Weight of from 2 to 3 lb., a 50% reduction from current weight.
- Capability of providing pilot with reliable analogy of real world.
- Flying in high performance aircraft.

Although degree of complication of the information to be processed would effect development time cycle, company says it feels generator can keep pace with all other elements used in ANIP display.

DV-2 and DV-4 equipments were purely stepping stones in hardware, with specifications decided as being within bounds of realistic accomplishment within time interval allotted.

The DH-2 rotary wing effort has yielded operational equipment in the HSS-1 helicopter, an anti-submarine warfare machine.

DV-2 involved modifying current instruments to yield a display on ANIP principles. Initiated in November, 1956, project had a time interval of approximately one year, was to satisfy requirements of a high visibility day fighter with ground controlled intercept capabilities. Equipment was to be evaluated in a T2V-1 aircraft.

First step was tabulating mission requirements, and situation and command information pilot needs were outlined for normal and intercept modes. In this, status and situation information were combined. Basic T2V-1 equipment was analyzed for human engineering aspects.

Track Control

Flight direction and command element of system was based on fact that any aircraft flight path is determined by its vertical and horizontal tracks with respect to a reference, such as earth. Control of these tracks to achieve a desired path is a function of speed, therefore, course, speed and vertical speed are only commands required for all flight modes.

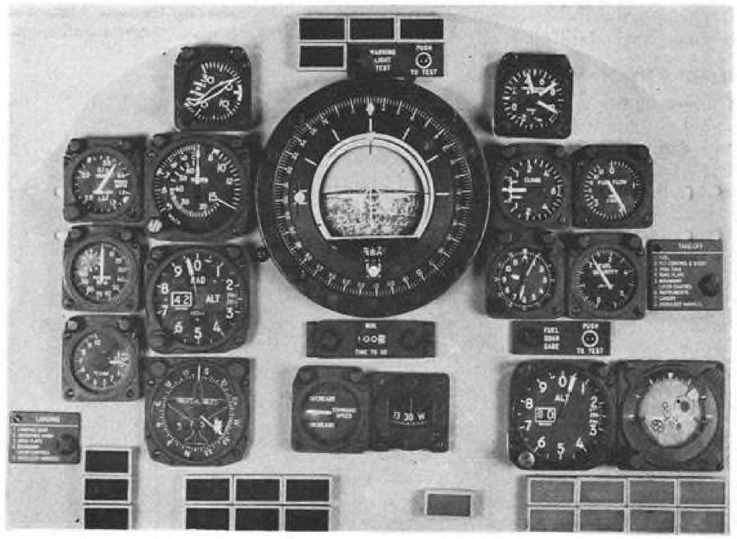
Real problem of flight command, the paper states, lies in establishing the desired path and determining optimum method of achieving it within structural and power limits of airframe. Airframe dynamics under all flight conditions, V-n diagram (plot of velocity and accelerations with curve indicating aircraft's structural limitations) at all altitudes and speeds become integral part of flight director and command system. These flight director requirements thus formed the design objectives of the central computer.

Computer involved is termed "Automatic Integrated Director Equipment," or AIDE computer, and its most important function is computing flight director information.

Ideally, Guarino says, it should be able to compute flight director information from continuous and automatic programming, but such a computer does not as yet exist for airborne applications. For DV-2 work, compromise was effected whereby pilot manually inserts parameters of existing flight conditions in place of automatic programming, after which computer arrives at desired flightpath.

Programming is accomplished by quickening, unburdening and command translation techniques developed for this phase from earlier studies conducted by Naval Research Laboratory. These programmed signals are then monitored by a mechanization of the V-n envelope so that optimum speed is continuously commanded, yet structural limits of airframe are never permitted to be exceeded. Programming is accomplished from a console.

Computer used for this phase is, Guarino says, effectively a three-dimensional dead reckoning navigational type computer providing for position and wind correction when plane is near a Tacan station. GCI or vectoring information is used in lieu when aircraft



DV-2 PANEL, which looks like today's panels yet gets its information from Army-Navy Instrument Program philosophy sensors and runs them through a computer, is devoid of duplication of gages or functions. Lower right gages are standbys for emergency operation.

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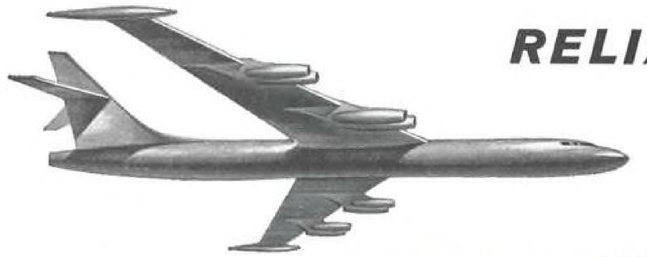

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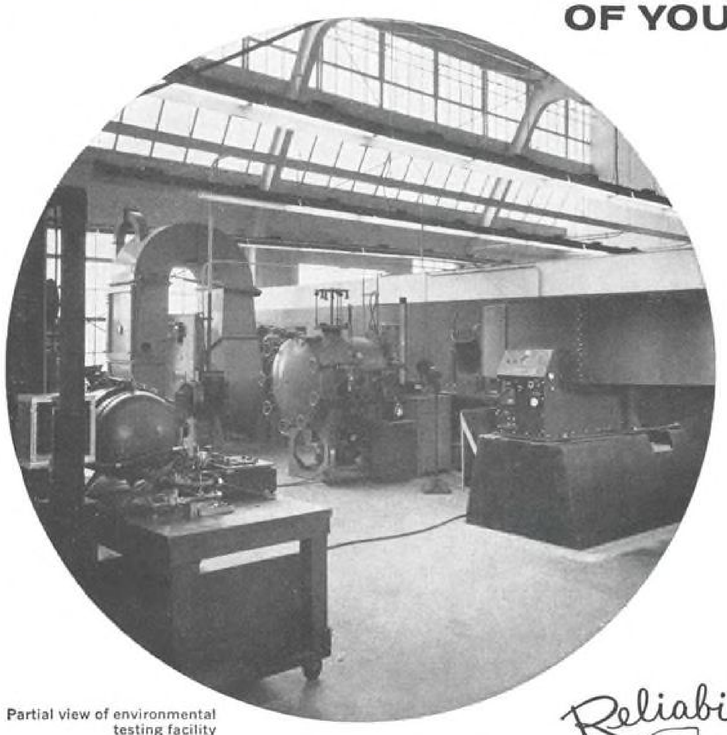

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is used in intercept mode. Three dimensional information is continuously computed and stored when aircraft is in GCI or vector mode, for use as required.

Several sensors are introduced in DV-2. Central gyro reference system, central air data system are basically new, and pressure ratio transducer is applied to aircraft as a status information generator, and for the intercept, the AN/USC-2 Discrete Address System is made a part of the system.

While the instrument panel resulting from this methodology does not show a radical departure from today's display, it is void of duplication, preserves the "three answer" objective of the research effort using presently available equipment.

Spatial Orientation

Spatial orientation is displayed in conventional manner, and cross pointers command the direction to be followed. Position with respect to destination or target is shown on central display as distance and bearing. Time to go to destination or target is shown as a counter. Below display is a row of instruments which are self-contained standby gages, could remain covered except in emergency conditions.

DV-2 panel now is being installed in T2V-1, with flights expected to start in August.

Reasons the DV-2 step was taken, since it provides little essential difference in what pilot sees, is that equipment behind the panel needs development as much as what the pilot sees, Guarino points out, and ironing out problems takes time, needs to be solved in flying hardware as well as in theory and on paper.

In addition, systems engineering approach was new to this application, needed to be tried, the results tested, before the basic philosophy became a keystone for future work. Otherwise, an undetected flaw might show up in several steps in the future, throwing entire previous work out of focus until error was discovered and proper remedy applied.

With DV-2 well under way, DV-4 was initiated in March, 1957.

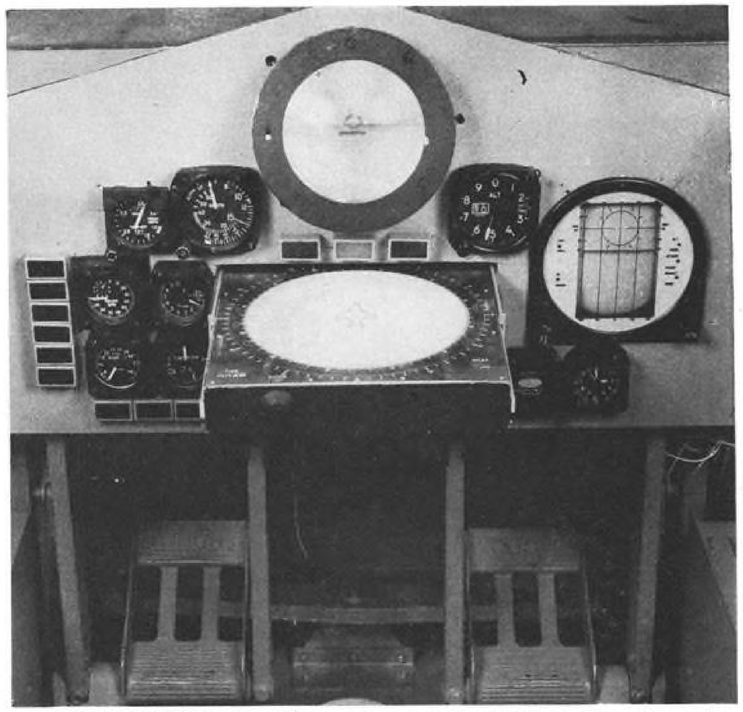
All-Weather Interceptor

Requirements were for all-weather interceptor, including vectoring, GCI, Low Altitude Bombing System (LABS), and airborne intercept. Fuel management was to be included in this effort. Approximately a one year time limit was applied to this effort.

DV-2 basics have been relatively well proved out, they were used as starting point for DV-4 work.

It was indicated that the following could be incorporated into this display:

- **Airborne intercept radar** could be integrated into the system at the lock-on point.
- **Flight range** and endurance data could be presented all along the mission profile so that point of return could be determined.
- **A computer known as LABSAC** which essentially removes necessity for an identification point could be included in the system.
- **Expanded navigation capability** based on great circle computation, and not limited by any latitude restrictions, was added.



DV-4 CONTROL PANEL as it would appear in an operational airplane is shown in a mockup.

Computer, based on these requirements, was to stay at same 25 lb. weight and ⅓ cu. ft. volume as had been obtained for the DV-2. It was to be operated from a console again with pilot manual inputs in place for the not-yet-available complete automatic programming.

Largest apparent difference between DV-2 and DV-4 units is in attitude display, with contact analogy development undertaken for DV-4 on two approaches.

One approach was electronic display generator for cathode ray tube presentation, the other was electro-mechanical. At time DV-4 was undertaken, it was determined that an electro-mechanical unit could be fabricated within the time limit, would be electrically and mechanically interchangeable with the central display in the DV-2 panel.

Kaiser signal generator was unknown at this time, and indications were that this type display would involve weight and volume penalties which were not worth tolerating, so electro-mechanical system was chosen.

Electro-mechanical display has grid lines, with apex moving toward pilot as a function of ground speed, apex moving laterally as function of turn rate, and cloud mass pictured above horizon to add more motion effect when turning.

Flight director display is in form of a plank, superimposed over other attitude information, as closest approach to "path in the sky" concept.

Relative Position

Horizontal situation display presents to pilot his position relative to a destination or target, with the objective shown as an illuminated reticle, yielding qualitative position information. Precise bearing can be read against magnetic heading ring or perimeter of display, while distance in miles and time in minutes to destination can be read out on counters. A scale changer is provided for the display.

DV-4 installation is being accomplished in a Grumman F9F-8T. A complicated radar installation is being accomplished, and plane is perhaps six months from flight test.

As in the DV-2, computer is keyed to dynamics of particular airframe, DV-2 for T2V-1 and DV-4 for F9F-8T. Both computers could easily be reprogrammed for any other airframe. In

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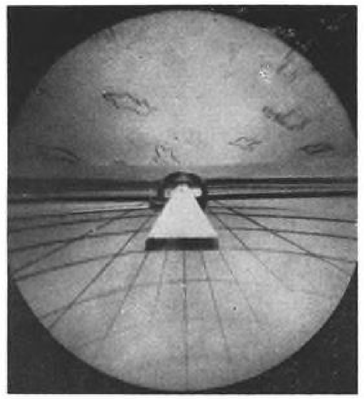

ATTITUDE display portion of DV-4 instrument panel uses plank to symbolize "path in the sky" concept, moving grid lines to symbolize ground speed, and variation of apex of grid to indicate turning. Unit is electro-mechanical.

both cases, use of the new equipments reduces gross weight of the aircraft, according to Guarino, leading to better airframe characteristics.

Following DV-4, next step will probably be designated DV-10, and mission will be a low-level attack-type. Here, the paper states, a great deal will depend on airborne equipment carried and its method of presentation. The value of this aircraft must be judged by adequacy of the pilot's environment.

To get best results, situation, command and aircraft status will be carried forward (although Kaiser generator almost certainly will make electronic signal system usable instead of electro-mechanical). New sensors appropriate for this particular mission will be added. New sensors will include a terrain clearance radar and a track-while-scan radar. Computer will further integrate the sensors and compute flight path from a programmer which considers all the sensors.

Investigated and found feasible for DV-10 are:

- **Addition of a servo** system activated from flight path signals to provide complete automatic flight throughout all attitudes, speeds and altitudes, with full monitoring from structural and power viewpoints.
- **Computation of flight path** from terrain clearance radar in accordance with predetermined instructions (preprogramming).
- **Use of signals** from track-while-scan radar to program path according to either strongest target, nearest target or most feasible target.

DV-10 work will bring forth equipment which would be of the level required for the proposed Douglas A4D production cockpit (AW Dec. 30, p. 56). Should there be a direct rerouting of the DV-10 equipment into the A4D program, designation would be AV-10, indicating application, fixed wing, Navy, fifth phase. In the AV-10 phase, the program would be carried through flight test and evaluation of the equipment for fulfilling mission requirement in A4D. Following this, ANIP designation would disappear, and project would become purely a production matter like the rest of the airplane, its systems and components.

However, it is emphasized that there is no direct link between the DV-10 and A4D proposal at the moment.

Considering the mission, it is more likely that a cockpit based on DV-10, with electronic path in the sky, will be proposed by AIL for the forthcoming Grumman low level attack plane, although there has been no official indication of this step.

Should DV-10 be rerouted toward a production airplane, the cathode ray tube presentation as in the A4D proposal most probably would be used, which is a conventional shaped tube rather than flat and transparent.

Also, indications are presently that while the path-in-the-sky could be used to present speed commands, the DV-10 changeover would probably use a conventional-appearing Mach-airspeed gage, but with readouts in computed state

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rather than raw information. A conventional-appearing altimeter would most probably be used. Engine gages would be conventional, and standby emergency gages covered.

Horizontal situation display would probably be the fixed airplane-moving map type, with a range circle incorporated and digital readouts also provided.

Illustrative of immediate payoffs, Guarino's paper outlined work done with HSS-1 helicopter, anti-submarine warfare craft. In accomplishing mission, pilot performs maneuvers comparable to a fixed wing ILS or GCA every 6 min. for a 4 hr. period.

Undertaken as DH-2, the development effort outlined requirements, integrated systems and developed an automatically programmed maneuver. Maneuver calls for hovering, motionless with respect to water, at present altitude of 20 to 50 ft. while headed into wind, and dunk the sonar, then proceed to next point and repeat the operation.

Computer-programmer developed for the mission, called Helicopter Integrated Director Equipment (HIDE), has provisions for long range navigation to target area, localized navigation in target area. It utilizes dead reckoning navigation techniques with Doppler correction for wind and preselection of dunking points, cruise altitude, cruise speeds and vertical speed rates. It computes flight path and issues director command signals for cyclic and collective control of aircraft.

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Although not the configuration of the DH-2 pilot display panel, the installation based on DH-2 has caused aircraft to be designated HSS-1N.

DH-2 panel itself provides complete instrumentation for pilot and copilot, and while presentations appear basically conventional, they are, like the DV-2, a basis from which future work can proceed.

An additional part of the ANIP program, a technique for measuring and evaluating human performance in aircraft has been developed, and equipment will be installed and used in the DV-2 flight test program.

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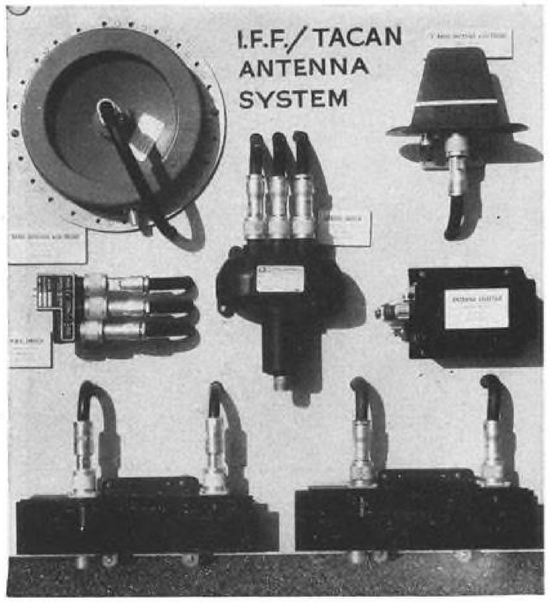
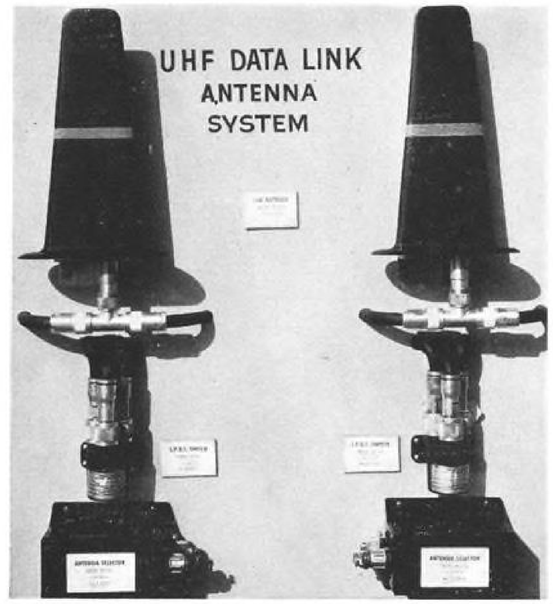




INTEGRATED antenna systems automatically select topside or belly antenna which provides optimum signal at the moment, also enable Tacan and IFF equipment to share a common pair of antennas and UHF and data link to share another pair.

Airborne Avionics Share Antenna System

Los Angeles—Antenna systems which provide more reliable communication, navigation and identification signals with only half as many aircraft antennas as previously, are now being produced here by Electronic Specialty Co. for use on all Century Series aircraft. One antenna system is used with Tacan and IFF (identification friend or foe) transponder; the other serves an airborne communications receiver, transmitter and data link system.

"Shadowing"

In recent years aircraft have employed two antennas, one mounted atop the fuselage or tail, the other in the belly, to get around the problem of "shadowing." Shadowing occurs when a portion of the airplane is interposed between antenna and the ground station as frequently happens during aircraft maneuvers.

With two antennas, the danger of shadowing is reduced but another problem arises: which antenna should be connected to the receiver-transmitter at any instant and when should the choice of antennas be changed. Systems which Electronic Specialty produces are designed to automatically solve this problem.

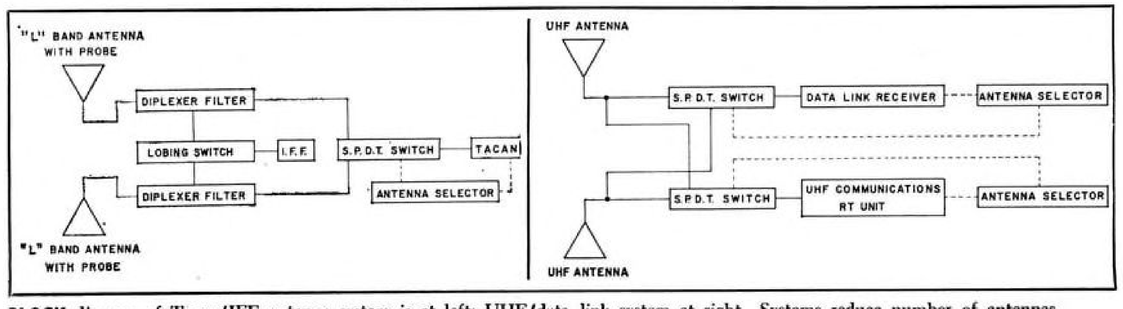
By means of two diplexer filters, it is possible to operate both IFF and Tacan equipment from a single pair of antennas (topside and belly) since both equipments operate in the 1,000 mc. band.

To assure that ground-based IFF interrogation will obtain a prompt reply from the airplane's IFF transponder regardless of aircraft attitude, the system employs a lobing switch which alternately connects the transponder to the belly antenna, then to the topside antenna, then back to the belly antenna at a rate of 20 cycles per second. The dwell-time in either position is sufficient for the aircraft to receive IFF interrogation and to make reply.

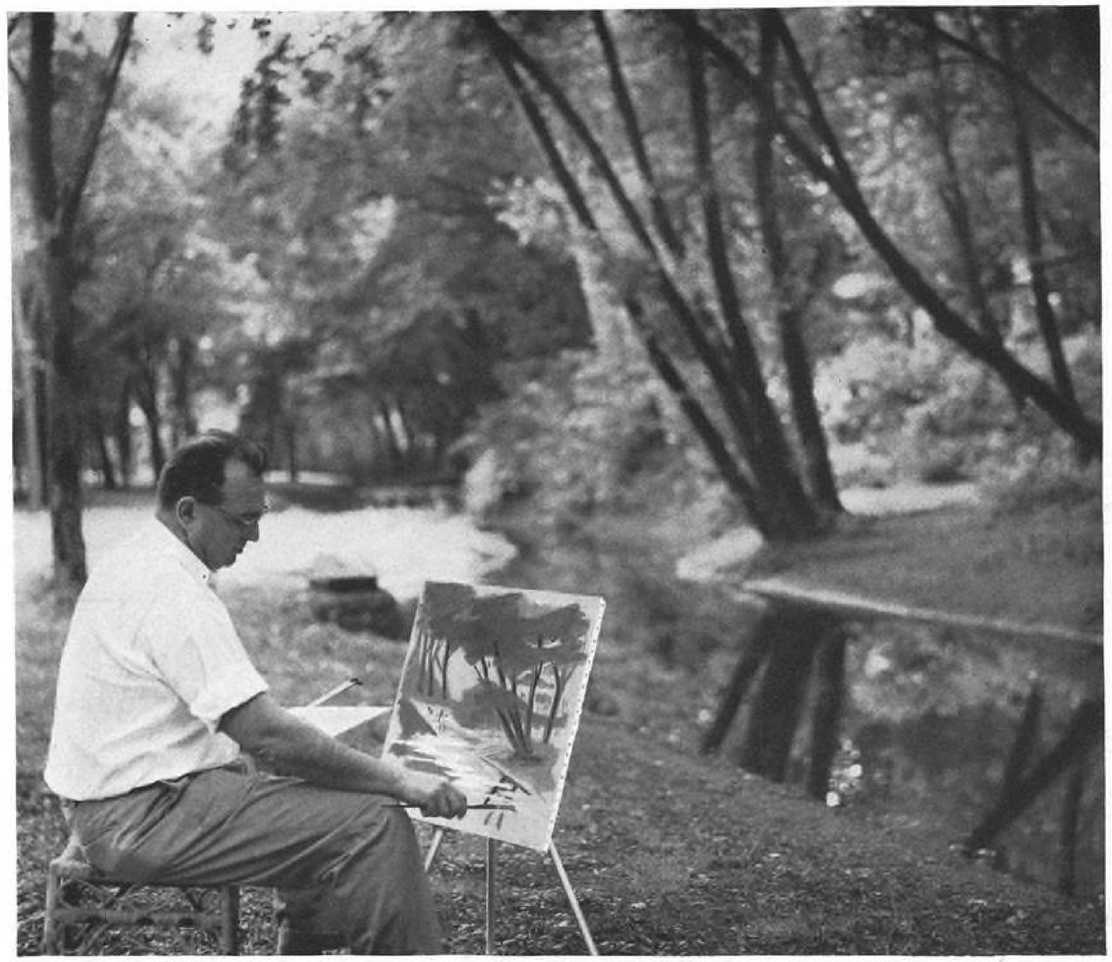
Lobing Switch

Lobing switch developed by Electronic Specialty employs splash lubrication of contacts and bearings to provide long, reliable service. Air Force requires the switch to pass a 1,000 hr. life test, or 72 million cycles without failure.

A signal-seeking arrangement is employed for selection of the optimum antenna for Tacan operation. Cycling switch transfers the Tacan receiver back and forth between the same pair of antennas used for IFF (isolated through diplexer filters) at rate of 70 cycles per minute. Selector picks the antenna with the strongest RF signal and stops cycling.



BLOCK diagram of Tacan/IFF antenna system is at left; UHF/data link system at right. Systems reduce number of antennas.



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When the RF signal drops below the pre-set value, the selector switches to the other antenna.

If no signal is available there, cycling continues until an adequate signal is obtained. During the cycling operation, the cockpit azimuth indicator is automatically disabled to prevent its giving an erratic bearing indication.

UHF Communications

Similar arrangement is used for UHF communications set and data link operation, but a different pair of antennas is employed because of the different frequency band. Automatic cycling operation stops when one of the two antennas provides sufficient RF signal to actuate the receiver squelch circuit relay. When the signal drops below the pre-set threshold, cycling automatically starts.

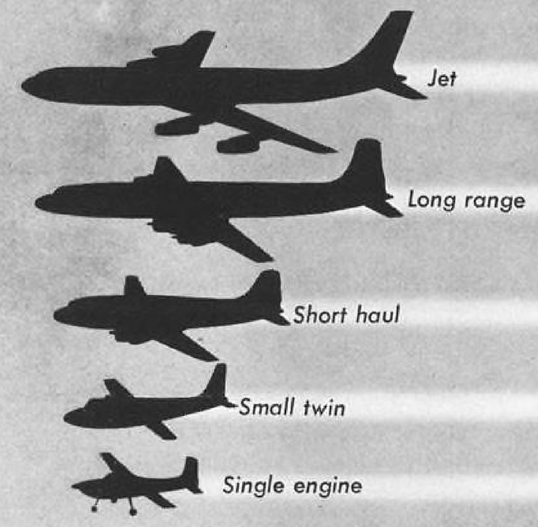
If the pilot wishes to make a voice transmission while the cycling operation is under way, indicating lack of sufficient RF signal from either antenna, the Electronic Specialty system "remembers" which antenna provided the last usable signal and automatically connects the transmitter to this antenna when the pilot pushes his microphone button.

Data link equipment has its own cycling switch and antenna selector, designed to seek the optimum signal antenna independently of the UHF communications antenna selector. Both can share the same antenna or operate

F-27 Gear Control

Integrated landing gear control used in Fairchild F-27 includes individual gear up-down indicators, wheel shaped control handle which is held in down position by solenoid until weight is lifted from landing gear to prevent inadvertent retraction on the ground. Warning light can be checked by pilot when desired. Entire panel is internally lighted in accordance with MIL-P-7788. Device is made by Avionic Products Engineering Corp., Dover, N. J.

FUEL FLOW SYSTEMS HEADQUARTERS



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from different antennas, depending upon the particular situation. However, at such times as the pilot is using his UHF transmitter, the data link set is automatically connected to the other antenna to provide at least minimum service, rather than disabling the data link transmission duration.

The single-pole double-throw (SPDT) coaxial antenna switch, developed by Electronic Specialty, weighs only 5 oz., has a switching time of 10 milliseconds. The two solenoids used each draw 0.3 amp. at 28 v.d.c.

The IFF/Tacan diplexer filters each weigh 1¼ lb. and measure 4 x 3½ x 2 in., considerably smaller than former equivalents, according to the company. Electronic Specialty Co.'s address is: 5121 San Fernando Road, Los Angeles.

Summers Gyroscope Ends Merger Talks

Los Angeles—Plans for proposed merger of Summers Gyroscope Co., Inc., Santa Monica, Calif. and Mercast Corp., (Atlas Corp. subsidiary), have been terminated. Both companies felt that it was not feasible or practical to merge because of the size of the Summers deficit. Company officers felt that Mercast shareholders would not approve the required agreement.

Discussions with the parent Atlas Corp. culminated in a $150,000 loan to Summers Co. at 6% interest, due June 15, 1963, with proposal for an additional $425,000 loan in periodic advances to be completed by first week of October, 1958.

Under January agreement between Summers and Mercast, Summers was loaned $284,205.05 on 6% subordinated promissory notes, principal and interest due March 1, 1960. These notes will be convertible into common stock of the company at any time prior to their maturity on basis of $1.50 per share, taking such notes at face amount plus any accrued unpaid interest.

Atlas also has proposed to use its efforts to obtain additional financing, not to exceed $925,000, on basis under which entire amount of additional financing would be furnished and convertible into common stock of the company on same basis, including conversion rights and options. However, there is no obligation of Atlas to provide or Summers to accept such financing.

Summers recently moved into its new 100,000 sq. ft. plant which utilizes extensive dust-free controlled atmosphere conditions for making precision instruments for aircraft and missiles.

Air Force has awarded Summers a new $1,700,000 contract for improved vertical gyro indication system which is smaller and lighter than predecessor model and gives added performance.

AMB Contracts

Washington—Airways Modernization Board obligated over 99% of the $15.1 million appropriated for its activities during first year of its existence, launching total of 24 equipment development programs and studies. List of AMB programs now under way, assigned contractors or government agencies, and amounts of the contracts follows:

CONTRACTOR	PROGRAM	AMOUNT
Airborne Instruments Laboratory, Inc.	Analysis of air traffic in the New York terminal area	$149,000
The Franklin Institute of the State of Pennsylvania	Operations analysis of air traffic demands and delays in the New York ARTCC area	59,000
Human Science Research Inc.	Evaluate and report on human engineering applicable to airport lighting and marking systems	40,000
United Research Inc.	Method for determining economic value of AMB program with application to landing system program	44,000
University of California	Investigating and establishing configuration of high-speed exit taxiways from runways	66,000
Airborne Instruments Laboratory, Inc.	"Quick reaction" engineering and scientific professional services	33,000
Aircraft Armaments, Inc.	Simulator for use with GPL data processing and display system	1,878,000
Cornell Aeronautical Laboratory, Inc.	"Quick reaction" engineering and scientific professional services	23,000
The Franklin Institute of the State of Pennsylvania	"Quick reaction" engineering and scientific professional services	17,000
International Business Machines Corp.	Fast-time simulation and statistical data	57,000
General Precision Laboratory, Inc.	ATC data processing central	8,245,000
Radio Corporation of America	Experimental automatic ground/air/ground communication system	1,401,000
Airborne Instruments Laboratory, Inc.	Experimental use of hyperbolic navigation system for helicopter	163,000
Bell Helicopter Corp.	Modification of H-13H helicopter with special instrumentation and flight training of AMB personnel	48,000
Bendix Aviation Corp., Pacific Division	Rental of Bendix-Decca navigation system for experimental helicopter operations	175,000
Mills, Petticord and Mills	Survey, evaluate and report on sites for AMB's proposed research center	9,000
Mills, Petticord and Mills	Preparation of plans and specifications for construction of 2,000' extension to runway 13-31 at NAFEC	$133,000
New York Airways, Inc.	To fly and report on performance of Bendix-Decca airborne navigational equipment	82,000
	Total—Private contractors	12,622,000
Department of Commerce, Civil Aeronautics Administration, Technical Development Center	Miscellaneous projects for the Directorates of Systems Analysis and Development	$1,139,000
Department of the Navy, Chief of Naval Research	Human factors work in problems of ATC	40,000
Department of the Air Force	Establish design parameters for landing control set	15,000
Department of the Navy, Bureau of Aeronautics	Miscellaneous projects for the Development Directorate	345,000
Department of the Navy, Bureau of Ships	Modify beacon interrogators and develop beacon video test equipment	65,000
Department of Commerce, Weather Bureau	Operate weather service at NAFEC	9,000
Total—Other Government Agencies		1,613,000
GRAND TOTAL		14,235,000

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B-58 Avionics Gear Tested on KC-97

Avionics nose section of Convair B-58 Hustler bomber is fitted to nose of Boeing KC-97 tanker, which will be used as testbed for Hustler's navigation equipment. Testing is being done by Sperry Gyroscope Co. at Air Proving Ground, Eglin AFB, Fla.

Expansions, Changes In Avionics Industry

The Ramo-Wooldridge Corp. has regrouped its major divisions and reassigned top-level responsibilities, following recent announcement of plans to merge with Thompson Products (AW July 7, P. 28). New shifts include:

• **Dr. Ralph P. Johnson,** formerly vice president for research and development, becomes group vice president in charge of the General Electronics Group of divisions, responsible for research, engineering, manufacturing and administrative activities of the company except those of Space Technology Laboratories and the Thompson-Ramo-Wooldridge Products Co., both of which report separately to the president.

• **Dr. Burton F. Miller,** formerly vice president in charge of Communications Division, becomes vice president in charge of advanced systems planning.

• **Milton E. Mohr,** formerly vice president in charge of Control Systems Division, becomes vice president of engineering, responsible for Control Systems, Communications Division and the Electronic Instrumentation Co., an R-W division located in Denver.

• **Irwin A. Binder,** vice president, manufacturing, will be responsible for these activities at both Denver and Los Angeles facilities.

Other recently announced changes and expansions in the avionics field include:

• **Adams-Russell Co., Inc.,** Cambridge, Mass., is name of newly formed company that will engage in electronic research, development, consulting and manufacturing. Address: 292 Main St.

• **Pyrometer Co. of America,** Penndel, Penna., is new firm organized to manufacture instrumentation, thermocouples and accessories. President is John V. Metzger. Address: 600 East Lincoln Highway.

• **Stanford Research Institute** has formed a Radar Aerophysics group within its engineering division to conduct applied research in radar meteorology. Dr. Myron H. Ligda heads new group.

• **General Controls Co.,** Glendale, Calif., will build $2 million engineering and manufacturing facility. First unit of plant will be 70,000 sq. ft., with plans for future expansion to 280,000 sq. ft.

• **Bruce Industries,** Gardena, Calif., has formed new Atohm Electronics Division which will produce miniature trimmer potentiometer. George Elliott heads new division.

• **International Electronic Research Corp.,** Burbank, Calif., has licensed two other companies to manufacture its heat dissipating tube shields. Cinch Manufacturing Corp., Chicago, will make and sell tube shields throughout U. S. Europelec, Les Clayes, Sous-Bois of Paris, France, will produce and sell shields in France. Italy, Germany, Switzerland, Holland, Belgium, Luxembourg and French possessions.

FILTER CENTER

▶ **Landlocked Whale**—Mobidic, a mobile digital computer mounted in a standard 28 ft. trailer, is being developed for the Army Signal Corps by Sylvania Electronics Products, Inc., to solve a wide variety of military problems ranging from battle strategy to logistics. Computer will be entirely transistorized and designed to function under battlefield conditions anywhere in the world.

▶ **Novel Conference**—There will be no formal papers delivered at Electronic Industries Assn. Conference on Reliable Electrical Connections, to be held Dec. 2-4 at the Statler-Hilton hotel in Dallas. Technical papers will be available at least 30 days prior to conference, according to present plans. Authors will merely give a 5-minute summary, then devote remainder of time to questions from the floor.

▶ **Signed On Dotted Line**—Major contract awards recently announced by avionics manufacturers include:

• **Allen B. Du Mont Laboratories, Inc.,** $311,485, for establishment of technical laboratory at Airways Modernization Board's new National Aviation Facilities Experimental Center in Atlantic City.

• **Bendix Radio,** more than $½ million from Civil Aeronautics Administration, for airborne radar, navigation and audio systems to be installed on recently acquired CAA aircraft.

• **Philco Corp.,** $1 million contract from Army, for installation of two inter-battery microwave communications systems between Nike missile sites and anti-aircraft operation centers in Alaska.

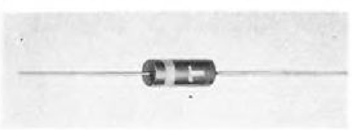
• **North American's Autonetics** Division, $10 million Air Force contract, for spare parts for MG-4 fire control system used in F-86Ks, employed by four NATO countries.

NEW AVIONIC PRODUCTS

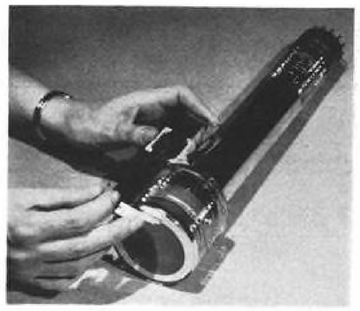
Components & Devices

• **Silicon voltage references** with temperature coefficients to 0.001%/deg. C are available in an axial package.

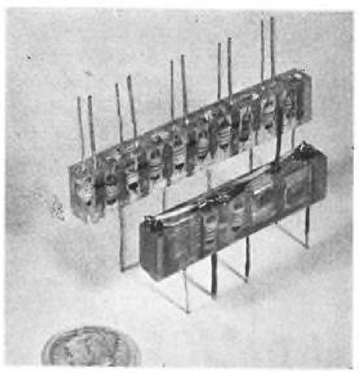
Reference voltage is stable over the operating range from −55 to +100C. References consist of hermetically sealed glass diodes capable of operating in any position. Transitron Electronic Corp., Wakefield, Mass.



• **Image orthicon tube,** Type WL-7198, is designed for extreme environmental conditions of shock, vibration, temperature and humidity. Tube will withstand vibration with 10G's acceleration up to 500 cps, as specified in MIL-E-5272A. At 5G's acceleration (50 to 500 cps.) tube shows horizontal resolution of at least 350 lines with 0.01 foot-candles illumination on the photocathode. Shock of 30Gs does not impair subsequent operation. Tube is sufficiently sensitive to provide 250 line horizontal resolution with 0.0003 foot-candles illumination of the photocathode. Westinghouse Electronic Tube Division, P.O. Box 284, Elmira, N. Y.



• **Cast modules** allow semiconductor and passive circuitry packaging densities to 74%. Instrument sticks are replaceable and repairable. Used with printed circuit boards, they provide wiring in three dimensions. With low power circuits, modules can be encapsulated with thermal lag packaging, while when wrapped together they can withstand severe shock. Lind Corp., 1181 Hughes Drive, Trenton, N. J.



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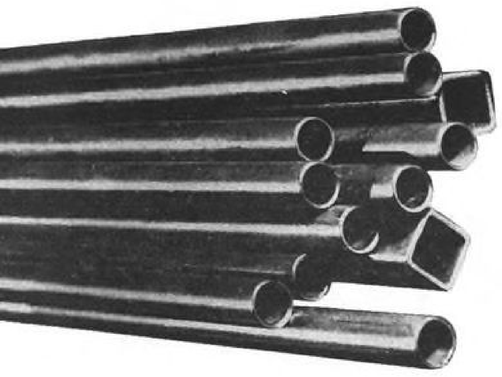

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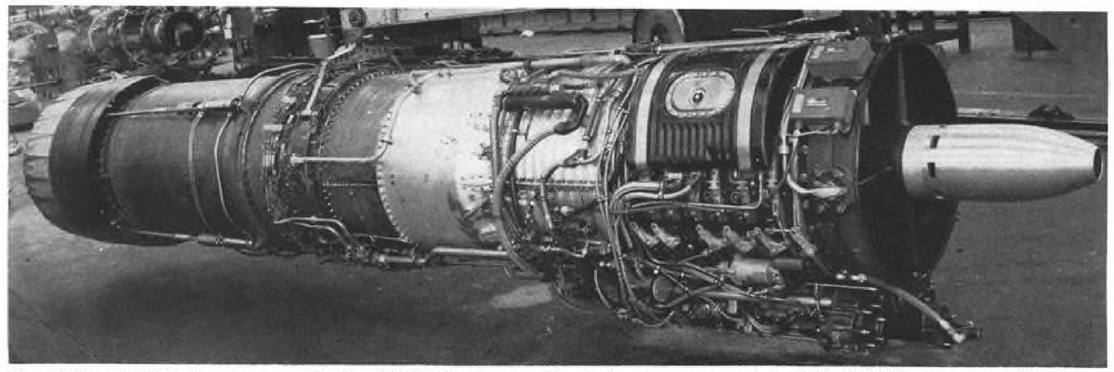


General Electric J79 jet engine can develop 18,000 lb. thrust with afterburning, compared to J47's, 7,500 lb. in same weight class.

J79 Uses Built-Up Parts to Save Weight

By J. S. Butz, Jr.

Evendale, Ohio—General Electric J79 turbojet, which is powering most of the Mach 2 aircraft in the U.S., has set a new standard for lightness, primarily through the maximum possible use of built-up sheet metal parts to carry the main engine loads rather than the more traditional castings and forgings.

Record of these built-up parts in service use to date has upheld General Electric's contention that this light type of construction would afford reliable operation while providing very high thrust-to-weight ratios and correspondingly good aircraft performance.

Basic engine weight of the Phase I J79 is about 3,200 lb.; thrust with afterburning is around 18,000 lb. This thrust-to-weight ratio of much better than 5.0 mostly explains the fine performance of such Mach 2 aircraft as the Lockheed F-104, which presently holds both the world altitude and speed records of 91,249 ft. and 1,404.19 mph; the Convair B-58 which outperforms most fighters, and the Chance-Vought Regulus II missile.

Newer aircraft such as the North American A3J and the McDonnell F4H use the improved Phase II engine which is roughly the same weight as the Phase I but has about 6% better thrust and specific fuel consumption. This is primarily due to an increase in turbine diameter of about 2 in.

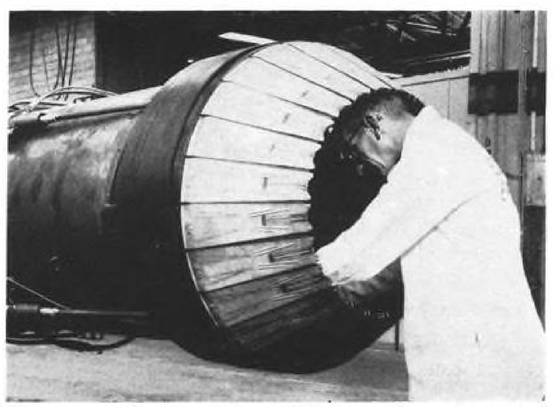
Total Running Time

Total running time on all dash numbers of the J79 is now well over 57,000 hr., including more than 10,220 hr. of flight time. Indicative of the type of use this has been, and the wide application that the engine has found, is the General Electric report that on one single day in June there were five aircraft in the air at the same time over the U.S., all traveling over Mach 2 and all J79 powered. They were the Grumman F11F, Convair B-58, McDonnell F4H, Chance-Vought Regulus II missile and the Lockheed F-104.

On the maintenance side, the early dash numbers of the J79 which have seen the most service have an approved time between overhaul of 300 hrs. The man hours required to accomplish this overhaul are difficult figures to arrive at because most overhauls include a good deal of retrofitting. Also, the experience of the facility performing the work is an important factor.

However, some of the civil firms that are bidding for the airlines' jet overhaul business are basing their cost estimates on 800 man hours to overhaul the CJ805, the commercial version of the J79.

Basically, the design philosophy behind the J79 is similar to that being



Variable stators are adjusted by General Electric technician (left). Exhaust area petals open or close (right) for maximum thrust at all speeds and altitudes. Photo shows the petals in closed position.

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Please write to: Mr. A. H. Stevenson, Engineering Personnel, North American Aviation, Los Angeles 45, California.

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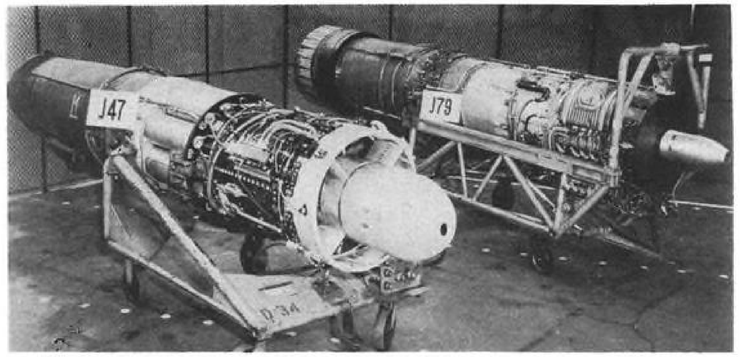


RATIO of hub-to-tip diameters is much larger on J79, allowing greater airflow and rated thrust. Length is 226.5 in. for J47 and 207 in. for J79 engine.

used today by General Electric and the Air Force in the development of the J93, Mach 3 turbojet. That philosophy is to mate a new engine with one particular air-frame.

The J93 is being designed specifically for use in the North American B-70, and the J79 was intended for the B-58 from its inception to give maximum performance to that engine-airframe combination. This design approach calls for close cooperation in all phases of the design between the airframe and powerplant manufacturers and certainly does not rule out using an engine to good advantage in other aircraft.

Navy Philosophy

The Navy is using a different philosophy in designing a Mach 3 engine. It is having Pratt & Whitney carry the J58 well into the testing phase before contracting for an airframe to use the engine. This procedure is to fix the engine's capabilities firmly before relying upon it in designing a weapons system. It would prevent the recurrence of the unhappy situation when the Navy's first group of transonic aircraft were almost all designed around the J40. The engine failed to meet its predicted performance.

Three primary requirements for the J79 were stipulated in 1952 so that it would provide the proper power for the B-58 at all design speeds. These three requirements remained more or less fixed throughout the detailed compromises between Convair and General Electric that resulted in a workable weapon system. They were for the J79 to provide:

- **Minimum thrust-to-weight ratio** of 5.0 to give the aircraft the desired speed, altitude and acceleration performance.
- **High thrust at Mach 2** at 35,000 ft. and above.
- **Efficient subsonic cruise at** about Mach 0.9.

The engine also was to be ready for production in 1956.

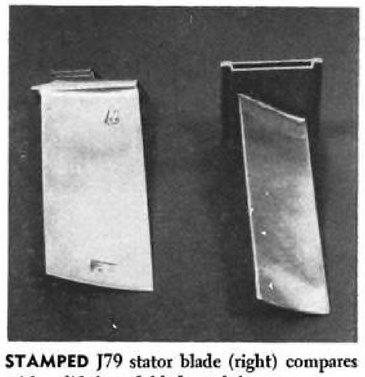
To meet the Mach 2 specification a maximum air flow of about 162 lb. per sec. was needed, and this meant using a very high tip-to-hub ratio compressor if the engine frontal area was to be adequately small. The engine also would require a large compressor of 17 or more stages to get the compression ratio of 12 to 13 needed for good fuel consumption at subsonic speeds.

In selecting the type of compressor, General Electric conducted two concurrent and separate studies of dual rotor and variable stator designs. The other known method of obtaining proper compressor operation at both supersonic and subsonic speeds, using pop-off valves on the rear compressor stages to prevent compressor stall and forward flow of air out of the compressor was judged to waste power and to be relatively inefficient.

The variable stator approach was chosen because it indicated a considerable weight saving through use of only one shaft and three main bearings in comparison with two shafts and nine main bearings with the dual rotor.

Final compressor design has a 17-stage rotor with 19 stator stages. The first six stators and the inlet guide vanes are variable.

Need for only three main bearings



STAMPED J79 stator blade (right) compares with solid forged blade at left.

Russians Show Vertical Takeoff Rig

Flight demonstration of Russian "Flying Table" vertical takeoff rig was made at Moscow's Tushino Airport (AW July 28, p. 24). Vehicle was designed by A. Raphaelyantz, is powered by single turbojet which bleeds flow off to control jets on four legs.

made it possible to use only three frames in the engine, a front frame ahead of the compressor, a compressor rear frame and a turbine frame with each of the frames housing a bearing. Decision was made to carry all of the engine bending loads in the outer casing and use it to keep the frames properly aligned. This promotes lightness by making maximum use of the material furthest away from the bending axis. Carrying this a step further, a conical shaft, which is lighter for a given strength than a cylindrical shaft, is used to connect the three stage turbine with the compressor rotor.

Structural Materials

Selection of the engine's structural materials and fabrication techniques centered mainly about handling the high stresses imposed by Mach 2 operation and providing the highest possible turbine inlet temperatures for greatest thrust and lowest possible specific fuel consumption at cruise.

Steel was chosen as the primary material to be used in the hot parts of the engine.

Titanium, which is finding favor with many engine manufacturers for supersonic use, was rejected because of its cost even though General Electric had generally overcome its early problems in learning to fabricate the metal in the J73.

For Air Force models of the J79 only, the front frame and the forward compressor casing, the cooler portions of the engine, are not made of steel. The front frame is a casting and the forward compressor casing is a machined forging both of a light metal such as a magnesium-thorium alloy.

The remainder of the engine, the two aft frames and the outer casings, are made of sheet steel stampings welded together and to flanges to form integral units. The compressor rear frame and the turbine frame, which house the bearings and the struts which carry the bearing loads out to the casings, are both made of stamped pieces of steel welded together.

The jigs and welding techniques needed to produce these built-up assemblies on a volume basis represent a major accomplishment for the General Electric Aircraft Gas Turbine Division's production dept.

The Navy version of the J79 uses steel throughout the engine because of the salt water corrosion problem with magnesium and the lighter metals. Built-up sheet steel construction is used on the front frame and the forward compressor casing. This increases the engine weight slightly but has the advantage of raising the allowable compressor inlet temperature and the maximum operational Mach number.

Other parts on the J79 that are made by welding stamped steel pieces together include many of the stator blades in the compressor. Compressor rotor blades, the turbine blades and some of the hotter stators are forged in the usual manner. The turbine blades are attached to the wheels with double tang fir trees and the compressor blades use a single tang.

Compressor wheels are bolted together with torque rings between them to secure the blades in the wheels and keep them in place. This, in effect, gives the compressor a conical shaft. The conical shaft joining the three turbine wheels to the compressor is a

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solid piece of metal that is formed by a cold power spinning operation. This operation is similar to hand spinning on aluminum except that a machine takes a premachined forging of steel and shapes it around a mandrel using about 400,000 psi. pressure.

The premachined forging that the machine begins with is 11 in. long. After a few minutes, the machine has formed it into the required conical shaft 31 in. long. Prior to the acquisition of this machine from the Cincinnati Milling Machine Co., the shafts were made by machining a large forging so that about half of its original weight was lost as chips, and the fabrication time was many times longer.

Phase II Front Frame

Front frame of the Phase II engine will have eight struts compared to four on the Phase I dash numbers. Main reason for this is to improve the anti-icing characteristics of the engine. Hot air is bled from the compressor through the front frame struts and the inlet guide vanes to prevent the formation of ice and allow all-weather operation.

Compressor casing actually comes in three sections for the Air Force engines. A small casing is placed between the forward magthorium casing and the rear steel casing to allow for the differences in their expansion qualities. On the Navy engines with all-steel casings, only two sections are needed. All of the compressor casings are split lengthwise into two sections to allow easy inspection and maintenance.

The variable stator blades on the compressor and the inlet guide vanes are actuated by two cylinders that are hydraulically operated on some of the early Phase I engines, but this has now been changed and the high pressure fuel provides the power for these cylinders before it is fed into the engine. This eliminates one of the hydraulic pumps from the engine accessory system.

Moving aft from the compressor section, the combustion casing is in one piece on the Phase I models but has been split into two pieces for the Phase II production and adds a little weight but relieves a difficult inspection problem with the combustors. The combustion chamber is all sheet steel and is a hybrid cannular and annular design. It employs cans situated in an annular section.

The turbine casing is split longitudinally on all models allowing easy inspection and maintenance of the interior of the turbine section.

The afterburner appears to be of conventional sheet steel construction and it is cantilevered off the turbine frame and is otherwise unsupported. It employs a type of aerodynamic flame holding that affords a minimum of drag

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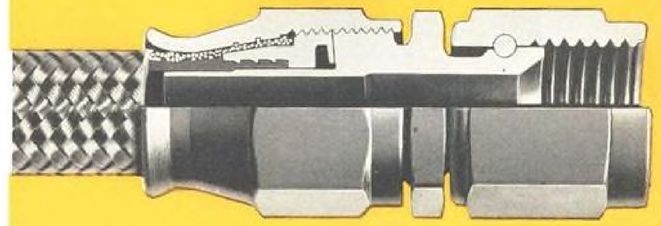

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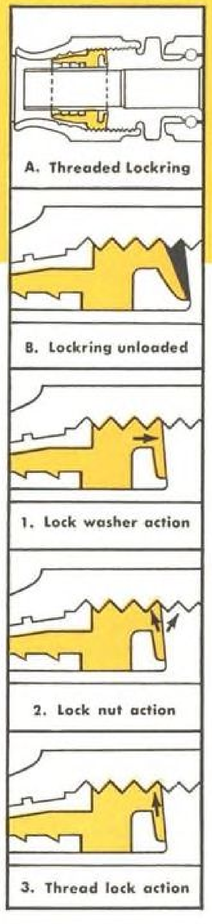

A Threaded lockring grips braid tightly; buried, it's tamper-proof.

B Before tightening—nipple about to contact coned disk of lockring.

1 Tightened . . . spring action of coned disk locks threads in compression.

2 Male threads are securely wedged against flanks of female thread.

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when the afterburner is not operating. In order to provide a high propulsive efficiency at supersonic speeds, the afterburner has to discharge the engine gas flow through a supersonic converging diverging nozzle. The J79 makes use of cooling air flowing around the engine to help provide the nozzle effect.

This secondary cooling air enters the afterburner near the aft end and is baffled so that it strikes the main gas stream nearly at right angles. Mixing of the two gas flows is negligible and the main gas stream is contracted. To complete the supersonic nozzle effect, the exhaust area of the afterburner is variable. It consists of interlocking steel fingers in a petal arrangement. Power for this nozzle system is provided by hydraulic actuators operated off of the engine oil system.

The variable area petal arrangement which controls the existing area of the afterburner is being modified on some of the newer dash numbers to provide a lower base drag for the subsonic cruise condition (afterburner is not operating).

During subsonic cruise the required exhaust area is relatively small, and the petals are almost fully closed. To decrease the afterburner base drag in this condition, the length of the petals is being increased so that the effective fineness ratio of the exposed nozzle is increased.

Power Control System

Power control system for the J79 is tied together to the extent that the pilot has only one lever to operate. The main fuel system for the basic engine, the afterburner fuel system, the variable stator control and the afterburner nozzle control are all integrated into one unit. Power for this control system is primarily hydraulic mechanical with electric trim. Information needed by the system to operate properly is believed to be limited to turbine discharge temperature, compressor inlet temperature and engine rpm.

The engine is mounted in an aircraft by the front compressor frame and the turbine frame. Side and vertical loads are taken out through the compressor front frame. Two suspension points are available there, and two of them must be used.

Thrust loads are taken out through the turbine frame which has three uniball fittings for thrust pins. The B-58 uses one of these and the F-104 two. Aft side loads are taken out through four tangential mounting links on the turbine frame.

Engine lubricating system is self-contained with the sump pressure provided from the compressor and the cooling from the fuel before it is burned.

U.S. Army Interested In Voltigeur SE-116

Paris—Interest shown by the U.S. Army in Sud Aviation's new turboprop multi-purpose aircraft, the SE-116 Voltigeur, has led to license talks between the French company and Beech Aircraft Corp.

Voltigeur first flew in early June (AW June 30, p. 65).

Initial flight tests are being carried out with two Curtiss-Wright R1300 powerplants. These engines will be replaced by two Turbomeca Bastan turboprop engines producing 740 eshp. each.

The 116 model is a three-seater which cruises at about 280 mph. Landing gear is tricycle type.

United States Army interest reportedly centers on an enlarged version of the Voltigeur which carries the designation 117. The main difference between this aircraft and the present Voltigeur is an enlarged fuselage which will permit carrying of five passengers in addition to the crew. Prototype of the 117 is presently under construction and the company expects to fly the aircraft by the end of this year.

The 117 Voltigeur would be a multimission aircraft. Besides liaison chores, the aircraft would fly observation missions and be equipped to make ground attacks once a target is established. The 117 reportedly would fly some seven hours. Observer takes up a prone position in a Plexiglas nose section. Photos of the present Voltigeur indicate an interchangeable pack fits under the fuselage which presumably would contain armament or photo equipment.

Voltigeur was developed by Sud Aviation at the request of the French government. Idea behind the project is to provide the military with a multipurpose aircraft which can be used in local conflicts where enemy air opposition is practically nonexistent.

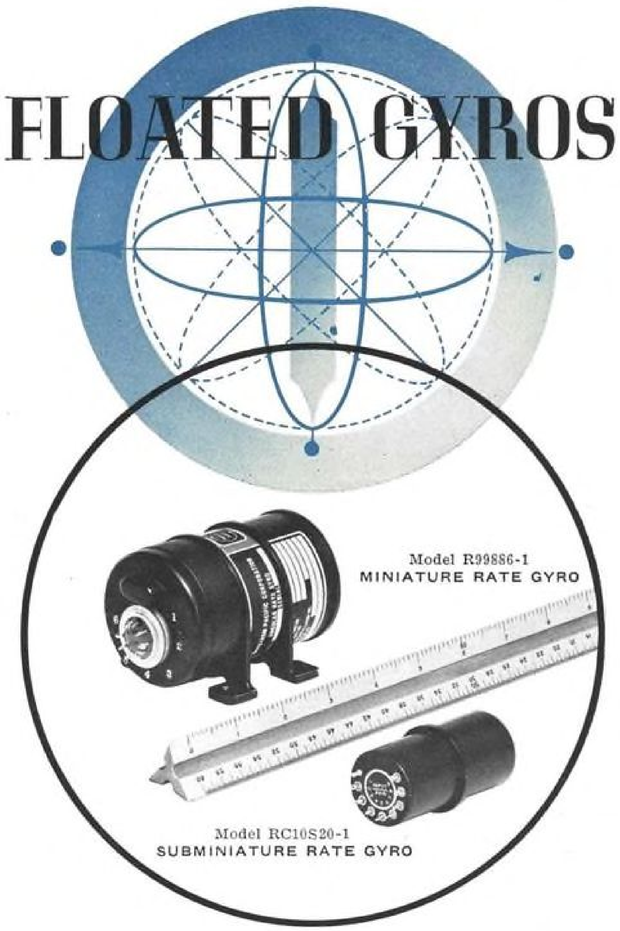
Voltigeur is one of four French projects designed to fit this concept. At present it seems that Sud Aviation's entry enjoys the most favor. Other projects are Morane Saulnier's Epervier and SIPA's 1100. The Epervier has fixed gear and is powered by one Bastan turboprop. The SIPA aircraft presently is powered by two Pratt & Whitney R1340 engines.

First SIPA prototype crashed recently, killing the test crew. Second prototype is under construction despite reports that the Voltigeur is the winning entry.

Latecomer to competition, AVIATION WEEK has learned, is the Dassault 415 Flamant. Capable of carrying eight passengers, the Dassault aircraft is powered by two Bastan turboprops. The aircraft is expected to make its first flight in December.

potentiometers / gyro instruments / airborne products

FLOATED GYROS



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Navy Contracts

Following is a list of unclassified contracts for $25,000 and over as released by U. S. Navy contracting offices:

DEPARTMENT OF THE NAVY, Bureau of Aeronautics, Washington 25, D. C.

Westinghouse Electric Corp., Washington, D. C., materials and services to remove, pack, crate and preserve government owned machine tools and other capital equipment, (NOa-58-053-c)IP-3-4520-58), $397,978.

Sikorsky Aircraft Division, United Aircraft Corp., Bridgeport, Conn., modification of helicopters, model HR2S-1 in accordance with BuAer change notice Aer-AC-422(IBCC no. F1052), NOas 58-589-r(PD-22-152-58), $1,996,665.

Stauffer Chemical Co., Richmond, Calif., research and development program to investigate new high energy monopropellants for liquid rocket engines, NOas 58-667-c (PP-22-1695-58), $63,758.

Aerol Co., Inc., Los Angeles, Calif., develop, design, fabricate, test and furnish individual unit suspension systems, NOas 58-608-f(MA-55-3686-58), $65,802.

Northwestern University, Evanston, Ill., analog studies of armament control systems and associated equipment, NOas 58-621-c(AV-32-2552-58), $99,987.

Autonetics Division, North American Aviation, Inc., Downey, Calif., automatic stabilization equipment designed as a preproduction prototype system suitable for flight testing, NOas 58-447-c(AE-72-2101-58), $32,074.

Babcock Radio Engineering, Inc., Costa Mesa, Calif., shipboard radio command radio transmitters in accord with BuAer experimental and developmental specification XAV-26, NOas 58-788-f(AV-31-2632-58), $39,999.

Federal Telecommunication Laboratories Division, International Telephone & Telegraph Corp., Nutley, N. J., aerial film titlers, NOas 58-673-f(PH-4-5040-58), $48,-500.

Pratt & Whitney Aircraft Division, United Aircraft Corp., East Hartford, Conn., model J57-43WA engines in accordance with specification Pratt & Whitney No. A-1704-D and model J57-P-55 engines in accordance with specification Pratt & Whitney no. A-1718-A, NOas 58-537-i(PD-41-717-58), $2,134,483.

Pioneer-Central Division, Bendix Aviation Corp., Davenport, Iowa, restoration, rehabilitation, modernization and modification of government owned machine tools and other capital equipment, NOas 58-040-c (IP-33-2293-58), $79,876.

Research Division, Curtiss-Wright Corp., Quehanna, Pa., research to obtain design parameters and performance analysis for in-flight turbojet exhaust noise supressor, NOas 58-724-c(PP-33-1708-58), $103,352.

Federal Telecommunications Laboratories Division, International Telephone and Telegraph Corp., Nutley, N. J., design, develop, fabricate and furnish one (1) experimental model of a lightweight airborne TACAN transceiver in accordance with BuAer experimental and development spec. NAV-15, NOas 58-734-c(AV-45-2607-58), $108,300.

Columbus Division, North American Aviation, Inc., Columbus, Ohio, design and develop a position light system for high performance aircraft, NOas 58-492-c(AE-82-2037-58), $73,110.

Sound Masters, Inc., New York, master shooting scripts and one (1) 35mm, Eastman color motion picture training film, in accordance with Joint Army-Navy spec. JAN-P-55 and Amendment No. 1 thereto, NOas 58-830-f(PH-51-5130-58), $31,353.

Del Mar Engineering Laboratories, Inc., Los Angeles, Calif., tow reel, launcher with adaption kit and scorer, in accordance with spec. MIL-N-18307(Aer) NOas 58-707-f (MA-36-3454-58), $2,563,176.

Special Products Branch, Food Machinery and Chemical Corp., Buffalo, N. Y., investigate the decomposition of hydrogen peroxide on catalysts, NOas 58-689-c(PP-22-1691-58), $232,950.

Willard Pictures, Inc., New York, master shooting scripts with complete storyboards and five (5) 35mm black and white sound motion picture training films in accordance with Joint Army-Navy spec. JAN-P-55 dated June 30, 1944 and amendment no. 1 thereto, NOas 58-833-f(PH-51-5131-58), $29,060.

All American Engineering Co., Wilmington, Del., study and design of a high acceleration catapult and arresting test site, based on the concept described in contractors drawing SK-4600, NOas 58-785-c(SI-43-1985-58), $32,944.

All American Engineering Co., Wilmington, Del., bridle and pendant arrester in accordance with Navy Air Engineering Facility (SI), drawing 405282, NOas 58-723-c (SI-32-1964-58), $173,214.

J. A. Maurer, Inc., Long Island City, N. Y., camera, film magazines and aligning units in accordance with spec. XPH-145 with modifications, NOas 58-739-f(PH-31-4875-58), $99,999.

Lockheed Aircraft Service, Inc., Ontario, Calif., services and materials necessary for the modification of government model P2V-7 aircraft, NOas 58-594(MA-33-3192-58), $237,000.

The Ryan Aeronautical Co., San Diego, Calif., manufacture and test ground velocity indicator, NOas 58-701-c(AV-45-2590-58), $289,879.

Industrial Products Division, Boeing Airplane Co., Seattle, Wash., air inlet modification kits for air supply carts, NOas 58-725-f (MA-51-3704-58), $26,496.

Aircraft Radio Corp., Boonton, N. J., radio receiving set in accord with spec. MIL-N-18307A(Aer), NOas 58-706-f(PD-32-1312-58), $1,255,227.

International Latex Corp., Dover, Del., redesign, manufacture and furnish four-man capacity pneumatic reconnaissance boats in accord with size A of spec. MIL-B-18750A (MC), and amendment no. 3, NOas 58-641-c (AE-52-2162-58), $74,764.

Ward-LaFrance Truck Corp., Elmira Heights, N. Y., bomb truck, Aero 34B, NOas 58-828-f(MA-51-3734-58), $161,514.

Collins Radio Co., Cedar Rapids, Iowa, AN/FRW2 radio transmitting set in accord with spec. MIL-T-19431(Aer), NOas 58-634-f(PD-32-1293-58), $518,212.

Grumman Aircraft Engineering Corp., Bethpage, N. Y., study of neutron activation on seaplane hull materials, NOas 58-729-c(AE-41-2217-58), $39,115.

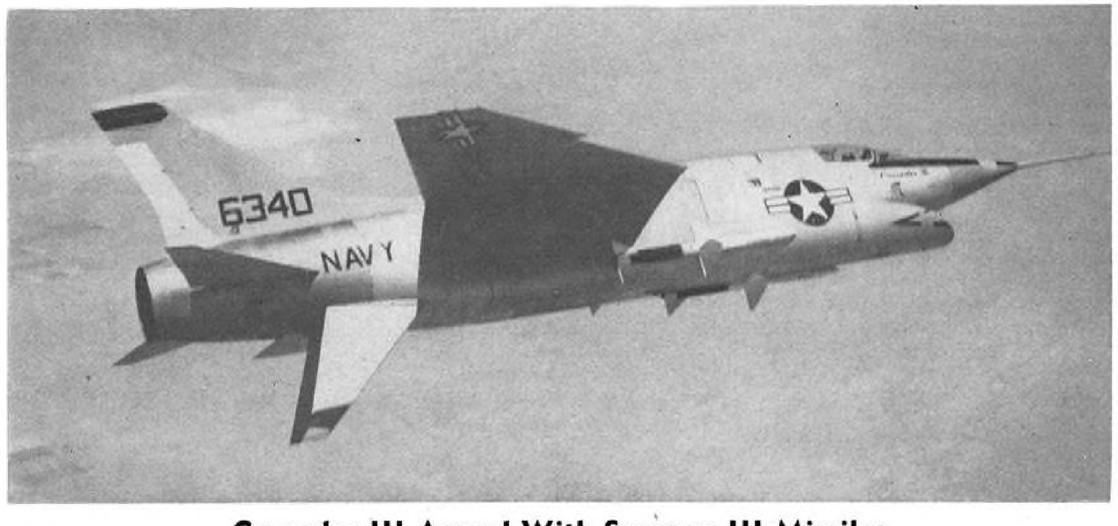
AVIATION SUPPLY OFFICE, 700 Robbins Ave., Philadelphia.

Gill Electric Manufacturing Corp., Redlands, Calif., aeronautic storage battery, dry and charge, N383-53399A(383/2140-211411 E6/1/55), $133,108.

Cook Electric Co., Chicago, Ill., relays, N383-53379A(383/8410-212513 E4/4/58), $33,615.

Polarad Electronics Corp., Long Island City, N. Y. radar test sets, N383-52227A (IRB-383-443-58), $690,916.

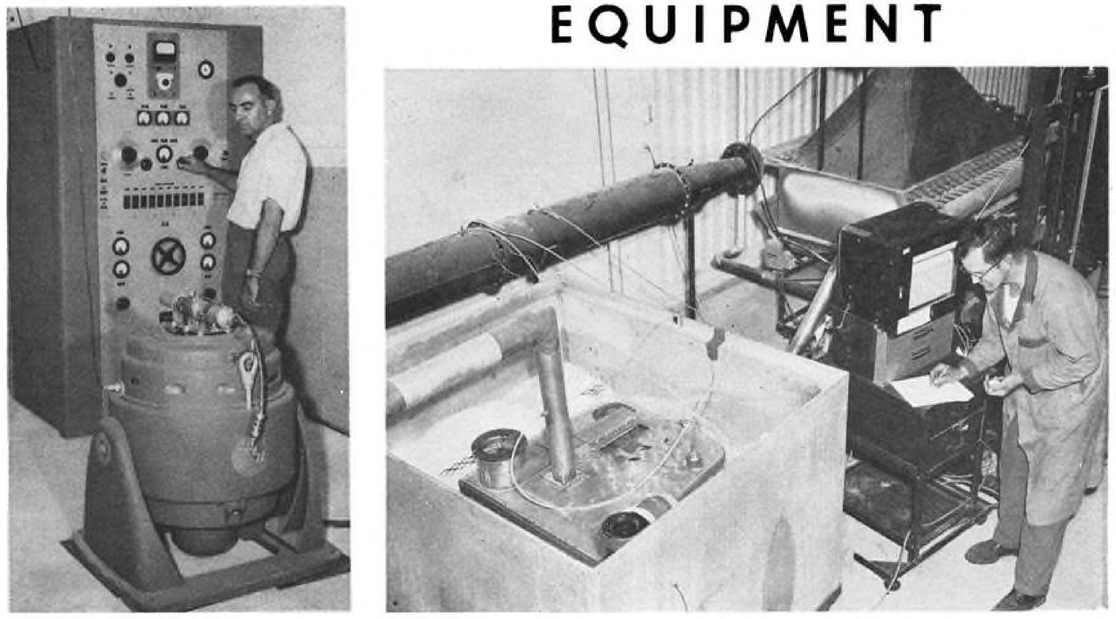
The Cleveland Pneumatic Tool Co. Division, Cleveland Pneumatic Industries, Inc., Cleveland, Ohio, pistons and adapters for use on strut assemblies, N383-52839A(383/6112-29373/56), $164,233.



Crusader III Armed With Sparrow III Missiles

First flight photo of Chance Vought F8U-3 Crusader III shows supersonic fighter armed with two Sparrow III missiles aft of swept-forward inlet lip during flight tests. Ventral fins are lowered for increased stability at high speeds, are folded for landing and ground operations (AW June 9, p. 21). Crusader III can be fitted with Sidewinder missile, or combination of Sidewinder and Sparrow. Aircraft is powered by Pratt & Whitney J75 engine which develops about 17,500 lb. thrust without afterburner and about 26,000 lb. with afterburner. Crusader III, along with McDonnell F4H, is entrant in Navy's Mach 2 all-weather fighter competition.

EQUIPMENT



TEST facilities include vibration machine (left) submitting 32,000 peak voltage ignition system to vibration at 3,000 cps and one-inch amplitude. Right, heat exchanger for Avro Arrow CF-105 fighter undergoes endurance testing packed in dry ice.

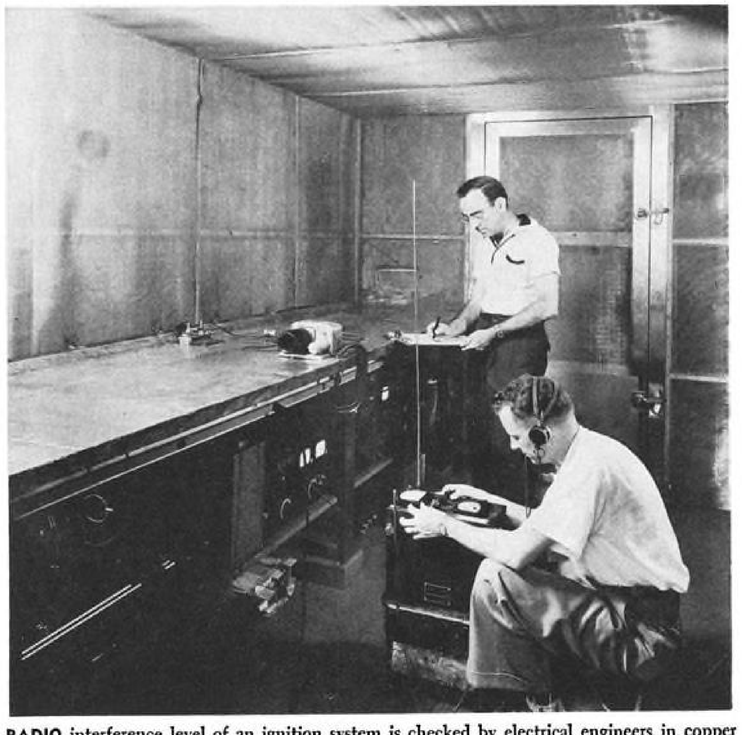
Janitrol Adapts Product Line to Jet Era

By Barry Tully

Columbus, Ohio—Improved production and test facilities of a new $2.5 million plant here are intended to aid Janitrol Aircraft Division of Surface Combustion Corp. during a period of change in product emphasis. A deteriorating market for its main money-makers—aircraft combustion heaters—is causing the division to expand its research activities and to put increased emphasis on its other products.

Turbine-powered aircrafts' utilization of engine heat for both cabin heating and wing and tail anti-icing will cut deeply into sales of combustion heaters. Janitrol, which claims to have produced the heaters for 90% of the commercial aircraft now flying, finds itself in the position of other "propeller era" component manufacturers who must retrench or diversify in order to remain solvent in the jet age.

Possessing the necessary corporate financial support, the division is banking on its design engineering team and its metals forming capabilities in choosing to diversify. Despite today's market requirements calling for production of fewer units, Janitrol hopes to offset its expected drop in heater sales with increased sales of its other products in both military and civilian markets. Division's present sales are described as being 10% military prime



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*Photographs show but 10 of the 36 different Cornelius compressors available.

Cornelius

WHEN IT COMES TO COMPRESSORS . . . THERE IS NO SUBSTITUTE FOR EXPERIENCE

contract, 40% subcontract and 50% civilian.

Large portion of Janitrol's product line is in components for high temperature pneumatic systems which furnish cockpit pressurization, fuel tank pressurization and wing and tail anti-icing on jet aircraft. These systems, which bleed high temperature air from around turbine engines, include as components: pressure regulators, shut-off valves, flow limiting valves, inert gas generators, evaporative coolers, heat exchangers, oil coolers, duct couplings and supports.

Quick-disconnect duct couplings are made of titanium and produced by a hot forming technique. Flanges, formerly made of stainless steel, are said to provide a light, strong coupling for pneumatic ducts at temperatures up to 750F when welded to ducting.

Missile components now comprise only a small portion of the company's sales total. Pneumatic controls for missiles, including the Regulus II and Talos, are being sold by Janitrol and the division appears to be intensifying its efforts in this area.

Heaters for ground support of both missiles and aircraft are produced by the division. Combustion heaters are used to heat missile fuel and surrounding buildings.

Division also turns out hot fuel prime units for starting reciprocating engines under extreme cold-weather conditions.

Division's new plant, occupying 130,000 sq. ft., is designed to provide extensive facilities for both engineering and inspection testing. Janitrol, specializing in precision metal forming operations, says that only through extensive testing can it avoid the weight penalties of over-design and unreliability caused by inadequate safety margins.

High altitude test chamber in operation at the new plant is capable of simulating altitude conditions at 102,000 ft. Cylindrical chamber, measuring 20 ft. long by 6 ft. in diameter, has a heat rejection rate capable of maintaining a pressure altitude of 80,000 ft. and a temperature of −65F, while testing a combustion heater delivering 1,000,000 Btu per hour. Altitude loop will be used to test heat exchangers, combustion heaters, pneumatic controls and duct couplings. Prior to the installation of the chamber, components had to be tested at installations scattered throughout the country.

Plant is designed to facilitate introduction of design modifications at any point during production, Janitrol says. Production lines are eliminated and machines and production processes are combined for each particular job. This system, the company says, provides maximum flexibility in the manufacture of precision components in relatively small quantities.

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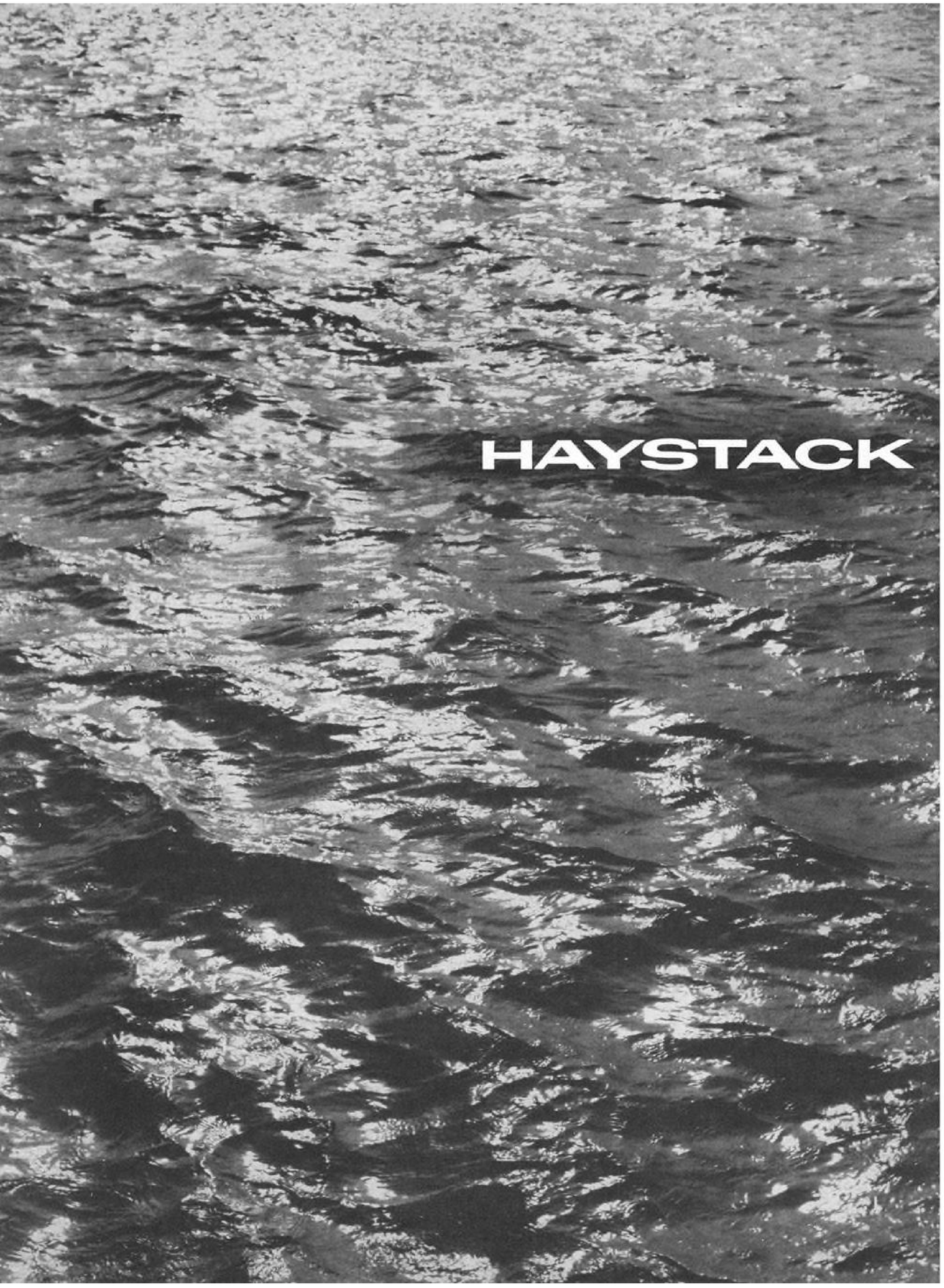

In it is a needle, manned and capable of launching missiles. Your Navy searches the aquatic haystack with Grumman S2F Trackers. These carrier-based airplanes can detect an invisible submarine by its subtle deflection of the earth's magnetic field. Their sophisticated equipment can spot a sub's fleeting peek with attack radar. They can lay electronic ears on the surface to hear a sub move fathoms below. Once contact is made, Grumman Trackers attack with weapons that silently seek and strike their prey skulking along the bottom.

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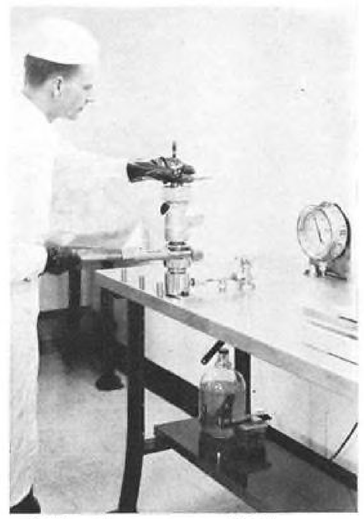


Clean room includes ultra-violet light inspection (left) and pressure tests (right).

Ultrasonic Device Cleans Valves

Ultrasonic cleaning and ultra-violet light inspection are two methods used to ensure cleanliness of valves for missile ground support equipment. Cleaning of the internal components—including thread roots and valve seats—is imperative with valve used with gaseous and liquid oxygen and nitrogen which may pass through minute control orifices. Valves must be free of dust and lint particles, and more particularly, free of oil or grease.

Superior Valve and Fitting Co., Pittsburgh, Pa., maker of manual control valves for Douglas Aircraft, carries out cleaning, assembly and inspection of its valves under controlled atmosphere conditions. Exact application of the valves is classified; however, valve in photographs appears to be a liquid oxygen valve, which would be used on ground support equipment for the Douglas Thor intermediate range ballistic missile.

Valves are packaged in heat sealed polyethylene bags for shipment.

Valve components, brought into the clean room are first cleaned ultrasonically.

Parts are immersed in the cleaning tank and subjected to 38,000 cycles per second vibration induced in the cleaning fluid by a crystal-controlled transducer. Vibration overcomes the forces of adhesion binding small particles to the valve components. Process is said to remove 96% of the dust particles down to one micron in size.

Ultra-Violet Inspection

After ultransonic cleaning operation, components are taken into an inner clean room and inspected under ultraviolet light, which will reveal even trace quantities of hydrocarbons. Operators wearing rubber gloves then assemble the valves and place them on special test fixtures. Valves to be pressure tested are mounted on a special jig and pressurized with nitrogen which is stored outside the clean room and piped to the fixture through a 50-micron filter.

Approved valves are immediately packaged in heat sealed polyethylene bags.

Valves remain in the plastic bags until just prior to installation on missile ground support equipment. Clean room, built in cooperation with Douglas, is typical in layout to others in the aviation industry. Room consists of two

MINNIE CONNECTORS

pass tough, new ALTITUDE-MOISTURE RESISTANCE TEST salt water immersion, 65,000 feet altitude

AMPHENOL

Designers and manufacturers of aircraft and missiles, as well as the military, have long recognized the need for a connector altitude-moisture test which would accurately simulate actual performance conditions. Such a test has been developed by manufacturers and the military and applied as standard procedure on the 67 Series *MINNIE* connectors in the AMPHENOL Laboratories. It consists of the following:

A plastic tank is filled with distilled water and salt added to obtain a solution of 1.050 specific gravity. Marker dye is added for tracing leakage paths. The connectors are given a dry insulation resistance (IR) reading with a 500 volt megohm bridge. All coupling rings are then securely hand-tightened and grommet clamps rechecked for tightness. The connectors are then completely submerged in the salt solution so that all cable bundle ends are out of the solution. The ends of the cable bundle from one side of each connector are taped. The tank and connectors are placed in an altitude chamber and another IR reading is made.

The pressure inside the chamber is then reduced to 0.82 inch of mercury (80,000 feet altitude) and held for one minute, then increased to approximately 2 inches of mercury (65,000 feet altitude). After maintaining 2 inches of mercury for ½ hour, the chamber is returned to room ambient pressure for ½ hour. This is considered one complete cycle. Connectors are subjected to a total of 10 cycles.

At the conclusion of the tenth cycle, connectors remain completely submerged in the salt solution container at room-temperature and pressure for an over-week-end soak (65 hours). Final insulation resistance reading is then taken. Immediately after last IR measurement, specific gravity of salt solution is taken.

The "E"-type construction of AMPHENOL 67 Series *MINNIE* connectors was originally designed to meet the moisture resistance requirements of MIL-C-5015C, Paragraph 4.5.21. Since the development of the new and far more stringent altitude-moisture test, *MINNIE'S* construction design has been modified and all AMPHENOL *MINNIE* "E"-type connectors pass this test.

Following the altitude-moisture resistance test, insulation resistance measurements (in megohms) on production *MINNIE* "E" connectors were as follows:

Cycle	Insulation Resistance Contact to Contact	Contact to Shell
0 (Initial)	6000	7000
1	7500	4000
2	5500	3200
3	5500	3000
4 (overnight 17 hour soak)	3000	1100
5	2800	1100
6	3000	1100
7	3000	1100
8	3000	1100
9	3000	1050
10	3000	1050
11 (overnight 17 hour soak)	2800	1000
12 (weekend 65 hour soak)	3000	1050

AMPHENOL *MINNIE* "E" connectors not only meet but surpass the requirements of this tough new test. 100 megohms is the minimum insulation resistance required by MIL-C-5015C after moisture; *MINNIE'S* minimum insulation resistance after immersion and altitude cycling is 1000 megohms.

67 Series *MINNIE* "E" Connectors

DESCRIPTION Miniature, multi-contact electrical connectors of the quick-disconnect bayonet lock type. Available as Plugs, Cable and Panel Receptacles, and Single Hole Mounting Receptacles. Shell design classes include:

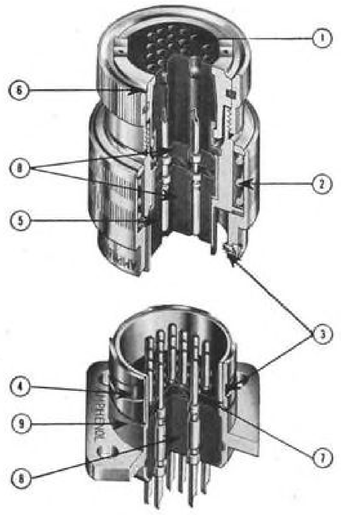
CLASS E—Environmentally resistant—individual wire seal
CLASS P—For potting
CLASS H—Hermetically sealed
CLASS J—For jacketed cable
CLASS C—Standard cable clamp

There are five shell sizes, and 17 insert arrangements—ranging from 3 contacts in the smallest to 48 contacts in the largest.

PART NUMBERING Descriptive part numbering of *MINNIE* connectors follows that used with AN (MS) connectors.

NOMINAL CURRENT RATING #20 contact is rated at 7.5 amperes and #16 contact at 17.0 amperes.

OPERATING TEMPERATURE −67°F. (−55°C.) to +257°F. (+125°C.).



HOODED SOCKET CONTACTS

Both #16 and #20 socket (female) contacts of AMPHENOL *MINNIE* connectors are resistant to test prod damage. The entering end of the socket has a one-piece hood that excludes the entrance of a pin 0.005" larger than the diameter of the mating pin. AMPHENOL Specification 340-43-2108, paragraph 4.5.14, gives this test to be used to determine resistance to test prod damage:

"A test prod of hardened steel having a diameter equal to a nominal mating pin shall be inserted into each socket contact to (a) .200 inch; (b) .255 inch; and (c) .310 inch depth. At each of these depths, measured from the face of the insert, a bending moment of 2 inch lbs. ±10 percent shall be applied to the 16 size contact prod and a bending moment of 0.8 inch lbs. ±10 percent shall be applied to the 20 size contact prod about the inserted ends of the prod. The connector shall be rotated in one direction through 360 degrees in order that a uniform force is applied to the inside surface of the socket contact. This test shall be performed with the socket contacts in the inserts and the contacts locked, if necessary, to prevent rotation in the inserts during the test."

After withdrawal of the fixture at the completion of the above precedure, the force needed to engage or separate the socket contact shall not exceed the following values:

Contact	Max. Force Ounces	Min. Force Ounces
#20	12	2
#16	26	3

FEATURES OF AMPHENOL *MINNIE* CONNECTORS

1. Environmentally sealed with unitized back end grommet. (Also available with provision for potting.) Grommet seal (type "E") meets altitude-moisture resistance requirements. Either grommet seal or potted seal meets moisture resistance requirements of MIL-C-5015C, Paragraph 4.5.21.
2. Spring-loaded coupling ring provides a positive locking action in the bayonet slot, and a constant compensating force which eliminates the effects of resilient face seal compression set.
3. Stainless steel bayonet slots and pins reduce wear and frictional characteristics and eliminate wear encountered with "hard-coat" and similar surface treatments of softer base metals. The three pin bayonet coupling minimizes the rocking action of the mated plug and receptacle.
4. Flattened incline angle of bayonet slots reduces mating force requirement.
5. Hooded contacts resist test prod damage as defined in Paragraph 4.5.14 of AMPHENOL Specification 340-43-2108.
6. Unitized grommet seal; clamp and grommet form a single unit for ease of assembly and maintenance.
7. Face seal gasket with individual barriers to isolate each contact.
8. Hard insert dielectric (plus resilient face seal) positively retains contacts with no possibility of contacts being pushed out of the insert.
9. A visual full engagement indicator is included in the design to insure the user that he has fully engaged the connectors. The indicator is an orange line around the receptacle shell.

- Insulation resistance of "E" type following altitude-moisture resistance test is a minimum 1000 megohms. MIL-C-5015C minimum following type "E" test is 100 megohms.
- When using mated sealed connectors, no derating for altitude is necessary at 70,000 feet.
- Test voltage 1,500 volts RMS 70,000 feet on sealed connectors.
- Vibration per Method 204 of MIL-Std-202A. 10 to 2,000 cps at 20 g's.
- Temperature cycling range per MIL-C-5015C, Paragraph 4.5.3 increased to 257°F. maximum and −67°F. minimum.

VOLTAGE RATING

	Rating	Mechanical Spacing (Nominal)	Flashover V-Rms	Test V-Rms	Recommended Working Voltage DC	AC
Sea level (unsealed)	A	.034	2,000	1,500	700	500
	B	.046	2,300	1,800	840	600
Sea level (sealed)	A	.034	2,500	2,000	700	500
	B	.046	3,000	2,500	840	600
70,000 ft. (unsealed)	A	.034	500	375	175	125
	B	.046	600	450	210	250
70,000 ft. (sealed)	A	.034	2,500	1,500	700	500
	B	.046	3,000	1,800	840	600

Send for your copy of the MINNIE catalog to complete information.

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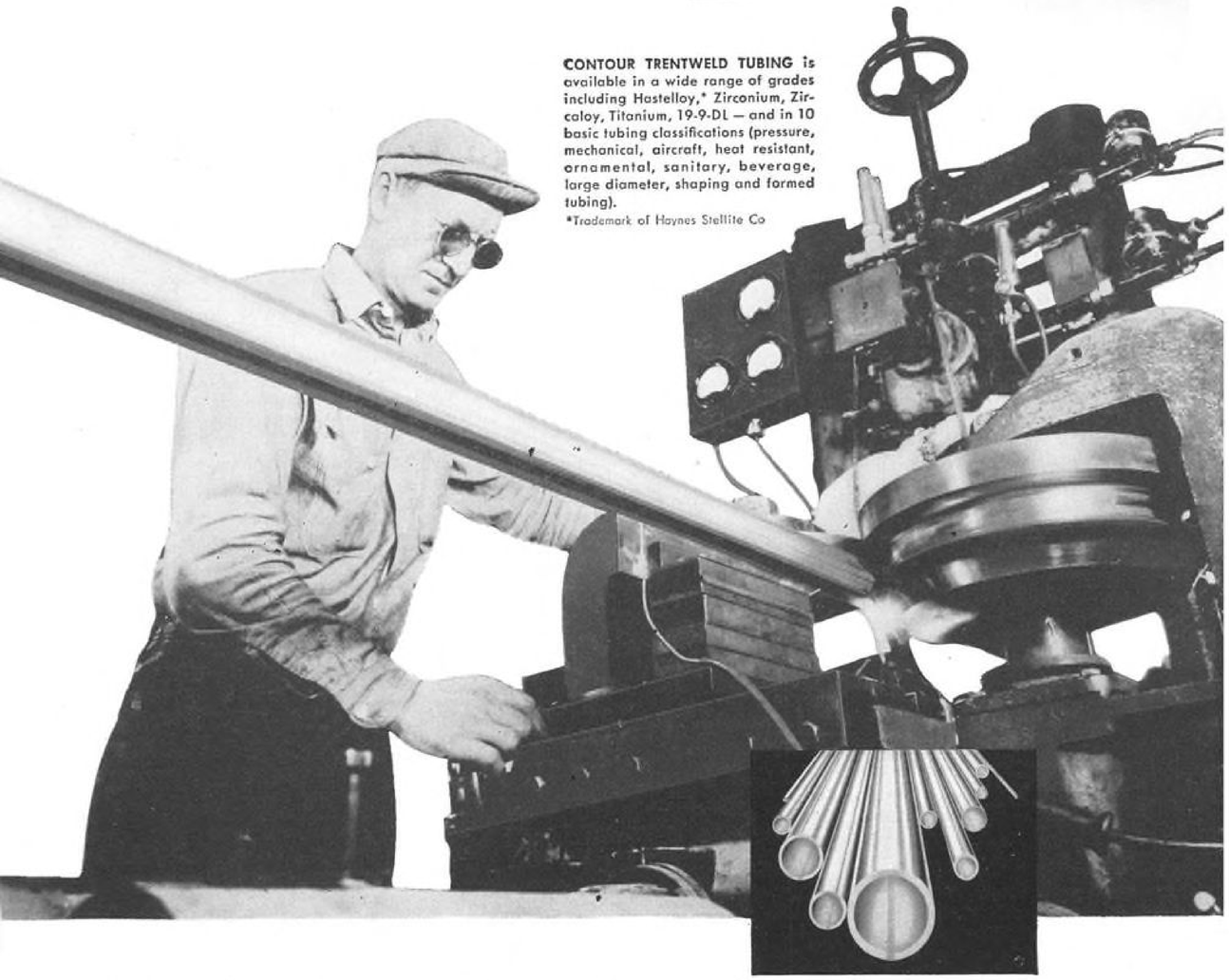

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chambers, one inside the other. Outer chamber is used to perform the ultrasonic cleaning operation and the inner chamber is used for final assembly, testing and packaging.

Two-ton air-conditioning unit is employed to change the air in the rooms at rate of 10 times per hour. An electrostatic filter capable of filtering dust particles down to one one hundred and fiftieth of a micron also is used. Vacuum type venting system removes fumes from the trichloroethylene cleaning tanks to maintain an uncontaminated atmosphere. One ounce per cubic foot of air over-pressure ensures an outward flow of air when the door is opened.

Navy Drone Launched By Compressed Air

Simplicity, economy and light weight are said to be the advantages of Navy's elastic cylinder-type drone launcher, developed by the Naval Air Engineering Facility, Philadelphia, Pa.

Launcher's carriage, to which the drone is attached, contains roller which fits tightly against a flattened length of standard six-inch diameter heavy duty fire hose. To fire the drone, compressed air is blasted into the hose forcing the roller to carry the carriage up the launching track.

By increasing the pressure in the hose during the run, the carriage is accelerated sufficiently to keep the drone flying until its engine cuts in. Carriage automatically drops off after launching has been completed.

Navy says production models of its elastic cylinder device will be one half the weight and 50% less expensive to operate than piston and jet-assisted takeoff drone launchers.

Production models of the new launcher also will differ from the original device in that the track will be an integral part of the accumulator. Accumulator will be built with flanges at both ends so that multiples of them may be attached together to launch heavier drones.

Tests indicate that one section would be sufficient to launch a 375 lb. drone with initial velocity of 85 mph. using 500 psi. air pressure.

Three sections in combinations would launch a 2,000 lb. vehicle at 200 mph., said to be the maximum requirement for drone launching equipment.

Navy is considering further applications of the elastic cylinder launcher, including use of a longer launcher and liquid gas propellant to accelerate a vehicle to near sonic speed. This might provide a substitute for first stage booster rockets, and permit small missiles to carry a considerably heavier payload.

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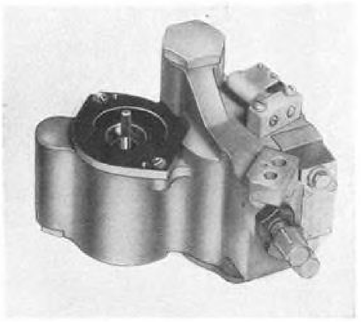


Missile Power Unit

Auxiliary power unit for missile controls receives mechanical shaft power at 12,000 rpm. and provides energy in the form of hydraulic oil under pressure.

Hydraulic power pack delivers 0.6 gpm. against a discharge of 2,000 psi. pumping MIL-O-5606 oil with an efficiency in excess of 70%, the maker states. Compensating bellows are said to adjust for thermal expansion of oil and to permit operation of the pack with a pressurized pump, ensuring operation at altitude aund under negative G loads. Check valve permits ground check out of hydraulic circuit without energizing power unit

Eastern Industries, Inc., 100 Skiff St., Hamden, Conn.

Instrumentation Tape Recorder

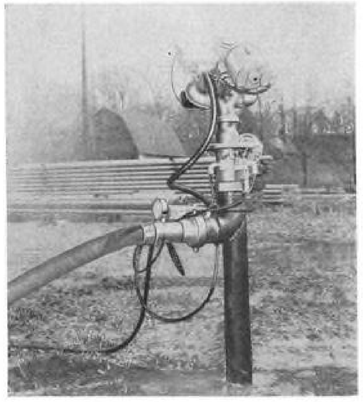
Transistorized instrumentation tape recorder is designed to handle 14 tracks of simultaneous data.

Model C-100 has an electronic remote control system that selects any preset group of 10 speeds between 3¾ and 60 in. per sec Recorder uses differential capstan drive and an electromagnetic braking system. System accepts input frequencies from 45 to 1,000 cps. Nominal input voltage is 117 volts, line voltage. Circuit is said to be adaptable to telemetry systems.

Mincom Division, Minnesota Mining & Manufacturing Co., 2049 S. Barrington Ave., Los Angeles 25, Calif.

Missile Fire Extinguisher

Foam fire extinguisher heads are designed to be set up on missile launch pads to combat missile fires. Operated by remote control from observation bunker units can be made to raise,



lower, rotate or change stream widths.

In use at Cape Canaveral, Fla., and at Atomic Energy Commission plants, the extinguisher uses the maker's UNOX foam.

Akron Brass Manufacturing Co., Wooster, Ohio.

Jet Control Valve

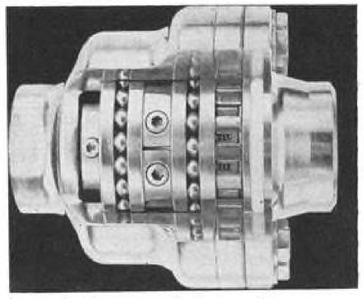
Pressure ratio control valve for direct mounting on jet engines has patented sensing mechanism permitting pressure ratio measurement to within ¼% over a pressure altitude range of 15 to 1, the manufacturer states.

Type 141VK14 utilizes a rectangular stainless steel diaphragm to sense pressure ratio error and to regulate a 3,000 psi. hydraulic servo valve. Weight of the unit, including hydraulic valve and an electro-magnetic remote resetting valve, is 7 lb.

Consolidated Controls Corp., Bethel, Conn.

Cryogenic Swivel Joint

Self-lubricating swivel joint permits liquid oxygen or other liquefied gases to circulate in the thrust bearing races, taking advantage of the lubricity of the fluid. Joint provides low-torque freedom of movement in as many planes as



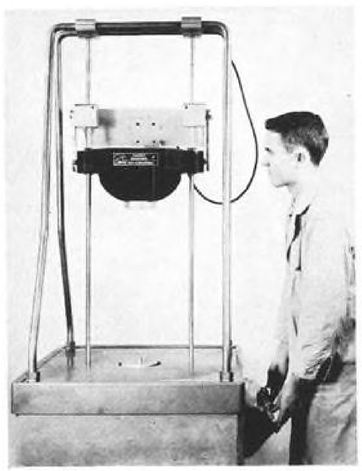
desired, the manufacturer states.

Swivel joints under 2 in. dia. handle pressures to 2,500 psig. at temperatures from −320 to +160F. Joints over 2 in. handle pressures to 150 psig. Sizes range from ½ in. to 16 in. with flanged, threaded or beveled-for-welding end connections.

Chiksan Co., 330 North Pomona Ave., Brea, Calif.

Shock Test Machine

Shock machine developed to test Titan ICBM components is versatile enough for any type of shock testing, the manufacturer claims. Machine is



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said to be capable of producing sawtooth-wave shock patterns of more than 100Gs over shock response spectrum of 80 to over 1,000 cycles per second.

Machine's carriage drops from a predetermined height, impacting against a molded lead pellet. By controlling the size and shape of the pellets, a variety of shock pattern can be obtained.

Electronic packages 12½ in. square and weighing 40 lb. can be handled by the shock tester.

Lycoming Division, Avco Manufacturing Co., Stratford, Conn.

Battery Charger

Automatic silver zinc battery charger is said to be capable of charging five aircraft batteries while discharging another.

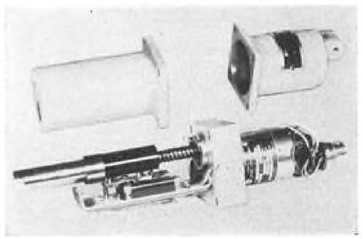
Chargers, operating on a constant-current principle with automatic shut-off to prevent overcharging, may be operated by unskilled personnel. Battery charger can recharge batteries as large as 21 cells, varying from .15 to 6 amp. Chargers are being marketed along with a silver zinc battery tester.

Republic Aviation Corp., Farmingdale, N. Y.

Transistorized Servo

Servo, developed for actuating drone aircraft and missile control surfaces, is said to have application wherever proportional positioning is desired.

Model 1350 servo has a center mount measuring 2½ in. square with 2 in. diameter tubing extending from mount block with 9½ in. between mounting centers in retracted position. Amplifier



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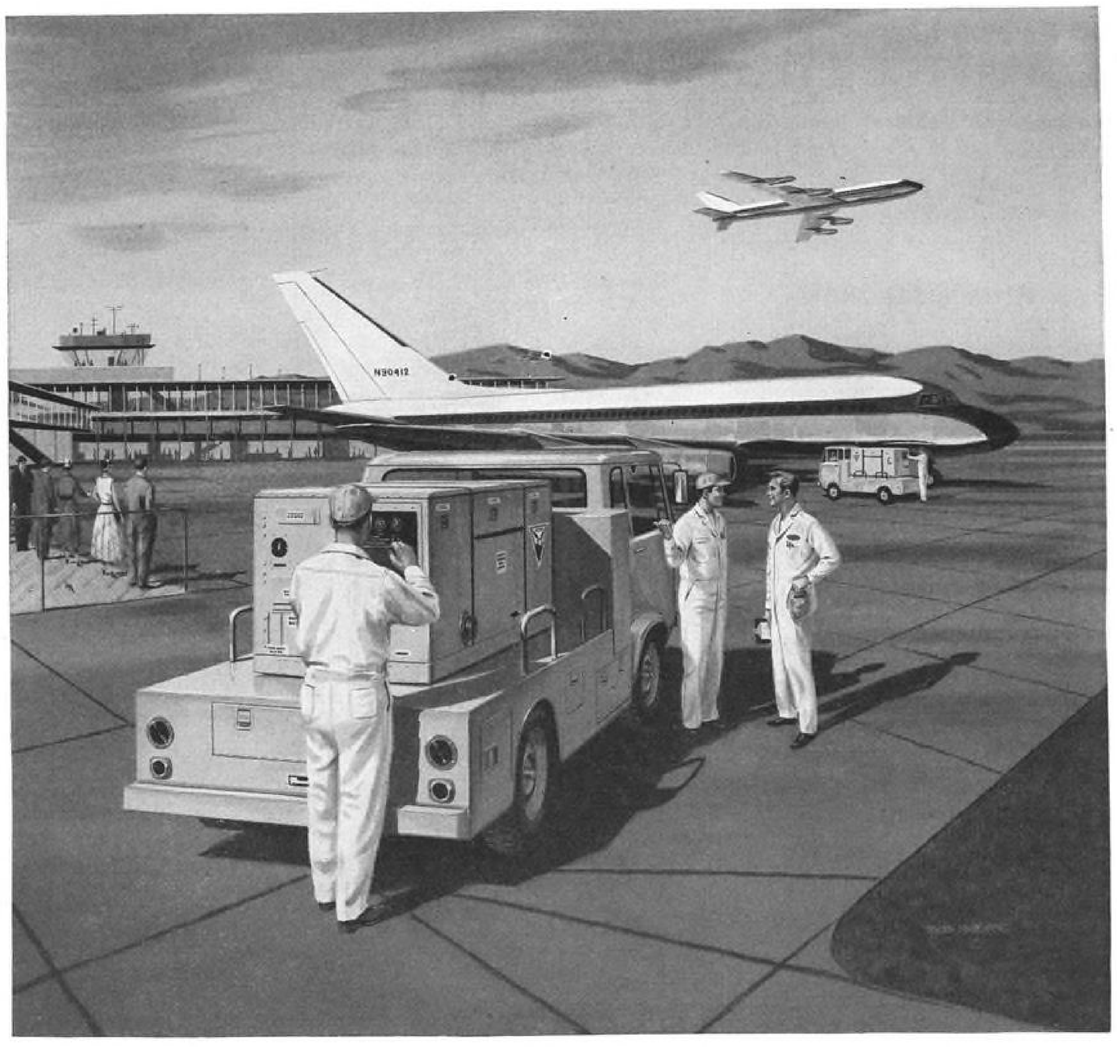

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SOLAR AIRCRAFT COMPANY — SAN DIEGO, DES MOINES

is transistorized with the exception of one subminiature vacuum tube in input stage for high impedance matching purposes in existing voltage systems. Servo has the following characteristics: travel, 1¼ in.; max. velocity, 5½ in./sec.; stalled thrust, 150 lb.; repeatability, + or − .007 in.; total weight, under 3 lb. Price of actuator, amplifier combination is from $520 to $700, depending on quantity.

Advanced Research Associates, Inc., 4130 Howard Ave., Kensington, Md.

Water Injection Pump

Jet engine water injection pump is designed to run dry after supplying thrust augmentation on takeoff.

Model 9753 pump, in use on J57 engines, delivers water at 90 gal. per min., 400 psi., operating at 6,200 rpm. After takeoff, pump is drained and moving parts continue to operate for duration of flight. Operational temperatures vary from −65 to 250F. Unit incorporates a boost impeller, vortex element and a relief valve. Drain valves permit drainage to prevent icing. Pump weight is 20 lb.

Chandler-Evans, West Hartford 1, Conn.

WHAT'S NEW

Publications Received

Behind The Sputniks—by F. J. Krieger—pub. Public Affairs Press, Washington, D. C. $6.00; 380P.

A survey of Soviet astronautics from its pioneering stage up to the launching of its first artificial earth satellite.

Missile Engineering Handbook—by Grayson Merrill, Capt. USN (Ret.)—Pub. D. Van Nostrand Co., Inc., 120 Alexander Street, Princeton, N. J. $12.50; 600P.

This book is the fourth volume in the series entitled, "Principles of Guided Missile Design." This series is intended to give well grounded material in the technology of guided missiles and space flight.

Aeroelasticity In Stability and Control—published by J. B. Rea Co., Inc., for Wright Air Development Center, U. S. Air Force. $8.00, 506 pp. (Order PB 131027 from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.)

This volume presents technical material which enables a practicing dynamics engineer to understand various aeroelastic phenomena and to apply methods for incorporating aeroelastic effects in equations of motion. Techniques are also given for solution of the equations. Material is presented by "example" rather than by a manual approach, since many of the techniques of analysis are still being developed.

Operation Grasshopper—by Dario Politella, published by Longo Publications, 1318 Beaumont Drive, Wichita 4, Kan. 200 pp.

History of the Army's light planes in combat in Korea from aggression to armistice, 1950-1953.

Digital Computer Components and Circuits—by R. K. Richards, published by D. Van Nostrand Co., Inc., 120 Alexander Street, Princeton, N. J. $10.75, 523 pp.

This book provides a ready source of basic engineering approaches related to digital techniques carefully organized for practical use. Logical functions and digital storage, basic operations to be performed by a digital computer, are discussed at length

Van Nostrand's Scientific Encyclopedia—published by D. Van Nostrand Co., Inc., 120 Alexander Street, Princeton, N. J. $30.00, 1,800 pp.

This work covers the principles and practical applications of the great physical and biological sciences, mathematics, engineering and medical technology in a book both thumb-indexed and cross referenced for convenience.

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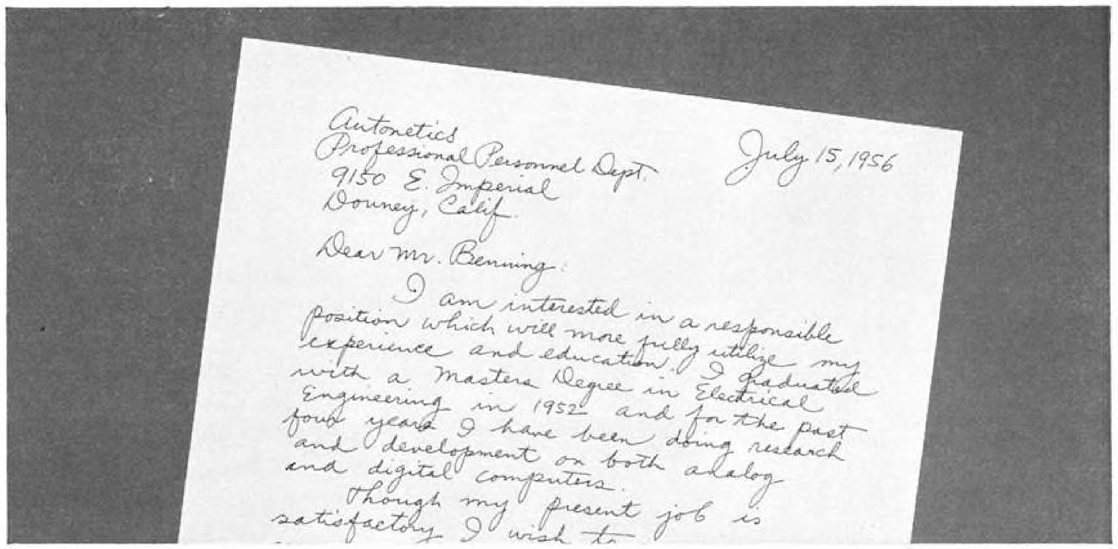

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WHO'S WHERE

(*Continued from page 15*)

Changes

Jesse Y. Bowman, project manager for the USAF Minuteman missile's guidance and control system, Autonetics, a division of North American Aviation, Inc., Downey, Calif.

Richard P. Frazee, director-sales and service, and **Harris D. Gilbert,** manager-contracts, Reaction Motors Division of Thiokol Chemical Corp., Denville, N. J.

David E. Aldrich, program manager responsible for advanced large rocket engine activity, Rocketdyne, a division of North American Aviation, Inc., Canoga Park, Calif.

Walter R. Woodward, director of engineering, Dynametrics Corp., Burlington, Mass.

Jack G. Anderson, director-military marketing, Hoffman Laboratories Division, Hoffman Electronics Corp., Los Angeles, Calif., and **Tom C. Clark,** marketing manager for the division's recently established Electro-Mechanical Department.

Frank Bobrick, chief engineer, Wells Industries Corp., North Hollywood, Calif.

R. L. Lobo, resident representative in charge of all Thor-Able Program operations, Aerojet-General's recently established field service office at Douglas Aircraft Co., Tulsa, Okla.

Dwight W. Kaufmann, manager, Titanium and Vacuum Metals Product Division, Crucible Steel Company of America, Pittsburgh, Pa.

Frank W. McCabe, special assistant to the manager, Beech Aircraft Corp.'s Boulder Division, Boulder, Colo. Also: **A. L. Clark,** manager-engineering and sales.

Robert E. Kemelhor, manager-future product planning and development, Pesco Products and Wooster Divisions, Borg-Warner Corp., Bedford, Ohio. Also: **R. B. Harlan, Jr.,** general manager, and **Allen T. Puder,** operations manager, Pesco Products newly established Western Branch, Los Angeles, Calif.

Howard D. Weissman, manager of contract procedures and analysis-military operations, Allen B. Du Mont Laboratories, Inc., Clifton, N. J.

Gordon S. Robinson, customer liaison manager, Subsystems Division, Servomechanisms, Inc., Hawthorne, Calif.

Michael Balog, manager-manufacturing and engineering, Semiconductor Division, Sylvania Electric Products, Inc., New York, N. Y. Also: **Dr. Sumner Mayburg,** chief engineer, and **Theodore R. Bunnell,** manager-manufacturing services.

John F. Harrigan, manager-Dayton, Ohio, area office, Grand Rapids Division, Lear, Inc., Grand Rapids, Mich.

Vernon G. Edwards, special representative-sales and service, Dallas Airmotive, Inc., Dallas, Tex.

Wyman L. Henry, director of marketing, Beech Aircraft Corp., Wichita, Kan.

D. R. Schaffer, Eastern sales manager, and **Charles H. F. Schuster,** comptroller, Hydrodyne Corp., North Hollywood, Calif.

John L. Greer, district sales manager, Cessna Aircraft Co., Wichita, Kan.

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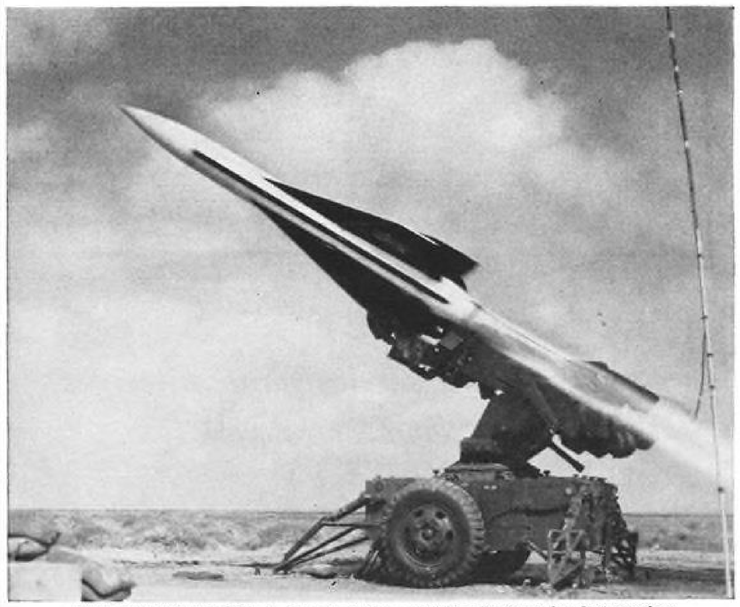

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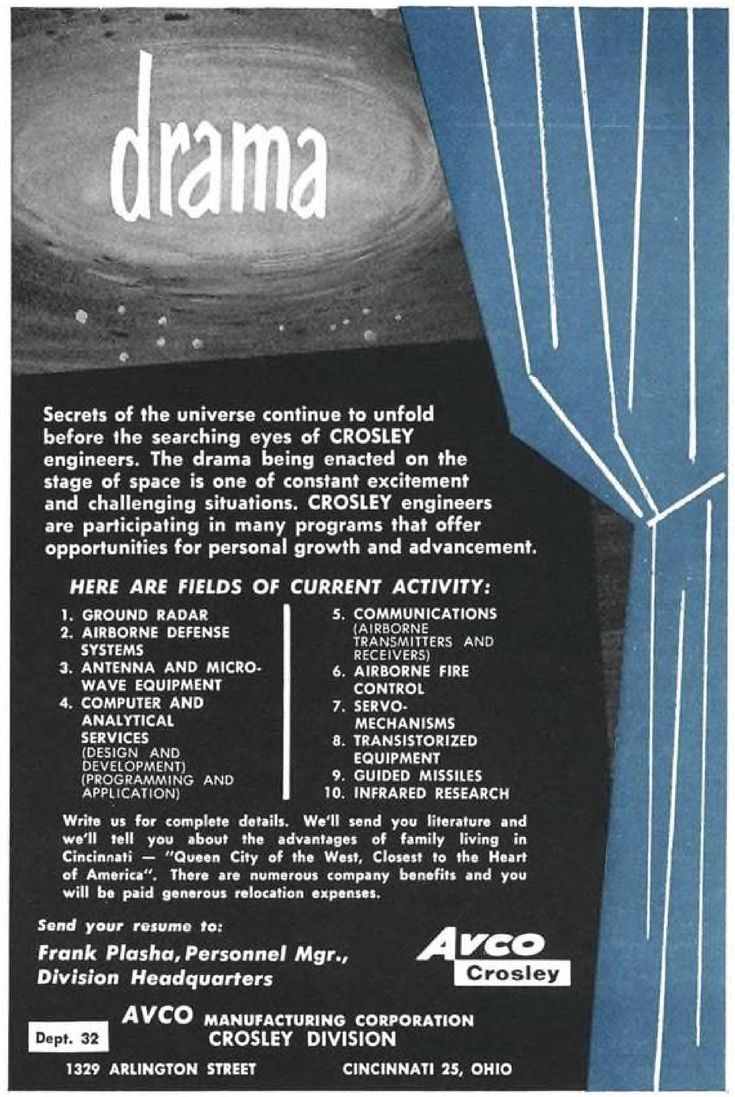

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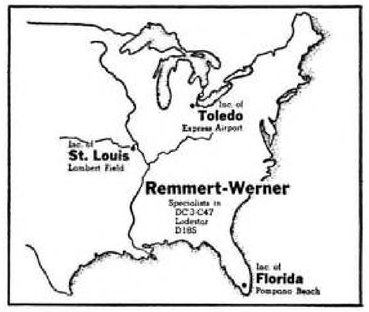

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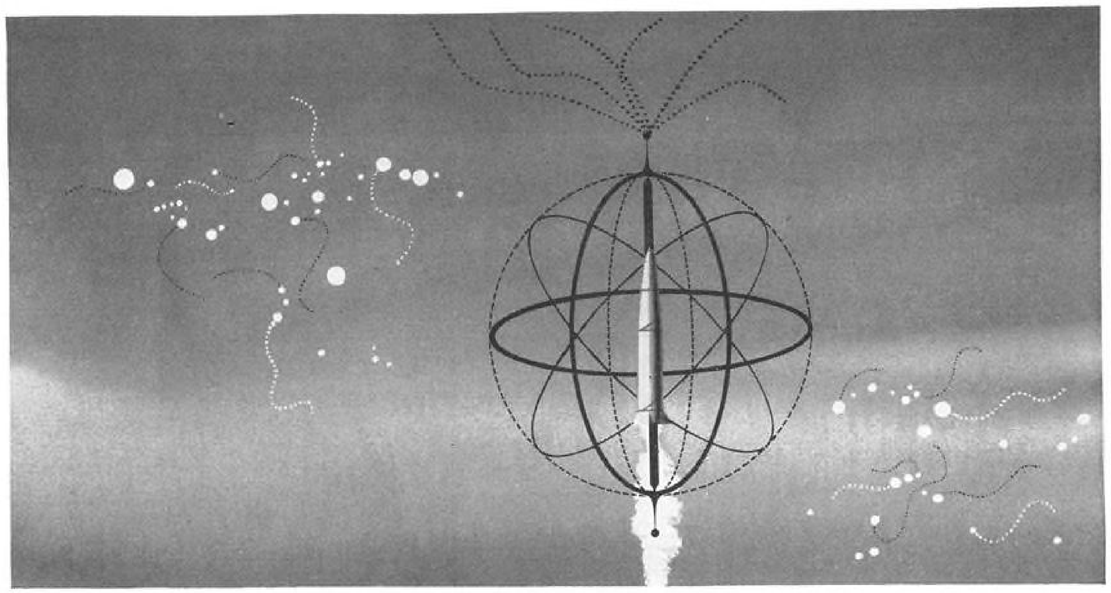

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LETTERS

Thermal Soaring

As a confirmed reader of AVIATION WEEK I have long wondered how something so fascinating as thermal soaring could be overlooked. Robert Stanfield's article on Schweizer Aircraft (AW July 14, p. 98) merits the plaudits of the soaring pilot for getting us out of the hated stick string and rag glider into soaring sailplanes. An open invitation is extended to Mr. Stanfield to try out the Florida brand of thermal this fall.

JOHN J. RANDALL
Capt., E.A.L.
Coral Gables, Fla.

Goose Engine

I'm afraid AVIATION WEEK has pulled a bu-bu. In the picture on the Fairchild Airplane Division "Goose" Missile and accompanying information in your June 23 issue (p. 27), it is stated that the engine used is the Fairchild J83. Actually, the engine installed in the pictured aircraft is the Armstrong Siddeley Viper 3 turbojet which Curtiss-Wright supplied Fairchild under a license agreement with Armstrong Siddeley Motors Ltd. A number of Viper 3 engines have been, and are still being, used most successfully in the development of the "Goose" Missile. To the best of our knowledge, the J83 has not as yet actually powered one of these aircraft in flight.

Knowing how you pride yourself on facts, I thought you'd like to be set straight so you could run a correction.

RONALD S. GALL
Director of Public Relations
Curtiss-Wright Corp.
Woodridge, N. J.

Courtesy by Mail

On looking through your issue of May 19, I was very interested to notice an advertisement by a well-known helicopter manufacturer, in which one was invited to drop them a line, to which was added "Prompt answer guaranteed."

For some time it has been a source of amazement to me why firms in the United States, and I do not mean only in the aviation industry, spend thousands of dollars individually on advertising and on public relations, yet when it comes to the one important item that really represents a company and their method or lack of method, as the case may be, in dealing with this, namely a firm's correspondence, so many can either ignore this altogether or take their own sweet time for the eventual courtesy of an acknowledgment.

I have found this particularly to be the case when seeking employment in aviation, as I have been just recently, and in this connection it is to be pointed out apart entirely from any matter of good will that may be concerned, that the person who may be seeking employment today—well, who knows—tomorrow may be in purchasing or another position to do business with those shortsighted enough to ignore him previously.

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.

In a country in Europe, in which I have been in the aviation business for some time, it is the usual practice that if a letter cannot be taken care of right away for any of a number of reasons an immediate and courteous acknowledgment is immediately sent out, which at least assures one that the business concerned is being taken care of, and also makes for a feeling of good will towards the firm concerned, or, as it is usually put here, shows that "they are on the ball."

Some time ago I was handling the sales of subscriptions, etc., for an aviation journal, and in addition to an immediate acknowledgment of all checks for subscriptions, etc., I sent a courteous letter thanking them for business. At the same time, any complaints, such as copies not received, etc., were immediately acknowledged, the matter investigated, and restitution made. The result was that I not only did not lose a single subscriber, but sold further subscriptions to existing subscribers in addition to good will sales from them, and later advertising sales to these same people.

These are such simple points that it is incredible to me that they should be ignored, and how small is the cost compared to money that is often wasted on other things.

It is only necessary for me to add, as I guess thousands must have done before me, that I consider AVIATION WEEK to be first class in every way, and not only a luxury of reading matter but an absolute necessity if one is to keep "au fait" with world aviation matters.

BENNO G. DE GREEUW
New York, N. Y.

Control Problem

Have just finished your issue of July 21, and find once again a letter "Flying Going Blind?" (p. 102) expressing the principle of "see and be seen" as the answer to mid-air collisions. I continue to wonder why you print such letters! Hearing all sides of an issue is certainly desirable. However, I humbly submit that anyone who offers increased cockpit visibility as the answer is quite obviously completely ignorant of the problems involved in maneuvering high speed aircraft. (I don't recall any comment by pilots of such aircraft to the contrary; do you?)

The frequent reiteration of this no doubt sincere but erring point of view lends itself only to confusion. Visibility is a desirable thing, and as an industry representative I have urged the Civil Aeronautics Board to require even more cockpit visibility again and again; however, for a variety of reasons. Increased cockpit visibility will unquestionably make the smallest contribution of any action taken to improve air safety as regards collisions. We are dealing with a problem of traffic control and nothing else.

So please—use your fine reputation for integrity to clear the air. Let us see the problem for what it is and work together to solve it.

Such emotional concepts as the "rights" of this group or that simply do not fit into such important (crucial) deliberations.

JOHN BURN
Airline Captain
New York, N. Y.

From Ground Up

In reply to Mr. Morton's letter (AW July 7, p. 110), I would certainly go along with the policy of aircraft filing IFR flight plans, but what about the thousands of civilian (private) aircraft and pilots who could not qualify for IFR flights?

The possibility of mid-air collisions is present from the ground up, and it is not limited to jet or high performance civil air carrier types.

In my letter (AW June 23, p. 94), my suggestions on paint and lights were intended as supplemental aids, not as a cure to the mid-air collision problem.

LCDR L. W. DILTS, USNR
Airborne Early Warning
Squadron 11
FPO, New York, N. Y.

Collision Solution

"What never? Well, hardly ever."

In his letter "IFR Filing" (AW July 7, p. 110) Copilot Morton wonders if facts (his) have been considered:

"1. There is no record of two aircraft having filed and flown IFR running into each other. 2. In each case of a mid-air collision one or both aircraft is/are VFR, thus making the accident possible."

If Mr. Morton will write to the CAB they might have a spare copy of Aircraft Accident File #2427-42 released June 21, 1943.

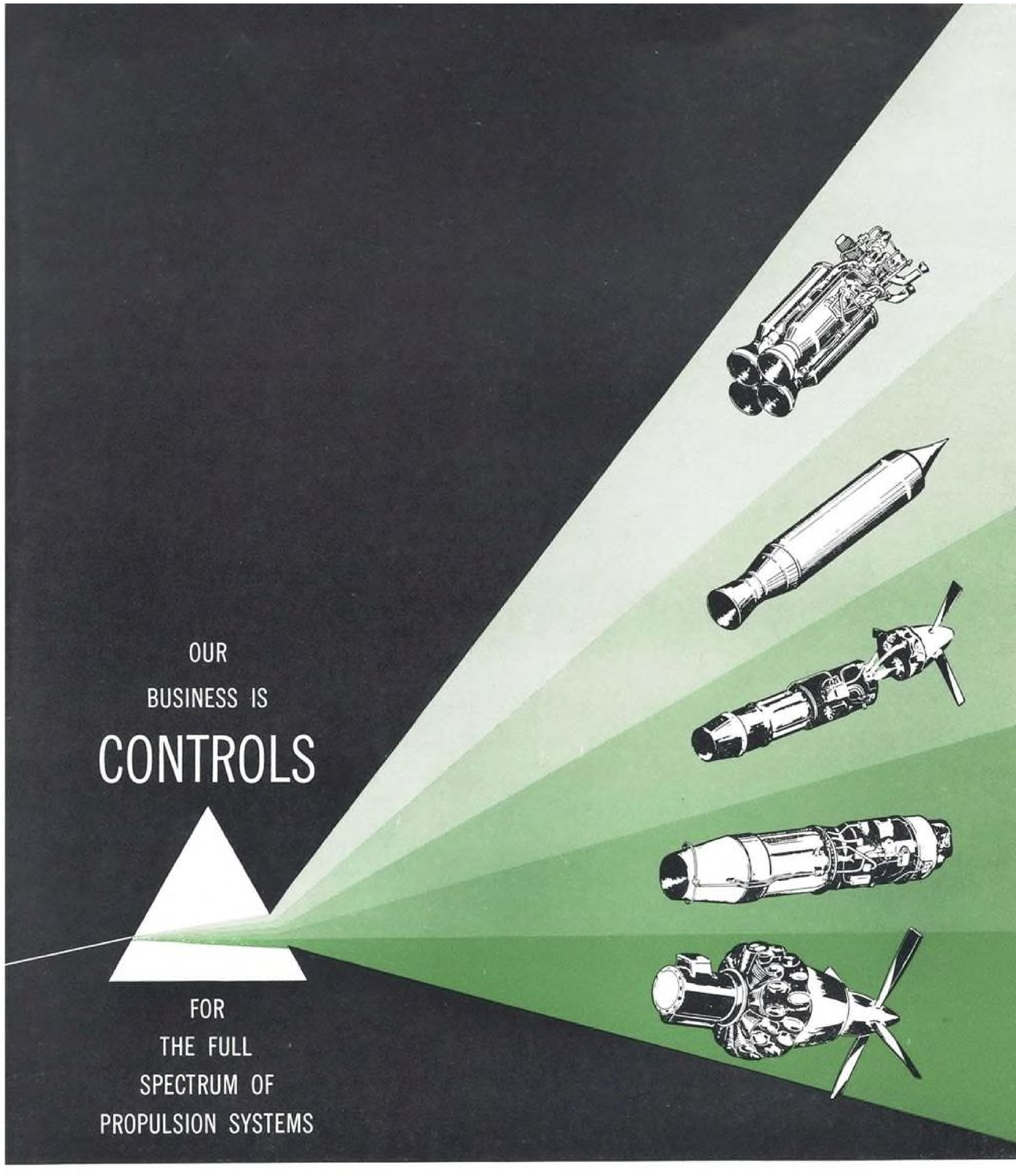
It officially records a mid-air collision in the overcast. Both aircraft had filed, flown and complied with IFR flight plans.

Mr. Morton has offered a simple solution for the mid-air collision problem, backed up by his facts. The seemingly obvious solution is for everyone to file IFR (above this, that, or some other altitude—it's hard to pin down where the IFR should start).

In the meantime other pilots wonder how long an overloaded traffic control system can continue without another factual accident cropping up—to say nothing of the traffic that just doesn't get a chance to go IFR because of delays.

It seems to me that the only real solution will be an effective anti-collision electronic warning device in the cockpit. Until one is perfected pilots will have to keep looking out the window regardless of what kind of flight plan they may file.

ROBERT E. TRIMBLE
Washington, D. C.



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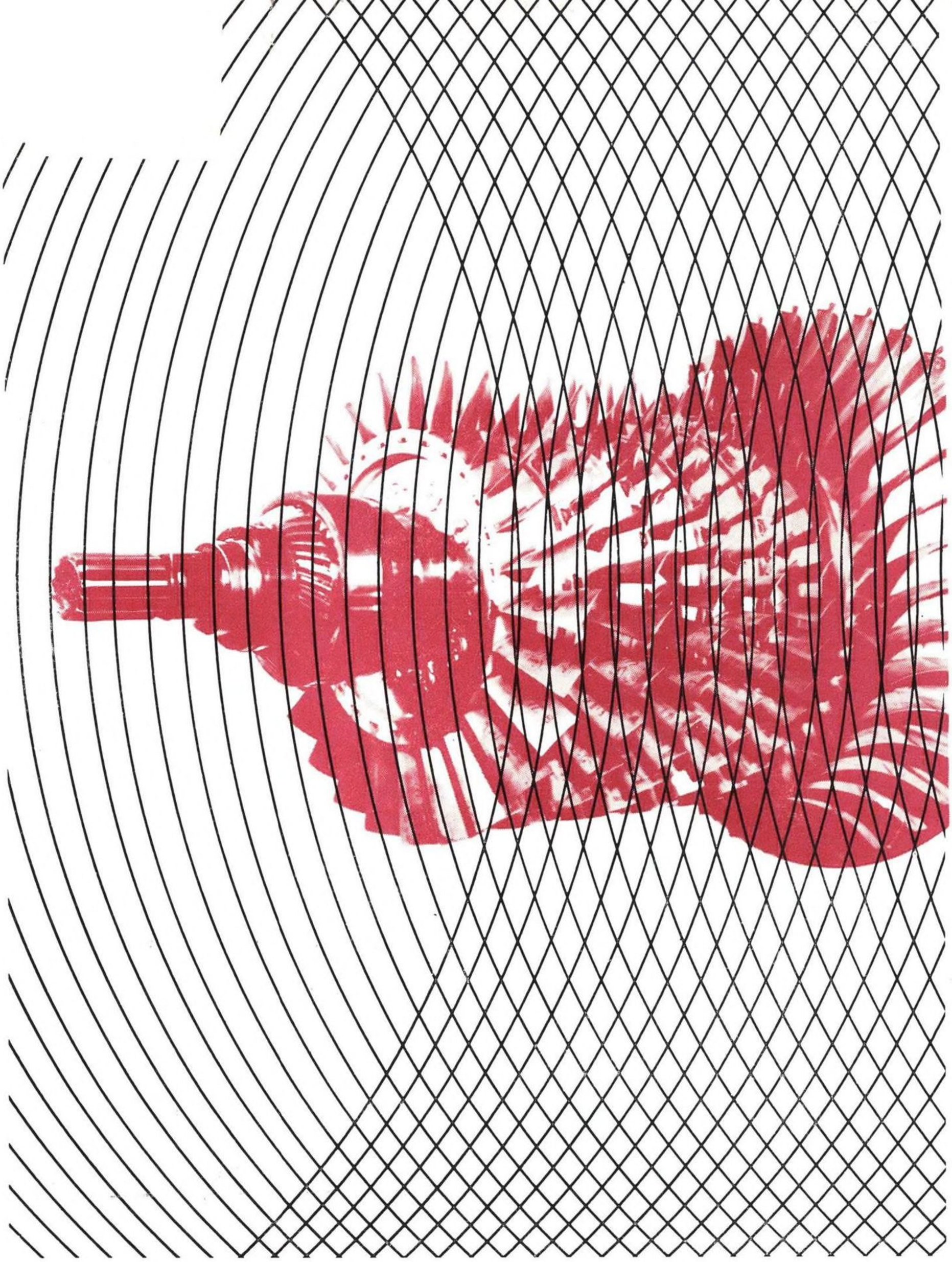

Lycoming's T53: 860 horses ride the earth, sea, and sky. Compact and rugged, the T53 gas turbine engine packs a roaring 860 horsepower. Its versatility is amazing: not only does the T53 power aircraft, but it is adaptable to industrial and marine use as well. It is a product of Avco's Lycoming engineers who are shaping a new age of power for America.

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