Aviation Week

Including Space Technology

75 Cents

A McGraw-Hill Publication

March 16, 1959

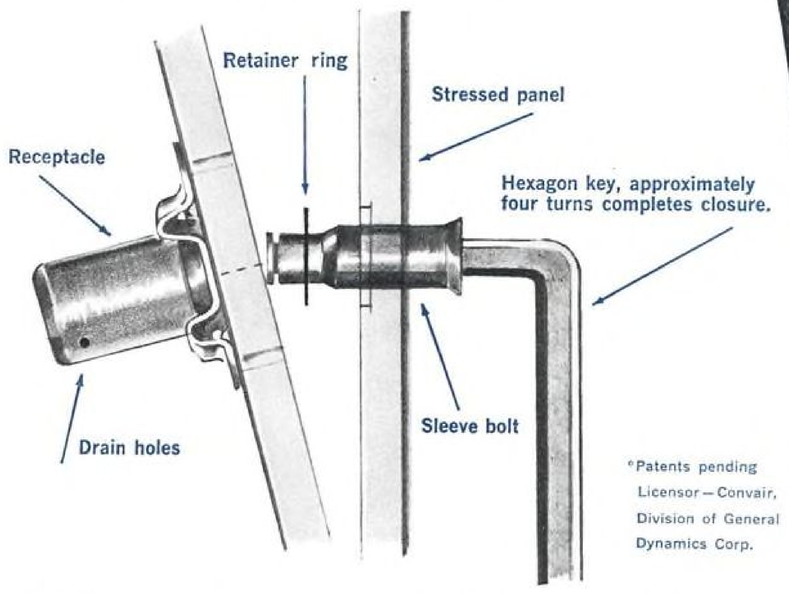
Sandwich Panels Cut Weight In Victor Bomber

Convair 880 Turbojet Transport

Pacific Missile Range to Play Big Tracking Role

MILSON STRESSED PANEL FASTENER...

The First Fool-Proof, Quick-Operating Panel Fastener!



*Patents pending
Licensor—Convair, Division of General Dynamics Corp.

For the first time, the Milson Fastener allows the stressed panel assembly to become an integral part of primary structure. For frequent servicing of components, with greatly reduced time, the Milson Fastener closes gaps up to .125 in., permits installation with hole misalignments up to .040 in., contains deep hexagon socket for superior power driving and high pre-load. Designed with only four parts and nothing to adjust, it provides two lug and corner floating receptacle styles, is manufactured in two temperature ranges—alloy steel for 550°F and corrosion resistant steel for 700°F service.

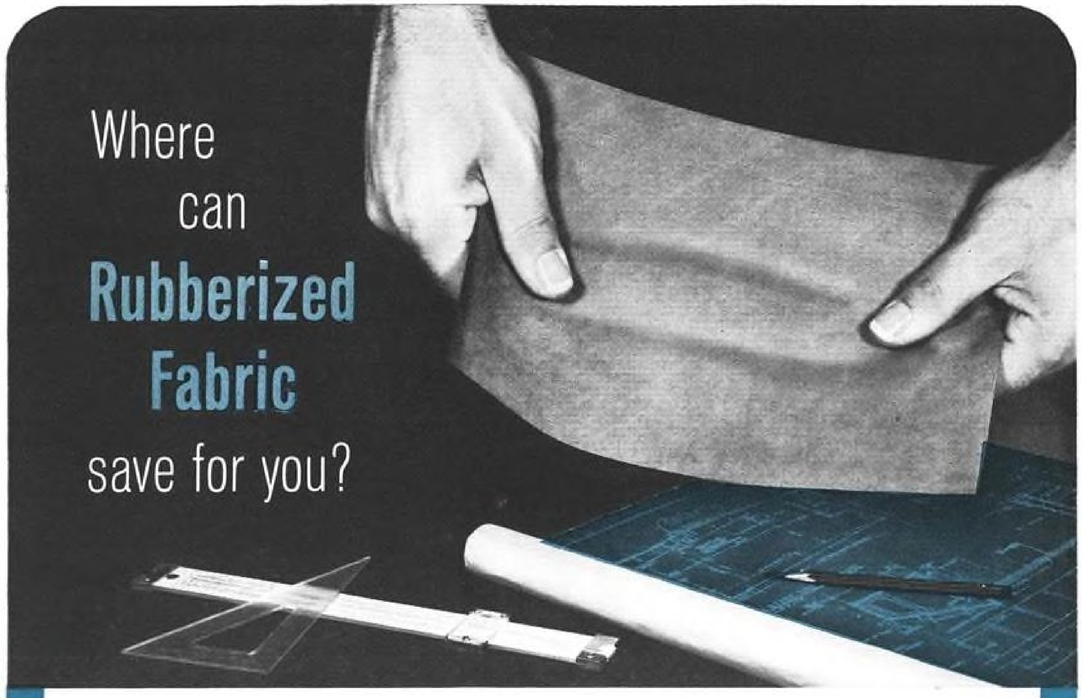
The sleeve bolt has a shear groove in the head to prevent over-torquing. This fastener has a common hole size in the panel and substructure, and all parts are completely interchangeable.

This is the newest and only device available that permits quick access to black box equipment as often as required... never before possible with stressed panels.

Technical assistance for your stressed panel requirements available on request.

VOI-SHAN

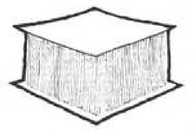
VOI-SHAN MANUFACTURING COMPANY
a division of Pheoll Manufacturing Company
8463 Higuera Street, Culver City, California



Need strength, flexibility and portability in one lightweight material? Goodyear Rubberized Fabric may be your answer.

INFLATABLE, PORTABLE

Air Mat Fabric provides excellent insulation against heat, cold, vibration. Ideal for personnel shelters, portable scaffolding, shock cushioning. Beams made of this unique rubber-coated inflatable material have highest strength-to-weight ratio known.



INFLATOPLANE

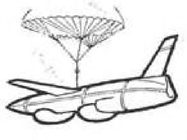
—another ingenious application of Air Mat Fabric. Pilot simply unfolds it, inflates it—and *flies away!* Do your plans call for a lightweight structural material that can be moved easily, occupies a bare minimum of storage space, can be erected quickly?

LOOK! COLLAPSIBLE FUEL TANKS

that unroll like a rug—can be set up, filled and pumping 45 minutes after delivery. Eliminates need for bulky, hard-to-handle metal drums. Designed for use wherever temporary or emergency storage of gasoline, oil, water—any bulk liquid—is required.

WANT TO BRING A MISSILE BACK?

Goodyear Recovery Bags—made of tough, rubberized fabric—fold into test missiles, inflate on way down to cushion ground impact. Saves the missile for firing another day, eliminates cost and weight of electronically operated conventional landing gear.



FOR DETAILED INFORMATION on rubberized fabric—and how it can save for you—write Goodyear, Aviation Products Division, Akron 16, Ohio, or Los Angeles 54, California.

AVIATION PRODUCTS BY

GOODYEAR

Inflatoplane—T. M. Goodyear Aircraft Corporation, Akron 15, Ohio

MORE AIRCRAFT LAND ON GOODYEAR TIRES, WHEELS AND BRAKES THAN ON ANY OTHER KIND

AVIATION CALENDAR

March 23-25—Flight Testing Conference, American Rocket Society, Daytona Plaza Hotel, Daytona Beach, Fla.
March 23-26—National Convention, Institute of Radio Engineers, Coliseum and Waldorf-Astoria Hotel, New York, N. Y.
March 25-27—16th Annual Conference, Pacific Coast Section of the Society of the Plastics Industry, Hotel del Coronado, San Diego, Calif.
March 31-Apr. 3—National Aeronautic Meeting, Society of Automotive Engineers, Hotel Commodore, New York, N. Y.
Apr. 2-3—Conference on Electrically Exploded Wires, sponsored by the Thermal Radiation Laboratory of the Geophysics Research Directorate of the Air Force, Cambridge Research Center, Somerset Hotel, Boston, Mass.
Apr. 5-10—1959 Nuclear Congress, Municipal Auditorium, Cleveland, Ohio.
Apr. 6-8—Fifth National Military-Industrial Conference, Palmer House, Chicago, Ill.
Apr. 8—Aviators' Post No. 743 Gen. William Mitchell Award Dinner, Waldorf-Astoria, New York, N. Y.
Apr. 12-15—Annual Meeting, American Assn. of Airport Executives, Savannah.
Apr. 12-16—International Conference on Fracture, Massachusetts Institute of Technology, Cambridge, Mass. Sponsors: Air Force Office of Scientific Research/Solid State Sciences Division, Office of Naval Research, National Science Foundation, National Academy of Sciences/NRC. (Contact: Dr. David K. Felback, National Academy of Sciences, Washington, D. C.)
Apr. 12-19—Air Force Assn.'s World Congress of Flight, Las Vegas, Nev.
Apr. 15-17—Second Annual Symposium on Information and Decision Processes, Purdue University, Lafayette, Ind.
Apr. 16—Conference on Aviation Safety.

(Continued on page 6)

AVIATION WEEK Including Space Technology

March 16, 1959

Vol. 70, No. 11

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AVIATION CALENDAR

(*Continued from page 5*)

Hotel Statler, New York, N. Y. Sponsor: Greater New York Safety Council.

Apr. 16-17—17th Annual Meeting, Aeronautical Training Society, Desert Inn, Las Vegas, Nev.

Apr. 16-18—11th Annual Southwestern Institute of Radio Engineers Conference and Electronics Show, Dallas Memorial Auditorium, Dallas, Tex.

Apr. 21-22—Spring Technical Conference on Electronic Data Processing, Cincinnati Section of the Institute of Radio Engineers, Engineering Society Bldg., Cincinnati, Ohio.

Apr. 21-23—Ninth Annual Convention, International Airline Navigators Council, Hotel Manhattan, New York, N. Y.

Apr. 22-24—1959 Annual Meeting, Institute of Environmental Engineers, LaSalle Hotel, Chicago, Ill.

Apr. 23—Annual Eastern Regional Meeting, Institute of Navigation, Friendship International Airport, Baltimore, Md.

Apr. 23-24—Quarterly Regional Meeting, Assn. of Local and Territorial Airlines, Bel Air Motor Hotel, St. Louis, Mo.

Apr. 29-May 1—First National Metals Engineering Conference, American Society of Mechanical Engineers, Hotel Sheraton-Ten Eyck, Albany, N. Y.

Apr. 30-May 1—Controllable Satellites Conference, American Rocket Society, Massachusetts Institute of Technology, Cambridge, Mass.

May 3-7—Symposium on Electrode Processes, Philadelphia, Pa. Sponsors: AFOSR/Chemistry Div. and Electromechanical Society. (Contact: Electrochemical Society, Inc., 1860 Broadway, New York 23, N. Y.)

May 4-6—National Aeronautical Electronic Conference, Institute of Radio Engineers, Biltmore Hotel, Dayton, Ohio.

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

May 6-8—Seventh Regional Conference and Trade Show, Institute of Radio Engineers, University of New Mexico, Albuquerque.

May 6-8—1959 Electronic Components Conference, Benjamin Franklin Hotel, Phila.

May 6-9—15th Annual National Forum, American Helicopter Society, Sheraton Park Hotel, Washington, D. C.

May 18-21—18th Annual National Conference, Society of Aeronautical Weight Engineers, Hotel Henry Grady, Atlanta, Ga.

May 20-22—National Spring Meeting & Exhibition, Society for Experimental Stress Analysis, Sheraton Park Hotel, Washington, D. C.

May 20-22—Second Jet Age Airport Conference, American Society of Civil Engineers, Shamrock-Hilton Hotel, Houston, Tex.

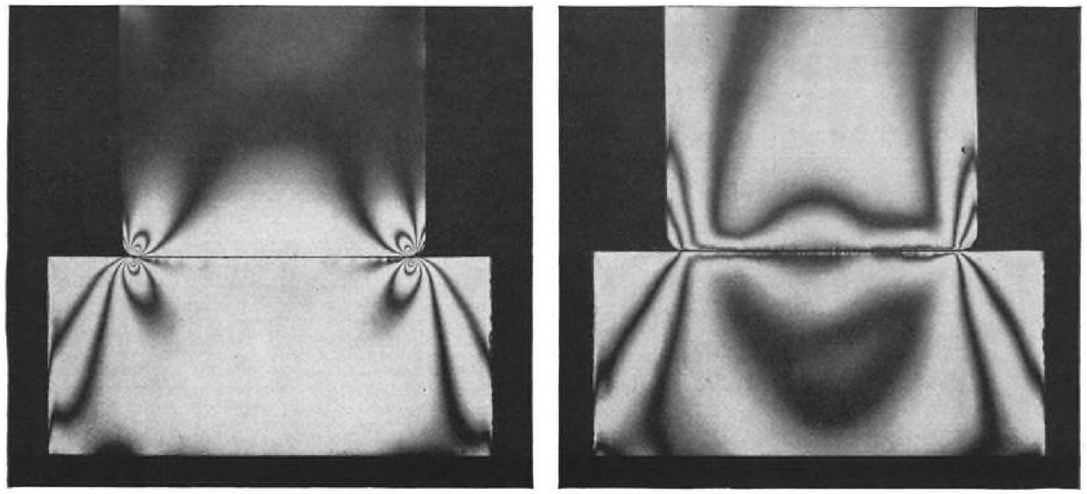
May 25-27—1959 National Telemetering Conference on Investigation of Space, Brown Palace and Cosmopolitan Hotel, Denver, Colo. Sponsors: American Rocket Society, Institute of the Aeronautical Sciences, American Institute of Electrical Engineers and Instrument Society of America.

June 12-21—23rd French International Air Show, Le Bourget, Paris, France.

One in a series of technical reports by Bower

BEARING BRIEFINGS

ROLLER BEARING LIFE AND CAPACITY LINKED TO STRESS DISTRIBUTION



These reproductions of photoelastic studies contain important evidence for every engineer and designer concerned with the performance and selection of roller bearings. In these photographs, the alternate dark and light areas, called fringes, indicate not only the magnitude of stress but also the stress distribution. The photographs were taken by Bower Research Engineers during a study of stress distribution in roller bearings.

The subjects represent rollers and raceways of two roller bearings under identical loads. The illustration at the left shows a roller of conventional design. The illustration at the right shows a Bower "Profiled" roller. That is, the roller is precision ground with a large radius generated along the body of the roller—a predetermined and controlled distance from each end.

The conventional roller photo (left) clearly shows how, under load, stress concentration builds up in and near the roller ends. This is called edge-loading. Such areas of concentrated stress are the breeding grounds for metal fatigue and eventual bearing failure.

In the photo of the "Profiled" roller (right) stress lines can be seen uniformly distributed across the whole length of the roller and raceway. There are no points of excessive stress concentration, consequently no starting points for early fatigue. Such a "Profiled" roller exhibits a great advantage in improved load carrying capacity, a most important bearing requirement.

Under actual operating conditions, Bower "Profiled" roller bearings show a considerably longer life at higher speeds and under greater loads than conventional roller bearings.

Because of this, and of other Bower features to be discussed in later technical reports, we suggest that you consider the advantages of Bower bearings in satisfying your future bearing requirements.

★ ★ ★ ★

Bower engineers are always available, should you desire assistance or advice on bearing problems. Where product design calls for tapered roller bearings or journal roller assemblies, Bower makes these also in a full range of types and sizes.

BOWER ROLLER BEARINGS

BOWER ROLLER BEARING DIVISION — FEDERAL-MOGUL-BOWER BEARINGS, INC., DETROIT 14, MICHIGAN

STEPS IN THE RACE TO OUTER SPACE

Mars Snooper

This nuclear-fueled reconnaissance craft is preparing to land on Mars' outermost satellite, Deimos—12,500 miles away from the "red planet" (center) and 35 million miles away from the Earth. Deimos' gravitational pull is so slight that a featherlight landing could be made, and a take-off could be accomplished with little more than a shove of the pilot's foot! (At Deimos' orbital speed, such a push would start the ship back to Earth at 3000 miles per hour.)

Our spaceship is designed to fly in two directions—nose first as a space rocket and tail-first as a ramjet airplane. Propulsion for both is provided by a single atomic heat source, reacting with hydrogen for rocket thrust, and with atmosphere to power the ramjets.

Travel to Mars, braking for landing, take-off and re-entry are accomplished by rocket-thrust. As the ship approaches the Earth's atmosphere, it assumes a tail-first attitude. The "petal doors" enclose the rocket nozzle, and the ship is transformed into a high speed, ramjet airplane with M-shaped wings. Control fins are located in the nose of the craft, near the crew's quarters.

* * *

Inertial navigation systems will play an increasing role in the exploration of outer space. ***ARMA***, now providing such systems for the Air Force TITAN and ATLAS ICBM's, will be in the vanguard of the race to outer space. ***ARMA*** . . . Garden City, New York. A Division of American Bosch Arma Corporation.

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step up
your missile program
with Solar's proven capabilities

❶ Solar's Proven Leadership in Engineering and Research

Since World War II, Solar's versatile engineering and research divisions have made many significant contributions to missile technology. They range from the development of lightweight, heat-resistant all-metal sandwich structures and high-temperature coatings to the solution of difficult manufacturing problems involving missile fuselages, fuel tanks, nose cones, liquid propellant thrust chambers, solid propellant rocket cases and others. Right now, Solar is participating in the design, development and production phases of 20 of America's major missiles.

Responsibility for Solar's current missile program is centered in a team of experts experienced in the many phases of missile development—from conception to prototype and volume production. *Collective experience of Solar's outstanding engineering and scientific team includes work on every major missile program!*

❷ 32 Years Experience in Taming 'Hard-to-Work' Metals

Today, Solar is the only company that has successfully furnace-brazed giant rocket engine chambers for all of America's largest missiles. The chambers—designed to withstand combustion temperatures of 5500 F—are but one example of Solar's proven leadership in high-temperature technology. This leadership, along with the nation's most advanced heat-treating facilities, is an important part of Solar's missile and systems capability.

❸ Solar's Diversified Output Strengthens Missile Capability

Solar's many products, while diversified, share a logical common bond. All are precision engineered; all receive the benefits of Solar's extensive research and testing programs, and all are built to withstand stringent service conditions. Major areas of activity include:

AIRCRAFT AND MISSILE SYSTEMS AND COMPONENTS: Missile fuselages, nose cones, thrust chambers, solid propellant rocket cases and nozzles, controls, air vanes, afterburners, and other precision-built components.

GAS TURBINE ENGINES: Lightweight, proven-in-service gas turbines ranging from 50 to 1100 hp for missile and aircraft ground support, airborne auxiliary power, propulsion and others. Solar has long been a leader in this field.

DUCTING SYSTEMS AND EXPANSION JOINTS: Design, testing and production of complete ducting systems for aircraft and missiles. Largest array of expansion joints in the world, precision engineered and manufactured to exacting standards for handling of liquid missile fuels and for other applications involving difficult problems of stress, temperature and vibration.

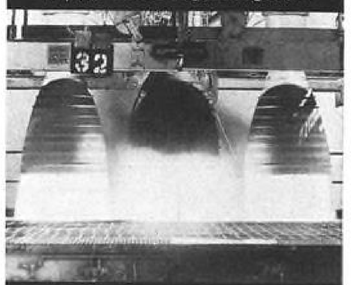
ELECTRONIC COMPONENTS AND SYSTEMS: Design and development—controls, tracking systems, missile instrumentation, data processing and communications systems, missile and aircraft guidance and control systems, target control systems, servomechanisms, telemetering and timing systems, analogue computers and others.

❹ Specialized Facilities in San Diego and Des Moines

Solar's large completely staffed and equipped plants in San Diego, California, and Des Moines, Iowa, have the capabilities, experienced personnel and specialized facilities to undertake missile and systems programs of the widest scope and variety. Engineering, research and production facilities are being expanded by construction of one of the largest controlled atmosphere pit furnaces in the nation (for heat-treating large missiles) and a new 60,000 sq ft engineering and research building.

For detailed information on how Solar can put its products, services and facilities to work for you, write to Dept. F-133, Solar Aircraft Company, San Diego 12, California.

Solar missile capabilities include top-flight missile engineering team.



Powerful Solar-made boosters for big missiles require special skills.

Plant and general offices in San Diego, Calif., total 600,000 sq ft.

Solar's Des Moines Division. Both plants total over 1,200,000 sq ft.

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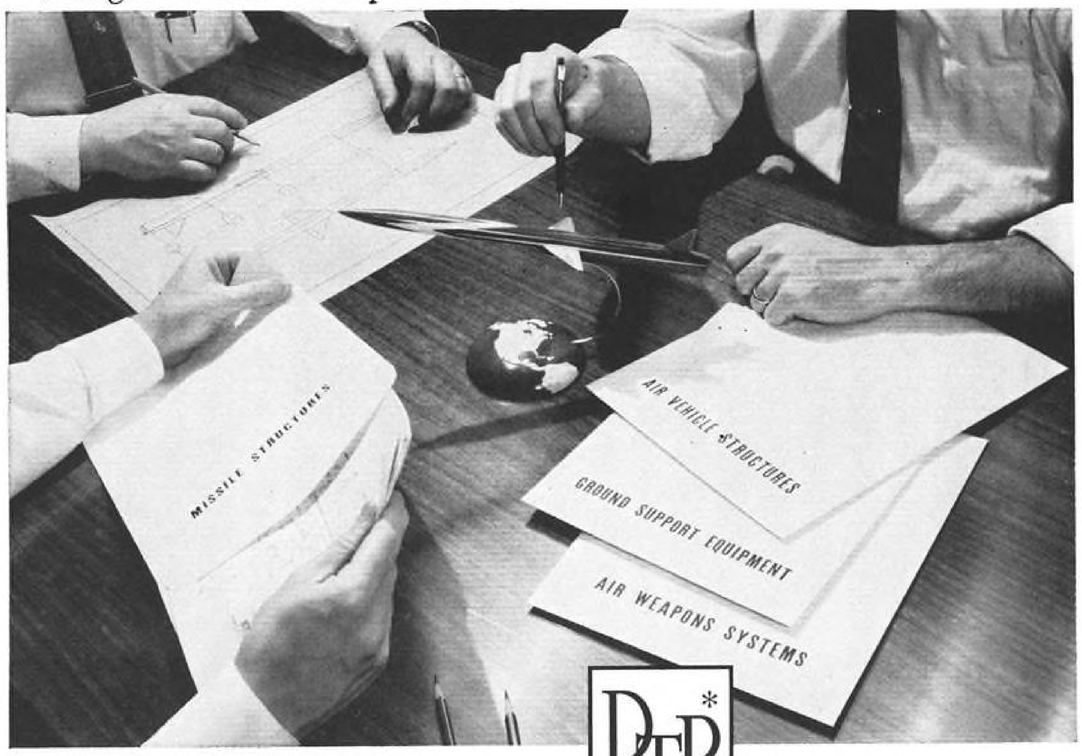

AERONCA'S DTP* PACKAGES

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* *Design Tooling Production*

Contemporary weapons systems, because of their complexity, necessitate sub-contracting of major components, sub-systems and structures. And versatile capabilities... theoretical, technological, mechanical and managerial . . . are required to produce these "envelopes" efficiently and economically.

Aeronca has these integrated facilities. That is why we can provide a *Co-ordinated Design, Tooling and Production Service.* This packaged service begins with evaluation of basic environmental data and culminates with "on schedule" deliveries. It has been eminently successful in supporting current operational weapons systems.

Aeronca's leadership is evident in its existing facility for designing and producing . . . in quantity . . . a complete range of brazed stainless honeycomb structures. This specialized capacity is one of the few *in actual operation* in the industry today.

With extensive background in proprietary and sub-contract programs, Aeronca is prepared to work with you on air vehicle, missile, ground support equipment and technical consultation projects. And we can say with confidence . . . *just give us the envelope and we'll do the rest.*

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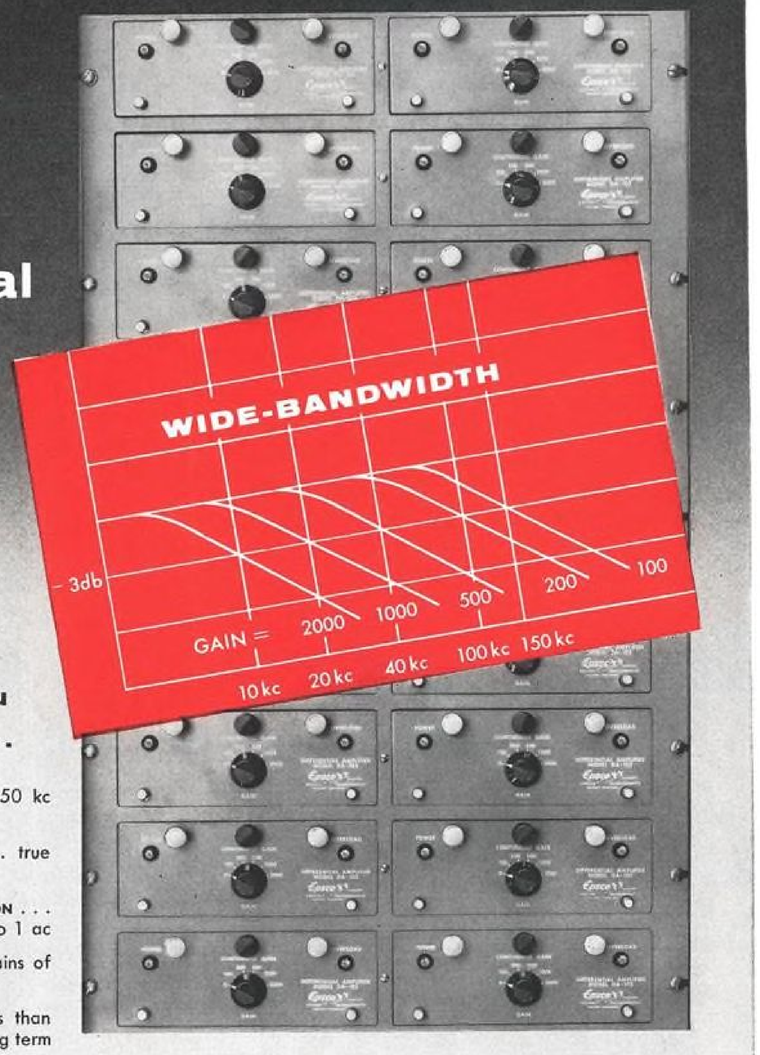

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An Announcement

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The new Military Products Division — with a background of twelve years experience as an integrated organization — will carry on and expand the work it formerly handled as a department of the Detroit Controls Division of American-Standard.*

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The Systems Department — navigation systems, stabilization systems, and related military equipment

The Components Department — gyroscopes, accelerometers, and auxiliary controls of exceptional reliability

The Central Manufacturing Department — precision contract production.

American-Standard, Military Products Division, 100 Morse Street, Norwood, Massachusetts

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ARMCO 17-4 PH 17-7 PH STAINLESS STEELS

Specified in America's Space-Shrinking Jet Airliners

In all of the new swift and sturdy commercial jet airliners, Armco's Precipitation-Hardening Stainless Steels are used to help achieve dependable rugged strength and economical performance-improving lightness.

Both of these special Armco Steels, developed specifically for the aeronautical industry, offer a unique combination of high strength-weight ratios at temperatures to 900 F, good corrosion resistance, and fabricating characteristics that assure producibility.

Their specification for components such as longerons, pod and pylon structures, thrust reversers, engine parts and accessories by manufacturers with enviable reputations is evidence of their effectiveness and economy.

Because of their unusual combination of properties and fabricating characteristics, Armco 17-4 PH and 17-7 PH are also widely used in all types of military aircraft as well as short and long-range missiles of all types. These space-age metals, plus Armco's newest precipitation-hardening stainless, PH 15-7 Mo, offer you the possibility of new and effective solutions to your design and production problems.

For complete information on Armco's Precipitation-Hardening Stainless Steels, other special stainless grades and all the standard types, write to Armco Steel Corporation, 1679 Curtis Street, Middletown, Ohio, or fill out and mail the coupon.

ARMCO STEEL CORPORATION
1679 Curtis Street, Middletown, Ohio

Send me design and fabricating information on the following Armco Stainless Steels:

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- ☐ **Armco 17-7 PH**
- ☐ **Armco PH 15-7 Mo**
- ☐ **Armco Ferrite-Free Type 431**
- ☐ **Armco Mod. 12 Chromium Grades**
- ☐ **Armco 22-4-9**
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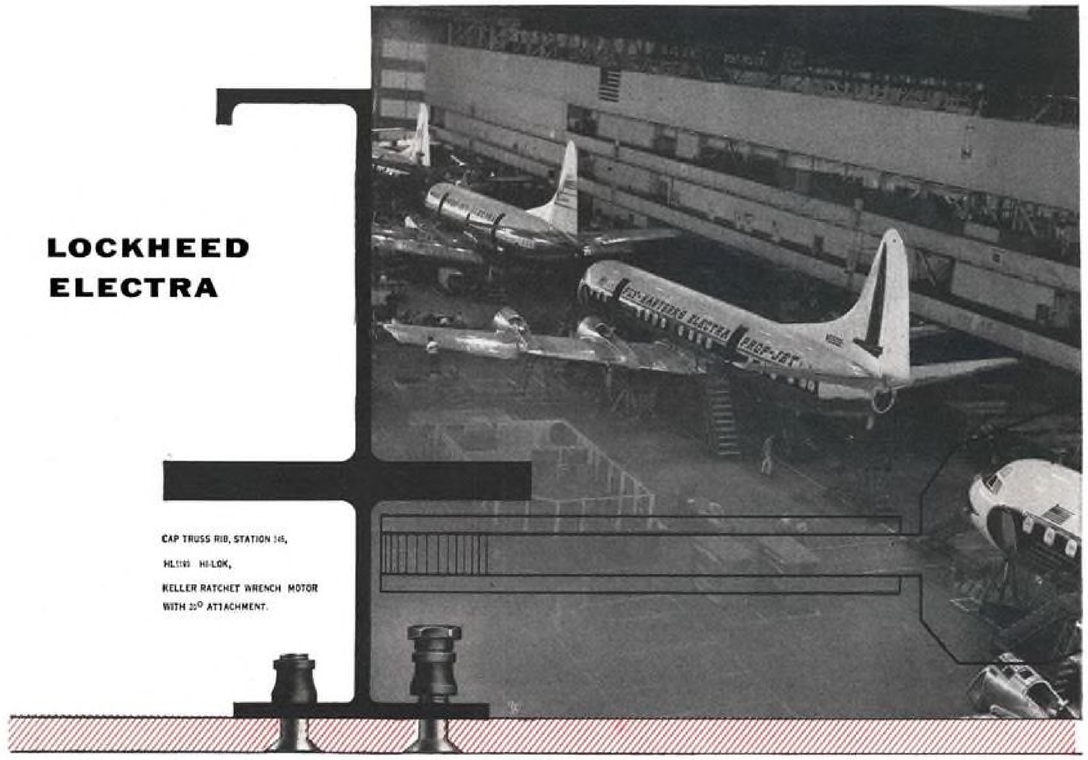

hi-Lok® FASTENER

ELECTRA AND HI-LOKS EMPHASIZE DESIGN SIMPLICITY

The Electra, fastest prop jet ever built for commercial service, emphasizes design simplicity to obtain weight and manufacturing economies. In keeping with this design premise, the new Hi-Lok fastener is used extensively in the wing and fuselage.

Basic fastener reliability stems from the consistent design preload maintained in each installed Hi-Lok fastener. The automatic torque-off of the wrenching end of the collar during installation to obtain the preload, also contributes to substantial weight savings in the installed Hi-Lok.

Installation tooling and driving techniques are simplified in the Lockheed shop because Hi-Loks are installed quickly and quietly with standard high speed air drivers. Using an automatic collar loading technique, Hi-Loks are installed up to 45 per minute.

Unique with the Electra "wet" wing is the standard Hi-Lok used as a sealing fastener, eliminating need for O-rings and other conventional fastener sealing methods.

Today, standard Hi-Loks are available in a variety of high strength and temperature resistant materials for use in aircraft, missiles and ground support equipment.

TRADEMARK REGISTERED, U. S. AND FOREIGN PATENTS APPLIED FOR

Contact your Engineering Standards Group for complete data on the new Hi-Lok fastener . . . or write to us.

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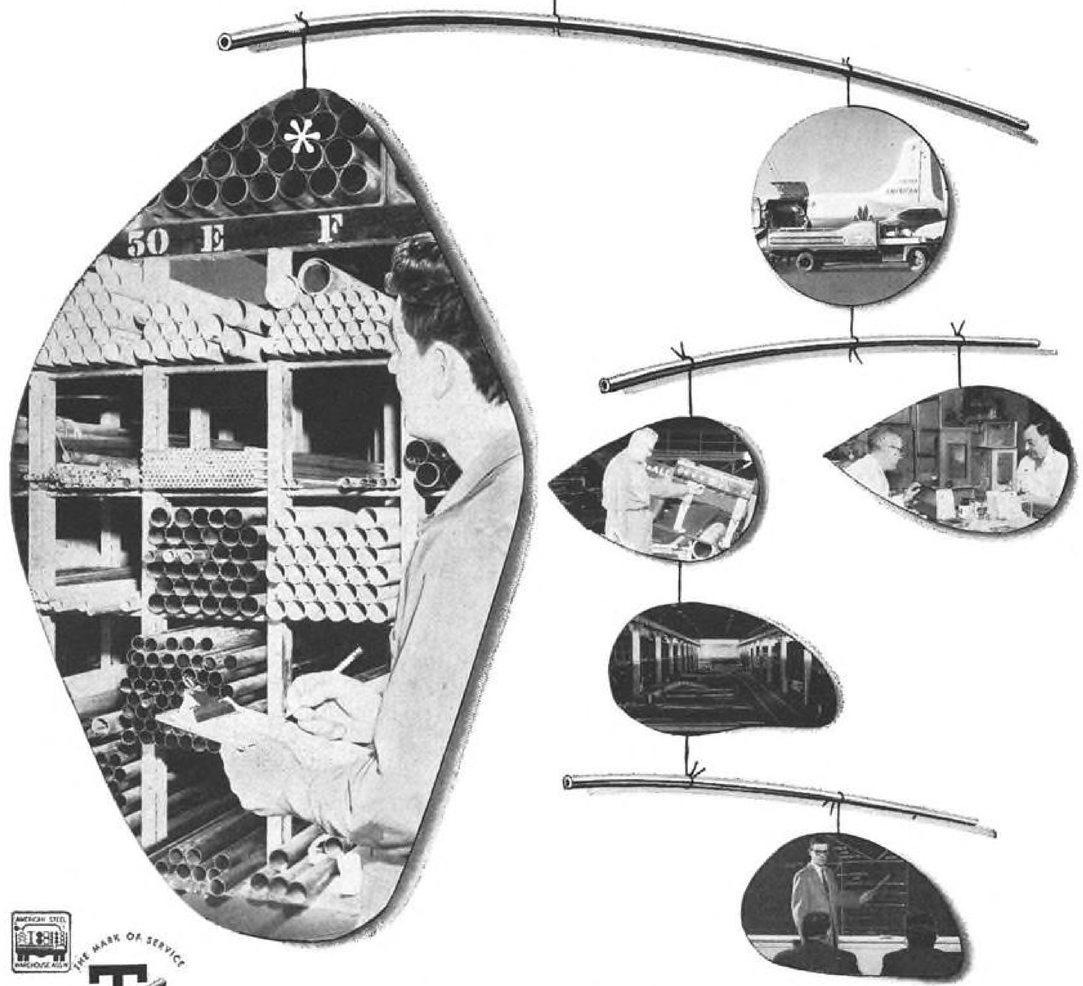

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March 16, 1959

Aviation Week
Including Space Technology

Vol. 70, No. 11
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COVER: Flight and ground testing of Convair 880 turbojet transport is well under way at San Diego, Calif., with aircraft attaining a speed of Mach .8 at 30,000 ft. on its fourth flight. Complete flight test program will require a total of 150,000 man hours. First Convair 880's four General Electric CJ-805-3 turbojet engines will be fitted with thrust reversers early in June; in August, it will go to Edwards AFB, Calif., for a month of accelerate and stop testing at nominal low and maximum weights. For other flight pictures, see pp. 46-47.

PICTURE CREDITS

Cover—Convair; 26, 27—Aviation Week; 30—Wide World; 32—U. S. Army; 35, 99, 101—General Electric; 43—Los Angeles Airways; 44, 103—Boeing Airplane Co.; 46, 47—Convair; 53 (bottom)—Charles E. Brown; 53, 56, 57, 58—Handley Page; 87, 90—USAF; 92—U. S. Navy; 98—Sperry Gyroscope Co.; 104, 105, 106—LeTourneau, Inc.; 108—Bell Helicopter Corp.

75,971 copies of this issue printed

EDITORIAL

Navy's Anti-Submarine Warfare Problem

The problem of developing an effective anti-submarine warfare capability against nuclear powered submarines is probably the Navy's top priority problem for the future. In addition to its anti-shipping capability, the nuclear powered submarine also offers a strategic threat when equipped for megaton missile launching.

The Soviet Union is developing a strong submarine warfare capability both in its peripheral waters and for long ranging transoceanic strategic operations. It now has an operational force of some 450 submarines, of which about half are long-ranging snorkeling types. This fleet is already larger than the most powerful submarine force Nazi Germany was able to launch at the peak of its terribly effective campaign against allied shipping in World War II. Soviet submarines have become increasingly active, well within their international rights, in the Atlantic where U.S. Navy ASW forces have contacted and tracked them underwater, unfortunately not long enough to force them to surface. The Soviets announced last December an extensive program of underseas scientific exploration, including explorations of the North American Continental Shelf.

Increasing Soviet Capability

There also is evidence that the Soviets are developing nuclear powered submarine capability. The three small nuclear reactors now being tested aboard the icebreaker Lenin are all types designed for eventual use in submarines, and submarine hulls designed for nuclear power are now under construction in Russia. Rear Adm. John S. Thach, commander of Task Force ALFA and one of the top U.S. Navy ASW experts, believes the recent reduction of the active Soviet submarine fleet strength from 464 last June to the present 450 is an indication that crews are being withdrawn from operational status for retraining in the techniques of nuclear submarines.

ASW is hard, dirty and unglamorous work and has never been a favorite career among top Navy officers. Until recently, it has been just as difficult to sell the importance of ASW within the Navy as it has been to the Defense Department and the Congress. However, in recent years, thanks to the evangelism of some devoted ASW advocates, the Navy has developed a growing capability in this field within the technical and financial resources available to it. Development of relatively small and air transportable nuclear depth charges has raised the kill probability, once a submarine has been definitely located, close to 100%.

Battling Obsolescence

However, the big deficiencies in current ASW technique are better detection and communications techniques, coupled with larger and swifter search forces.

The Navy also has developed a sound weapon system concept for ASW that utilizes every resource available, from other submarines through surface craft to airborne equipment. A good example of how combinations of equipment can stretch the capability of old-standbys just a little farther are the current experiments with drone helicopters operated from a destroyer to extend the latter's killing radius.

But all of the re-soling of old shoes, even with some shiny new technical patches, is only an interim, makeshift solution to the Navy's real ASW problem of the future. What is really needed is some basic research and development breakthroughs all along the ASW line, with the possible exception of "kill" weapons where a long-term solution apparently is already in hand. This research and development effort must range all the way from basic exploration of the ocean floor and the world below the water's surface to new methods of communication through air and water and combinations thereof, new methods of long range detection down to depths far below present capabilities and through new vehicles for airborne, surface and underwater search efforts.

While current ASW capability must be developed and stretched to its technical limits, the real ASW problems now lie in the research and development area. Therefore, it is particularly depressing to note the shockingly small funds being allocated to the Navy's ASW Research and development effort in both the current Fiscal 1959 and the future Fiscal 1960 budget. This item is now creaking along under a somewhat anemic budget ceiling for Fiscal 1959 despite a $48 million boost by Congress above Administration requests. Prospects are that ASW research and development will take a slight cut in the Fiscal 1960 defense budget now being debated on Capitol Hill. We urgently recommend that Congress take a long and detailed look at this particular area when it considers items in which the present submitted budget is materially deficient.

Aid From Industry

In face of this official budgetary indifference, it is encouraging to note the response of the aviation industry and its related technologies to the Navy's plea for a broad attack along the research and development frontiers of ASW. Within the past year, several major firms have created ASW research and development organizations within their own industrial structure to provide a systems approach to this problem. Because of the paucity of Navy funds for this work, many other firms are tackling research and development problems on token "dollar a year" Navy contracts. The active response of industry to the Navy's needs in this area has been in marked contrast to the relative indifference at the highest official levels.

We fervently hope that industry will continue this long-term investment in the ASW problem and that the crusaders within the Navy who have been fighting so hard to throw a factual spotlight on this problem will not be daunted by top-level official criticism or indifference, and that the Congress will devote considerable attention to this important facet of our over-all defense structure.

—Robert Hotz

WHO'S WHERE

In the Front Office

Lee S. Johnson and **Paul L. Smith**, directors, The Bullard Co., Bridgeport, Conn. Mr. Johnson is vice president of United Aircraft Corp. and general manager of Sikorsky Aircraft Division; Mr. Smith is The Bullard Co.'s treasurer.

Edward K. Foster and **A. P. Fontaine**, directors, Bendix Aviation Corp., New York, N. Y. Mr. Foster is vice president and group executive-Bendix divisional operations; Mr. Fontaine is engineering vice president of the company.

Krafft A. Ehricke, of Convair (Astronautics) Division of General Dynamics Corp., a director, Kentron Hawaii, Ltd., Honolulu, Hawaii.

W. H. Schwebel and **Don L. Walter**, directors, Marquardt Aircraft Co., Van Nuys, Calif. Mr. Schwebel is vice president-finance, and Mr. Walter, vice president-power systems group of the company.

Kenneth Brown, consulting engineer and a director, Specification Packaging Engineering Corp., North Hollywood, Calif. Mr. Brown is a member of Space Technology Laboratories, Inc.

Consolidated Electrodynamics Corp. has announced that the Systems Division is now Consolidated Systems Corp., Monrovia, Calif., operating as a subsidiary of CEC. **Philip S. Fogg**, CEC president and board chairman, and **Kennett W. Patrick**, CEC vice president, are board chairman and president, respectively, of the new company. **Harry E. Burke, Jr.**, has been named vice president and general manager of the new corporation. Other officers are: **Franklin H. Donnell**, financial vice president; **Victor J. Pollock**, secretary; **Wilford R. Penny**, treasurer and assistant secretary; **John J. McDonald**, director of engineering; **Linden G. Criddle**, director of manufacturing.

John T. Jackson, a vice president, International Telephone and Telegraph Corp., New York, N. Y.

R. W. Hardesty, vice president-ground operations, Capital Airlines, Inc.

John J. Carpenter, a vice president, Bulova Research and Development Laboratories, Inc., a subsidiary of Bulova Watch Co., Woodside, N. Y.

W. Gifford Myers, corporate vice president-sales, Lockheed Aircraft Corp., Burbank, Calif.

George S. Shaw, staff vice president, Radiation, Inc., Melbourne, Fla. **Dr. Charles R. Burrows** succeeds Mr. Shaw as vice president and director of engineering.

Robert L. Lair, a vice president, Cessna Aircraft Co., Wichita, Kan. Mr. Lair continues as general manager of Cessna's military aircraft division.

John A. Maxwell, Jr., vice president and general manager of operations, Fenske, Fedrick & Miller, Inc., Los Angeles, Calif., a subsidiary of Temco Aircraft Corp., Dallas, Tex. Mr. Maxwell continues as a Temco vice president.

Col. Dorr E. Newton, assistant vice commander and chief of plans and programs, Air Research and Development Command, Andrews AFB, Washington, D. C.

(*Continued on page 109*)

INDUSTRY OBSERVER

► Boeing has abandoned the solid-propellant approach to a booster for its entry in the Dyna-Soar orbital bomber competition and is expected to team with Convair. Boeing probably would use a modified Atlas plus the Convair-Pratt & Whitney Centaur 35,000 lb. thrust liquid hydrogen engine as a launching vehicle. Centaur, originally planned as a 15,000 lb. upper stage for Thor, now will be a two-barreled, 30-35,000 lb. upper stage for Atlas.

► **Martin-Bell Dyna-Soar concept now calls for a four-barreled Titan as the booster vehicle rather than the cluster of three Titans plus high-energy second stage as originally planned.**

► Army committed a total of $18.5 million as its share to the Plato transportable, anti-ballistic missile system recently canceled by the Defense Department (AW Feb. 16, p. 32). Program, begun by Army as a defense weapon for front-line troops, was taken over last year by the Advanced Research Projects Agency.

► **McDonnell Aircraft Corp.'s two-stage test vehicle for an air-launched ballistic missile has eight fins equally spaced around the circumference of the body. Body itself is approximately 20 ft. long. Four fins are spaced 90 deg. apart on the first stage. Four more are spaced 90 deg. apart on the second stage but offset from those on the first stage by 45 deg. Vehicle was recently ground-launched over the Atlantic Missile Range (AW Mar. 2, p. 25).**

► ARGO D-4 four-stage research sounding rocket using Honest John as a booster, two Nike Ajax motors in tandem and a top-stage rocket developed by Navy Bureau of Ordnance and Allegany Ballistic Laboratory, will be fired within the near future by Aerolab Development Co., Pasadena, Calif., under military contract. Three vehicles are now being built; each will carry a 60-lb. payload to a 1,000-mi. altitude.

► **North American F-100 Super Sabre in service with Tactical Air Command will get a 700-mi. boost from a modification program now in progress at North American's Los Angeles Division. F-100s will be equipped with two 450 gal. external tanks suitable for aerial refueling from either regular TAC tankers or other Super Sabres using the "buddy" system. Prior to this modification program, only the 1,185 gal. capacity of the F-100 internal fuel tanks could be refilled by aerial refueling.**

► Passive communications satellite to be launched next year by National Aeronautics and Space Administration will be put into a 1,000 mi. orbit, giving it a period of about 118 min. The 65-lb., 100-ft.-diameter inflatable plastic sphere, coated with aluminum, will require ground equipment consisting of a high-powered transmitter, low-noise receiver, large steerable directional antenna and computing equipment.

► **First flight for the Saturn 1.5 million lb. thrust cluster of Rocketdyne engines is now scheduled for September of next year. Booster is being developed by Army Ballistic Missile Agency. Full-scale captive test firing is hoped for before the end of this year.**

► Army-Martin Pershing selective range missile, the solid-fueled replacement for Redstone, was allocated $100.2 million for development during the current fiscal year. Program was initiated in late Fiscal 1958 with an allocation of $20 million.

► **Navy will make a major, possibly last-ditch, effort to win approval of its proposal to purchase three British Princess flying boats for partial conversion to nuclear power during the forthcoming hearings on the U. S. ANP program by the Joint Congressional Committee on Atomic Energy. Proposal, regularly vetoed by the Administration, envisions a total cost of approximately $100 million; would have all three aircraft converted and flying as testbed vehicles within five years.**

Washington Roundup

President Views Defense

President Eisenhower said last week that if Congress persists in trying to make the Defense Department keep Army and Marine Corps manpower higher than the Administration desires, "I'll have to put these people . . . just some place where it's nice to keep them out of the way, because I don't know what else to do with them."

The President had been asked at his press conference where he got "the right to thwart the will of Congress" in cutting Army and the Marine Corps strength or refusing to spend money given him for missiles, etc. He said he thinks "Congress is sometimes mistaken, and I think in the past they have made some very bad mistakes in dealing with defense. All right. I try to correct them."

Another reporter mentioned the charge that the Administration puts a balanced budget ahead of national security and asked if the President would spend more on the armed forces if he could look forward to a surplus in the treasury.

The President said he would not ". . . I'm just tired even of talking about the idea of a balanced budget against national security," he said. "This—I don't see where this thing ever comes into it. I say that a balanced budget in the long run is a vital part of national security. . . . Why doesn't anyone have the courage to get right up and say, 'I want 55,000 men,' and maybe they want them sometimes because they'll be stationed at nice convenient places and—why don't they say, 'but we want the taxes for it.'"

Rep. John McCormack (D.-Mass.), House majority leader, recently urged the President to call for higher taxes if this is necessary to finance greater defense spending within a balanced budget (AW Feb. 16, p. 25). And, following the Eisenhower statement, Sen. Stuart Symington (D.-Mo.) echoed McCormack's earlier remarks, saying if higher taxes are needed to support an adequate defense program "we certainly ought to have them."

Pluto Slowdown

Major slowdown in the Pluto nuclear ramjet project (AW Oct. 13, p. 33) also is being forced by Budget Bureau. Atomic Energy Commission's request of $10 million construction funds for Fiscal 1960 was cut to $2 million. In addition, Budget Bureau withheld all Fiscal 1959 construction funds for six months, did not release them for commitment until January. Members of the Joint Congressional Atomic Energy Committee, after executive briefing sessions, are satisfied with progress on two other advanced AEC projects—Rover nuclear rocket project, and the Snap project to develop several small auxiliary nuclear powerplants.

McElroy's Departure Schedule

In another area, Defense Secretary Neil McElroy hopes to leave government service before the end of the year to become chairman of the board of Procter and Gamble Co. where he had served as president before coming to Washington. Chairmanship carries with it a large stock option plan. At a recent press conference, McElroy said:

"I am staying on in this assignment, as I announced when I came in, at the pleasure of the President. There are, as the President knows, certain personal factors in my life which rather urgently push me toward a departure before the conclusion of this Administration's term of office. I don't expect to have this urgent question come before me before the end of the year. I expect to stay throughout this session of the Congress. . . . I expect to be here in the setting up of the principles of the 1961 appropriation budget. . . ."

Schriever, ARDC Head?

Also, watch for Maj. Gen. Bernard Schriever, now head of USAF's Ballistic Missile Division, to be named commander of the Air Research and Development Command, replacing Lt. Gen. Samuel Anderson, who formally left this post on Mar. 10 to become commander of the Air Materiel Command.

Judgeship for Durfee?

On the civil side of the Administration, one of two top contenders for appointment to the judgeship of the Federal Court of Claims is chairman of the Civil Aeronautics Board James Durfee. If Durfee wins and accepts the post, which observers here say he will, chances are strong that the Federal Aviation Agency will have a major voice in the presidential nomination of Durfee's successor in order to ensure close cooperation between the Board and the new agency. Another Board position will open the end of this year when Harmar D. Denny's term as a Board member expires.

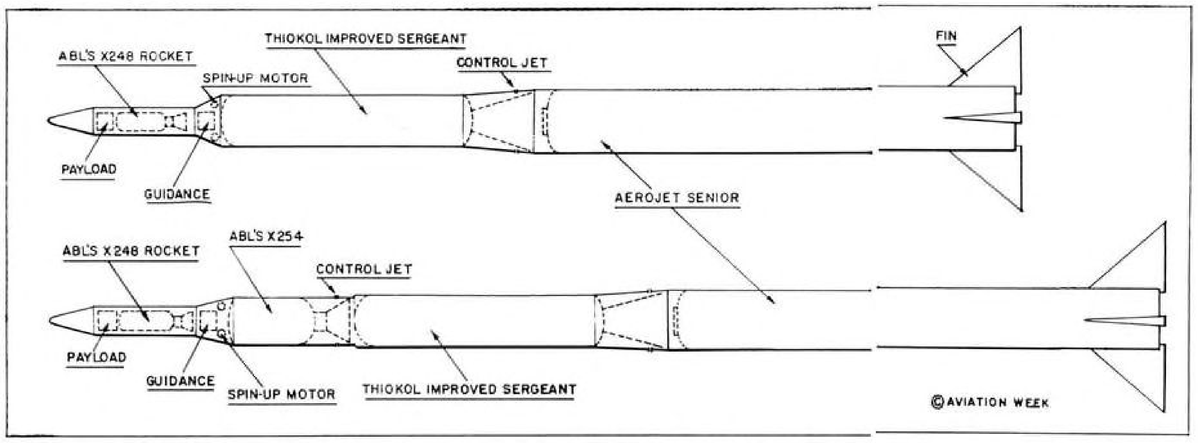
CAB Probe of ATA

And, Civil Aeronautics Board last week began a full-scale inspection and review of the Air Transport Assn., the first since 1940 when ATA's articles of association were first approved by the Board. Of particular interest to the Board will be an investigation of the formula for proration of dues as well as assessments on, and contributions by, the association's members. The Board also emphasized in its order calling for the inspection that it wants "to determine to what extent, if any, the large carriers control the actions of all carriers through the instrumentality of the ATA. . . ." In its review, the Board will look into "diaries, minutes and agendas of all meetings of members, committees, board of directors' conferences and arbitration boards" and all other accounts and records.

IDA Personnel

In Congress, the House Military Operations Subcommittee is focusing on industry connections of the personnel employed by the Institute of Defense Analysis. IDA was organized with a $500,000 grant from Ford Foundation to supply the personnel for technical evaluation studies for Department of Defense. Garrison Norton, former Assistant Secretary of Navy, is president; Albert G. Hill, former physics professor of Massachusetts Institute of Technology, is vice president. Initially, IDA borrowed personnel from universities and industry for Defense Department studies, but, at present, all personnel are directly employed by IDA. Hill told the subcommittee that the possibility that personnel may do temporary service with IDA to obtain inside defense information of high value to industry is "a very grave concern."

—Washington staff



LAYOUT of Scout III (top) and Scout IV (bottom) is shown. Principal difference is addition of the X254 engine in Scout IV.

Space Technology

First Scout Vehicle Delivery Due Aug. 15

Bids for airframe contract will be submitted this week in push to develop space research project.

Washington—Industry will submit bids this week for construction of the airframe for the Project Scout general-purpose space vehicle (AW Feb. 2, p. 26) in an effort to meet an Aug. 15 deadline set by the National Aeronautics and Space Administration for delivery of the first unit to Wallops Island.

Tempo of the pace being set by NASA for acquisition of the first of the Scout vehicles to be used for orbit, re-entry and probe research is indicated by the fact that proposals for design, fabrication and assembly were only received by bidders early this month. Proposals are to be submitted to NASA's Langley Research Center, cognizant agency for the program.

Two Scout vehicle configurations are involved—the three-stage Scout III and the four-stage Scout IV. Two each are being procured initially. Both versions will use all solid-propellant rockets to achieve low cost, reliability and a simple firing procedure. They are intended for elliptical and circular orbiting, re-entry shots and vertical-type trajectories. In addition, Scout III will be used to check out the components of Scout IV before the first flight of that vehicle.

August 15 delivery will be a Scout III and launcher. Other deliveries of Scout vehicles are scheduled to follow at one-month intervals.

Initial specifications are for only four Scout vehicles, but some bidders are basing tooling estimates on at least 12 of the missiles.

The four-stage vehicles are expected to cost about $500,000 each. NASA will turn basic development specifications over to the Air Force, which will modify vehicles for its own tests. USAF, however, will not use the vehicles for orbital shots.

Scout vehicle staging probably will be designated by NASA by the names of stars. Details of Scout III staging are:

• **First Stage.** Planned designation of this stage is Algol. Rocket is an Aerojet-General Senior. Stabilization will be with fins; control with fins and jet vanes. Algol rocket weight is 22,980 lb.; structure is expected to total 500 lb., control equipment 80 lb., for a total stage weight of 23,560 lb.

• **Second Stage.** Castor is designation of this stage. Rocket motor, built by Thiokol, is an improved Sergeant bearing number TX-33-20. Thiokol will modify this rocket to expand the nozzle in order to boost performance substantially. Burning characteristics require that the nozzle thickness be appreciable. Nozzle probably will be used as the structural connection between the first and second stages. Stabilization for the second stage will use hydrogen-peroxide fixed jets, and control will be via fins and jet vanes. Minneapolis-Honeywell guidance package will be located at top of the second stage. Thiokol Castor with modified nozzle is estimated to weigh 8,900 lb. Structure probably will add 120 lb., control equipment another 125 lb., for a total stage weight of 9,145 lb.

• **Third Stage.** Designation will be Altair. Rocket is Navy Bureau of Ordnance-Allegany Ballistic Laboratory's X-248, which has been used in the Vanguard, and USAF's Thor Able and Pioneer lunar probe vehicles. Stabilization will be attained through spin technique. There will be no control. The X-248 will weigh 501 lb.; structure will add 60 lb. Payload caried on this stage will be 100 lb., making total stage weight 661 lb.

Scout IV staging will be as follows:

• **First stage** will be similar to stage one of Scout III in all respects.

• **Second stage** also will be similar to stage two of Scout III.

• **Stage three.** Designation of this stage will be Antares. Rocket motor will be the BuOrd-Allegany X-254, a scaled-up version of X-248. Stabilization will be by hydrogen-peroxide fixed jets and control by fins and jet vanes. Minneapolis-Honeywell guidance package for the vehicle will be located at the top of this stage. Rocket weight is 2,200 lb.; structure will weigh 50 lb.; spin-up, control equipment and autopilot another 130 lb., making a total stage weight of 2,380 lb.

• **Fourth stage** will be similar to Scout III's stage three.

Except for the addition of the X-254 rocket motor, hardware used in Scout III and Scout IV will be practically the same.

Firing scheme for the various rockets of the multistage Scout vehicles probably will follow this pattern:

• **First stage** will be ignited from the control blockhouse, a standard procedure.

• **Second stage** will be ignited after burnout of first stage or following a coast interval in which the first stage still will be attached. Coast between first and second stages can reduce the effort required to overcome unstable aerodynamic forces. If coast is not used, it is likely that this ignition will be initiated by a pressure-actuated switch coming into operation when the first stage chamber pressure tapers to about 200 psi. Where coasting is employed, ignition probably will be initiated by delay-type of equipment actuated by a pressure switch or, as an alternative, a timing device which begins its count at liftoff.

• **Third stage ignition** may be inaugurated at burnout of the second stage through use of a pressure-actuated switch, but another possibility is that a coast period may be employed between second stage burnout and third stage ignition.

• **In Scout IV,** fourth stage ignition will be accomplished by a signal from the control programmer.

Payload of equipment and instruments will have to be protected against aerodynamic heating, but the material features involving excessive weight to accomplish this protection will be jettisoned before final staging is ignited.

For trials involving orbiting and re-entry, top two stages of the Scout vehicles probably will coast together after the next-to-final stage burns out, with attitude maintained by Minneapolis-Honeywell guidance and control units in the next-to-top space. For orbital firings, attitude of the two stages will be at an angle equal to that of the local horizontal at the apogee of the ascent trajectory, when the final stage will be rotated by spin rockets and the stage fired.

Final stage spin rate will be a function of the thrust vector misalignment anticipated and flight path deviation tolerated. Scout IV fourth stage spin rate may be 160 rpm; about 80 rpm. is expected for third stage of Scout III.

In re-entry attempts, attitude, spin-up timing and last stage firing will be programmed so that the last stage will burn out at altitude of about 19 mi.

Vertical trajectories will be launched in the range between 75 and 90 deg. from the horizontal. All rocket motors will fire successively with no coast between stages.

Highlights of the structural plan, checkout program, launch system and associated aspects are:

• **Zero-lift trajectories** are programmed with the orbit perigee altitude varied by changing either the initial launch angle or period of coasting between burnout of first stage and ignition of second stage. Because loads imposed are dependent upon airframe design, choice of flight paths and launching attitudes will be the airframe contractor's responsibility. Selected flight paths and launching attitude will be analyzed with regard to safety aspects in the event of

Titan Test Plans

Cape Canaveral, Fla.—Success of the first two Air Force-Martin Titan intercontinental missile test flights has allowed Martin to incorporate a number of test objectives into the program earlier than planned.

Two remaining shots in the A series will attempt a greater number of objectives than originally scheduled and may attempt to double the 200-250 mi. range over which the first two A series shots were fired.

BG missile, the ground facility checkout vehicle for the B series, and the BL or laboratory missile for the B series, which is used to checkout systems, already are at Cape Canaveral.

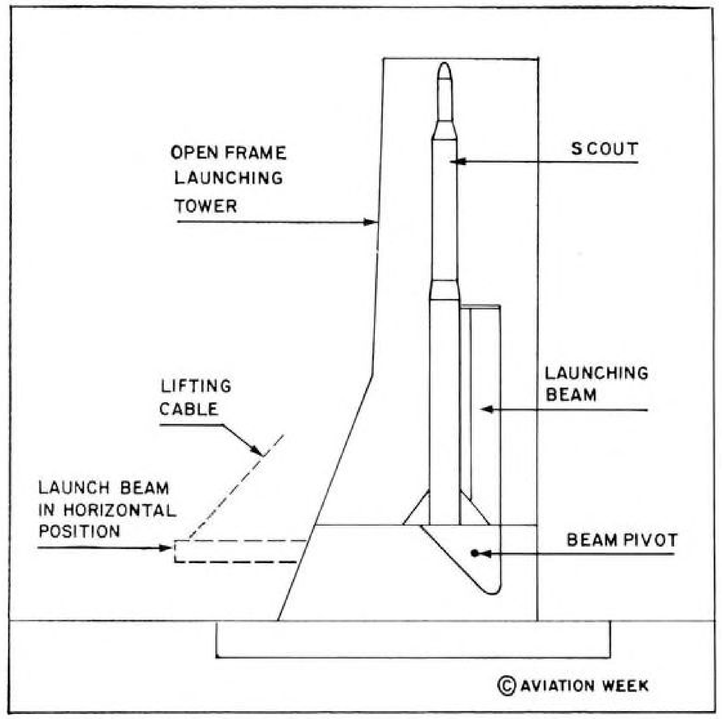
Second A series missile provided an unplanned test of the flight control system when the missile rolled slightly. System corrected satisfactorily.

Venus Probes

Washington—U. S. will fire two space probes toward Venus next June, as reported by Aviation Week (Feb. 23, p. 26), but National Aeronautics and Space Administration will not call them Venus probes "because I have the feeling that in truth the accuracies that we can achieve with our current technology are not great enough to be able to define these as Venus probes," Abe Silverstein, NASA's director of Space Flight Development, said last week.

"I would prefer to say that we will fire in the general direction of Venus with a hope perhaps that we will measure in deep space some new information regarding, for example, communications," Silverstein said on Columbia Broadcasting System's television program "Face the Nation."

"We are going to fire—our program includes firings to great distances to see whether or not we can preserve the power within the satellite for long enough periods of time so that we can get reception from distances of 20 or 30 million miles." Silverstein pointed out that astronomical data is so imprecise that the position of Venus is known only within about 50,000 mi.



LAUNCHING scheme for Scout vehicles calls for an 80 ft. launching tower mounted on a turntable, rotating 45 deg. either direction for various azimuths.

Air Launched Missile Competition

Washington—Industry this week is making presentations to the Air Force on the WS-138A air launched ballistic missile (ALBM). More than 20 companies are believed to be competing for the 1,000-1,500 mi. missile. Decision is expected about May 1.

ALBM is intended principally for use on the North American B-70 but probably will be used first on the Boeing B-52 and Convair B-58.

It is an outgrowth of the competition which provided the 400-mi. range North American Hound Dog for use on the B-52. Air Force followed the Hound Dog with ALBM feasibility studies, known as Project Bold Orion, under an Air Research and Development Command Study Requirement 168 (AW Dec. 22, p. 22). Weapons system designation was WS-199.

Companies making proposals include the three who participated in feasibility studies:

• Martin Co.—Martin made six test flights, using a Boeing B-47, including one shot that traveled more than 1,000 mi. Flights included three drop tests of the two-stage frame, a light-off test, a single-stage test that traveled to about 300 mi., and the two-stage shot over more than 1,000. Two vehicles remain unfired. Main purpose of tests was to determine whether a missile could fly in two aerodynamic environments—subsonic before and during part of its climb, and supersonic in its ballistic flight. Forward stage was guided by a Martin system called DOMAR (Doppler-Martin), and subcontractors were General Precision Equipment Co. for guidance and Thiokol for propulsion. Missile is bell-shaped at the rear for aerodynamic stabilization. Interim version consisting of the test vehicle could be carried by B-47 and B-52 to extend their range.

• Convair Division of General Dynamics Corp.—Teamed with Lockheed for two shots of its single-stage test vehicle from a B-58. Second shot was considered very successful. A proposed interim 500 mi. vehicle would be ready before ALBM. Vehicle also is bell-shaped at the rear for stabilization and is an adaptation of the Sergeant-powered Lockheed X-17 re-entry research vehicle.

• McDonnell Aircraft Corp.—Test vehicle is called Draco. It is two-stage with four fins on each stage. Only one of three planned test vehicles has been fired, from an Honest John ground launcher at Cape Canaveral, Fla. Final stage is guided.

Other companies and teams believed to be in the competition:

General Electric Co.-Douglas Aircraft Corp. team; Bell Aircraft Corp., probably teamed with Thompson-Ramo Wooldridge; North American Aviation, Inc.; Boeing Airplane Co.; and Northrop Aircraft, Inc.

guidance or control system failure, loads imposed on airframe as a result of maneuvers or wind shear, heating effects and amount of control energy required.

• **As a safety provision** Scout will incorporate a destruction system that will destroy only the propulsive capability of the second and third stages. Target is to accomplish this by a simple approach such as rendering the rocket motor cases incapable of retaining pressure. Destruction system will be the job of the airframe contractor, using NASA-supplied ground command equipment to initiate the signal, vehicle command receiver, antennas and power supply.

• **Loads and elastic requirements** will be determined by the airframe contractor, who will perform complete dynamic and stress analyses and also outline the program of static and other ground tests required to prove the engineering design.

• **Structure will be required** to give positive margins of safety for design yield load and design ultimate load. Limit load will be equal to the anticipated load on the structure, design yield load will be equivalent to 1.15 times the limit load while ultimate design load will be equal to 1.50 times the limit load. Fittings on the vehicle will have a factor of safety of three based upon the material yield stress.

• **Analyses of first stage** aerodynamic fin efficiency, torque tube and aileron control elastic characteristics and the resulting loss in control effectiveness, airframe bending frequencies and divergence investigations will be supplied by the airframe contractor.

• **NASA's jet vane material** and configuration is scheduled to be tested this month by Aerojet-General in static firings of the company's Senior (Algol) rocket. Data will be supplied to the airframe contractor to assist in development and manufacture of the vane. Rocket motor blast will envelop the vane for only a short period, because it will be jettisoned from the first stage after only a few seconds of flight.

• **In addition to engineering** and fabrication of the Scout vehicle, the airframe contractor also will perform a series of tests.

Type-approval tests will establish the capability of design to withstand limit loads, vibration and environmental effects. Items that are type-approval tested will not be used for other tests or in flight trials.

Operational tests will be conducted either on assemblies or mockups and will include operation of controls, stage separation, spin-up and nose cone separation. These tests will be required on each item of flight hardware as a qualification check. Items which have only one-shot operational capability will be evaluated statistically.

Qualification tests will be performed on critical units of flight hardware, will include a complete stage coupling and fin structural test to establish that tolerances, component mating and deflections are within limits.

Dynamic testing will be conducted, when necessary, to determine the amount of additional loading occurring as a result of vibration. During this test run, dynamic balance of the spin-up assembly also will be determined.

• **Under delivery planned,** engineering layouts and preliminary load analyses of Scout covering assembly, handling and launching features are scheduled to be turned over to NASA within 30 days after the airframe contract is awarded. Contractor will supply launch-site assembly procedure, check list for the entire assembly program and preflight procedure within 30 days before delivery of the first Scout III vehicle.

• **Airframe components** will be delivered to Wallops Island together with one launcher which will be erected by the airframe contractor on the site pad.

• **Ignition timing devices** for the rocket motors as well as the fairing for protection of exterior stage-to-stage wiring, will be designed, manufactured and assembled by the airframe contractor, who also will supply ignition power supply and associated wiring and junction box for ignition leads.

• **On-the-job training** of NASA personnel in assembly of airframe components and operation of the launcher also will be provided by the airframe contractor. NASA personnel will launch the Scout vehicles.

• **Launching tower,** approximately 80 ft. high, will be composed of an open framework mounted on a turntable, rotating 45 deg. either way from a reference position to afford various azimuths.

• **Work platforms** will be positioned at stage-joint heights. Both ladder and elevator will provide access to the work platform. Top of launch tower will have a small hoist to lift the top stage onto the vehicle.

• **Launcher will include** a cable-lifted beam pivoted to permit lowering so that the bottom stages of the vehicle may be assembled in the horizontal position. Beam will have sufficient strength to restrain the first and second stages plus an additional weight tolerance in the horizontal position.

Military Objections Spur Budget Probe

By Ford Eastman

Washington—Reservations expressed by members of the Joint Chiefs of Staff as to the adequacy of certain programs in the Fiscal 1960 defense budget prompted Congress last week to resume its appraisal of the nation's defenses and needs.

The inquiry, conducted by the Senate Preparedness Subcommittee headed by Sen. Lyndon B. Johnson (D.-Tex.), got under way with the service chiefs the first to testify behind closed doors. Also scheduled to appear were Defense Secretary Neil McElroy and Budget Director Maurice Stans.

Johnson said that—while doubts had been expressed earlier as to whether sufficient funds were requested by the Administration for certain programs—the Berlin crisis has placed a new light on the subject.

"We cannot afford to indulge in wishful thinking," Johnson said, "but rather must appraise the facts as they exist and steadfastly face the issue squarely. We must determine whether the military policies of our country are being written by military officers through the judgment of our Joint Chiefs or a budget officer."

Service Reservations

During the subcommittee's initial hearings in January, it was brought out that each member of the Joint Chiefs had signed a letter supporting the Fiscal 1960 military budget with certain reservations. Johnson requested each chief to furnish the subcommittee with a detailed list. Doubts expressed by the military leaders included:

• **Gen. Thomas D. White,** Air Force Chief of Staff, said the Fiscal 1960 budget does not provide sufficient funds for replacement of the Boeing B-47 (presumably by the Mach 2 Convair B-58) as rapidly as requested, acceleration of the nuclear powered aircraft program or correction of certain deficiencies in the construction program and operations and maintenance area.

• **Gen. Maxwell D. Taylor,** Army Chief of Staff, said insufficient funds were provided for modernizing Army equipment, initiating production of the Nike Zeus anti-missile system, maintaining active and reserve Army units at the recommended personnel strength and for providing for the procurement of the recommended number of surface-to-air missiles.

• **Adm. Arleigh Burke,** Chief of Naval Operations, said more funds should have been provided for Navy modernization, procurement of equipment and to increase research and development.

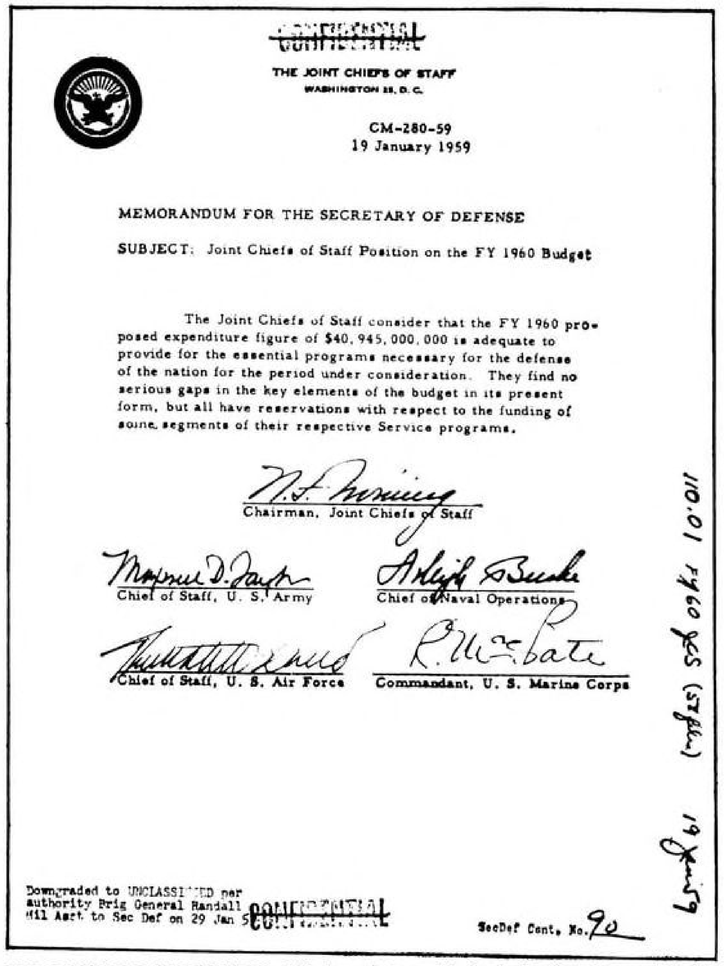
• **Gen. Randolph Pate,** Marine Corps commandant, said the budget does not provide proper funding for personnel, ships, aircraft and construction and maintenance of facilities.

Gen. Taylor said that experience in the Army's modernization program indicates that 10% of the current equipment inventory should be replaced annually due to wear, consumption and obsolescence. Since the inventory is about $14 billion, he said funds required for replacement would amount to $1.4 billion. In addition, the inventory should be increased from $14 billion to $20 billion, an objective he hopes to attain in five years. This would mean that the Army requirement for this purpose would amount to $2.8 billion for procurement, exclusive of the Nike Zeus program, annually for the next five years in adition to $200 million for industrial mobilization and transportation.

The 1960 budget will make available $1.19 billion for procurement and $176 million for industrial mobilization and transportation, Gen. Taylor said.

While the Nike Zeus program is provided sufficient funds to continue research and development at an optimum rate, Taylor said, no funds are provided to initiate production of tactical equipment and missiles.

His reservation in this area, he said, arises from the now-unopposed threat from intercontinental ballistic missiles and his conviction that the importance of obtaining the anti-missile weapon at the earliest possible date outweighs



CONFIDENTIAL

THE JOINT CHIEFS OF STAFF
WASHINGTON 25, D. C.

CM-280-59
19 January 1959

MEMORANDUM FOR THE SECRETARY OF DEFENSE

SUBJECT: Joint Chiefs of Staff Position on the FY 1960 Budget

The Joint Chiefs of Staff consider that the FY 1960 proposed expenditure figure of $40,945,000,000 is adequate to provide for the essential programs necessary for the defense of the nation for the period under consideration. They find no serious gaps in the key elements of the budget in its present form, but all have reservations with respect to the funding of some segments of their respective Service programs.

N. F. Twining
Chairman, Joint Chiefs of Staff

Maxwell D. Taylor
Chief of Staff, U. S. Army

Arleigh Burke
Chief of Naval Operations

Thos. D. White
Chief of Staff, U. S. Air Force

R. McPate
Commandant, U. S. Marine Corps

FY 1960 DOS (Staff) 19 Jan 59

Downgraded to UNCLASSIFIED per authority Brig General Randall Hill Asst to Sec Def on 29 Jan 59 CONFIDENTIAL

SecDef Cont. No. 90

OUR DEFENSE IS "ADEQUATE"—This is a photographic facsimile of a statement to the Secretary of Defense signed by the Joint Chiefs of Staff saying the military budget for Fiscal 1960 is "adequate."

Over-Temperature Indication Cuts X-15 Flight Check

North American Aviation's X-15 research vehicle was carried aloft for 70 min. last week for the first time, slung under the right wing of a Boeing B-52, but first captive flight was cut short at that period when an over-temperature indication was registered in the rocket-powered aircraft. Over-temperature condition was possibly connected with a supply of hydrogen peroxide monopropellant carried aboard the X-15 since it is required in operation of part of the jet reaction control system. Some unexpected smoke was observed. With NAA test pilot Scott Crossfield aboard, the X-15's controls, stability augmentation and communications systems were checked during the flight, which reached an altitude of 38,000 ft. and a speed of Mach 0.8. Boeing B-52 mother ship was piloted by Capt. Charles C. Bock, Jr., and three chase planes accompanied it. North American plans to make about 20 flights in its structural integrity systems proving program on the first X-15. Fewer flights are expected to be made on the second two X-15 vehicles, since a large amount of B-52—X-15 compatibility work already will have been accomplished, plus a certain amount of structural and systems proof work.

the possible financial risks inherent in initiating selective production now.

Gen. Taylor said funds for Army surface-to-air missile programs fall substantially short of those needed to reach the goals recommended by the Joint Chiefs of Staff and which he feels are required for the indefinite future to cope with the high and low-altitude threat of the manned bomber and the air-to-surface missile.

Gen. White told the subcommittee that, while certain scientific advisers do not feel the U.S. is ready to begin construction of a nuclear-powered aircraft, he considers the program sufficiently advanced that construction of a prototype airframe could proceed and the propulsion phase of the program accelerated.

Later, Rep. Melvin Price (D.-Ill.), chairman of the Joint Congressional Atomic Energy subcommittee on research and development, pointed to Gen. White's statement as "further evidence" of the importance attached by military experts to accelerating the aircraft nuclear propulsion program.

"It is clear," Price said, "that Gen. White and his expert military advisors . . . believe strongly . . . that the program is sufficiently advanced technically to warrant the commencement of work on an airframe and propulsion system suitable for first flight."

In another area, he said, the coverage that will result from the Bomarc procurement proposed by the budget is substantially less than what the Air Force initially submitted.

Gen. White said the Air Force military construction program is marginal in terms of support-type facilities and does not provide for the cumulative and growing deficit in many equally important areas. Also, he said, the Fiscal 1960 Air Force operations and maintenance funding is minimal and will require deferral of certain programs which would be desirable and, in some cases more economical, to accomplish with Fiscal 1960 funds.

In order to maintain Navy capabilities, Adm. Burke said more funds should have been provided for maintenance and modernization of ships and aircraft; procurement of new ships, aircraft, guided missiles and their associated electronic equipment; acceleration of anti-submarine warfare progress; procurement of fleet ballistic missile weapon systems, and increased research and development effort.

Gen. Pate told the subcommittee he felt the Marine Corps requires personnel to adequately man three divisions and three aircraft wings and therefore calculated strength at 200,000. The budget provides for only 175,000.

Hawk Cut

Washington—Army disclosed last week that its Raytheon Hawk low-altitude defense missile will not be deployed at fixed installations in the U.S. and that it has formally abandoned plans to integrate the Navy-developed Talos defense missile into its program "because we could not afford it." Army had planned to couple the Hawk with the high-altitude Nike Hercules for all-round defense. The project, however, was rejected by the Joint Chiefs of Staff. Hawk may still be used by NATO nations.

Boeing 707 Development Writeoffs Shave $9 Million From Earnings

New York—Heavy developmental writeoffs for its 707 jet transport played a major part in clipping almost $9 million from Boeing Airplane Co.'s earnings last year and the outlook is for another substantial drop in earnings this year.

Lower military sales this year also will be a factor, the company reported. Transition of the B-52G bomber and Bomarc interceptor missile from cost reimbursement type contracts to fixed price contract basis will bring earnings on these programs to low levels in the first half of 1959.

Boeing's 1958 sales of $1,711,929,576 were an all-time high for the company—the previous record was $1,596,508,515 in 1957—and came within $5 million of equaling the all-time sales high for any aircraft company racked up by Curtiss-Wright in 1944 (AW Mar. 10, 1958, p. 25).

Stressed by the company, however, was the lack of effect the booming sales total had on earnings, which dropped from $38,159,707 in 1957 to $29,360,013 last year. Boeing's 1958 profit margin on sales was only 1.7%, a drop even from 1957's anemic 2.3% figure. Per share earnings last year were $4.01 compared with $5.28 the year before.

A substantial loss is being incurred on 707s delivered or on order based on the current order book. But the company expects an aggressive sales campaign to turn the program into a rewarding one over a period of years.

Writeoff for 707 research, developmental, administrative and other general expenses were approximately $34 million in 1958. In addition, there was charged against earnings a $16 million total which "represents the amount necessary to reduce accumulated charges (work in progress) at Dec. 31, 1958, on the 707 program to estimated proportional sales value based on the quantity of airplanes scheduled for production," the company said.

Total charges, including the prototype cost, have amounted to 94 million since the program's inception in 1952.

The Los Angeles Regional Renegotiation Board has recommended that Boeing make a $6 million refund for 1955, less allowances for tax recomputations. Boeing said that if the Renegotiation Board makes a finding of excessive profits it will take another appeal to the U.S. Tax Court (AW Nov. 17, p. 31).

Other 1958 financial reports:

• **Temco Aircraft Corp.** sales were $119 million and earnings were $2.5 million in 1958, with both sales and profits holding at the same level experienced in the previous year. Temco reports earnings last year were $2,555,883, or $1.50 a share, only a slight increase from the figures of $2,514,023 and $1.48 a share for 1957. Total sales dipped slightly from $119,160,000 in 1957 to $119,100,000 last year. Backlog at the end of 1958 was about $108 million.

United Aircraft Earnings

United Aircraft Corp. last week reported sales and earnings in 1958 were second only to 1957's record company highs. Company-financed developments, phase-outs of older products and United's own decision to enlarge its technical capabilities explained what decline there was, the company said.

Sales were $1,200,427,387 compared with $1,232,919,313 in 1957. Earnings declined from $51,366,108 in 1957 to $42,294,728. Military engine deliveries are forecast to decline next year, but commercial engine deliveries will rise so the totals will not be much smaller than 1958, the company said. Heavy development costs in the space and missiles field will continue, and may affect 1959 earnings if no government support is obtained for projects.

Backlog at the end of 1958 was $1,400 million compared with $1,975 million a year earlier.

Vanguard Wobbling Hampers Data Return

Washington—Wobble of the Vanguard II cloud cover satellite about its major axis is making interpretation of the data "unexpectedly difficult," National Aeronautics and Space Administration said last week.

Goal was to stabilize the spherical satellite around the longitudinal axis of the cylindrical instrument pack inside the shell by giving the whole satellite a final spin rate of 50 rpm. Spin instead is about 15 rpm., causing the longitudinal axis to wobble by as much as 20 to 45 deg.

But Army Signal Corps engineers expect to be able to produce eventually a picture of a part of the earth's cloud cover from the quarter-million feet of taped signals broadcast during Vanguard's 18 days of radio transmission.

From launch on Feb. 17 until the batteries expired at 9:37 p. m. EST on Mar. 7—about four days after they were expected to die—Vanguard II had made 211 circuits of the earth and had been interrogated successfully 152 times by ground stations. On 19 orbits, it did not pass within range of an interrogation station. Recorder stored 50 min. of data and transmitted it on signal in 60 sec. bursts. NASA said the thermal design of the satellite was proved when internal temperature remained within one degree of the 110F design temperature for a satellite spending about 68% of its time in sunlight.

Refined orbital figures for Vanguard II as of Feb. 24 are:

• **Apogee**—2,065 mi.; apogee velocity, 13,093 mph.
• **Perigee**—346.9 mi.; perigee velocity, 18,312 mph.
• **Orbital period**—126.85 min.
• **Inclination to equator**—32.869 deg.

Discoverer I Orbit

Los Angeles—Discoverer I, polar-orbit satellite fired from Vandenberg AFB Mar. 4, is reported to have been sighted visually from Air Force installations in the vicinity of Fairbanks, Alaska, early last week, although official confirmation was not available.

Previous figure of 41 tracking reports has been swelled by additional radio contacts, including signals received by General Electric's Ithaca station which uses the Krause method, based on reflection of signals by ionization tracking of the satellite as it moves through space. Signals from the satellite's radio beacon were still sporadic, indicating that the complete orbiting second stage was still tumbling.

Most recent figures indicate the orbiting period of Discoverer I is 95.569 min., perigee 176 mi. and apogee 519 mi. Life of the satellite is expected to extend beyond 30 days from launch date.

No skin tracks (radar sightings) have been achieved. Viewed sidewise, orbiting second stage would present a 19-ft.-long target for a radar beam. From the end, the satellite would offer only a 5-ft. diameter surface, making radar contact difficult.

Civil Jetstar Order

Lockheed Aircraft Corp. will deliver the first corporate Jetstar airplane to Continental Can Co. by Jan. 31, 1961. Approximately 70 position options are held by Lockheed and the company is negotiating on contract wording, delivery dates, types of engines, and special equipment. Corporate versions may be powered with either two or four engines, depending on customer preference. Prototypes are flying with Bristol Orpheus turbojet engines. Four-engine versions will use P&W JT-12s.

NASA Reports Data On Pioneer IV Orbit

Washington—More precise figures for the Pioneer IV lunar probe's launching and solar orbit (AW Mar. 9, p. 321) were reported last week by National Aeronautics and Space Administration's Jet Propulsion Laboratory. New figures are.

- **Period**—394.75 days.
- **Average speed in orbit**—64,800 mph.
- **Perihelion**—91.7 million mi., to be reached at 9 p.m. EST on Mar. 17, with a speed of 69,500 mph.
- **Aphelion**—106.1 million mi., to be reached at 6 a.m. EST on Oct. 1, with a speed of 60,000 mph.
- **Closest approach to moon**—37,300 mi., passing 7.2 deg. ahead and 5.7 deg. south of the moon, at a speed of 4,490 mph. Desired closest approach was 20,000 mi. At closest pass, probe was 233,000 mi. from the earth.
- **Tracking**—Probe was tracked for 82 hr. and four minutes after launch to a distance from earth of 407,000 mi. Last signal acquisition was at 10:24 a.m. EST on Mar. 6 by the 85-ft. Goldstone antenna. Probe's 18 standard mercury batteries also had powered the transmitter for four hours on the ground before launch.
- **Launching**—Errors in trajectory included minus 4.5 deg. in elevation and plus 1.3 deg. in azimuth. Maximum velocity was 24,789 mph., or 196 mph. below the desired velocity.
- **Next approach to earth**—July, 1972, at a distance of something more than 10 million mi.
- **Instrumentation** — Geiger-Mueller tubes indicated nothing unexpected in the way of high-intensity radiation. Photo sensor did not work because moon's image at 37,300 mi. was not large enough to actuate it. De-spin mechanism did work. Internal temperature rose to 42C at injection and remained there.
- **Ascending node**—2 a.m. EST on Saturday, Sept. 12, 1959, at which time the Pioneer IV's orbit will have an inclination to the ecliptic of 0.127.

New figures also have become available on Soviet Russia's Mechta lunar probe (AW Jan. 12, p. 26):

- **Perihelion**—91.1 million mi. on Jan. 12, 1959.
- **Aphelion**—120 million mi., Aug. 21, 1959.
- **Period**—443 days.
- **Average speed in orbit**—63,100 mph.
- **Tracking**—63 hr. to a distance from earth of 370,000 mi.

Work Starts on Vandenberg Titan Silo

First of three Titan intercontinental ballistic missile underground silos is under construction at Vandenberg AFB, Calif., where the mission will be primarily training, although operational capability will be provided (AW Mar. 9, p. 125). Layout will be similar to Titan base at Lowry AFB, Colo., except the Lowry complex will include nine silos.

Radiation Belt Data Reviewed by Soviets

Moscow—Radiation belts around the earth are less intense than originally believed, according to data received from the Soviet Lunik cosmic rocket and reported in Pravda.

S. Vernov, corresponding member of the Soviet Academy of Sciences, and his laboratory collaborator, A. Chudakov, said in an article that the data indicates that manned space vehicles will require relatively less shielding frrom X-rays than had been expected. The article said:

- **Large number of electrons** are circling the earth at altitudes of up to 31,000 mi., but their energy is relatively small, ranging from 30,000 to 100,000 electron volts.
- **Cosmic radiation intensity** at great distances from the earth is "negligible," with only two particles passing through one square centimeter every second. At distances beyond approximately 36,000 mi., the intensity does not change.
- **Data proved experimentally** that electrons moving around the earth waver in their motion, wandering "for a very long time" while locked in a magnetic trap created near the earth by the earth's magnetic field. "These phenomena are similar to what takes place in installations where physicists are trying to produce thermonuclear reaction."

At a height of 9,300 mi., there are 700 times more particles than at a height of 250 mi. on the same line of force.

This means that of the 700 particles at 9,300 mi., only one flies down to a low altitude.

All others waver along the line of force, going from one hemisphere to another and back, and do not fly down to low altitude.

The article said that there are grounds to indicate that the inner zone of intensive radiation around the earth consists mainly of protons, though no details are given. "Electrons of the outer zone possess energies which are relatively small."

Space Technology

Military Limits Space Effort to 600 Mi.

By Ford Eastman

Washington—Military space efforts in the immediate future will be limited to 600 mi. above the earth, according to Roy W. Johnson, director of Defense Department's Advanced Research Projects Agency.

Johnson told the House Committee on Science and Astronautics during closed-session testimony released last week that, militarily, there did not appear to be any present need for concern beyond 600 mi. Efforts in the immediate future are being concentrated in building military hardware to maneuver and orbit in this area, he said.

Transfer of the lunar probe shots from ARPA to the National Aeronautics and Space Administration by the President was a clear indication that probes in the area of the moon were outside the military purview, at least for the present, Johnson said.

He said, however, that, in time, this department would become concerned with space outside the 600-mi. limit when technology has advanced to the point to indicate there were military requirements beyond this area. The one exception seen at this time, he said, is the 24-hr. stationary satellite scheduled to be placed into orbit at 22,000 mi. in the communications satellite program.

ARPA Developments

On other aspects of ARPA's assigned role in military space technology, propellant chemistry and ballistic missile defense, Johnson told the committee:

- **Four contracts have been** awarded for comprehensive research endeavors in solid propellants. This work, broad in scope, involves ingredient synthesis studies, thermochemistry, thermodynamics and performance calculations, propellant formulation, property investigations and necessary related chemical engineering and research. Initial objective is development of solid propellants having specific impulses 10 to 20% higher than those now available.
- **Government in-house** solid propellant research programs include work on synthesis, engine-cooling techniques, detonation studies, thermochemistry and new compound evaluation and characterization. Over-all objective of the entire ARPA program, including industrial research contracts and contracts with universities and non-profit organizations (AW Nov. 3, p. 34), is the discovery of new chemicals, development of practical methods of synthesis and obtaining the knowledge required to utilize these materials in practical and highly efficient solid propellants.
- **Later phases of the Discoverer** satellite program may use the Convair Atlas intercontinental ballistic missile as a booster for larger payload capabilities still later, he said, the program might include the 1.5 million lb. cluster booster being developed for NASA. Present Discoverer schedule calls for launching one vehicle a month for the remainder of the calendar year.
- **Navigation satellite program** is planned to provide an instantaneous, all-weather system for determining position at any point on the globe by passive means. Receiving station will listen to radio frequency signals transmitted by the satellite as it comes over the horizon. Signal is initially shifted up by the Doppler shift due to the satellite rate of approach to the receiver. Satellite will relay to the receiving station the signal for the Doppler shift, a coded signal of synchronous time and coded signal signifying the orbital diameters in effect. By using this system, the position may be located within four-tenths of a mile.
- **Four tactical cloud-cover** satellites are expected to be delivered by May along with six other satellites for laboratory environmental and other tests. First launching, with an estimated life of five months, will be attempted in July or August; the second in February or March of next year. Three cameras, strategically positioned in the satellite, will feed pictures into separate magnetic tape recorders for playback on command. A thousand pictures will be produced every 24 hr., with each picture showing its detail in 500 television lines per millimeter.
- **ARPA visualizes a future** need for a national space data coordination center to serve the entire U.S. requirement, including NASA, ARPA and any other organization engaged in space activities. It would, Johnson said, be responsible for categorizing all space vehicles, and the program should call for broad goals in date acquisition as well as in data read-out analysis and dissemination.
- **Advanced research** in the development of a missile defense assigned to ARPA is Project Dam. This has instrumentation on a converted liberty ship, American Mariner, recently launched to observe firings from the Atlantic Missile Range. Another program concerns the motor yacht Acania, which is equipped with a large variety of research radar and equipment. In addition, research radars are being installed at Wallops Island to observe small rocket firings and aircraft are being instrumented with optical and infrared instrumentation to study atmospheric processes that take place during launch and re-entry of a ballistic missile.

Military Aviation Funds

The military services had an unobligated balance for new contracting in aircraft and guided missiles of $9.2 billion on Jan. 1. The unexpended balance totaled $19.5 billion. Following are details released by Department of Defense.

	OBLIGATIONS (000 omitted)		EXPENDITURES (000 omitted)	
	July 1, 1958 through Dec. 31, 1958	Unobligated Balance Jan. 1, 1959	July 1, 1958 through Dec. 31, 1958	Unexpended Balance Jan. 1, 1959
Aircraft, Engines, Parts				
Air Force	2,478,860	4,096,559	2,829,728	9,019,629
Navy	662,965	2,290,891	1,078,856	4,220,039
Army	25,100	132,031	74,276	142,069
Total	3,166,925	6,519,481	3,982,860	13,381,737
Guided Missiles				
Air Force	1,455,895	1,706,342	918,097	3,921,634
Navy	414,540	473,781	158,174	1,107,867
Army	431,000	530,082	470,183	1,162,203
Total	2,301,435	2,710,205	1,546,454	6,191,704
Electronics and Communications Equipment				
Air Force	274,124	759,144	181,910	1,624,869
Navy	94,834	216,186	93,656	465,219
Army	134,660	89,368	85,594	369,456
Total	503,618	1,064,698	361,160	2,459,544

U.S. Space Lag Blamed on Bureaucracy

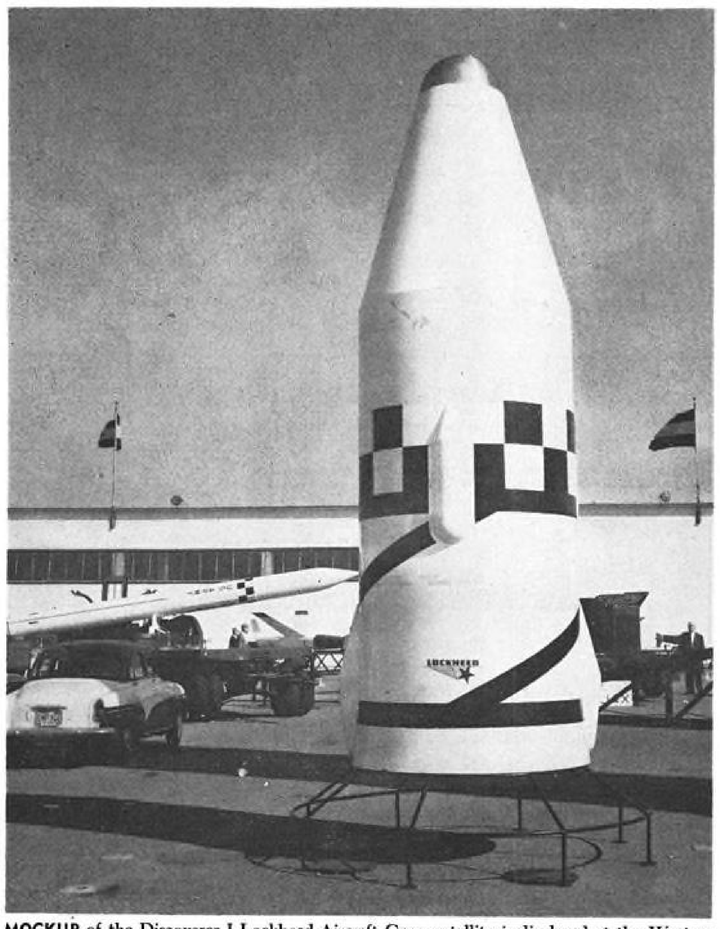
Los Angeles—United States is lagging behind Russia in the missile-space age rush, not due to a dearth of technical talent, but because of a "lack of bureaucratic skill," according to Sen. Clair Engle (D.-Calif.).

Speaking at the Western Space Age Conference sponsored by the Los Angeles Chamber of Commerce, Engle said a surplus of government agencies and congressional committees hinders industry's efforts to progress. Citing Dr. Wernher von Braun's experience as director of the Development Division of the Army Ballistic Missiles Agency, he said von Braun went twice monthly to the Pentagon for committee meetings. "And if that wasn't enough, from time to time the committees visited the Huntsville project," Engle said.

Man-in-space projects are an example of how project developments overlap, resulting in a faltering development program, because "our talent is spread too thin." There are presently five man-in-space programs, run by the Army, Navy, Air Force, National Aeronautics and Space Administration and Advanced Research Projects Agency, Engle went on to say, but, "happily, the Marine Corps does not have a man-in-space program."

The Senator also cited the proliferation of agencies and "czars" advising the President. "Here is an incomplete listing of the groups he turns to for assistance: the National Science Foundation, the National Science Board, the Chief Scientific Adviser, Dr. J. R. Killian, Jr., the Federal Council of Science and Technology (proposed), the President's Scientific Advisory Council, the special aviation adviser, Gen. Elwood Quesada, the National Security Council, the Federal Aviation Agency, NASA, the Bureau of Standards, and the Department of Defense with all its subdivisions such as ARPA and guided missiles and the military services. If Mr. Eisenhower wanted to know about the value of a certain proposal, I doubt if he would be sure where to turn or whether he could get better information from someone other than the adviser he was consulting."

Sen. Engle said he didn't know all the answers to the problems plaguing contractors as a result of excessive government administration, but that it was an important challenge to our form of government to prove our ability over Russian communism.



MOCKUP of the Discoverer I Lockheed Aircraft Corp. satellite is displayed at the Western Space Age Conference sponsored by the Los Angeles Chamber of Commerce.

Massive Retaliation

Doubts of the military value of a nuclear-propelled bomber (see p. 67) were attacked during the conference by F. A. Cleveland, chief advance design engineer for Lockheed Aircraft Corp.'s Georgia Division. He said the concept of massive retaliation is invalid unless:

- **Enough of the retaliatory force** is invulnerable to surprise attack.
- **Retaliatory force** is capable of finding and destroying enemy's mobile strategic striking force as well as large fixed targets.

The last point is important since it is the requirement that we be capable of winning the war if the deterrent threat fails. A nuclear bomber, being manned, has the capability of seeking out the difficult targets and making comparatively invulnerable low altitude target approaches because unlike chemically powered bombers, fuel economy does not demand a high altitude approach.

The trend in development of bombers has been toward greater speed and higher altitude and defensive systems have been oriented to cope with those traits. "Such an orientation has tremendous inertia because the defensive system is so complex, consisting of missiles, aircraft, warning, search and tracking equipment and an enormous communication and data correlation network. Recent estimates of the effect on aircraft crews of high altitude nuclear bursts indicate that attrition rates in the high altitude approach can be increased significantly," Cleveland said.

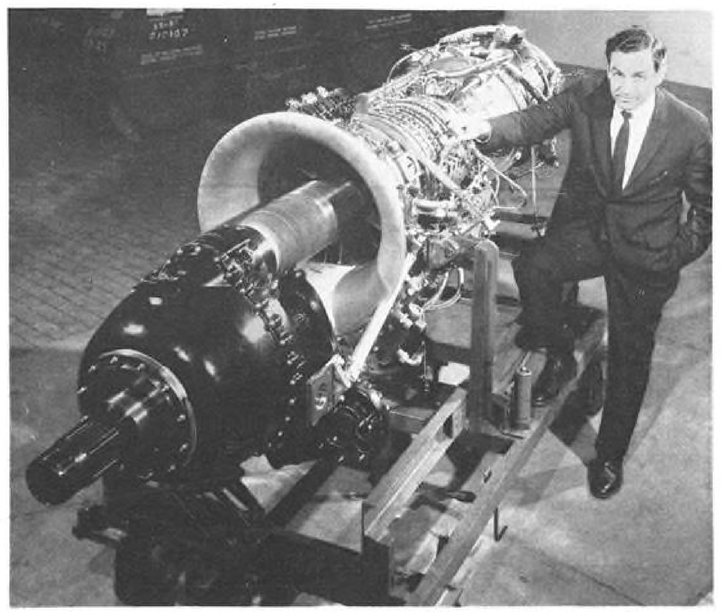
Rand, USAF and Lockheed studies indicate that attrition due to enemy defenses would be relatively slow in the low altitude approach. Existing chemical-fueled bombers can use the low altitude approach but radius of action is sharply limited. Only nuclear propulsion offers combination of performance and range at low altitude.

A high altitude bomber passing over a radar station can be detected for over 15 min. but one passing at minimum altitude can be detected for only three minutes. Studies show that over 40 times as many radar sites are needed to maintain a tight defense perimeter against low-flying intruders as against high altitude, high speed bombers. Identification and tracking of low intruders is difficult because the intruder presents the enemy with many extremely brief single sightings. The difficulty of identifying and tracking is compounded if there are several intruders nearby flying random courses. The enemy is faced with an extremely difficult data correlation problem.

Interception and attack are difficult because of the short range of detection and tracking and because an airplane close to the ground does not present an easy target to airborne radars and infrared detectors because of ground clutter. Short tracking range means interceptors tend to get sucked into a tail-chase in which they are likely to expend fuel before getting within range.

Cleveland also described USAF's nuclear-propelled continuously airborne missile launcher and low level system (CAMAL). He called the airframe conventional except for the variations needed to protect against radiation damage. No untried design or fabrication methods are required to produce the system. "The propulsion system itself, which is today in a rapidly developing state, is also designed by today's state of the art. Every basic concept requiring solution has been evaluated, tested and solved in the laboratory or in the actual hardware itself," he said. While shielding in CAMAL is very heavy, it does not approach the weight of fuel eliminated by use of nuclear power. Cleveland said:

- **CAMAL is no larger** than present Strategic Air Command bombers.
- **CAMAL carries more payload** than present SAC intercontinental bombers.
- **It will be able** to operate many more hours per year than current bombers after it reaches full operational status.
- **It can operate** from present runways of SAC bases.
- **One mission** will rarely last more than one week in the air despite the absence of any significant limit on range or endurance and despite the fact that shielding will permit crews to fly same number of hours per year as in conventional aircraft for 10 years without exceeding AEC limits.
- **It can launch** long range air-to-surface missiles against industrial targets and then bore in at low altitude for attacks against hardened installations.



General Electric Unveils T64 Turbine Engine

First photo shows completed General Electric T64 free turbine engine which has entered development testing at GE's Small Aircraft Engine Dept. Engine, being developed under $58.5 million Navy Bureau of Aeronautics contract, uses basic power section to which individual units can be added to make it either a turboprop or turboshaft engine (AW May 20, 1957, p. 34). Engine is rated in the 2,600 shp. class.

News Digest

Solid propellant escape rocket on which the Project Mercury passenger will depend for safety insurance during 160 sec. of acceleration to orbital altitude will be designed, developed and tested by Grand Central Rocket Co. under a subcontract awarded by McDonnell Aircraft Corp.

British government will contribute half the remaining cost of developing an advanced version of the Fairey Rotodyne VTOL transport, although the figure has not been revealed.

Irish Airlines will order three Boeing 720 medium range jet transports for its European and transatlantic routes. Irish government sources gave the prices as $4.2 million per airplane.

George P. Sutton, 38, has been named chief scientist of the Advanced Research Projects Agency to fill the post left open last December when Dr. Herbert York became Defense Department's Director of Research and Engineering. Last September, Sutton took a leave of absence as manager of advanced design for Rocketdyne Division of North American Aviation, Inc. to become Hunsaker Professor of Aeronautical Engineering at Massachusetts Institute of Technology. Sutton holds Bachelor of Science and Master of Science degrees on mechanical engineering from California Institute of Technology.

Piper Aztec light-twin business plane prototype crashed after undergoing glide tests near Lock Haven, Pa., plant, killing the pilot, Robert Piggott. Tail of the airplane was found about 2½ mi. from the wreckage.

French government is considering placing a limited order for a larger version of the Dassault Mirage IV twin jet bomber which may be powered by Pratt & Whitney J75 turbojet engines. Current version, set for first flight next month, is powered by Snecma Atar 9 engines.

U. S. Army has awarded contracts totaling $23 million to Bell Helicopter Corp. for production of HU-1A and H-13H turbine-powered helicopters.

Radio Corp. of America's Electron Tube Division says it has an approach to development of subminiaturized electron tubes particularly suited for mechanized production. New design, called Nuvistor, is aimed at reducing tube size and power drain and increasing performance.

Latin Rate War Nears Showdown Stage

Predicted settlement of fare cutting dispute not expected to trim foreign-carrier competition.

By L. L. Doty

Miami—Stormy rate-cut war that has embroiled some 60 airlines throughout Latin America and the Caribbean for the past five years finally appears headed for a showdown.

However, any settlement of the conflict, which reached its peak with the under-cutting of established fares by as much as 40% by some South American carriers, is not expected to stem the torrent of competition that has built up against the U.S. airlines. Despite the apparent harmony reached on the rate and fare issue, hidden protective barriers—created by the strong surge of nationalism that has swept the Latin American continent since World War II—will continue to stifle attempts by U.S. carriers to meet that competition squarely.

Most observers here close to the Latin American picture feel the fare issue will be resolved only because the undercutters are now threatened with the possibility of being undercut themselves. Recently, U.S. airlines and other member carriers of the International Air Transport Assn. won the right to charge fares 10% less than the low rates offered by non-members of IATA.

Latest Developments

Here are the latest developments in the airline situation in South America:

• **Meeting of governments** in Rio de Janeiro in January (AW Jan. 19, p. 39) created an air of optimism that an equitable fare pattern could be reached that would bring a halt to cut-throat competition. Participating countries agreed in principal that IATA fare levels would be set as standards in South American rate structures. Meanwhile, present fares have been frozen temporarily to stave off an all-out war until all airlines concur on IATA standards.

• **Meeting of airlines operating** in South America, scheduled to begin today at Lima for the purpose of setting rates, has been postponed temporarily. U.S. is waiting for assurance that rate of currency exchange and agent commission issues will be resolved before any meeting on fares is convened. Observers say the postponement does not indicate a delaying action on the part of South American carriers, but that is simply the result of time-consuming efforts to coordinate all countries on all the issues involved.

• **South American carriers** are still determined to impose stiff restrictions on Fifth Freedom traffic. These airlines are insisting that 75% of all traffic traveling between two South American countries should be diverted to the flag carriers of those countries.

Small balance of 25% to be flown on U.S. carriers will have a depressing effect on gross revenues of those airlines, according to officials of companies here.

Principal problem lies in the large number of airlines which now saturate the Latin American and Caribbean markets. And, of the 62 carriers competing for business in these areas, 47 operate to the U.S. as compared with 14 scheduled airlines that serve the U.S. through the transatlantic route.

Among the scheduled carriers competing for business throughout the area are eight major European airlines, with KLM, for example, serving as many as 28 cities in Latin America and the Caribbean. Japan Air Lines this year plans to begin scheduled service on its South American route to add to the runaway battle for traffic (AW Dec. 29, p. 30).

Latin American Story

Cut-rate war among South American carriers has focused attention on the problems U. S. airlines are facing in the development of Latin American air travel markets. Following a survey of carriers serving Latin America, Aviation Week has prepared a series of two articles analyzing the major issues creating these problems. The accompanying article covers the fare issue as it now stands. A second article next week will deal with specific traffic problems as they are related to rates and to the bilateral pacts between the U. S. and Latin American countries.

Majority of the South American carriers are IATA members, as are all U.S. flag carriers offering scheduled passenger service south of the U.S. border—American, Braniff, Delta, Eastern, National, Panagra, Pan American and Western. However, in the foreign-flag carrier group there are 13 non-members of IATA which refuse to abide by IATA fare standards and offer bargain rates far below fares charged by their competitors.

Round Trip Rates

For example, CINTA, a Chilean airline and non-member of IATA, quotes a fare of $515 round trip between New York and Santiago as compared with the $771.60 tourist and $983.40 first-class rate published by Panagra. Aerolineas Peruanas offers a $451.80 round trip Miami-Buenos Aires fare as compared with Pan American's tourist fare of $778 round trip between the two points.

Attempts to force such carriers to hike their rates to more reasonable levels have failed in the past. Generally, these operators have been able to survive lower revenues because of low costs.

They have purchased second-hand aircraft with low writeoff charge and kept wage-scales at minimum levels. They hold down overhead costs through such devices as renting ground equipment from airport operators or other carriers for the short periods of time it is actually needed and used. Also, the cut-rate lines generally confine service to the plush, profitable routes leaving the less productive areas to IATA members.

IATA Conference

To combat these fares, the IATA traffic conference held in Cannes last year (AW Oct. 27, p. 26) adopted a resolution which permitted IATA members to reduce first-class and tourist fares on South American routes to a level not less than 90% of the lowest fare available on the routes in question. The Civil Aeronautics Board approved the decision and later reaffirmed its stand when the 13 non-members of IATA protested.

Thus, according to airline officials here, these carriers now face the threat of being undercut and are ready to make peace in the price-cut war. In addition, chances are strong that the 13 carriers will take advantage of the opportunity to join IATA and place themselves under the pledges of IATA obligations.

First signs that harmony could be reached appeared when the South American carriers met last December as members of the Association Latino-Americano de Transportadores, a traffic association of the Latin American carriers. At that time, Rene Pairoa, head of CINTA, attempted to justify the low rates but acknowledged that some settlement must be reached. Ruben Berta, president of Brazil's Varig—an IATA member—has led the move to resolve the fare issue.

However, the fare structure is not the only factor that has inhibited U. S. carriers in meeting South American competition on even terms. Three other elements—currency exchange, agents' commissions and the regional concept of traffic—also bar U. S. flag carriers from operating in a free market.

The first two of these items now appear headed for a settlement as a result of agreements reached at the January Rio de Janeiro meeting. In fact, if they are not resolved, U. S. carriers see little point in any further discussion of fare levels since both the agents' commissions and currency exchange issues, as they now stand, could cause a continuance of sharp rate differences.

On the currency exchange problem, it was unanimously agreed that the U. S. dollar will be used as a standard in the construction of fares. In addition, it was decided that a free market rate of exchange will be adopted as a means of stopping the spiraling inflation of prices on airline travel.

Such inflation has provided South American carriers with a net profit of as much as 30 to 50 cents on the dollar.

For example, normal rate of exchange in Chile is about 1,050 pesos to the dollar. However, airline tickets are being sold by some airlines at a rate of 350 to 500 pesos to the dollar to create a tremendous competitive advantage over carriers selling similar tickets in dollars at the open market dollar exchange rate.

Use of the dollar as a standard for fare construction and the adoption of a free market rate of exchange will satisfy U. S. carriers that all passengers, at any point of purchase, are paying an equal value for tickets purchased between any two points.

Second item on which agreement is also expected concerns agents' commissions. U. S. carriers have charged that high agents' commissions of as much as 30% designated for travel agents in Argentina and some other countries do not necessarily go to the travel agent, large portion of the commissions is allegedly used as a rebate to passengers purchasing the tickets as a hidden means of granting a reduced rate on tickets.

TWA to Start Jet Flights; Seems Sure of Getting More 707s Soon

By Glenn Garrison

New York—Trans World Airlines' plans to begin transcontinental jet service Friday with a single Boeing 707-120 are probably based on assurance of early additional deliveries, although Howard Hughes-imposed official secrecy last week still surrounded TWA's future jet situation.

Tenth TWA airplane, however, is about to roll off Boeing's line at Renton, Wash. Two of the jets were at the Boeing field commercial delivery center last week in TWA's new markings, four were on the preflight line at Renton, and two were on the factory ramp for final checkout.

Airline received its first jet several weeks ago and has been using it for training, but this is an NP (provisionally) certificated airplane, and cannot be used for backup in the scheduled service until its certificate is changed. First NC (certificated) aircraft was due at Kansas City last week and this plane will assume the initial transcontinental task.

Hughes Tool Co., which takes delivery on TWA's planes and releases them to the airline, obviously has arranged at least some firm financing for jet purchases, because Boeing turns over its jets only after final payment has been made. The two planes turned over so far unquestionably were paid for in full after they were delivered at Kansas City.

While TWA will not discuss specifics in its equipment transactions through Hughes Tool, bookkeeping procedure in the past has been for the airline to lease-purchase airplanes from Hughes Tool. TWA's fleet of Lockheed 1649A Constellations was handled that way, and title to a number of them has passed to the airline. Civil Aeronautics Board recently approved lease of the first 707-120 to TWA by Hughes Tool, and presumably the jet fleet will be acquired by the airline in the same manner as the Constellation.

First TWA jet schedule is expected to depart San Francisco Friday afternoon for New York, and the daily westbound flights are to begin Saturday. The nonstop service was announced Mar. 5 after a lengthy silence concerning TWA's jet scheduling.

Unresolved last week were negotiations between TWA and its pilots, whose contract expired last October. The contract dispute is in mediation, however, so there will be no question of a strike at least until Railway Labor Act procedures and cooling-off period are exhausted. The airline last year signed with Flight Engineers International Assn., guaranteeing the mechanic-qualified engineers jet jobs until January, 1961.

TWA is prepared to begin jet service with supervisory pilots if that becomes necessary. Line pilots have been taking flight and ground jet training, and the airline expects to have about 20 fully checked out pilots by start of service. Boeing 707-120 simulator was put into use earlier this month.

TWA will offer 46 first class and 65 coach seats in its jets on the New York-San Francisco run. Scheduled times are 4 hr. 40 min. eastbound and 5 hr. 45 min. westbound. Daily departure from San Francisco is scheduled at 2:30 p. m. local time and the New York departure is at 9:30 a. m. local.

By way of comparison, American Airlines started its New York-Los Angeles service with two NC jets, received a third 10 days later and presently, seven weeks after the inaugural, has a fleet of six of the 707-120s. And American was able to inaugurate service from both cities simultaneously.

TWA will perform its basic line maintenance at New York, with turnaround servicing at San Francisco. Engine overhaul procedure last week was still undecided, TWA said. The airline has been negotiating for possible outside overhaul of the Pratt & Whitney J57s, but had not definitely made up its mind whether this system would be used or whether the engines would be overhauled at TWA's big new Kansas City maintenance base. The base is not now tooled for such work.

The airline has been accumulating ground equipment for its jets and is now set up at Idlewild to handle them. Engine and airframe parts are positioned at various stations.

For engine starts, TWA has both the Ace start bottles and Boeing Turbostarter truck at Idlewild. One Turbostarter unit has been delivered and another is on order. Experience will determine which will be regularly used.

The airline's target for getting its long-range 707-320s into international service is understood to be sometime this fall.

Construction of the futuristic-design TWA building (pictured in AW Nov. 18, 1957, p. 40) has been delayed, according to the airline, by revisions necessitated by higher-than-authorized cost estimates. Bids for the construction ran in excess of $11 million, TWA said, whereas only $8.5 million had been voted for the project.

Engineers Charge Pilot Cockpit Violations

By Robert H. Cook

Washington—Charges of violations of federal safety regulations in the cockpits of Eastern Air Lines aircraft were leveled today against a "hard core" group of the company's pilots by the Flight Engineers International Assn.

Basis of the complaints filed with the Federal Aviation Agency is a compilation of more than 200 reports submitted to FEIA by Eastern flight engineers since the termination of the union's strike against the company on Dec. 31, which settled the crew complement issue by agreeing to retain mechanic-qualified flight engineers aboard jet aircraft with a third pilot added as a safety measure. Hazardous cockpit incidents charged in the reports range from inability of pilots to operate engines according to company manual procedures to inadvertent failure to maintain a proper collision watch as a result, the union charged, of many captains' insistence upon performing duties normally assigned to flight engineers.

Referring to the small "group of Captain Queegs, which for years has been trying to discredit the flight engineers," George R. Petty, Jr., FEIA president, said these pilots, claiming "command prerogative" have "thrown away the operations manuals prepared under the guidance of the FAA, manufacturer and company and are rewriting them in the union halls."

Petty, however, indicated that most Eastern pilots have continued to follow company operational manuals and that there has been no difficulty of this type with any other carrier operating turboprop or piston engine aircraft on similar routes.

ALPA Rebuts

ALPA spokesmen say the Eastern pilots are merely exercising their right of command under CAR 40.351(C) and CAR 40.261 to become more familiar with all cockpit duties. Company notices to pilots and engineers point out that, although the captain may sometimes familiarize himself with other cockpit controls, normal operation of the plane calls for operations conducted according to the company manual with deviations made only at the direction of the captain.

Pilot authority under 261 emergency situations is not affected, Eastern said. FAA letters, calling for closer crew coordination, took note of some cases where Eastern pilots, by not following company manuals, had "adversely affected safety" and announced plans for an increase in in-flight crew inspections.

After issuance of both company and FAA communications, G. M. Sheridan, chairman of ALPA's master executive council, advised the local Eastern chapter to ignore the letters since, he said, they failed to clarify the issue. Sheridan also asked immediate notice of any pressure by the company or "any others" to relinquish any pilot command authority.

Meanwhile, FAA is investigating the complaints which also have been brought to the attention of Administrator Elwood Quesada, with FEIA urging the agency to "take steps to intervene" to make certain that normal operating procedures, as spelled out in company manuals, are followed by all crew members.

The engineers' union said it began collecting reports on Eastern flights after many of its members sent unsolicited complaints on the local situation to union headquarters. The problem of lack of crew coordination was brought to the attention of Robert C. Hutton, air carrier safety inspector for the FAA in Miami, by the engineers in January. FEIA said there is a need for adherence to a standard set of operating procedures, not "based on the whim of individuals, or the prestige of associations" as a means of attaining the ultimate in flight safety.

ALPA told Hutton that Eastern pilots are carrying out a delegation of duties as spelled out in sections of the operating manuals, and have no desire to make "excess baggage" of any crew member through relieving him of his duties.

However, the pilots' union has said that Eastern Air Lines manuals are deficient in that they do not make it clear that the duties performed by other crew members are delegated duties and that the pilot in command has the right to perform such functions at his discretion.

During this exchange of correspondence, the airline reminded both pilots and engineers that FAA has outlined specific functions for crew coordination but has left a number of regulations and supervision up to airline operators for incorporation in their operations manuals, which, in turn, are approved by the agency. Underscoring a need for maximum safety, the company reassured the pilots of their command over all crew members but added that such authority carries a "solemn responsibility" for the captain to see that FAA and company regulations and procedures are followed not only by other crew members but by himself as well.

Hutton replied to both unions and the airline, that 26 en route flight inspections of Eastern aircraft showed that some flight crew members had not operated in accordance with procedures established in operating manuals and by such action "adversely affected safety."

He also reminded Eastern that its certification is based upon equipment, manuals, methods and operating procedures established and presented for approval. Safety, he said, can only be accomplished by strict compliance with operating procedures established in the operating manuals and by complying with appropriate regulations.

Hutton declined to comment last week on the progress of his investigation on the grounds that he did not care to become involved "in a labor dispute which is purely jurisdictional."

However, additional information has been given to William B. Davis, director of FAA's Bureau of Flight Standards, who recently advised FEIA that Eastern pilots' claim of CAR 40.351(C) command authority, while quite valid, "only serves to emphasize that the pilot in command must operate aircraft with the highest degree of care. It obligates him to effect the best possible crew coordination and discipline in accordance with the company's operating manual and other instructions," he explained. Davis added that CAR 40.261, also mentioned by ALPA, would not cover routine operations and that FAA is maintaining a close surveillance of the situation.

In general, most of the flight engineers' reports stated that the captains either made a preflight statement that they were assuming engineer duties to "keep their hand in" or bluntly announced that engineers would not follow normal procedure but do only what they were ordered. Many FEIA members walked off rather than fly under these conditions.

Reported Incidents

Among the incidents were reports that as soon as the landing gear of one Eastern plane was retracted, pilots were so busy setting correct takeoff power that the plane almost settled back onto the runway. Overboosting of engines on takeoff was a particular abuse listed by the complaining engineers, most of whom were ordered not to make their customary takeoff settings. Many mentioned incidents of both pilots so engrossed with "becoming familiar" with engineering functions that for periods of from 12 to 20 min. there was no outside watch for a possible midair collision. Many captains, the complaints said, were unable to start aircraft engines properly, while others ignored flight engineer warnings on improperly functioning fire warning systems, inaccurate fuel measurements, malfunctioning of cabin temperatures, failure to keep symmetrical engine power between wings and improper use of engine cowl flaps.

In one case, the engineer reported that an Electra flight overflew a scheduled Daytona stop, after the pilot said he was "too rusty" after the 38-day Eastern strike and flying new equipment and preferred to land in Jacksonville, although the weather was good.

President Views Jets

Washington—Asked about the expenditure of funds for turbojet transports for administrative use by the White House and the Pentagon, President Eisenhower had this to say at his press conference last week:

". . . I have never asked for a jet plane and I'm not sure that I'll ever be riding in one. One reason I haven't asked for a jet plane is because of the paucity of fields in this world, in the United States. When I ride in a plane, I want to be able to go into any state that I—that occurs to me to go, whereas you have to pick and choose when you are going into these places with these big jet planes.

"So, I have authorized, I forget whether it is either two or three jet planes, for the military, and I know of no other way how they can decide—of transport types—whether they are efficient and effective means for supporting the logistics of the forces."

First of three identical military transport versions of the Boeing 707 is scheduled to be delivered to the Air Force in April. For a description of their interiors, see the Feb. 23 issue of Aviation Week, p. 45.

An-10 Difficulty

Moscow—Soviet aviation authorities admit that the An-10 turboprop transport aircraft was involved in two near crashes during test flights, thus contributing to the long delay experienced in placing this plane into regular passenger service.

On one occasion, when flaps were fully lowered during a flight at top speed over 16,000 ft. altitude near Kiev, an An-10 suddenly made a steep bank, went into a tight spiral and almost hit the ground before leveling off with great difficulty. On landing, it was discovered that a flap had peeled off near the wing root.

On another test flight, an An-10 coming in for a landing banked sharply, causing a wing to touch the ground before the plane was righted. Cause of the mishap was not disclosed.

FAA Unit to Probe Near-Miss Reports

Washington – Federal Aviation Agency last week established a Central Reporting Office with the assignment of accelerating the evaluation of reports of near-miss incidents.

The new facility will be located in the Washington Air Route Traffic Control Center and be operated on an around-the-clock basis seven days a week. The Central Reporting Office will be manned by a staff of five trained specialists who will analyze basic information on near-misses as when received.

Control towers, air route traffic control centers and air traffic communication centers have been instructed to relay the details of near-misses to the Central Reporting Office immediately. After processing by the Central Office, the reports will be sent to FAA headquarters for full investigation.

Incidents reported will not be used for statistical purposes but to determine preventative measures or changes in systems that can be adopted to reduce the threat of midair collisions.

Civil Aeronautics Board continues to compile data from voluntary data received from pilots throughout the U.S. Such information, however, is not subjected to the detailed investigation the FAA plans in its program.

Organization of the Central Reporting Office did not stem from the recent increase in near-miss incidents, according to an FAA spokesman. A series of three highly publicized near-misses during the week of Feb. 16 did refocus public attention on the threat of the midair collision, however.

During that week, an Eastern Air Lines Lockheed Electra was involved in a near-miss with a Boeing B-47 flown by a test pilot of Lockheed Corp. Later, a Capital Airlines Viscount was forced to take evasive action northeast of Charlotte, N. C., when the pilot spotted a B-47 on a direct head-on collision course. In a third incident, a Capital Airlines' Constellation and an Air Force Fairchild C-123 took simultaneous evasive action near Knoxville.

American Wins Round In San Francisco Case

Washington—American Airlines was recommended for new nonstop service between New York and San Francisco last week in an initial decision issued by Civil Aeronautics Board examiner Walter W. Bryan.

Citing the need for "vigorous competition" in this market area, Bryan said American was selected because it needs only a lifting of present restrictions on its Route 4 to permit the service and is best qualified to compete for nonstop traffic with United and Trans World airlines' existing "monopoly" in the area. Northwest Airline's application in the New York-San Francisco Nonstop Service Case was recommended for denial on the grounds that the carrier would incur heavy expenditures in inaugurating service over an entirely new route segment and would be unable to provide equal competitive service with other carriers on the route until July, 1960, when it receives its first jet equipment.

At the same time, Bryan said that jet travel in this transcontinental market is expected to stimulate traffic by an increase of 10%, or 33,000 additional passengers, by the end of 1960.

Pointing out that, although the New York-San Francisco market is one of the four markets in the country that generates over 5,000,000 annual passenger miles, Bryan said it has only two carriers able to provide nonstop service as compared with three or more for the Miami, Los Angeles and Chicago-New York markets.

Referring to a need for more competitive nonstop service on the route, the examiner cited the "immediate public acceptance" of additional nonstop service provided by United and Trans World Airlines in mid-1957 as evidence that the market was inadequately served prior to that time. In January of 1957, United reported an average load factor of 72% and TWA a load factor of 68%, he said. Raising the number of daily nonstop flights from only five to 14 flights, gave united a September load factor of 72% and TWA a 71% load factor for the same month, the examiner said.

SAS Crew Dispute

New York—Scandinavian Airlines System was still operating last week on reduced schedules resulting from a lockout Feb. 28 of members of a flight crew organization involved in a contract dispute.

SAS's transatlantic operation to New York was down about 50% from normal, while polar schedules were about 85% of normal. On the airline's European network, all Convair 440s were still in operation.

Some 160 members of the Scandinavian Flight Personnel Organization were involved, mostly Swedish pilots but including some Danish and Norwegian navigators and flight engineers. Main issue was pay for jet work. SAS says it offered a 20% increase in pay for Douglas DC-8 crews, but the group was demanding about 40%. Negotiations were continuing last week.

World's newest, fastest long-range jetliner... the Boeing 707 INTERCONTINENTAL

The Boeing 707 Intercontinental, shown above on its first flight, will bring a new order of performance to the air routes of the world when it goes into service later this year.

This new Boeing jetliner has greater range and payload capabilities than any other jet transport. With a range in excess of 5,000 miles with full payload, it is designed to fly nonstop over the longest stages of airline routes. Cruise speed is more than 600 miles per hour.

The Intercontinental is a longer-range sistership of the 707 Stratoliner. Although it is the world's newest long-range jetliner, the Intercontinental is a *proved* aircraft . . . backed by more than 4½ years of flight testing of the 707 prototype, as well as extensive test programs completed by production 707s. In service since last October, the 707 Stratoliner has been demonstrating the unparalleled passenger-appeal of Boeing jets. Public response, in the words of the operating airline, is "the most enthusiastic to a new airliner in aviation history."

*These airlines have ordered 707 and shorter-range 720 jetliners (*indicates Intercontinental purchasers):*

*AIR FRANCE • *AIR INDIA • AMERICAN • *B.O.A.C.
BRANIFF • CONTINENTAL • CUBANA • *LUFTHANSA
*PAN AMERICAN • QANTAS • *SABENA • *SOUTH AFRICAN
TWA • UNITED • VARIG • *Also* MATS

BOEING 707 Intercontinental

LOS ANGELES AIRWAYS Sikorsky S-55 helicopter delivers passengers to United Air Lines' flight. Note passenger "scooter".

Los Angeles Airways Plans Turbine Fleet

SIKORSKY S-55 takes off from Long Beach Municipal Airport (above). During passenger loading (below), the helicopter's rotor rpm. is maintained but blades are in flat pitch, producing minimum downwash disturbance to the passengers. Company-installed seats fold against wall, making helicopter convertible from passenger to cargo carrier in 3 min.

By William S. Reed

Los Angeles—Los Angeles Airways plans to convert its helicopter fleet to turbine-powered aircraft to take advantage of a potentially large traffic growth in the sprawling Los Angeles metropolitan area.

Two factors are unique to the area:
- **Inadequacy** of public transportation.
- **Tremendous growth** in both population and area of Greater Los Angeles.

Only certificated passenger helicopter operator in this area, Los Angeles Airways already is tapping the market for about 30,000 passengers per year, a relatively small percentage of the 5,000,000 persons who used the airport last year. But future growth figures indicate the need for new equipment to capture the huge potential market foreseen for the future. Conservative estimates by the City of Los Angeles predict that the passenger volume in and out of the airport will reach 11,000,000 annually by 1968.

Said to be the fastest growing community in the world, Greater Los Angeles covers some 5,000 sq. mi., is actually about 300 separate but clustered cities with a total population in excess of 7,000,000 and growing rapidly.

Public transportation similar to New York and London subways does not exist. R. P. Hubley, Los Angeles Airways traffic manager, points out that public transportation in Los Angeles, mostly buses with a few streetcars, moves at the rate of 9.5 mph. Additions to the freeway system are obsolete almost as soon as they are inaugurated because of the tremendous increase in automobile population.

Although passengers in today's jet airliners make the Los Angeles-New York trip in 4½ hr., they may spend as much as 1 to 3 hr. in transit from home or office, depending on distance from the airport and mode of transportation. Helicopter service can cut this time from 10 to 30 min.

Los Angeles Airways believes it will grow along with the general increase in passenger traffic because it has "had to turn down 10 requests for every one passenger carried." Explanation for the inability to accommodate the number of requests lies in the limitation of present equipment.

Biggest drawback in today's operation for Los Angeles Airways is relatively low payload (1,100 to 1,200 lb.) and high operating costs of the Sikorsky S-55, a design that was not intended primarily for airline passenger operation. Operating five S-55s and two S-51s (used for cargo only and soon to be phased out), LAA carried 31,663 passengers in 1958, and slightly less, 31,283, in 1957.

Lack of increase resulted from a saturation of passengers and cargo because of the helicopters' limited payload capacity and unwillingness of LAA to expand service until new equipment, which can carry a greater payload and operate more profitably, is available.

Estimates of LAA are that adding more S-55s or purchasing any other helicopter available now, would not decrease passenger or ton-mile costs.

For this reason, Los Angeles Airways is waiting for delivery, commencing late in 1960 or early in 1961, of the Sikorsky S-61, a 25-passenger helicopter powered by two General Electric T58 gas turbines. Los Angeles Airways believes that the S-61, scheduled for unveiling at Sikorsky in late spring (AW Feb. 23, p. 45), will permit profitable operation. As an interim measure, however, it plans to purchase two Sikorsky S-62s, primarily for the experience in turbine operation, but also because it will afford an 80% increase in payload over the S-55.

The S-62 has the following parts common to the S-55: main and tail rotor blades, main and tail rotor head, main gear box with new power input section, intermediate gear box, tail gear box, shafting, major portion of flight controls, including servos, major portion of hydraulic system and tail rotor pylon (AW Aug. 25, p. 64). Estimates of operating expense for the S-62 are that it will operate for the same cost per passenger mile as the S-55.

Once LAA has put its new equipment into service the main sales pitch will be aimed at airline travelers rather than commuters. The cost of commuting by helicopter is high, ranging from $3.85 to $8.00 for a one-way trip, depending on distance traveled. Airline passengers, using helicopter service in connection with either American, Trans World, Continental or United Air Lines, receive, through a bilateral agreement, transportation to the airport for about $2.00, added to the ticket cost. Major portion of the difference in cost is borne by the major carriers, but is restricted to flight destinations beyond Kansas City and points of similar distance.

Commuting by helicopter has not proved too popular to date, both from the standpoint of cost and heliport location. Should the City of Los Angeles construct a downtown heliport, the service might then prove attractive. Los Angeles Airways believes once the airline passenger market has been served, attention can then be turned toward commuter service.

Indication of Los Angeles Airways' amount of experience is that one of its S-55s recently underwent a 10,000-hr. major inspection. Average daily utilization on all five S-55s is slightly more than five hours per day during winter months and six hours per day during summer. (Disneyland excursions account for a good bit of the summer increase.)

Fleet utilization per day is 80%, meaning that four of the five helicopters are scheduled daily for operations, necessitating some very efficient maintenance techniques. One indication of the complexity of helicopter maintenance is that there are more than 100 parts in a rotor head that are time-change items.

Engine overhaul life on the S-55 is now at 700 hr., rotor heads are changed at 800 hr., while transmissions must be replaced at 1,000 hr. All routine and periodic maintenance is performed at the company's facilities at Los Angeles International Airport.

Helicopter maintenance, according to Los Angeles Airways' shop chief, is much more exacting and complicated than fixed wing aircraft maintenance, primarily due to the transmission, rotor head and rotor blade service demands. Direct maintenance costs in 1957 were $31.40 per hour. Figures for 1958, although not yet available, will be higher, due mainly to wage increases.

One other facet pointing up the difference in helicopter vs. fixed wing maintenance is the logging of rotor time, ground operation of which accounts for about 11% of the total flying time logged. Thus, for purposes of determining, in full, actual wear and tear imposed on the machine, time is logged continuously from rotor start to stop. The 11% factor is included in helicopter maintenance time, but is subtracted from the utilization figures, so that daily utilization is actual flying time, rather than rotor time.

All-weather operation is a factor which is still being weighed by the company in future planning. Present schedule completion is 92%, despite the fact that the company must operate under visual flight conditions. Schedules are backed up by limousine service and the company's record of getting passengers to the airport in time for flights has been good. Los Angeles Airways makes about 100 flights per day from 4:00 a.m. to 11:00 p.m., the time of heaviest airline traffic.

The ultimate would be to offer 24-hr. service and to operate in any weather. Adding the necessary weight to a heli-

First S-62 Orders

Los Angeles Airways is the first of four commercial operators to sign firm orders or take options for the Sikorsky S-62 helicopter, powered by a single General Electric T58 turbine engine and having an amphibious hull.

The order book, which totals five:
- **Los Angeles Airways—order for two ships for delivery possibly late this year or early next year, depending on availability of engines.**
- *** Rotor-Aids, Ventura, Calif.—option on one ship.**
- **Petroleum Helicopters, Inc.—option on one ship.**
- *** Aero Services, Philadelphia—option on one ship.**

Certification of the S-62 is scheduled for November and deliveries will commence after that.

Los Angeles Airways

Air Mail Carried

*1947	209,325 lb.
1948	2,573,608 lb.
1949	4,310,775 lb.
1950	4,424,052 lb.
1951	4,759,839 lb.
1952	4,633,977 lb.
1953	5,624,223 lb.
1954	6,148,552 lb.
1955	6,015,842 lb.
1956	5,761,367 lb.
1957	4,582,067 lb.
1958	4,359,409 lb.

* From Oct. 1, 1947.

Air Express Carried

*1953	5,568 lb.
1954	686,516 lb.
1955	1,549,948 lb.
1956	1,820,698 lb.
1957	1,893,350 lb.
1958	2,020,362 lb.

* From Dec. 17, 1953.

Passengers Carried

*1954	210
1955	4,951
1956	20,586
1957	31,269
1958	31,948

* From Nov. 22, 1954.

First Boeing 707-320 Intercontinental Taxiing

First Boeing 707-320 Intercontinental, now undergoing Federal Aviation Agency certification tests, taxis out for test flight at Seattle, Wash. In background is the second Intercontinental; both airplanes will enter service for Pan American World Airways following certification. A total of 84 Intercontinentals have been ordered by nine airlines.

copter in the form of avionic gear and flight instruments however, would necessarily reduce the payload. Eventually, all-weather operation will become a necessity, but Los Angeles Airways anticipates that advances in the state of the art will permit equipping a helicopter for this capability without the compromise in payload and performance that would be exacted with equipment presently available. Unquestionably, the S-61, a helicopter with the passenger carrying capacity of the pioneering, Douglas DC-3, will need more sophisticated navigation methods than are now employed. The only means of navigation now in use by Los Angeles Airways is pilotage and its S-55s carry only voice radio.

Routes and approaches to airports, particularly Los Angeles International, have been fixed by the company with the approval of the airport traffic control zones concerned. Routes, as well as en route altitudes, have been selected with safety as the prime concern. First consideration is to avoid other air traffic. Approaches are made at right angles to prevailing instrument runways and do not interfere with landings or approaches.

En route altitudes are based on considerations involving sites for possible autorotation landings, should engine failure occur. Height flown on each run, therefore, varies according to ground congestion.

Experience of Los Angeles Airways staff of 11 line and three supervisory pilots averages 3,500 hr. of rotary wing time. At least three times each month every pilot receives proficiency time, during which the primary emphasis is on autorotation landings. Attesting to the company's safety record is the fact that since introduction of passenger service in November, 1954, it has not had an accident.

Another statistic which points up the type operation conducted by Los Angeles Airways is distance flown per passenger. From the 31,663 revenue passengers carried in 1958, passenger miles flown came to 1,168,000, or slightly less than 37 miles per passenger. At the S-55's average block speed of 70 mph., each passenger spent about 32 min. getting to his destination by helicopter. In comparison, on public surface transportation, which averages 9.5 mph. as noted before, he would have to spend almost four hours covering the same distance.

Los Angeles Airways' case for certificate renewal was presented recently to the Civil Aeronautics Board on Docket 8178. In citing its case for renewal, which has been granted, plans were outlined for expansion and the purchase of new equipment. Cost of the S-61 is about $375,000 or a total projected outlay of $1,875,000 during the period 1961-63.

As part of the docket, Los Angeles Airways exhibited a letter of intent from Bank of America to C. M. Belinn, LAA president, to extend credit in the amount necessary for the purchase of the new equipment. Belinn stated that introduction of the new equipment, allowing time for flattening of the learning curve, could mean a subsidy-free operation. Best estimate quoted on the time to release subsidy would be 1965.

British Aircraft Cost Estimates Attacked

London—British Auditor-General has issued a report strongly critical of discrepancies between original estimates and actual costs in development of military aircraft and aircraft engines.

Sir Edmund Compton, controller and auditor general, gave three major examples in the civil appropriation accounts published recently.

Development cost estimates of the de Havilland Sea Vixen, naval version of the DH.110, originally set at $3.6 million, have since been raised to $13.7 million. Cost estimates per production aircraft have risen by more than 85%.

"Government's contribution to development of the Rolls-Royce Avon RA.29 engine for the Comet IV was first estimated at $4.6 million but the Ministry of Supply's final liability amounted to $24.6 million. Government tried to terminate its development contract when the estimate reached $21.3 million, but found it would be liable for heavy breach of contract damages, particularly because of de Havilland's commitment to supply Comet IVs to BOAC and other customers.

"Estimates on development of the Bristol Orion, which was to have replaced the Proteus in the Bristol Britannia, rose from $18.2 million to $36 million before the Ministry of Supply withdrew its support last year."

Sir Edmund also cited the case of a radar scanner, estimates for which rose from $168,000 at the time of contracting in 1951 to $5.3 million last year.

Sir Edmund quoted various reasons given by the Ministry of Supply for the discrepancies, chiefly the unknowns of complex work in new fields, and misunderstandings between suppliers and government over what was estimated.

In the case of the Orion, for instance, six engines needed for testing were reportedly omitted from original estimates.

In the case of the Vixen, Sir Edmund has asked the Ministry of Supply to report whether it was satisfied with steps taken to make sure estimates were sufficiently exhaustive and accurate to form a reasonable basis for proceeding with development and production.

De Havilland has refused official comment, but a spokesman pointed out that there were substantial design changes in the course of development, notably the change in armament from cannon to Firestreak missiles.

SHORTLINES

► **American Airlines** flew an estimated 364 million revenue passenger miles during February as compared with 337 million passenger miles flown in February, 1958. Load factors for the first five weeks of Boeing 707-120 transcontinental operation held at 96.2%.

► **British Overseas Airways Corp.** claims a new Tokyo-Honolulu speed record with a Bristol Britannia airliner. The flight was made in preparation for BOAC's hoped-for round-the-world jet service using Britannias and de Havilland Comet 4 aircraft.

► **Continental Airlines** has completed disposal of its surplus piston aircraft with the sale of three Convair 440 airlines to Frederick B. Ayer Associates, Inc. The airline has sold some 14 aircraft for $5,250,000 in 13 months.

► **Flying Tiger Line** reports a company record for January revenue—$1,208,342, a 58.6% gain over January, 1958.

► **Guest Aerovias (Mexico)** plans to reinaugurate Mexico City-Miami-Lisbon-Madrid-Paris service this week as a result of a reorganization of the airline. Five Mexican businessmen have joined the airlines' board of directors and are planning an expansion program which also includes the purchase of additional Douglas DC-6B airliners from Scandinavian Airlines System. Also, watch for a move by Iberia Air Lines to restore its service to Mexico City.

► **Northwest Airlines** reports a January net income of $35,042, the first such monthly income since 1946 according to the airline. Operating revenues were $9,305,727, up 47.5% from January last year, and operating expenses of $9,141,354, 50.3% above last January.

► **Pan American World Airways** will begin all-cargo service on its transpacific route from San Francisco to Manila on April 1 with Douglas DC-4 aircraft. Pan American also plans another service from San Francisco to Tokyo on a combination passenger-cargo basis.

► **Transocean Airlines**, a supplemental carrier, has set new tourist fare from the West Coast to Hawaii of $89.10 for a one way trip on off-season flights. The carrier will still hold to its regular $99 fare during the season. At present, certified carriers have a $116 one-way fare on 15-day excursion tickets and $133 regular tourist fares.

► **Trans Texas Airways** earned a net profit of $180,327 during 1958.

AIRLINE OBSERVER

► Airline business during January declined slightly below the passenger traffic carried the previous January, primarily because of the strikes against Eastern and American Airlines. Revenue passenger miles dropped 0.9%, an improvement over December when the decline reached 13%. Passenger load factors for the industry in January stood at 60.37%, a 1.42% improvement over January, 1958.

► **Look for an agreement between Western Air Lines and Allison Division of General Motors for the lease of $4 million worth of turboprop engines to power the carrier's fleet of nine Lockheed Electras.**

► Russian press, which unfailingly reports every major commercial and military plane crash in the U. S., sometimes lets its enthusiasm for capitalist disasters get out of hand. The newspaper Sovetskaya Aviatsiya, official organ of the Red Air Force, tells its readers that "452 collisions involving passenger planes took place in the U. S. during a period of only four months last year." It added that "4,429 passengers perished" in these midair crashes. Figures cited apparently include passengers on planes involved in near-misses. Soviets presumably make no distinction between persons frightened to death and those actually killed.

► **Watch for new purchases by Australian airlines of Fokker Friendship and Vickers Viscount 800 turboprop transports. Australian government is determined to resist strong pressure by the carriers for authorization to place additional orders for Lockheed Electra turboprops but apparently will allow the purchase of the Dutch and British aircraft.**

► American Airlines has revised its seat configuration on the Boeing 707-120 jet transports to increase the number of first-class seats. Originally, the plane carried 112 seats divided equally between first-class and tourist. Now 68 seats are designated first-class and the coach section contains 38 seats.

► **De Havilland Comet jet transports have flown 29,200 hr. to date and have operated a total of 13 million miles. Comet 4s in service on British Overseas Airways Corp. North Atlantic routes have logged 3,500 flying hours. BOAC plans to introduce the Comet 4 on its London-Tokyo route April 1.**

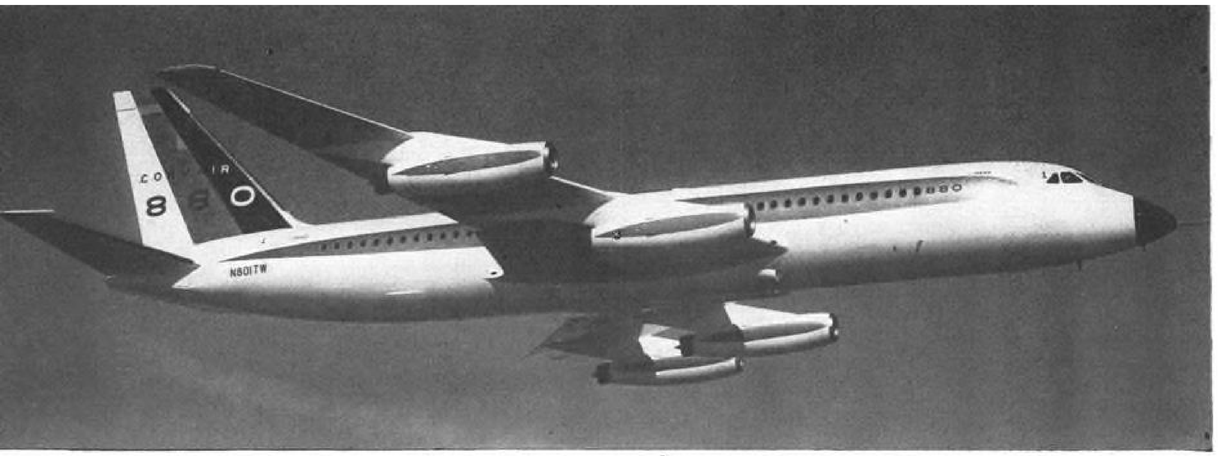
► Civil Aeronautics Board hearing on the equipment lease agreement between Pan American and National airlines has been postponed from Mar. 9 to Mar. 18 because all evidence requested from National, Eastern and Northeast by the Board hearing examiner had not been submitted at the appointed time.

► **Lake Central Airlines has completed its $1 million financing program as a result of a $750,000 bank loan secured by a chattel mortgage on the company's aircraft, engines and spare parts. In December, the first phase of the program was completed with the sale of $300,000, 6% convertible subordinated debentures.**

► O. K. Antonov, a leading Soviet transport designer, will turn his attention to sports planes and "participate in the creation of international-class motorless aircraft (gliders)" during the USSR's new Seven Year Plan. Antonov has been subjected to official Soviet criticism for the performance of his last two turboprop-powered transport aircraft, the twin-engine An-4 and the four-engine An-10.

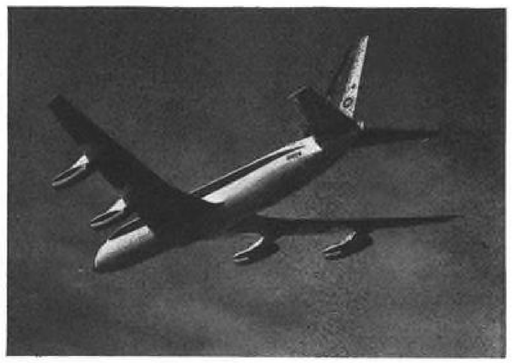
► **Philippine government has terminated 13-year-old bilateral air agreement with the U. S. Government officials say termination came after three unsuccessful attempts to revise the 1946 pact to adjust what Manila calls inequitable treatment of traffic rights. Far East observers fear renegotiations will be drawn-out and difficult because of present strained relations between the two countries.**

► Air Coordinating Committee report of "U. S. policy concerning the disposal of piston-engine aircraft to be replaced by turboprop and turbojet" aircraft will be released early this week.

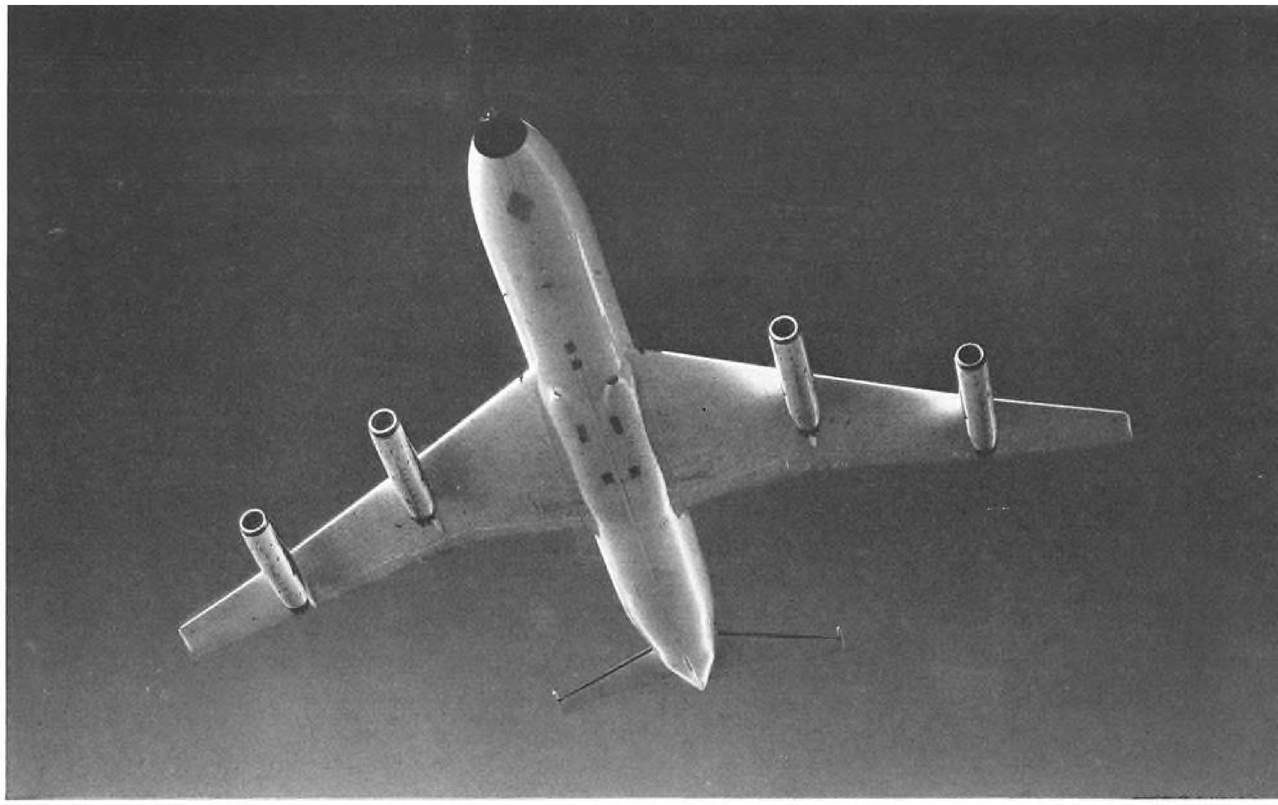


Convair 880 turbojet transport, now undergoing flight testing at San Diego, Calif., will carry 88 passengers in first-class configuration.

Convair 880 Jet Transport Enters Flight Tests



Intercontinental version (not yet built) of the Convair 880 will have 4,210 mi. range. The four General Electric CJ-805-3 turbojet engines are commercial versions of military J79. Engines are fitted with daisy-type sound suppressors with thrust reversers planned.



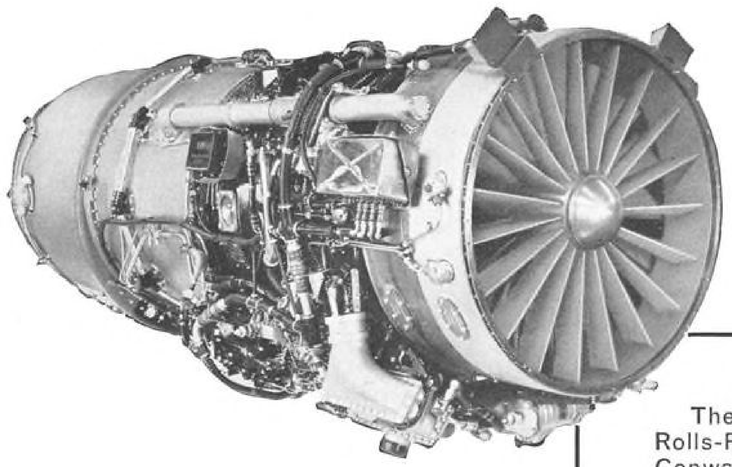
Another Convair 880 currently is undergoing proof-load testing on the ground; stub-wing fuselage will be pressure-tested under water.

Transport, shown in "dirty" configuration, uses fuel at the rate of 12,000 lb./hr. to maintain top cruise speed of Mach .89.

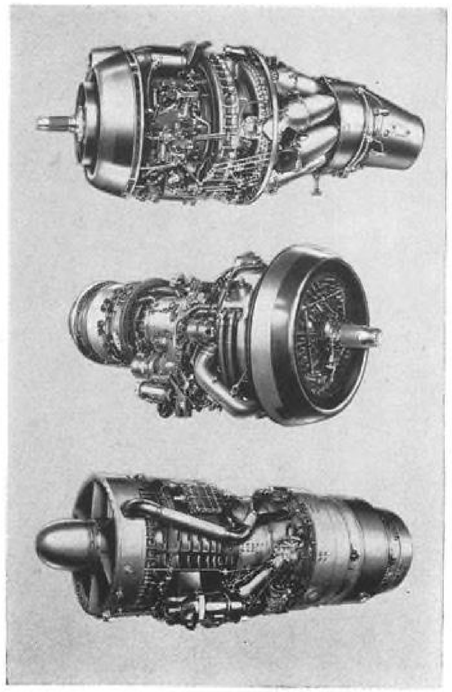
A NEW ERA IN JET POWER

THE ROLLS-ROYCE CONWAY BY-PASS JET ENGINE

has now been granted a full certificate of airworthiness by the Air Registration Board at a minimum rating of 18,000 lb. thrust.



ROLLS-ROYCE EXPERIENCE IN THE AIRLINE OPERATION OF GAS TURBINES IS UNIQUE



THE DART

—the first, and for four years the only prop-jet in airline service has flown over 6,000,000 hours. The Dart is currently operating at overhaul lives of up to 2,300 hours.

THE TYNE

—a most advanced prop-jet engine, is due to enter service in 1960 at ratings of 4,985, 5,525 and 5,730 e.h.p. It has a specific fuel consumption comparable with the latest compound piston engines.

THE AVON

—the first turbo jet on the North Atlantic route, and now in daily service, began scheduled operations with an approved overhaul life of 1,000 hours.

DEVELOPED FROM EXPERIENCE

The by-pass principle which Rolls-Royce have proved in the Conway engine is now accepted as the correct formula for all jet transport and for certain military applications.

The new RB.141 family of by-pass jet engines is based on seven years' development experience of the by-pass principle gained with the Conway and on six years' operation of other gas turbine engines in airline service. The first of this series has already been chosen to power the new British European Airways medium range jet airliner.

ROLLS-ROYCE

GAS TURBINES

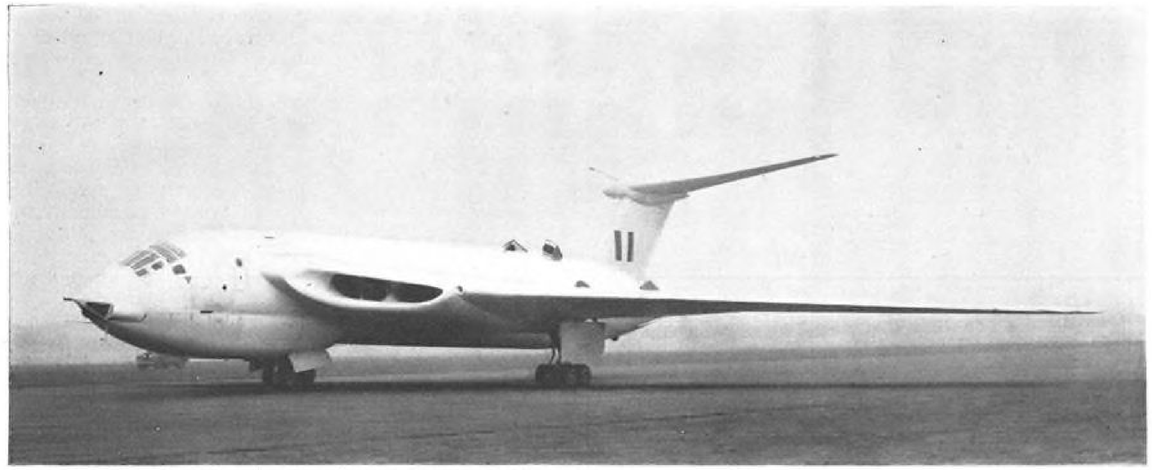
ROLLS-ROYCE LIMITED, DERBY, ENGLAND

AERO ENGINES · MOTOR CARS · DIESEL AND GASOLINE ENGINES · ROCKET MOTORS · NUCLEAR PROPULSION

Airline Traffic—Year End, 1958

	Revenue Passengers	Revenue Passenger Miles (000)	Load Factor	U. S. Mail	Express	Freight	Total Revenue Ton-Miles	% Revenue to Available Ton-Miles
DOMESTIC TRUNK								
American	7,208,120	4,906,061	66.1	21,248,963	9,607,782	91,177,571	592,596,102	57.1
Braniff	2,101,105	919,243	59.1	3,914,148	2,055,696	6,705,412	100,954,072	48.8
Capital	3,541,292	1,413,982	57.9	5,702,523	2,809,245	3,771,890	147,733,125	47.4
Continental	853,931	422,463	51.2	1,207,335	542,825	1,968,751	44,292,995	43.7
Delta	2,783,205	1,408,958	58.5	5,189,413	3,269,680	12,800,994	156,906,211	53.6
Eastern	6,934,861	3,813,473	52.79	9,985,325	4,884,716	12,671,574	395,082,921	48.16
National	1,568,213	1,001,430	56.1	3,848,899	720,828	6,232,905	107,949,023	47.3
Northeast	957,961	409,235	47.4	1,107,874	372,492	1,174,937	41,890,682	39.3
Northwest	1,562,394	1,120,240	55.4	5,829,278	2,828,395	11,125,490	127,369,240	49.0
Trans World	4,404,356	3,671,913	64.5	13,676,525	7,065,422	24,017,671	396,557,521	57.3
United	6,792,947	4,962,564	64.6	31,132,283	11,024,527	66,984,129	585,877,042	57.8
Western	953,322	506,711	54.5	2,130,166	708,053	2,396,573	53,739,924	45.6
INTERNATIONAL								
American	126,306	115,302	52.8	113,264	5,211	3,215,539	15,438,215	56.0
Braniff	46,458	88,902	48.8	153,243	.....	1,183,241	11,085,775	44.7
Caribbean-Atlantic	253,421	17,675	59.4	19,913	.....	43,201	1,913,443	64.8
Delta	57,185	68,018	51.9	93,280	.....	484,816	8,164,434	45.8
Eastern	342,383	477,185	50.76	965,826	.....	1,235,907	51,374,911	51.71
Mackey	90,558	18,184	40.0	.....	.....	23,226	2,020,447	41.2
National	96,348	68,302	51.7	110,603	61,872	507,442	7,974,136	46.6
Northwest	140,906	315,007	54.5	15,107,881	201,120	9,218,739	58,007,396	65.9
Pan American								
Alaska	43,016	48,271	54.0	376,332	.....	1,950,853	7,289,323	53.1
Atlantic	1,180,531	1,595,015	61.0	16,171,764	.....	28,875,307	212,538,244	59.0
Latin American	1,167,116	1,261,245	64.3	4,797,166	.....	50,145,327	177,086,478	63.8
Pacific	265,663	988,999	72.3	14,457,597	.....	19,933,427	138,026,677	69.0
Panagra	128,776	163,351	53.4	838,807	.....	5,121,823	23,883,977	57.1
Resort	.....	.....	.....	.....	.....	43,399,793	43,399,793	78.2
Trans-Caribbean*	.....	.....	.....	.....	.....	.....	.....	.....
Trans World	318,803	920,762	58.8	10,394,101	.....	10,706,064	117,731,859	59.6
UMCA	2,259	743	39.4	.....	.....	21,231	98,592	47.9
United	101,178	251,291	61.3	1,672,800	.....	1,011,169	28,393,801	59.0
Western	17,176	26,732	52.0	18,294	.....	44,694	2,970,338	54.3
LOCAL SERVICE								
Allegheny	475,852	84,196	47.3	139,042	224,634	235,759	8,638,754	47.4
Bonanza	182,086	42,336	45.5	64,515	31,420	93,118	4,238,219	43.7
Central	138,090	26,872	34.4	65,361	34,490	107,349	2,780,325	31.0
Frontier	231,935	62,704	48.3	230,449	100,594	672,940	7,036,527	56.9
Lake Central	182,589	29,289	38.1	43,291	174,266	.....	3,024,510	41.1
Mohawk	453,765	87,291	51.8	92,657	165,914	179,682	8,771,278	52.1
North Central	746,496	125,931	46.6	302,144	406,476	.....	12,792,316	47.3
Ozark	423,785	72,578	45.7	131,418	210,327	191,455	7,464,695	47.7
Pacific	375,718	83,468	51.4	135,624	57,215	91,983	8,245,835	49.6
Piedmont	410,891	86,435	52.3	170,825	145,056	153,422	8,754,574	52.1
Southern	222,956	41,818	39.8	111,436	120,395	91,482	4,333,498	39.6
Trans-Texas	240,439	54,934	38.9	176,654	101,458	331,412	5,875,284	39.9
West Coast	248,436	46,520	47.72	56,189	30,042	104,806	4,634,051	45.79
HAWAIIAN								
Hawaiian	409,053	88,043	65.3	58,499	.....	1,498,932	9,172,730	62.4
Trans-Pacific	183,005	24,781	56.0	9,976	.....	91,668	2,092,048	56.2
CARGO LINES								
AAXICO	.....	.....	.....	111,695	209,374	40,365,217	40,686,286	76.0
Aerovias Sud Americana	.....	.....	.....	.....	.....	8,105,518	8,105,518	81.3
Flying Tiger	81,632	362,577	99.6	473,410	480,770	104,073,462	141,285,547	88.8
Riddle								
Domestic	.....	.....	.....	339,806	376,973	58,594,710	59,311,489	89.6
Overseas	.....	.....	.....	.....	.....	8,923,611	8,923,611	70.0
Seaboard & Western	51,213	199,130	100.0	1,660,721	.....	19,314,656	40,950,183	65.7
Slick	25,826	155,041	96.58	75,817	45,041	4,440,293	20,058,214	89.31
HELICOPTER LINES								
Chicago Helicopter	109,136	1,997	37.3	17,614	.....	.....	208,189	28.5
Los Angeles Airways	31,663	1,181.5	53.1	48,005	22,527	.....	183,256	58.4
New York Airways	91,114	1,761	44.8	17,823	10,378	6,127	202,610	44.6
ALASKA LINES								
Alaska Airlines	72,079	38,686	38.6	683,381	34,878	2,738,331	7,418,435	43.0
Alaska Coastal	51,458	4,610	61.8	48,352	49,543	10,725	569,649	64.8
Cordova	11,466	1,937	42.2	49,253	.....	233,994	483,056	48.5
Ellis	52,521	3,106	58.6	24,005	.....	28,052	368,597	69.7
Northern Consolidated	21,805	6,928	45.8	301,719	.....	687,159	1,749,888	61.3
Pacific Northern	112,871	105,595	50.3	1,248,331	48,396	3,201,413	15,397,354	60.6
Reeve Aleutian	12,745	10,171	41.0	350,968	.....	1,119,364	2,584,092	56.9
Wien Alaska	35,087	11,636	21.5	397,134	.....	2,197,258	3,790,931	57.6

* Not available.
Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board.



HANDLEY PAGE Mk. 2 Victor bomber utilizes crescent wing planform. Ram air scoops on aft fuselage provide equipment cooling air.

Sandwich Panels Cut Weight in Victor

By John Tunstall

London—Extensive use of spot-welded sandwich construction in wing torsion boxes, spar webs, fin and tail plane are among notable weight saving, constructional and fail-safe aspects of the Handley Page Victor bomber.

These aspects include high-efficiency transport wing joints in the sandwich which feature tension bolts buried in line with the centroid of the panel cross-section.

Sandwich construction plays a major part in the particularly low structural weight claimed for the Victor and the exceptional surface stability and smoothness of its cranked "crescent" wing configuration.

Another weight-saving feature is the extensive use of magnesium-zirconium castings for detailed components. Titanium in the ribs, near the engine bay and in some bolts saves 250 lb.

Control features include the use of skew levers in the operation of elevator, rudder and aileron which enable the control mechanisms to be kept within local contours.

According to K. R. Obee, deputy chief stressman at Handley Page, structural efficiency of the Handley Page sandwich construction over a honeycomb structure is due to the core—which has closely pitched corrugations in the direction of the principal load—sharing the end-load and primary bending stresses with the outer skins. Honeycomb core takes no load; it merely stabilizes the section.

Sandwich skin panels used in the

STRUCTURAL ruggedness is emphasized in this view of Victor at top of a loop.

The King of Air Fighters

(Continued from Inside Back Cover)

thousand feet and headed for home. A flight commander from Squadron 74 had just saved the skin of one of his pilots by drawing the enemy on to himself.

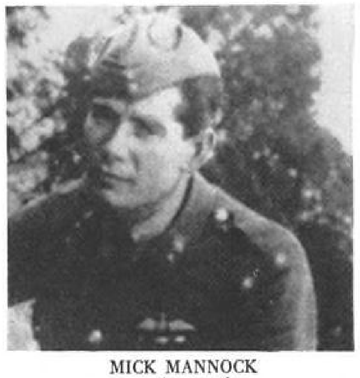
Such a man was Britain's Edward (Mick) Mannock—an implacable fighter, a cool, calculating technician, the greatest fighter pilot of World War I. This sturdy patriot was accepted by the Royal Flying Corps despite a bad left eye and the handicap of age, for Mannock was 30 when he arrived in France early in 1917 for assignment to a fighter squadron.

An Irishman who had been born on the wrong side of the tracks, Mannock joined the army before the war, following five years of travel in the Middle East. He served in the ambulance corps and with the engineers before being transferred to the R.F.C.

Unfortunately, he was neither a natural flier nor a good shot. Both took practice, and it was two months before Mannock shot down his first German. He proceeded cautiously at first—often to the chagrin of his comrades—but within three weeks he bagged five more enemy planes.

Mannock scored the majority of his 73 victories in an S.E.5 or S.E.5a, the mainstays of the R.F.C.'s high-altitude air defense. The British-built S.E.5 was famous for its dive-and-zoom maneuvering. Originally powered by a 150-hp. Hispano-Suiza engine, its maximum speed was 119 mph. at 6,500 feet and 98 mph. at 15,000 feet. One Vickers machine gun fired through the prop, and a Lewis gun could be swung from the top wing to shoot upward. The plane was as easy to handle as the Sopwith Camel was difficult, but it couldn't match the Camel for maneuverability. First production models were delivered at about the time Mannock arrived in France.

During the latter part of 1917, Mannock was averaging a victory a day in



MICK MANNOCK
...a victory a day

his S.E.5. Before the year ended, he had 56 confirmed kills and was a flight commander. It was as a flight commander that Mannock added to the luster of his name. This impressive air fighter was equally great as a flight leader. Although he was protective of his young pilots, Mannock had no patience with the shortcomings of the more experienced fliers under his command.

The year 1917 was the year of heroes. Mannock became the No. 1 air fighter of the Royal Flying Corps—and his only fear was death by fire. He carried a pistol with which to end his own life in case his plane was set afire. Mannock never had a chance to use the gun.

Late in June, 1918, Mannock was dogfighting. In following an enemy plane down to confirm the kill, he flew too low and was killed by a German infantryman's bullet. Shortly afterward, his father accepted Mick Mannock's Victoria Cross from the hand of the King of England.

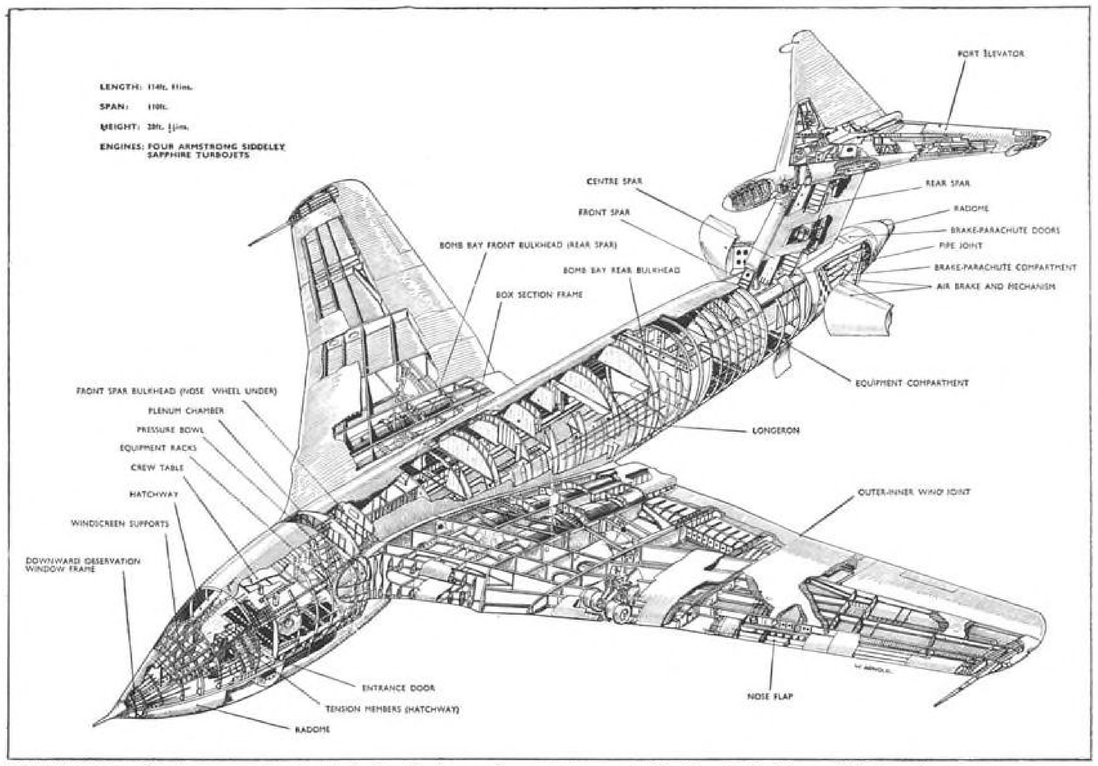
Heritage of the Air

One of the most inspiring chapters in the history of flight is the story of the men and flying machines of World War I. It is a highly personalized story of brave men—and the wood, wire and linen that converted manpower to airpower.

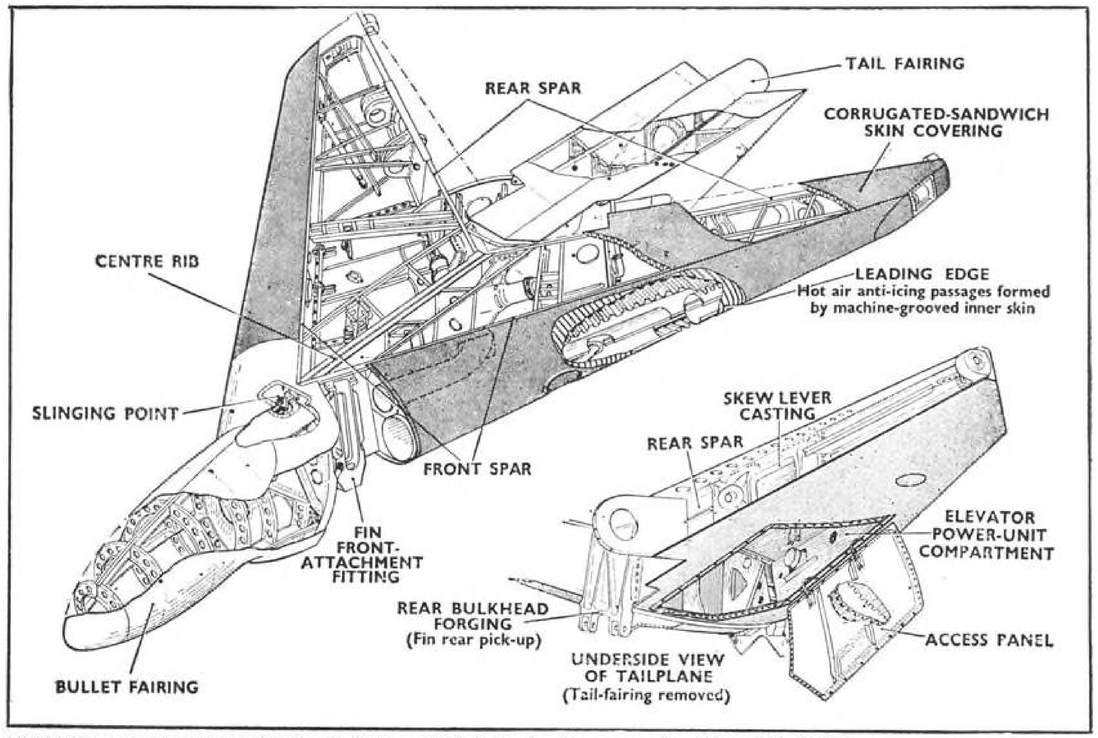
From the open-cockpit, helmet-and-goggles era to the space age, the Leach Corporation has served aviation with active components of unsurpassed reliability. Because it shares the many fine traditions of aviation, Leach is proud to present this Heritage of the Air Series.

Free Reprints for Framing...

Color prints of the cover illustration of Mick Mannock's S.E.5a and other World War I planes are available for framing. Reserve a set of these collector's items—complete with scale drawings and specifications—by addressing requests on company letterhead to: Heritage of the Air, Leach Corp., 18435 Susana Rd., Compton, Calif.



PRESSURIZED cabin in nose section is attached to fuselage at four points associated with principal top and bottom longerons.



MULTI-SPAR arrangement provides for duplicate or triplicate torsion boxes as another Victor fail-safe feature.

multiple wing torsion boxes have a spanwise corrugated sheet core, spot-welded to the outer skin and blind-riveted to the inner skin. By stabilizing the skin under compressive spanwise loading, the number of full-width ribs is reduced to eight only in each wing.

Chord-wise bending and shear stiffness of the panel is also sufficient to reach fuel loading chord-wise as well as the aerodynamic load, without the additional reinforcement needed by an integral milled skin.

The fuel inertia and superimposed fuel pressure loading (needed to prevent boiling) reaches 20 psi. in the Victor's torsion boxes. This fuel loading develops stresses at right angles, and of the same order as the major spanwise stresses.

The welding technique developed by Handley Page uses comparatively large diameter electrodes which leave the surface so smooth that lines of spot-welds are virtually indiscernible to touch or eye. Local indentations are eliminated and the technique avoids the cumulative panel creep experienced along a riveted joint.

Same construction is used in the webs of ribs and intermediate spars to provide lateral bending stiffness against fuel loads as well as providing a smooth envelope for bag tanks.

Provision of smooth internal surfaces was a particular attraction of the sandwich construction as at the time the Victor design was frozen, there was little experience of integral wing tankage.

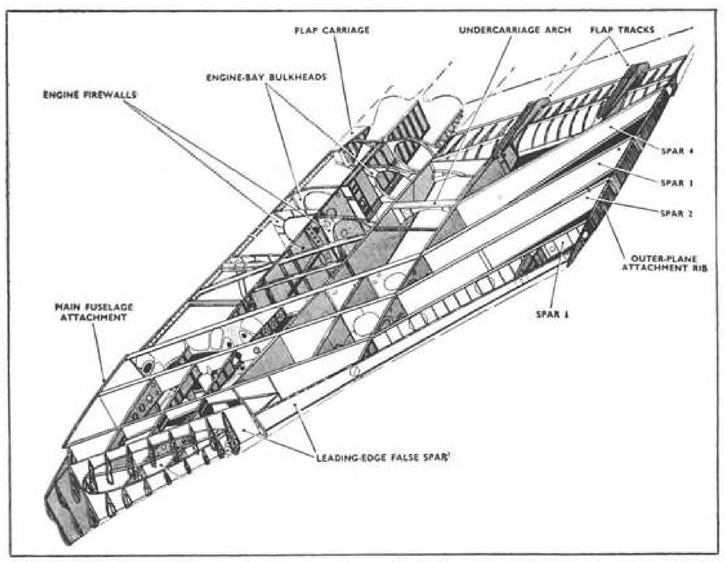
The sandwich system, Obee claimed, was the lightest of all practical multi-load path structures investigated. In addition, the spot-welded panel and the corrugated core offered surface smoothness and stability characteristics at least equal to a milled-plank structure. Lack of machining operations was especially attractive from a production viewpoint. A milled panel with integral stringers was also less able to react fuel pressure loading as efficiently, Obee said.

The wing has a double torsion box structure at the center and root sections with a triple torsion box structure outboard. Three shear webs in the center section are at right angles to the fore and aft center line. Major kinks in the wing planform occur at the fuselage sides which form transport joints and at the outboard wing joints. Substantial ribs in each wing are located principally at the transport joints and in the region of the landing gear and engine compartments.

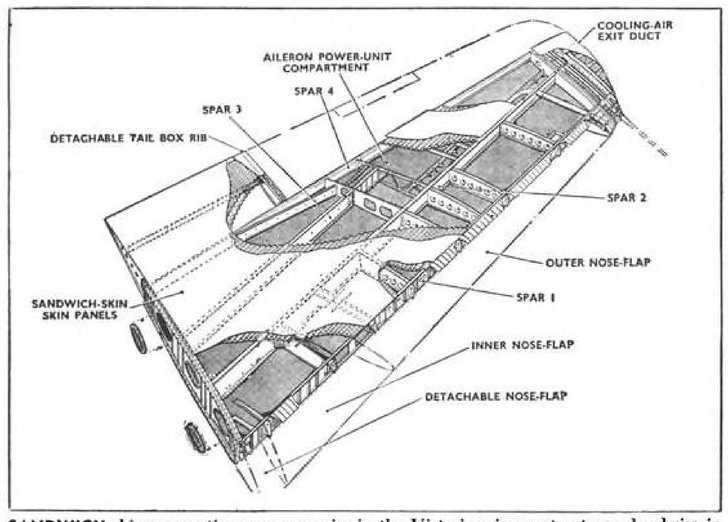
Large elliptical cutouts in the primary spar webs to accommodate the engine air intake duct were one of the major stress distribution problems in the Victor design. The cutouts remove most of the spar web in this region. To meet strength and stiffness requirements, these webs are now forged with integral reinforcement around the cutout.

Panel Joints

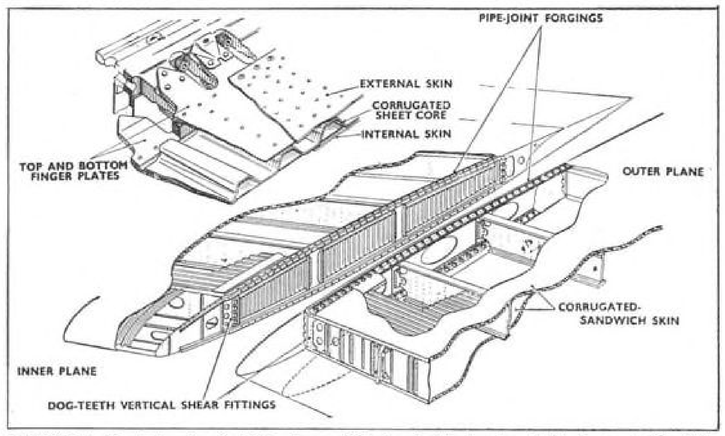
At each wing joint face, the panel core is cut back to receive the lugs of two forged bars which run chordwise continuously around the primary wing box profile between front and rear spars. These bars are secured between the outer and inner skins reinforced by finger plates. Upper and lower forgings at jointing faces butt together and are secured by buried, horizontal pan-



CUTAWAY shows triple spar torsion box inboard. Four spars are in section outboard the engine and landing gear ribs.



SANDWICH skin corrugations run spanwise in the Victor's primary structure; chordwise in the secondary structure.



DRAWING illustrates pipe joint forgings which locate the tension bolts in centroid of the panel section. Finger plates are detailed at top left.

head tension bolts located between the lugs, and in the same plane as the centroid of the sandwich cross-section.

Vertical shear at the joints is reacted by engagement of dog-teeth fittings projecting from front and rear spar-webs. Fore and aft shear loads are reacted by the bolts.

Secondary structure, aft of the multiple torsion boxes, has a spot-welded outer skin with corrugated sheet stiffening but no inner skin. Using a comparatively thin outer skin with the corrugations arranged chordwise reduces the spanwise stiffness.

This arrangement allows the secondary structure to follow load deflection of the primary structure without collecting spanwise loads, and avoids development of permanent shear waves which are characteristic of conventional skin-stiffener combinations in secondary structure.

Multiweb and sandwich skin construction is used in the fin and tail planes for the same weight saving and surface stability reasons. But the fin has a single skin with corrugated stiffening which offers a superior aerodynamic surface without incurring a weight penalty.

Prototype Tail Unit

The prototype aircraft had a tail unit of conventional fabrication. The switch to sandwich construction was made purely for production reasons, Obee told Aviation Week, and was not related to the tail failure which had led to the loss of the prototype.

The cause of this failure has still not been officially disclosed although it was generally conceded to be due to flutter. Known modification to the tail and fin attachment included stiffening of tail and fin joints. Panels have fail-safe characteristics. Unique fail-safe characteristics of the wing joints have been proved in structural tests. These tests have shown that a crack virtually always starts at the wing joints in the outer skin of the sandwich where it can easily be detected. Propagation rates are very slow.

This crack location is due to the fact that the outer skin, being spot-welded, is stiffer than the inner skin and therefore collects more load. It is also further from the neutral axis.

Dividing the corrugated core spanwise between webs is another fail-safe feature. It limits crack propagation to one-half panel width, and failure of a core sheet would reduce bending strength of the wing by only 10% and use a much smaller reduction in the torsion strength.

Skin Cracks

Other useful features of the panel revealed in tests show that the outer skin cracks always appear before core cracking. Cracks here would be difficult to detect. At each spar there are complete spanwise panel joints.

The fuselage is largely conventional with continuous frames and stringers but design is compromised by the very large bomb door cutouts. A number of substantial extruded longerons are added for bending reinforcement.

Discontinuity created by the deep wing torsion box structure in the fuselage is compensated by placing the front fuselage floor, two reinforced longerons and the bottom wing skin all in the same horizontal plane.

The nose section mainly consists of the pressurized cabin which is attached to the fuselage at four points associated with the principal top and bottom longerons. Pressurized section is bounded by the cabin floor, shell, and a rear spherical bulkhead. Equipment is contained in an adjacent compartment which is pressurized by ram air.

Republic SD-3 Drone Makes Initial Flight

Republic SD-3 combat surveillance drone, developed for U. S. Army Signal Corps and designated Snooper, has completed first flight and evaluation tests. Remote controlled drone has made four successful flights, including rocket launch and recovery. SD-3 has interchangeable nose unit (AW Aug. 18, p. 27) for photography or infrared detection, radar or television. Unit weighs less than 1,000 lb., is 15 ft. long and has wingspan of 11 ft.; powerplant is a 140 hp. Continental engine. Drone is launched from a mobile trailer by two Arrow II rocket motors.

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AND RARE
GASES

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NITROGEN
NITROUS OXIDE
HYDROGEN
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HELIUM
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KRYPTON
NEON

PART OF THE PICTURE

when Twigg makes the remarkable sandwich panel . . .

AIRCO INDUSTRIAL GAS SERVICE

1. HIGH S-W RATIO. One of the most efficient of modern structural forms is the lightweight honeycomb assembly—dubbed the sandwich panel. Typical is this one, designed for the supersonic B-58, and providing the strength of solid steel at less than half the weight. Here's how it's made—

2. "FOILED" FOR SUCCESS. Twigg Industries produce the sandwich panel for Convair. It calls for the most modern, most skillfully applied brazing technique.

Over each face of this stainless steel honeycomb "core" technicians lay a paper-thin sheet of brazing alloy. And here Airco is part of the picture—as supplier of this vital silver-copper-lithium "foil," which must produce uniform, high-strength joints resistant to corrosion and extreme operating temperatures.

Next come the panel's stainless steel skin sheets.

3. IN THE BAG. Now chemically clean core, foil, skins, edge members and slugs are assembled and spot-tacked. Components pre-joined, the panel is weld-sealed within an airtight stainless steel bag.

At the purging station Airco again is part of the picture, supplying argon to replace the air in the bag.

4. BRAZED IN ARGON. Entire unit, now placed in a stainless steel retort in a furnace, is brazed for about 5 to 8 minutes at 1665°F. The atmospheres within both retort and envelope are purged continuously to maintain an environment of 100% Airco argon.

After the brazing cycle, the panel is chilled to −100°F with CO_2, reheated and X-rayed to make certain that fillets are completed and sound—an important step in the final checkout.

5. EVER-READY SUPPLY. From these Airco bulk trailers, argon and hydrogen are streamed directly into the Twigg brazing processes at Martinsville, Indiana.

More and more, the bulk trailers of Airco are part of today's industrial picture: they represent an economical way to assure an ever-ready supply of needed industrial gases.

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NEW AVIATION PRODUCTS

Missile Motor

Direct current motor, designed to drive a 3,000 psi. 0.5 gpm. hydraulic pump on an aircraft, is available for hydraulic pump drives, pneumatic compressor drives, fuel pump drives and antenna rotating drives on both aircraft and missiles.

Model D-1000 motor operates at 28 volt d.c. and 69 amp., motor delivers 1.6 hp. at 2,000 rpm. Higher output speeds to 25,000 rpm. are available by deleting the reduction gear box. Motor life in field use is in excess of 1,500 hr., the maker states. Actuator operation is at 260F ambient temperature at 60,000 ft. altitude. Motors for higher ambient temperature, 500F and 200,000 ft. altitude are available for missile applications.

Hoover Electric Co., 2100 S. Stoner Ave., Los Angeles 25, Calif.

Aircraft Coffee Cup

Drinking cup designed for use aboard aircraft retards spillage. Plastic cup has anti-spill baffle ring which deflects the liquid inward, thus reducing the chance of spillage.

Cup is designated Aero-Cup Model K600-5.

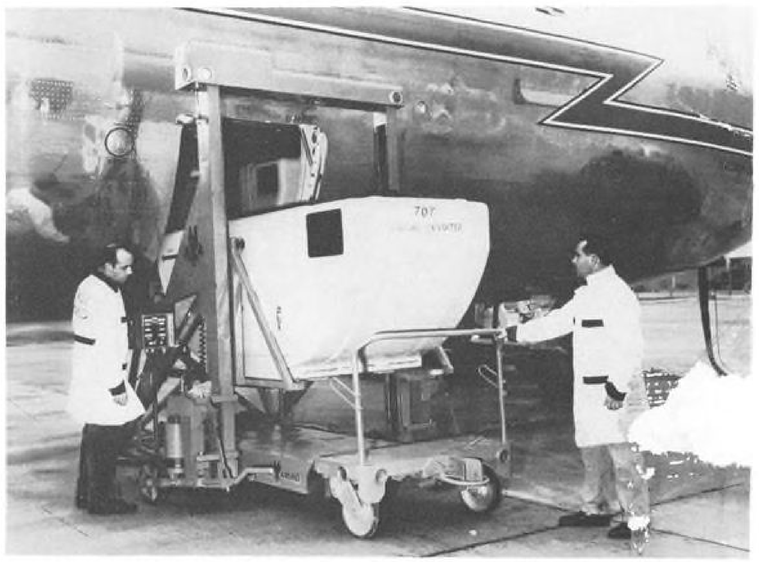
Robinson Aviation Inc., Teterboro, N. J.

Jet Oil Pressure Gage

Aircraft oil pressure transmitter, designed for direct mounting to jet engines, is capable of withstanding vibration to 2,000 cps. at 20 gs.

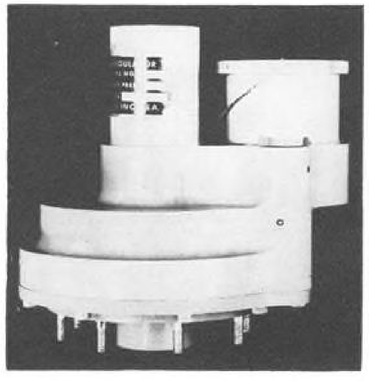
Model 318 transmitter is available for ranges of 0 to 60 psi. and 0 to 100 psi. Indicators available for use with the transmitter are available in sizes of 1½ in. diameter, 2 in. diameter, and integrally lighted 1½ in. diameter. Pressure indicator system operates on 26 v. 400 cps. power. Transmitter operates in a temperature range of from −65 to +232C. and meets USAF specification MIL-T-26638. Weight of transmitter is 1.0 lb.

McGraw-Edison Co., 61 Alden St., West Orange, N. J.



American's Baggage Expediter Used on Jets

American Airlines baggage expediter system will be used in conjunction with the line's Boeing 707-120 jet transport schedules. System includes six containers, each holding up to 35 bags, which are carried in the aircraft's forward compartment.



Gas Pressure Regulator

Regulator provides tank pressurization and pressure regulation in fuel, propellant system of aircraft and missiles.

Pressure regulator operates at 300+ or −3 psi., over an inlet pressure range of from 3,000 to 400 psi. and a flow demand change of 140 to 640 SCFM of nitrogen. Weight of the unit is 4½ lb. and maximum dimension is 6½ in. Dynamic response is less than 0.09 sec. Modified versions of identical size can operate at 25 to 500 psi. with flow rates to 2,000 SCFM of nitrogen. Regulator operates between −65 and +225F with helium, nitrogen, oxygen.

Reaction Motors Division, Thiokol Chemical Corp., Denville, N. J.

Constant Speed Drive

Differential type constant speed drive is said to combine accurate speed control, efficiency, low heat rejection and reliability.

Planetary gear train is principal power vehicle and a variable displac

draulic pump motor adds or subtracts speed and power in response to a speed governor.

Input speed range of the 60 kva. unit is from 3,800 to 7,000 rpm., output speed is maintained at 6,000 rpm. under varying loads. Steady state speed control is + or −0.25% over a 200F oil temperature range, with efficiencies to 97%. Transient response is 0.5 sec. maximum.

Vickers, Inc., 1400 Oakman Blvd., Detroit 32, Mich.

E CONVAIR A NEW LEASE ON LIFE

Your Canadair/Convair 540 now covers more distance per hour. Speed increases by 50 m.p.h. Time to cruising altitude lessens by 54%. Maximum payload range leaps from 240 miles to 650 miles (with reserves). Jet-prop propulsion also allows you to carry more passengers. The Convair 340/440 now has a standard capacity of 44 passengers. In the Canadair/Convair 540 you have flexibility—from the deluxe configuration of 48 passengers to a tourist configuration with 64 seats. Therefore you can tailor your seating plan to meet your specific needs.

STRONGER PASSENGER APPEAL

You can have several *strong new selling points* for your advertising and promotion to passenger prospects.

MORE COMFORTABLE AIR TRAVEL

The Napier jet-prop reduces noise and vibration to a bare minimum . . . greatly increasing passenger comfort and satisfaction.

SWIFTER AIR TRAVEL

With the improved speed, you can cut down flying time between stops. With less need for maintenance and refueling, you can minimize ground time.

WORLD-WIDE SERVICE FACILITIES

As the owner of a Napier-powered Canadair/Convair 540, you have at your disposal the combined service facilities of Canadair, a subsidiary of General Dynamics Corporation, and of Napier, a subsidiary of the English Electric Company.

World-wide in scope they will provide you with continuous analysis, correction, and prevention of service problems during the operating life of your Napier-powered Canadair/Convair 540.

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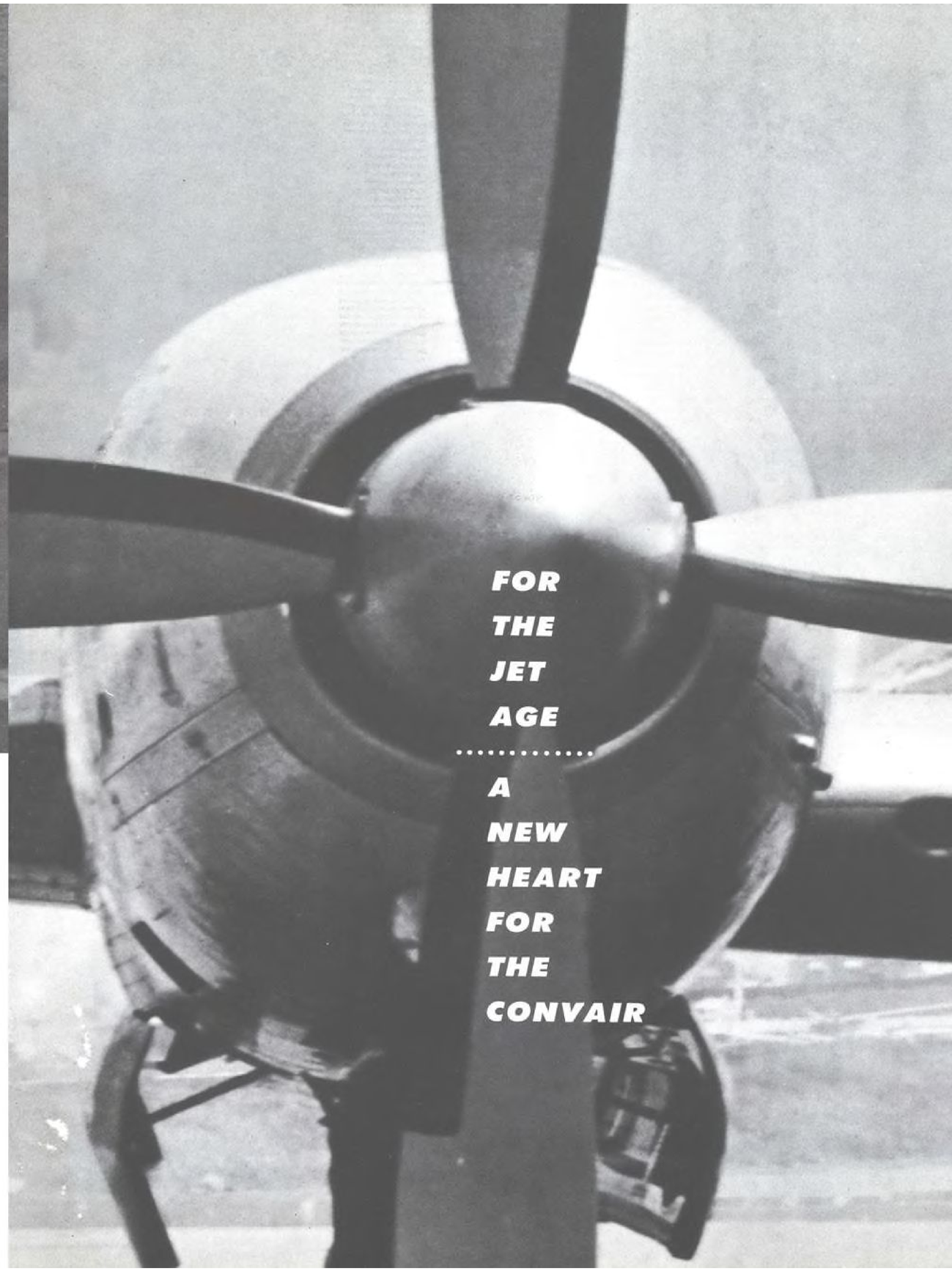
Napier invites all airline operators, and executive and corporate aircraft operators, to fly the Canadair/Convair 540. The Napier world-wide demonstration tour begins in March . . . using several Canadair/Convair 540's. To schedule your flight, write to Napier Engines, Inc., 909 Dupont Circle Building, Washington 3, D. C.



GE Official Details Nuclear Plane Need

(John W. Darley, Jr., manager of the operational analysis section of General Electric Co.'s Aircraft Nuclear Propulsion Department, sent the following letter and text outlining the importance of accelerating the U.S. nuclear aircraft program, the feasibility of such a plane and its potential as a weapon system to President Eisenhower on Jan. 14. In his letter, Darley explains that his outline was spurred by the President's statement that, at present, there is "no usefulness" for such an aircraft and by the progress the Soviet Union has made in this field. A month later, when he had received no reply from the White House, Darley sent the same information to Rep. Melvin Price [D.-Ill.], chairman of the Joint Atomic Energy Committee's research and development subcommittee, who made it public [AW Feb. 23, p. 27]. *Because of the current debate within the Administration, the Pentagon and industry as to what tack the U.S. program should take,* Aviation Week *is reprinting below the text of the letters to President Eisenhower and Rep. Price and the accompanying document written to support his stand:)*

Hon. Melvin Price
House of Representatives
Washington, D. C.
Subject: The aircraft nuclear propulsion program.

Dear Mr. Price: One month ago, on Jan. 14, I sent the attached letter to the President concerning the national aircraft nuclear propulsion program. In this letter, I stated that I did not plan further distribution until after an appropriate period of time had elapsed and would not further distribute this information should he instruct me that such an act would be contrary to the best interests of the United States.

One month has now elapsed. No further word has been received from the White House.

Due to your expressed interest and work in the area of the ANP program, coupled with your responsibilities as a member of the Joint Committee on Atomic Energy and the House Armed Services Committee, I am here transmitting this information for your use as you see fit.

Speaking frankly, I have become convinced that if any corrective action can be taken, the impetus for same must now come from the legislative branch of the government.

All other avenues of approach to the decision making problem appear to have been exhausted.

I join in your conviction that the ANP program badly needs a definitely targeted date for nuclear flight—with programatic decisions and funding levels consistent with that target.

Without same, there is no possible ANP program which can still meet the needs of this nation.

Sincerely,
John W. Darley, Jr.

Hon. Dwight D. Eisenhower
The President of the United States
The White House, Washington, D. C.
Subject: The aircraft nuclear propulsion program.

Dear Mr. President: I am an industrial manager engaged in the national aircraft nuclear propulsion program—having been connected with this activity for the past seven years. I have sought neither counsel nor approval from my associates or superiors, however, for what I am about to say.

I am speaking as a conscientious voting citizen who is sorely troubled by the trend of events taking place in the world around me.

While the individual statements contained within this letter are not security-classified, their over-all content is certainly sensitive. Since you occupy the most powerful office in the world and are the only common authority over all of the agencies and departments who effectively administer the national aircraft nuclear propulsion program, however, there are certain things which cannot be left unsaid.

Gain Understanding

I am trying to gain your understanding that what has been written here has been decided upon after very careful personal thought and after an evaluation of the pending risks versus the responsibilities involved. Opinions, of course, must be properly evaluated; please consider my specialized experience and the personal knowledge thus acquired when you evaluate mine.

On Dec. 10, during your scheduled press conference, and in answer to a question on the subject of aircraft nuclear propulsion from Mr. Merriman Smith, you are reported to have replied as follows: (1) "There is no usefulness that anyone could possibly see from such a plane;" (2) "There is no use of going into a field where the whole purpose would be to get a plane a few hundred feet off the ground;" (3) "There is absolutely no intelligence to back up a report that Russia is flight-testing an atomic-powered airplane."

I recognize that your responses were based upon the best information available to you.

I am only concerned as to the quality of that information and, speaking frankly, it is my opinion that you have been on the receiving end of some sloppy staff work, which may be setting some sort of historical records in this direction.

Because I know full well that this letter has only a small chance of reaching you through a buffering staff wall unless some incentives are offered, I have simultaneously prepared copies of this letter for eventual distribution to the managing editors of selected magazines and newspapers. I do not plan to send these copies to these editors until after an appropriate period of time has elapsed, and will not send same if you instruct me that such an act would be contrary to the best interest of the defense of the United States.

John W. Darley, Jr.

John W. Darley, Jr., has been in the nuclear aircraft program since 1951 and is now manager of the operational analysis section of General Electric Co.'s Aircraft Nuclear Propulsion Department. His section is responsible for project planning and measurements, organizational analysis, policy and systems planning and operations research. Darley, 33, has an engineering degree from Cornell University and a degree from Harvard University's School of Business Administration.

You may be wondering why I have delayed so long after your press conference of Dec. 10 before sending you this letter. Speaking frankly, I have been caught on the horns of the dilemma as to whether or not I would be doing the ANP program more harm than good by responding to the situation in this way. The compelling reasons behind my choice were that (1) The situation is urgent, (2) It does not show signs of straightening out through the normal channels, (3) The problems of understanding and motivation are so massive that it appears to me that they can only be overcome by a thorough airing.

The text which I have used, and which is attached to this cover letter, is quite lengthy; to assist you in its understanding, I will be following this outline:

I. Strategic considerations.
II. Soviet ANP capability.
III. The promise and status of the U. S. ANP program.
IV. Criticisms of the U. S.-ANP program.
V. The national problems of administering the U. S.-ANP program.
VI. Recommendations for action.
VII. Concluding remarks.

It is my hope that by the time you have digested these remarks you may agree with my premise that you have not been receiving the best information. Further, I hope that, through such an over-all view of the ANP program, you will join those of us who are moved by a compelling faith and conviction that the program is vital to the continued security of the United States.

At the least, I hope that I have provided another point of view.

Sincerely,
John W. Darley, Jr.

Supporting Text

Let me first talk to your first point that "there is no usefulness . . . from such a plane," dealing in order with various elements of national strategy.

If I correctly understand our country's strategic concepts for survival, they are based upon:

(A) Posing a massive retaliatory threat such that a potential enemy cannot help but see that he will suffer considerably more damage than he will be able to inflict should he decide to start anything. In consideration of the amount of effort which is going into it, this seems to be our No. 1 strategy.

(B) Erecting sufficient air defense to warn of an incoming attack in sufficient time to permit the dispatching of our retaliatory force, to minimize civilian casualties, and to cause an enemy some loss in his attacking force; included in this element is passive civil defense through dispersal, evacuation, shelters, etc., on which little has been done to date.

(C) Deploying sufficient mobile ground and sea forces to quench local eruptions in so-called police action or small wars.

I share with you the absolute conviction that the United States must never engage in a preventative war; this then rightly means that we have effectively granted an enemy any advantage accruing to the initiative. Any retaliatory threat posed by the United States will therefore only prevent a war as long as a potential enemy can only conclude that he will not be able to stop this retaliatory force from destroying those targets which he cannot afford to lose if he is going to eventually prevail in the disagreement.

I agree with you that there will be no winning of any future war—only the prevailing of one ideology over the other. It is my opinion that a disciplined and ruthless enemy will decide that the side which prevails—all other massive destruction forgotten—will be that side which has remaining an active strategic force after all the major strategic forces of the other side

have either been spent or destroyed.

Our real war to end war, then, is the task of convincing of the other side that **(A)** he cannot save any portion of his active strategic force should he decide to embark on the path of armed conflict, regardless of how mobile and unpredictable in location that strategic force may become; **(B)** he cannot destroy the strategic striking force of the United States, due to the fact that it is mobile and dispersed beyond his reach or beyond his ability to destroy before it retaliates against his forces.

Concept of Mobility

I realize that the above looks like the application of a double standard to the two systems. The key to this effect is that for the United States and the Western Allies, mobility provides an even greater advantage than it does for the Soviet Union. This is because of the fact that **(1)** we are already granting them the initiative; any additional advantage due to mobility is sugar coating to their main capability and mainly defensive against our retaliatory strike, **(2)** the world's area available for on-alert dispersal of our mobile force far exceeds that behind the Iron and/or Bamboo Curtain.

I will be dealing more with the meaning behind this concept in subsequent paragraphs.

Our No. 1 strategy—the retaliatory threat, including current plans for the implementation of same—involves the use of **(1)** intercontinental missiles, **(2)** intermediate-range missiles—ground, air and undersea launched, **(3)** manned strategic chemically powered bomber aircraft.

All of these missiles, since they can hit targets of known importance and location, are certainly vital weapons in the military inventory. They do, however, suffer on two counts one of which is being worked on and the other of which is beyond their reach: **(A)** In that all missiles have to possess sufficient protection against attack or a sufficiently quick response time to get off the ground after warning and before the enemy's weapons strike—they either have to be put on active standby underground or under the sea—or fueled by propellants which permit the necessary quick response on short notice (hopefully 15 min. in the case of the ICBMs but shorter in the case of the IRBMs). I can see that both of these methods of improvements are being undertaken; **(B)** in that missiles, however, are only able to hit targets of known importance and location, they absolutely fall short of being able to hit the highest priority targets—namely those containing or contributing to the enemy's mobile strategic striking force—a force which can only be predicted in location by the most detailed intelligence information. It is my understanding that we do not have nor will we ever have this quality of intelligence coverage. Should the Russians come to possess operational quantities of air-orbiting nuclear-powered aircraft, the problem will become even worse than in our current situation—which is already difficult enough (I will deal more with this later).

Continued Need

Because of this need to pose a threatened strike at these mobile and unpredictable targets of opportunity, the role of the manned aircraft will continue to exist. The availability of human eyes and human minds in target areas—whether on weapons carriers or reconnaissance vehicles—is absolutely needed if these highest priority military targets are to be identified and subsequently destroyed.

That this need will continue into the future is verified by the existence of the B-70 program.

Chemically powered aircraft, however, will suffer some definite drawbacks during future years due to the following:

(A) Limitations in airborne time—risks taken: Because of the fact that airborne time—limited by chemical fuel capacity or by the programing or logistic complexities of in-flight-refueling operations—is relatively short compared to ground turnaround maintenance time, only a fairly small proportion of a total chemically propelled bomber force can be in the air at any one time—or, for that matter, be gotten into the air within that period allowed by a 15-min. alert warning time. This means that, assuming that a potential enemy would logically concentrate on such ground-bound targets, only a fairly small proportion—namely that airborne—would survive the initial, all-out blow.

I recognize that it is hoped that geographical base dispersal will save a larger proportion of the force which cannot get off the ground prior to the attack. My only reaction here is that, for the long-term future, the cost of an enemy's missile and launching sites zeroed in on a larger number of dispersed bases will be appreciably less than the cost of these dispersed bases. For those who say that the potential enemy's ICBM's are not as accurate as required, I can only say that if this is true now, it won't be true for long.

(B) Complicated fuel logistics—risks taken: Because of the fact that modern day military strategic aircraft require extensive aerial in-flight refueling in order to reach their targets, the total operation becomes dependent upon a critically linked chain of events involving (1) the availability of aerial tanker bases—both within the continental United States and overseas—all of which are subject to the same manner of obliteration and the need for discouragingly quick response times that apply to the regular bomber force; as a matter of fact, this could be the major weak link in the chain; (2) a critically programed and extremely complicated requirement for rendezvous meetings between the surviving bomber and tanker forces at the right time and at the right place and with the right amount of fuel available.

(C) Vulnerability of chemically powered aircraft at high altitudes: Due to the technical characteristics of air-breathing jet powerplants, chemically powered strategic aircraft—even if suitably refueled near the enemy's perimeter—can only reach the required target areas by flying at high altitudes. If I interpret the recent test results on high-altitude nuclear bursts correctly, the survival of a manned aircraft at high altitudes—almost regardless of the speed at which it is traveled—will become increasingly less probable with the passage of time. If during the target-zone penetration portion of their mission chemically powered aircraft are forced to low altitudes, their range becomes so limited as to reach only a small proportion of the required target coverage.

This then is a technical fact. There is no known way by which any current or proposed chemically propelled strategic aircraft can reach anything more than a very small proportion of required target areas if it is required to approach same at low altitudes. This same limitation does not apply to nuclearly powered aircraft.

Promise of ANP

Here, then, due to an imposing combination of the above, is one primary regime of usefulness for the nuclearly powered aircraft, namely, in the area of retaliatory threat, strategic reconnaissance, and bombardment.

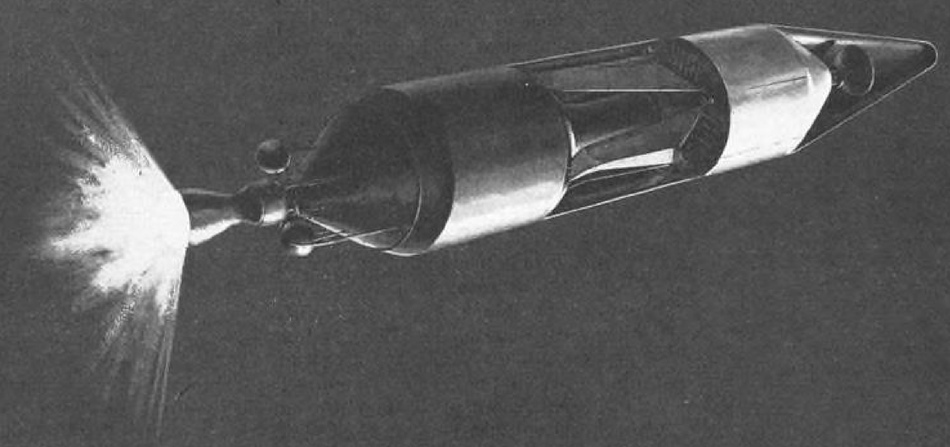
1. Nuclear aircraft—extended airborne alert: Because of their inherently large fuel capacity, nuclear aircraft will have much extended airborne time, i.e., the amount of time they spend in the air will grow to equal or perhaps even exceed the amount of time they spend in maintenance turnaround on the ground. This means that a much, much higher percentage of the total number of aircraft will be airborne at all times—airborne and armed at variable and unpredictable locations throughout the world from which they pose a maximum retaliatory threat without range limitations.

In effect, this airborne alert capability raises the percentage of the total force which is saved from the initial enemy blow in order for it to be able to go on and do its job. A potential enemy, recognizing this capability, is thus faced with the realization that he will not be able to eliminate that which will eventually destroy his mobile strategic force. I would call this an improved retaliatory threat.

2. Nuclear aircraft—independence from complicated logistics and foreign bases: Already airborne, the nuclear aircraft can do its job independent of any need for aerial in-flight refueling or foreign-based aerial tanker fleets. It is my opinion that our relations with our allies are or will be increasingly strained by the existence of these tanker fleets based overseas (and which constitute important military targets) in much of the same way that there was definite foreign reaction against the basing of IRBM's in England or Italy. I am not proposing isolationism—only trying to identify a trend in the climate of world opinion.

3. Nuclear aircraft—versatility in application: Once airborne, that portion of the nuclear aircraft force on retaliatory patrol duty is independent of any other logistic need—and only requires a signal that the United States has been attacked and that it should proceed on its assigned retaliation mission. Due to the inherently large weapons carrying capacity of nuclear aircraft, its armament can include a number of air-launched air-to-ground missiles and regular laydown weapons which far exceed the weapons carrying capability of their chemically powered counterparts. This means that fewer aircraft can do the job.

Due to this enlarged load-carrying capability, coupled with high endurance, the nuclear strategic aircraft possesses a tremendously improved versatility in usage which embraces (a) airborne retaliatory patrol, safe from initial attack, (b) missile launching from outside the enemy's defense periphery; (c) reconnaissance and warning near the enemy's periphery; (d) omnidirectional low-altitude penetration under the enemy's radar warning net for reconnaissance and location of the enemy's mobile strategic forces; (e) low-altitude penetration, followed by either missile launching and/or conventional bomb laydown or by a combination of both.



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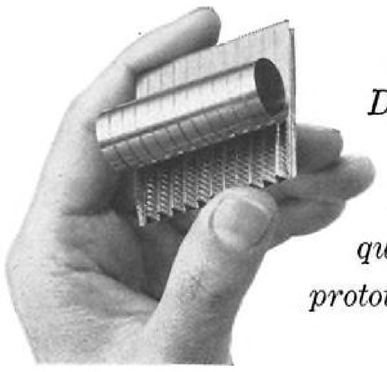

Designers may now obtain experimental quantities for prototype development

WHAT IT IS: SPACEMETAL is a stainless-steel sandwich with the light weight, high strength, and heat resistance required for Space Age missiles and planes. Inner sheet is beaded to form a V-shaped corrugation which allows rapid heat dissipation, permits hydrostatic testing for quality control. Yields weight savings (theoretical) as high as 75 percent over solid materials.

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HOW TO GET IT: SPACEMETAL is available in experimental quantities to designers seeking its unique properties for application in missiles, supersonic aircraft, and related projects. Please write for complete information, outlining your requirements, to: SPACEMETAL, Dept. 496A, Missile Division, North American Aviation, Inc., 12215 Lakewood Blvd., Downey, Calif.

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The significance of the low-altitude approach is treated in the following paragraph.

4. Nuclear-aircraft—potency of alternate low-altitude attack: Contrary to the range-limitation of chemically powered aircraft at low altitudes (where survival will become increasingly more probable than penetration at high altitudes), a nuclear-aircraft could actually come down from its cruise altitude and penetrate the enemy's early-warning perimeter from an infinite choice of directions and at extremely low altitudes—holding this low altitude on its way to its assigned target area. If you want to get a reading as to the enormous potential potency of this kind of attack, I would suggest that an answer can be acquired by postulating that an enemy had such a method of delivery. The answer may surprise you.

For those who would say that it is easy for a potential enemy to protect itself against such a manned-retaliatory force, I would suggest that for a country with the land mass and extended perimeter of Russia, they are welcome to try. The Soviet Union could very easily bankrupt itself in just erecting a low-altitude warning net—not to mention the number of active defensive missiles and aircraft which would have to be employed.

5. Nuclear-aircraft—Fewer aircraft, fewer bases: Let us talk next as to the number of bases from which nuclear aircraft would need to be deployed. Because of the fact that a higher percentage are airborne at all times, because each aircraft has appreciably more weapons capacity, and because lower comparative attrition can be increasingly expected due to the omnidirectional low-altitude attack, a much fewer number of manned strategic aircraft would be needed. This translates into a fewer number of costly bases.

My best estimate is that from two to three nuclear-aircraft bases—appropriately located on Atlantic and Pacific islands to take an enemy's major attack away from the continental United States—would do the peacetime job. It is to be assumed that all of these bases would be lost in an initial attack—but an attractive percentage of their based force would have regularly been airborne and would constitute a manned strategic force to fight the war.

The next question here is that of rearming and restriking with this surviving force after their return from their first strike mission. There are two services which will be needed, namely the probable replacement of the nuclear powerplants (in that the remote-handling base facilities for individual detailed powerplant maintenance will no longer be available) and the rearming of the aircraft with new weapons. Both of these services can be provided from mobile ground equipment and at locations which are variable and unpredictable. Any number of currently available landing and takeoff areas would do the job. This rearming and restriking problem is essentially no different from that with chemically powered aircraft.

Comparative Costs

6. Nuclear aircraft—lower total costs than the massive chemical system: As a final note on this matter of a nuclear-aircraft retaliatory force, let us take up the matter of comparative costs. The best information which I have, and which is based upon appropriately detailed study, is that the nuclear-powered retaliatory force will cost appreciably less than its chemically powered counterpart system. I recognize that this statement is hard to believe in these days of accelerating weapons obsolescence; the major factor producing this situation is the fact that our current manned retaliation system is enormously expensive. The cost advantage accruing to the nuclear-aircraft force is predominantly due to (a) a larger percentage of aircraft airborne at all times; therefore, fewer losses on the ground and fewer aircraft required in total; (b) a larger weapons-carrying capacity per aircraft; therefore fewer aircraft required; (c) no tanker aircraft required; (d) no bases required, foreign or domestic, for the basing of the tanker aircraft; (e) no complicated chemical fuel logistics and staging required at a wide number of bases, foreign or domestic; (f) considerably fewer bases from which the manned retaliatory force would need to operate.

And, interesting enough, none of the above cost elements have even stopped to consider (a) that chemically powered aircraft can't even do the job if they are forced, as predicted, to attack at low altitudes, where their range is drastically limited; (b) that omnidirectional nuclear aircraft will suffer fewer losses using low altitude penetration than will their chemically powered brothers at high altitudes—again acting to cut down on the total number of aircraft required.

Practically all of the foregoing reasoning has concentrated in the area of continuing to pose a real threat of retaliation as a means of making the instrument of war appear unprofitable for a potential enemy. While this area alone testifies as to the potential usefulness of nuclear aircraft, the story does not end here.

Encouraging Circumvention

At numerous times during the history of the world, countries have based their longevity upon static, immobile means of defense. The Chinese Wall, the Maginot line, and now the DEW line, have all acted to create the popular impression of impregnability. While the DEW line, supplemented by BMEWS equipment for ballistic-missile warning, is heavily useful for protecting the retaliation force, its coverage is still based upon the threat coming from a predictable direction and at a predictable altitude. If history teaches us anything, it is that a potential enemy is thereby provided with an incentive to circumvent the erected defense or warning line.

To me, the DEW or BMEWS line means two things: (1) That a potential enemy will strive to develop a weapon whose manner of attack will neutralize the usefulness of the erected defense; (2) that there is a supplemental need for mobile warning facilities which can react to various technological and political threats by virtue of the mobility.

Interestingly enough, the Russians already appear advanced in the development of weapons designed to neutralize the warning line. Their already recognized submarine force—improved in armament through the use of submarine-launched missiles—is in the process of being further supplemented by nuclear aircraft. Both of these threats circumvent our erected warning line.

If we are to be responsive to these threats, we should not respond by more massive, immobile, narrow-range equipments, but rather by systems whose versatility and mobility are matched to the changing and variable challenge. Air-orbiting, nuclear-powered, radar-warning aircraft constitute one family of such systems.

I have now responded to two of the major comments which you are reported to have made relative to the ANP program—namely, that "there is no usefulness that anyone could possibly see from such a plane" and that "there is no use of going into a field where the whole purpose could be to get a plane a few hundred feet off the ground."

As indicated by the foregoing analysis, there is plenty of "usefulness." The "few hundred feet" comment, as provided to you by your advisers, is a dangerously simple statement which completely misses the point of low-altitude penetration attack.

I realize that you may think I am proposing that the nuclear aircraft is an "ultimate weapon." Believe me, I am not. I do believe, however, that without them we stand every chance of no longer having a stalemate in the strategic chess game.

The third comment which you are reported to have made went to the effect that "there is absolutely no intelligence to back up a report that Russia is flight testing an atomic-powered airplane," the question which prompted your reply was undoubtedly triggered by the article in the Dec. 1 issue of Aviation Week which reported on the estimated status of the Soviet ANP program.

I would like to say, however, that the staff man who provided your text, was a hair-splitter of the first order:

1. Intelligence is available: In the first place, I am positive that there is intelligence on the relative state of the Soviet ANP program. Considering the strategic incentives which we have given them in the form of our Dew line plus their natural interest in showing evidence of technological supremacy, it should not be surprising if they were ahead of us. Maj. Gen. D. J. Keirn, in charge of the U. S. program, made a public statement to this effect a few weeks ago, adding that it would not surprise him if the Soviets flew on nuclear power within a year.

2. Characteristics of Soviet aircraft are significant: To a second point, I understand that there is significant evidence that a Soviet aircraft of the size and configuration described in the Aviation Week article has been sighted.

Using the article's over-all design dimensions—and unless the Soviets have suddenly retrogressed in their ability to competently design chemically-powered aircraft—there is little doubt but that this particular airframe is intended for use with nuclear powerplants. As a purely chemical airplane —even with advanced chemical turbojets— it is not a very good aircraft or weapons system.

As a side note, this is the first very large Soviet aircraft with pylon-mounted powerplants—it being the usual Russian design approach in such cases to bury their powerplants within the wing structure. This difference is particularly significant, however, because this is the direction you would take for easier later replacement of chemical with nuclear machinery and subsequent easier maintainability of the nuclear powerplants.

3. Existence of Soviet aircraft verified by their announcement: Subsequent to your Dec. 10 press conference, on Jan. 1, Moscow radio, in a formal multilingual announcement, made two promises for 1959. These were that the Soviets would shoot a rocket to the moon and that they were going to fly a nuclear-powered civil aircraft during the next year.

I think that you will find that your intelligence agencies place a high credibility on this particular type of formal announcement, even without the fact that the Soviets —within two days—had a 50% scoring record.

I agree with your advisers, however, that the Aviation Week article presented no concrete evidence that this Soviet aircraft currently has nuclear powerplants installed. To the contrary, it is difficult to believe that any nuclear engine is currently installed within the small engine nacelles indicated on their drawings.

Whether or not this aircraft has actually flown on nuclear power, as questioned by your advisers and provided in their text for your use, is not really to the point.

ANP Relative Progress

It does not take any classified information to realize that if the United States started today on its prototype-aircraft program for ANP purposes, it would be approximately three years before any substantial chemically powered flight-test program on the aircraft would take place. As far as the relative airframe programs are concerned, therefore, we now have a pretty good fix on relative progress.

Sightings of this Soviet aircraft, of course, do not necessarily testify as to the state of progress in the Soviet nuclear powerplant program. Some criticism of the news article takes this direction, with the additional inference that the Soviet nuclear powerplant program is probably only to follow with an installed powerplant at a much later date. Even if this opinion is partially true, as it would be for any such program where the approach must be to take logical sequenced steps, it is a defensive comment and underestimates Russian technological competence in those areas where they really apply their effort. Certainly it does so if you believe, as I do, their Jan. 1 announcement.

Completely aside from all of the above, however, I join you in the belief that just because some other country is doing something is no reason for the United States to undertake a similar program in the same direction. That which the United States needs to accomplish should be tailored to its particular situation and to the particular objectives which it must reach in order to survive and prosper.

While I have already adequately dealt with some of the unique usefulness of nuclear-powered aircraft within Part I, there are other questions and subjects which need to be discussed.

It is for this reason that I would be irresponsible if I stopped here. Going by the theory that better understanding cannot but help in the evaluation and decision-making process, I would now like to turn to the other issues which are raised by this general subject.

In the foregoing pages, I have already laid a foundation with respect to the promise of the U. S.-ANP program. We have dealt with (a) the property of versatility and mobility, (b) the airborne alert-force concept, (c) the manned nuclear-aircraft retaliatory mission, (d) low-altitude penetration for reconnaissance and bombardment, (e) the freedom from chemical-tanker logistics, (f) the freedom from foreign-basing restraints, (g) the reduction in the number of bases required, (h) the inherently large load-carrying capacity of nuclear aircraft, (i) the cost implications due to increased simplicity in the total manned retaliatory system, (j) the air-defense potential of nuclear aircraft warning systems.

In many respects, this identified promise for the nuclear aircraft sounds much like that popularly assigned to the nuclear-powered submarine. A pure extrapolation here, however, would undershoot the mark.

The nuclear submarine provides quite a

revolution over its diesel-electric-snorkel predecessors but, in terms of the relative gain in total systems simplicity, the revolution in the air due to the nuclear aircraft is of a much higher order of magnitude. By total system I mean the vehicle itself, its weapons, range, lethalness, vulnerability, and the total complex of logistics and communications which permits it to do the job.

Compared to the submarine, nuclear aircraft have a more massive effect on these logistic parts of the over-all system which, in the aircratts' case, constitute a very major part of the whole.

The promise, however, does not stop here.

The U. S.-ANP program for manned nuclear aircraft is important beyond the high value of its initial applications; this additional importance is due to the following:

1. Much technology transferable into space vehicles: The basic technologies of the manned nuclear aircraft program are transferable and/or expandable into the nuclear missile, heat transfer, nuclear rocket, and nuclear powered space vehicle areas.

2. Reason to believe aircraft must precede space vehicle: There is serious reason to believe that the United States will never proceed on sure footing into the more exotic nuclear space vehicle regimes until it has learned how to live and operate with a manned nuclear aircraft program. The king sized step otherwise required appears indigestible from a practical mobilization and technological point of view.

3. Technology in forefront of nuclear reactor field: By the very nature of its effort in the area of comparatively lightweight, high-performance nuclear machinery, the ANP powerplant program is automatically working in the forefront of nuclear reactor technology, with resulting long-range ramifications in the atomic-electric field.

Thirteen Years Invested

As you know, 13 years have now been invested in the aircraft nuclear propulsion program. With a modest beginning in 1946, feasibility studies into 1951 resulted in the conclusion that the application was feasible and deserving of development effort.

It is interesting to note that studies made during this feasibility period predicted the amount of time and money which would be required to do the job.

The predicted time has now been exceeded; less than half of the predicted amount of money has thus far been spent. In periods of national emergency, we have rightfully excused the trading of more money for less time; in consideration of the threat now around us, I wonder if going so far in the other direction (trading more time for a lesser expenditure per year) makes real sense.

With engineering development beginning in 1951, the program was directed toward a flying-testbed application in which the initially flyable powerplant would be tested within a worked-over and modified B-36 aircraft—the aircraft retaining its normal chemical powerplants in order to carry the nuclear powerplant aloft for testing purposes. This is normal practice with new aircraft powerplants and is practiced with chemical turbojets today.

But what happened? In 1953, the program was cut back (and nearly canceled in total) because the B-36 wouldn't fly high enough or fast enough to make it a military weapon—something which this B-36 was never intended to be in the first place. You may remember the word "shitepoke" which was a term of endearment provided by the Secretary of Defense at that time.

It is my firm opinion that had this cutback step not been taken in 1953, we would be flying a nuclear-powered aircraft today.

In consideration of what the Soviets show every sign of doing during this next year, we may live to massively regret this 1953 decision. At the present time, however, we have yet to go through this flying-testbed stage—or its equivalent using an experimental aircraft. It is absolutely vital that this step be taken at the earliest possible moment.

The way support seems to be leaning

in 1959, however, this event is still some years away.

Don't get me wrong.

The decision in 1953 of heading toward a better airframe for initial testing of the powerplant was not a bad idea.

It is just that (1) at a point practically six years later, we have yet to even commit for the airframe part of the program, (2) the announced reason for making this 1953 decision did not reflect any sophisticated understanding of aircraft powerplant development philosophy—or normal research and development practices.

Engineering Development

Actual powerplant development has now been proceeding for practically eight years, with full-scale reactor and reactor-turbojet-systems tests in process since 1956. Considerable airframe studies have taken place intermittently and at a variable pace during the same period.

During 1954-55, the Air Force—undoubtedly remembering its 1953 experience—began to clothe the ANP development effort in the mantle of a weapons system. It must be remembered that it was the fashion of the day (particularly since 1953) that if more money was needed to get the job done, the only way it would be forthcoming was to prove that the project was going to result in something which flew higher and faster or carried more or what have you.

This originally visualized weapons system (called 125-A) was to do everything that regular chemically powered aircraft could do—and then some—rather than harnessing the particular and special capabilities of nuclear propulsion.

While this 125-A affiliation was undoubtedly on shaky ground from the start—due to nuclear propulsion trying to compete initially with the best of chemical propulsion in the chemical regime's own backyard, it did accomplish one very beneficial result. Some additional money was made available, at least enough to really get a leg up on the powerplant development work.

Since then, some real powerplant development progress has been made.

The powerplant development work is now at a stage whcere it is ready to proceed at a faster pace. It is true that some solutions in detail (as opposed to feasibility) are required, but these are the reasons why the development is necessary in the first place.

In today's environment, I get the impression that the only way to really get development support is to prove that everything is already comfortably in position—with all challenges answered in minute detail. In such a position, there will be development money made available—when, if such was really the case, the weapon should be in quantity manufacture.

Today's situation on the nuclear-aircraft program is similar to that which prevailed on the missile programs three to five years ago. At that time, development work was accelerated on propulsion and guidance aspects of the work; today, we are just beginning to see signs that we will have operational missile systems over the next two to four years.

The same situation can prevail for nuclear aircraft.

Capability in Depth

When I say we are ready to proceed, I am not referring to an informal group of scientists working in the laboratory. I am talking about a balanced and sizable organization of scientists, design engineers, manufacturing engineers, and test engineers—all backed up by a complex of pilot-line manufacturing facilities, raw material sources, subcontractor installations, and hardware vendors.

Of considerable significance to the nuclear-aircraft program is the fact that the initial powerplant and the initial application can now be clearly seen to be the first of a family of improving performers. Enough is known about the designs farther back in the conceptual and preliminary design stages to predict with certainty

that the initial hardware approach will improve in performance even beyond that which is now called the requirement.

As a matter of fact, this promise is one of the problems.

The vacillator and the fence sitter want to wait for the 1985 model, although the 1959 model will still manage to out-distance anything on the road.

It is my conviction, however—and I have lots of knowledgeable company—that failure to buy the 1959 model is not going to result in any improvement in what the 1985 model will do in its time.

As a matter of fact, if we delay in facing up to the full-scale development of what can be done today, the 1985 capability won't come out until the year 2000, if ever.

One of the main reasons behind the fact that program acceleration now makes such sense is the unique concept of the "CAMAL" mission, as described in summary fashion in Part I. This approach not only takes perfect advantage of the unique properties accruing to nuclear propulsion; it also turns out to offer a uniquely different and extremely valuable weapon for the defense situation which faces us.

Further, this approach will not only do a real job of using the initially developable airframe and powerplant, but will also improve in performance and capability as the second cousins come out of the developmental brooder.

Let's face it. Nuclear-powered aircraft are inevitable. The sooner we get about really facing up to the job in total, including an airframe, the sooner they are going to be a valuable weapon in our arsenal.

With all of the promise and all of the progress which I have talked about thus far, you may well ask: "Where has all the trouble been coming from?"

Let's take a look at the collection of critical comments which have been made against the nuclear aircraft program, examine them in some detail and see if some pertinent conclusions can be reached.

Criticisms of the U. S.-ANP program can generally be classified into three broad areas: These are: (a) Applications (the use to be gained); (b) technology (the state of the development); (c) administration (program decision problems).

Let us deal with each of these areas in sequence.

Answer to Critics

Critical comments in the area of applications or the use to which aircraft nuclear propulsion would be put, can be listed as follows:

"The aircraft is too big or too slow."

Here we find the man who wants to go higher and faster all of the time, regardless of where he should be. I can understand the necessity for going higher and faster with part of our retaliatory force—just to force the Soviets to defend against such an attack—but less and less of our total force will be able to penetrate in this way.

This critical comment therefore fails to recognize that the survival of aircraft at high altitudes and even very high supersonic speeds will become increasingly less probable with the passage of time. Attrition in this regime will be markedly higher than that at extremely low altitudes and respectable subsonic speeds. Chemical aircraft can't do the latter.

On the comment of size, initial nuclear aircraft will be no bigger, and possibly smaller, than today's larger chemical aircraft. They may weigh more; that is, be "denser" aircraft but I can't see where the point is. As a matter of fact, nuclear power may very well cause a complete re-evaluation as to what constitutes the optimum size of an airplane.

"The aircraft would be easy to shoot down."

This is probably the same gentleman who wants to go high and fast. He doesn't understand the overwhelming defensive requirements superimposed by an omnidirectional, low-altitude penetration attack. He doesn't realize the magnitude of investment required for a low-altitude, radar-warning net and the associated defensive missiles and air-defense aircraft (which are range-limited at these low altitudes).

In short, he hasn't recognized that for a country with the land mass and perimeter of the Soviet Union, he now has the weapon of economics (and possible bankruptcy) on his side.

"We don't really need a nuclear aircraft."

This gentleman either doesn't understand anything mentioned . . . (here) or else he is a saturation war man. This latter breed says if anything starts we will just plaster everything and everywhere, using an immense number of missiles carrying atomic and hydrogen warheads. This way, he says, we will be sure and hit everything worth hitting.

Fallacious Reasoning

This reasoning is fallacious on two counts. First, the rest of the world would be in danger of becoming uninhabitable. Second, I don't believe the United States will ever choose to adopt this inhuman and reckless defense posture.

It has been said: "As soon as men decide that all means are permitted to fight an evil, then their good becomes indistinguishable from the evil that they set out to destroy."

"The application being worked on is the wrong one" (regardless of which one is being worked on).

Here is the man who says that we should make up our mind over and over again. Or perhaps he is stating that he doesn't want to do anything until everybody decides to do it his way. I really don't know.

I only know that the application chosen is a particularly valuable one and that after satisfying this first step there will undoubtedly be others.

"I don't understand it."

We have found an honest man; he is one of the gentlemen for whom this letter is written.

Critical comments in the area of technology, or the state of the development, are fairly represented by the following:

"An airborne reactor is too dangerous."

What this gentleman is saying is that aircraft are dangerous. As far as the aircraft's crew is concerned, a reactor with its radioactive parts is less dangerous than several tons of inflammable aviation fuel.

It is true, however, that experimental and perhaps operational nuclear aircraft will have to fly in specified corridors when over land to eliminate the danger of a possible crash in populated areas. This will undoubtedly be a function of the demonstrated reliability of the total aircraft system as well as the appropriate selection of locations for the operational bases. Significant study has already been devoted to this problem with encouraging findings.

Please understand that what is being talked about here is not an atomic explosion, but the potential spillage of radioactivity should an aircraft crash.

Possible Risks

A fair comment in this area would be: There are some risks; they are the types of risks which can be overcome by operational procedures and system reliability; they are a very long way from being sufficiently large enough to give up what the aircraft has to offer as a military weapon.

"The radiation is too high; the crew can't last."

Without going into a mass of technical data, much of which is classified, let me just state that current design of the system is based upon each operational crew flying for a very appreciable number of days each year, for a very appreciable number of years, and still at the end of the period have received no more radiation exposure than they would have had they spent those years working in an AEC industrial laboratory.

And please believe me, this is just about as radiation-safe as you can get—anyplace, anywhere.

"The reactor temperatures aren't high enough."

This is the comment of the man who wants to wait for the 1985 model . . . The temperatures are high enough to do what needs to be done first; they promise to be higher by the time they need to be higher. If we wait until then before we accomplish development-testing needed now, the whole program will suffer and be delayed.

As a side comment, there is little if any doubt but that as the development progresses, the designed temperature capability of the reactor will come to put extreme engineering pressure on the designers of the remaining parts of the powerplant. Believe me, this is plenty high enough.

"It isn't being done the way I would do it."

No comment appears necessary.

"I don't understand it."

The people who have already built and test-operated reactor-turbojet systems do understand it, and they'll talk to anyone who has a security clearance and a desire to listen. As a matter of fact, they won't let you get away.

Critical comments in the area of administration, or making program decisions, can be summarized as follows:

"Aren't ready; wait until next year when things will be better."

Here is the administrator, either technically or politically motivated, who either wants to wait for the 1985 model or who is too tired to fight for what he believes is right. Perhaps he just doesn't want to risk his position by being a nonconformist in a bureaucratic world. Whatever he is, he is not doing a responsible, risk-taking, managerial job.

"It's too expensive."

Too expensive? Relative to what?

Individual nuclear aircraft will be more expensive than their individual chemical aircraft brothers, just as nuclear submarines are more expensive than conventional submarines. But the total cost of doing the over-all larger and necessary job will be less through the nuclear application.

This is the gentleman who either doesn't understand the cost situation, or who equates a currently positive bank balance with lower over-all, long-run costs. I will have more to say about this later.

"The other government agency hasn't made up its mind."

This is perhaps better described as the Alphonse-Gaston phenomena. It is the frame of mind which says that the only good decision is the unanimous decision. I firmly believe that many unanimous decisions, appropriately watered down and denatured to achieve unanimity, are the worst kinds of decisions. True, they are better than none at all, but unanimous decisions or "no decisions" appear to me to be the only kinds of decisions the ANP program has had.

"Government leadership on the program is too weak."

Here is a crackerjack. This is hard to believe but some government representatives have actually withheld enthusiasm for the ANP program because they felt that the government leadership on the program wasn't strong enough. I can only say: either discard the criticism or fix the situation; don't use it as a reason for continued vacillation.

All of these critical comments raise major questions.

It is evident that little understanding exists, that there are overlaps in responsibility and authority, that people have decided that it is much more politically comfortable to be against something or to be silent than it is to have faith and conviction and to fight for what they believe.

Let's take a look at some of these national problems of administering the U. S.-ANP program.

National Problems

Many administrative problems of the U. S.-ANP program tend to be peculiar to it, and to it alone. These are disturbing.

Many additional problems of the U. S.-ANP program are shared with many other national defense programs. In that these have an even larger effect, they are even more disturbing.

We are trying to compete technologically

with inadequate attention to the creaking administrative system for doing the competitive technological job. Our administrative machinery must be as up-to-date as the technology which it energizes.

Let's take a look at some of this machinery.

Those major administrative problems which tend to be peculiar to the ANP program can be described as follows:

• **Multiple offices, agencies, and departments.** I would conservatively estimate that there are well over 60 separate and effectively independent offices, agencies, and departments in the U. S. government which have a measurable influence over the rate of progress of the ANP program. While there is currently existing an ANP office, its relative authority falls far short of that necessary to accomplish the job.

For example, in addition to the ANP office, there are: (1) The AEC (including the Division of Reactor Development, multiple staff groups, various committees, etc.). (2) The USAF (including the Air Research and Development Command, the Air Materiel Command, the Strategic Air Command, at least 15 different staff groups, various committees, study groups, etc.). (3) The USN (including the Bureau of Aeronautics, the Office of Naval Research, staff groups, committees, etc.). (4) The DOD (including the Deputy Secretary and his office, essentially all of the assistant secretaries and their offices, various staff groups, committees, study groups etc.). (5) The NASA (NACA)—(I haven't figured this one out yet). (6) The Bureau of the Budget. (7) The Central Intelligence Agency.

• **Conflicts from the contributing** government departments. In the case of the Air Force, the issue is mostly a question of decision making and delegating authorities to do the job. In many major respects, the decision mechanisms (even for many minor matters) only reside at the very top of the USAF organization. This means that even if major policy decisions are made, many of the individual implementing decisions either have to go bubbling back to the top or be laboriously handled through satellite staff or administrative offices.

AEC Contributions

The contributions of the Atomic Energy Commission have been very real and valuable. Although the AEC also suffers occasionally from bureaucratic strangulation, you can usually count on them to make a real college try. The AEC's responsibility, however, has been greatly complicated by the problems which the Air Force has had in making up its mind in the face of severe budgetary pressures.

The Navy definitely wants a nuclear aircraft program. But unless they can have a nuclear aircraft as soon or sooner than the Air Force, I am convinced that they will do everything in their power to destroy the Air Force program.

• **No strong governmental program** leadership. The issues of multiple offices, agencies and departments and conflicts from contributing departments would be less severe were the ANP program vigorously led by a program manager with appropriately delegated responsibilities and authorities. This has not been the case.

With all due respect to Maj. Gen. D. J. Keirn, he has not received necessary support and authority to do the job (regardless of various surface changes made). Even if he had received such delegations, however, he is too much of a gentleman to knock heads together when the going gets rough. With so many different people going in so many different directions, somebody has to be able to say follow me and keep in line.

There are other administrative problems which the nuclear-aircraft program shares with other defense programs. Since some of these are fairly well understood, I will only comment on those which appear to me to need some more understanding.

• **Remote decision-makers** have meant the usual (easy way out) use of review committees. The problem here is that most, if not all, review committees are also remote. How a group of men can spend

two to four hours—at intervals of 18 to 24 months—talking with the people who are doing the job—and then say they have reviewed the program is beyond my understanding.

Depending upon their length of time in their positions most committee members are previously committed to the support of other programs. Since these members are well aware of the pressures of funding, they are not going to support anything which looks as though it will steal support from something they feel they have already staked their reputations on.

Delaying Proposals

Many committee members are simultaneously in other positions, either in government or industry, where they can advance competing or delaying proposals of their own. Don't misunderstand; most competition is a good thing. It is just that here is an avenue for the guy who says "Why don't you do it my way?" He can really delay decisions; after all, he is a member of the committee who will review the new idea he has just proposed.

There are those who say that the use of review committees is a fundamental part of the process of democratic government. This is hard to defend; we had democratic government long before we had review committees. The use of such committees is, in my opinion, a fundamental symptom of faulty organization. If policymakers are so enmeshed that they can't get closer to their decision-making job, then their positions are too big and should be split into smaller responsibilities. Adding extra layers of organization doesn't help either, and there are plenty of them.

• **High security classifications** and multiple security systems. It should be no surprise that the extent and height of security classification would come under criticism. Enough has been said about this elsewhere.

What is even more difficult to understand is why we continue to need both a military-security system and an atomic-energy security system. They duplicate one another in the military reactor field and only manage to get in one another's way to the detriment of everything else.

• **Excessive checks and balances.** Many laws passed by Congress and many other administrative laws created and installed by government agencies are based upon the premise that it would be horrendous for anybody to make a mistake. Mistakes must be prevented.

The result is that we now have erected an enormous, overlapping, and detailed system which goes significantly beyond the original intent of checks and balances and effectively achieves partial strangulation. Harmful program delays are inevitable.

• **The tremendously large number** of people who can say "No" and the effective absence of anyone who can say "Yes." I believe that I have adequately commented on this subject. . . . It is a shorthand description common to many of our major administrative problems: Extreme competition among the military services; absence of vision re something different, the solutions to problems and the predictable future; complacency re the Soviet threat; the concept of business as usual.

Recommendations for Action

In consideration of what I have already said, my recommendations should come as no surprise.

The United States desperately needs and must regain the initiative in all fields. In the military area, initiative should be equated to the concept of mobility and mobile forces, as opposed to relying almost solely on static concepts.

The United States should adopt the nuclear aircraft as one prime contributor to the operating concept of mobility; the implementation of this decision requires at this time: (1) The strengthening of government program leadership in the nuclear-aircraft field; (2) growth in support for the powerplant program; (3) initiation of the prototype airframe program.

In closing, I want to quote some extremely pertinent remarks by others on the general question of the defense posture of the United States.

Early in 1958, the Rockefeller Report (from Panel II) on "International Security —The Military Aspect," had this to say:

1. The basic requirement . . . is a retaliatory force so well protected and numerous that it can overcome any defense."

2. "The hard core of this striking force, whether based at home or overseas, must be continuously alert, fully armed, and as secure as we can make it against destruction or neutralization by surprise attack."

3. It is therefore imperative that . . . we develop units which can intervene rapidly and which are able to make their power felt with discrimination and versatility."

4. Accelerated research and development support should be provided for all key programs including missile and advanced reconnaissance systems."

5. The panel is convinced . . . that . . . increases in defense expenditures are essential and fully justified. . . . We can afford to survive."

6. When the security of the United States and of the free world is at stake, cost cannot be the basic consideration. The cold war cannot be won and a hot war cannot be avoided without a major effort. This is clearly not the time for complacency. . . . What is required throughout the country is an attitude of sustained and informed determination."

Late in 1958, the nonpartisan, nonpolitical National Planning Association issued a significant warning:

"The dismal fact is that unless the United States takes many measures not contemplated in its present military program, the moment is approaching when (the assumption that United States retaliatory power is an effective deterrent to Soviet military action) will have lost its validity. If steps are not promptly taken vastly to strengthen American retaliatory capability, the Soviet Union in the not distant future will be in a position, by the use of ICBM's and IRBM's armed with thermonuclear warheads, to inflict so strong a blow on SAC bases in the United States and Europe that retaliation by the United States would be held within limits acceptable to the Soviet Union."

Any feeling of complacency in this defense area must be based upon a judgment that (1) communism is self-destructive; (2) an internal collapse of the Soviet system is inevitable; (3) only reasonable retaliatory strength is required.

I cannot identify any compelling evidence which supports this judgment.

I am sure, however, that the overwhelming majority of Americans are behind you in the mounting battle to balance the national budget. I believe that your leadership in the fight to eliminate deficit financing makes a real contribution to the noninflationary economic growth required over the next decade.

The problem then is one of making choices.

The Rockefeller Report (from Panel IV) on "The Challenge to America: Its Economic and Social Aspects" emphasized this problem of choice—concluding that the United States could afford all defense essential for survival if it decided to do so.

In my opinion, the real danger lies in an underestimation of the American people. They are willing to pay for more national security, even if this means reduced government services in other less immediate areas.

The proposed federal budget for fiscal year 1960 has already taken at least part of this willingness into account.

But does it go far enough?

I cannot help but conclude that it does not. I believe that an overwhelming majority of American citizens would prefer to be absolutely sure that the amount of national defense available is adequate for security, rather than risk even a momentary period of potential collapse in retaliatory deterrent.

The nuclear-aircraft program can help to prevent this potential collapse.

Respectfully,

John W. Darley, Jr.

MISSILE ENGINEERING

Pacific Range to Play Big Tracking Role

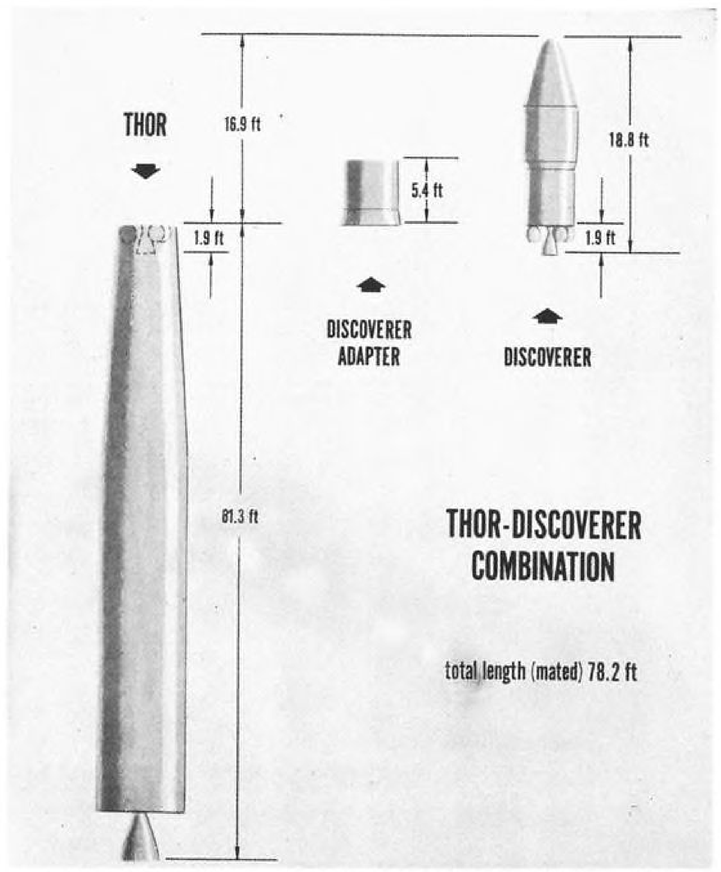
By Russell Hawkes

Los Angeles—Agencies with missile and satellite tracking capabilities can be expected to merge these into a single global tracking net before the beginning of the new fiscal year in July, Pacific Missile Range officials believe.

Under the present arrangement, some projects have their own specialized tracking nets. This is becoming progressively more uneconomical as projects multiply and new space and missile agencies arise.

Pacific Missile Range will be bidding for a large part of the world-wide instrumentation job with mobile and shipboard equipment as well as fixed tracking and telemetry stations in California and Hawaii.

Pacific Missile Range is assigned the job of providing range services for all projects launching long range missiles and satellites from the West Coast as well as the job of operating the old sea test range and inland range of Naval Missile Test Center, Pt. Mugu. Facilities which are part of Pacific Missile Range include Mugu, Naval Missile Facility Pt. Arguello, installations at San Nicolas Island 50 mi. offshore and others at Midway, Wake and Eniwetok. Distant island stations are administered from an advanced base at Kaneohe Bay, Oahu. Vandenberg AFB, adjacent to Arguello, is not part of the range. It is a training base and a tactical launch site of the First Ballistic Missile Division, Strategic Air Command. Live, peacetime missile shots from Vandenberg get Pacific range support upon request and are coordinated with other activities in the neighborhood by Pacific Missile Range.



OVER-ALL LENGTH of Discoverer I, including a modified Douglas Thor and Lockheed satellite vehicle, is 78.2 ft. Satellite was the first to be launched from Pacific Missile Range.

The range is not expected to achieve its full growth for 15 years, and the total outlay in that time should amount to about $4 billion, of which half would be spent in the first five years. Expansion plans include extension of the sea test range from an area of 150 mi. x 250 mi. to a band 500 mi. wide and 1,500 mi. long. This would lie parallel to the coast and just off shore. It could not be used as an impact area for the big ballistic missiles but would probably be useful for development and test firings of some fairly long range missiles because of the ease with which instrumentation could be placed along the coast. It would also be handy for recovery of satellites. The Fiscal 1960 budget can expand the sea test range to an area of 260 mi. x 500 mi. from the present 150 mi. x 250 mi. dimensions.

Any piece of ocean 1,500 mi. from the pad is a potential IRBM impact area for the range's shots and ICBM impact areas are out beyond Midway, Wake and Eniwetok. Plans allow for extension of the ICBM range to impact areas over 10,000 mi. away in the Indian Ocean. Mobility is a necessary characteristic of the range's instrumentation if advantage is to be taken of the flexibility available in the concept of the range. Inland range between Pt. Mugu and the Army's Dugway proving ground in Utah which was used during Chance Vought Regulus programs was instrumented completely with truck and trailer mounted gear. It now is being transferred elsewhere to assist in other projects. Inland range will be reopened in about a year and a half. Long range planning calls for 12 range ships to serve the missile ranges and satellite projects being fired from Vandenberg and Arguello. The ships will provide tracking, telemetry, recovery facilities, etc. They will belong to civilian operating contractors or will be obtained from Military Sea Transport Service. Navy considers the use of fleet units for range jobs uneconomical.

At present there is one range ship operating and another is being requested in Fiscal 1960. The one operating is USNS Private Joe E. Mann. It is manned by a civil service crew of Military Sea Transport Service and is permanently assigned to Pacific Missile Range. Instrumentation in Joe E. Mann is operated by Lockheed under an Air Force-administered Advanced Research Projects Agency contract to support the Discoverer-Sentry-WS-117L program now launching polar orbit satellites from Vandenberg. On the Discoverer I launch, Joe E. Mann was stationed 900 mi. down range.

The new ship being requested will be a modified VC-2 victory ship. It will cost about $2 million and will take about two years to convert it into a range ship. USS Norton Sound, the only ship now equipped to launch large rockets, is based at nearby Port Hueneme Navy yard and is sometimes used by Pacific Missile Range as a command ship.

Pacific Missile Range is not offering precise down range tracking because the equipment is not available and no development missions are assigned to the range which would make it necessary. Missile impact locator stations (MILS) are being installed at Midway, Wake, Eniwetok and other Pacific islands as a check on accuracy. The MILS use World War II SOFAR underwater sound ranging technique to locate impact. An explosive charge in the missile warhead is detonated at a depth of about 2,000 ft. which is approximately the level of the deep sound propagation channel in the ocean. It can be heard at great distances and a comparison of time of arrival of the sound at several stations provides a fix on the point of detonation.

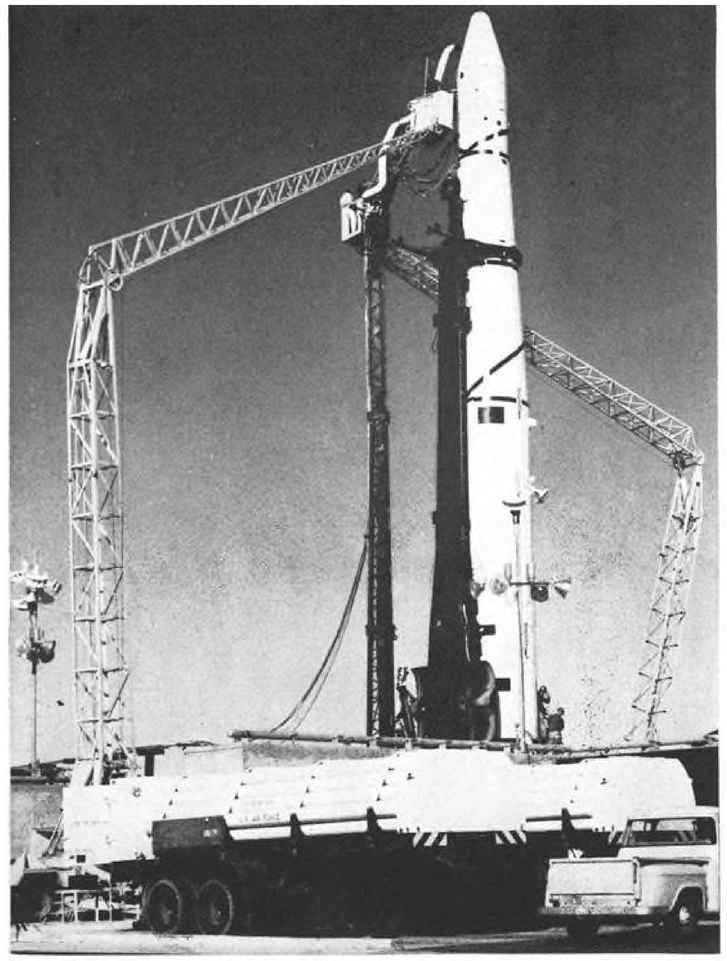
Pacific Missile Range has offered to supply the instrumentation for the much discussed equatorial satellite launching range and is now awaiting a decision on the proposal. Launch site and most of the programs would probably be run by National Aeronautics and Space Administration. No launch site has been selected as planning is by no means firm.

It could be one of a number of islands or it might even be possible to launch from a ship.

It has not been definitely established that there is a need for an equatorial satellite launch site. There are two important advantages to be had from the equatorial orbit. The orbit is repetitive so that the satellite goes over the same stations on every pass. This eases recovery for manned satellites and cuts down the number of stations needed to get continuous data.

The other advantage is that the plane of the equator always is within 23½ deg. of the plane of the ecliptic, near which all the planets of the sun except Pluto are located. Therefore, interplanetary orbits must always be in the plane of the ecliptic. If the number of programs needing equatorial orbits is small, it may prove more economical to accept the performance sacrifice necessary to maneuver from the inclined orbit into the equatorial one. This could cut payload by as much as 50%.

Most of the fruitful uses for satellites such as weather mapping and military reconnaissance call for polar orbits because they offer line of sight coverage of the entire earth every 12 hr. Since it is the only established range from which a polar satellite can be safely launched, Pacific Missile Range will probably have an important role in development of these satellites despite the fact that its primary role in the big rocket field is supposed to be training.



DISCOVERER I launching from Vandenberg AFB over the Pacific Missile Range (AW Mar. 9, p. 323) tested operational aspects of the range and Air Force stations that monitored the shot.

As development bases, Arguello and Mugu also offer advantages of safety and convenience since they are far from population centers and are surrounded by ranges of hills which would localize blast from nuclear rockets and the big 1.5 to 250 million lb. thrust chemical boosters now being discussed. Line between development and training shots is thin anyway since high cost, short flight duration and single trip life of a missile or satellite never allows much flight test time to accumulate. Therefore double missions are likely to be the rule in the future.

Growth of Pt. Arguello plays a large part in Pacific Missile Range planning since it is the intended launch site of many polar orbit satellites. It is the only land owned by the range from which it will be possible in the near future to launch large rockets. It is located in a right angle corner of the California coast west of Santa Barbara and a big rocket launched from there flies over nothing but water between the beach and the South Pole.

Many facilities at Arguello are already complete. Tracking and surveillance radars are operating, roads and utilities are under construction and sites for telemetry, range operations and communications are being prepared. Concrete has already been poured for pads in the first launch complex which is to be used by ARPA but for the next year nearly all major firings will be from the completed pads at Vandenberg.

NASA is also reported to be interested in building a launch complex at Arguello but no definite decision has been reached.

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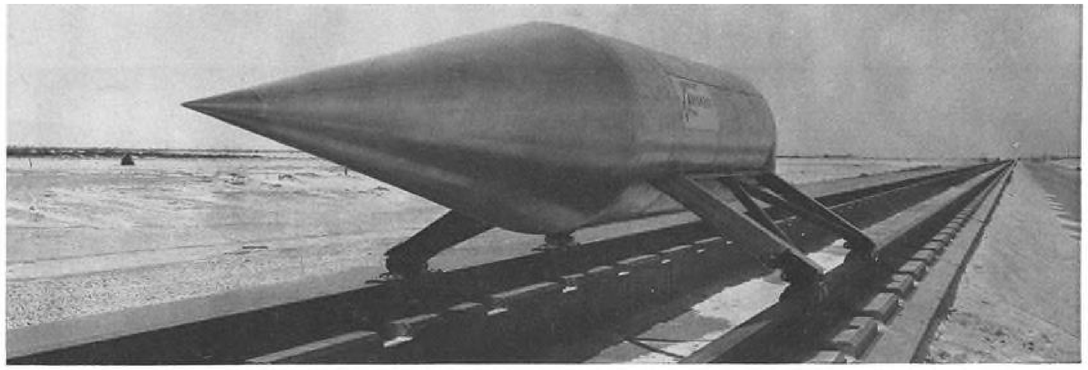


CLEAN aerodynamic design characterizes this sled at Captive Missile Test Track. Sled can carry a 200 lb. payload at 2,700 mph.

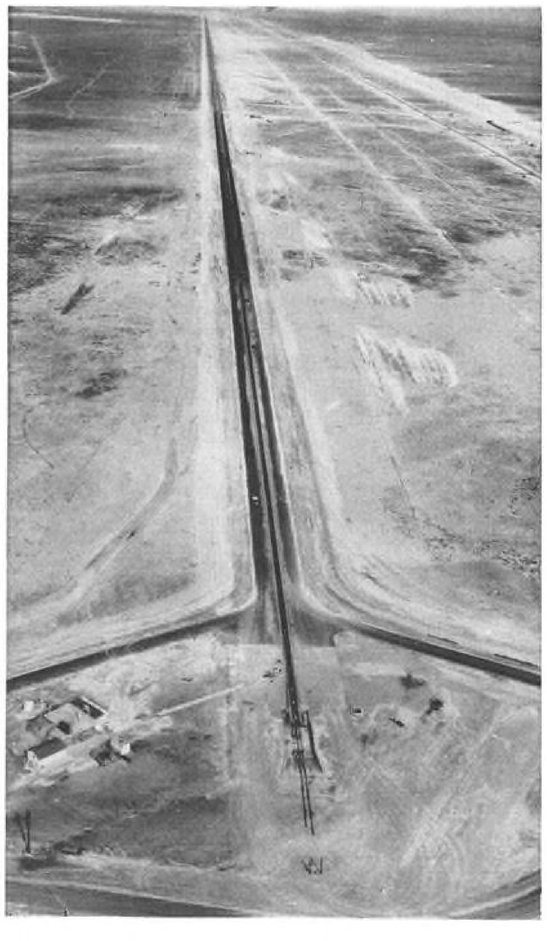
Rocket Sled Achieves Mach 4.1 Speed

Holloman AFB—Velocity of Mach 4.1 was achieved at the Air Force Missile Development Center's 35,000 ft. sled track shortly after its formal opening last month (AW Mar. 2, p. 23).

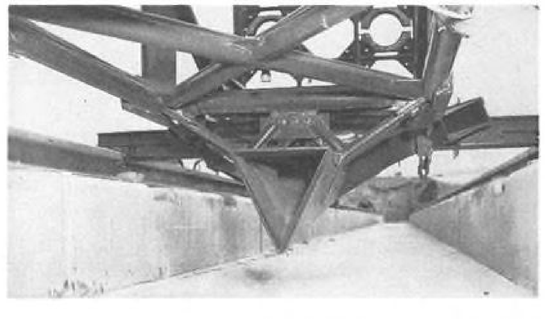
Two-stage, rocket-propelled monorail sled hit a top speed of 4,530 feet per second, or 3,090 mph., in a test to determine friction wear on the steel slippers on which the sled rides.

High-speed sled was first boosted to about Mach 2 by an 8,300 lb. thrust Cajun rocket, and to its final velocity by a cluster of four Loki rockets. Although friction between the steel slippers and the rails is considerable, it accounts for only a small fraction of the over-all drag when the sled is traveling at supersonic speeds.

Sled track was constructed for testing of missile components, human factors, vibration tests, accelerations and wind blast effects. In some cases complete missiles, such as Snark, have been given high-speed captive tests on the track prior to free flight.



AERIAL view of I-beam test sled shows vehicle hitting the water brake. Triangular shaped scoop mounted below the sled (lower photo) picks up water in the trough and throws it out on both sides and behind the sled, thus bringing it to a stop.



The Holloman track extends for 35,000 ft. near White Sands Proving Ground. The two rails were forge-welded in 10-ft. sections, joints ground smooth so as to be seamless along their entire length. To prevent buckling at high temperatures, rails were stretched by hydraulic jacks so that they are under constant tension at temperatures below 120F. Total elongation due to this stretch process, over the entire length, is 23.5 ft. at a temperature variation of zero to 120F.

Profile of track shows a rise of only one foot per thousand feet of length. Topography of the area is such that the track can be extended for an additional 90,000 ft.

Accelerations up to 100g are possible and decelerations up to 150g can be achieved through a water-braking system. Variations in deceleration are controlled by changing the depth of the water brake and altering the shape and draft of the scoop beneath the sled. Water level is maintained by frangible dams which burst as the scoop contacts them. The sled's velocity is then imparted to the water, resulting in deceleration.

Programed decelerations have been accurate to within 2%. "Rooster tail" thrown up by the water brake makes the sled resemble a desert borne Gold Cup racer.

According to Holloman officials, use of sled track facilities will result in considerable saving in testing of missile components. Items normally not recoverable after a missile free-flight can be subjected to an environment similar to actual flight conditions and recovered afterward for study.

USAF Contracts

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

WRIGHT-PATTERSON AIR FORCE BASE, U. S. Air Force, Wright-Patterson Base, Ohio.

Link Aviation, Inc., Binghamton, N. Y., contract technical services, project 19-AMC-2-1, $59,785.

Federal Electric Corp., Paramus, N. J., Contract technical services, project 19-AMC-2-2, $31,500.

Bendix Radio Corp., Baltimore, Md., contract technical services, project 19-AMC-2-3, $39,030.

ACF Industries, Inc., Riverdale, Md., contract technical services, project 19-AMC-2-4, $30,300.

Defense Electronics Division, General Electric Co., Syracuse, N. Y., project 19-AMC-2-5, $133,800.

Philco Corp., Philadelphia, Pa., contract technical services, project 19-AMC-2-6, $84,000.

Gilfillan Bros., Inc., Los Angeles, contract technical services, project 19-AMC-2-7, $86,000.

RCA Service Co., Camden, N. J., contract technical services, project 19-AMC-2-8, $39,800.

RCA Service Co., Camden, N. J., contract technical services, project 19-AMC-2-9, $96,700.

Allison Division, General Motors Corp., Indianapolis, Ind., contract technical services, project 19-AMC-2-10, $26,900.

National Scientific Laboratories, Inc., Washington, D. C., contract technical services, project 19-AMC-2-11, $48,700.

Emerson Radio and Phonograph Corp., Jersey City, N. J., contract technical services, project 19-AMC-2-12, $33,600.

Republic Aviation Corp., Farmingdale, N. Y., contract technical services, project 19-AMC-2-13, $146,300.

North American Aviation, Inc., Los Angeles, contract technical services, project 19-AMC-2-14, $73,600.

Nuclear Products, Erco Division, ACF Industries, Inc., Riverdale, Md., contract technical services, project 19-AMC-2-15, $34,300.

Madigan Corp., Carle Place, L. I., N. Y., contract technical services, project 19-AMC-2-16, $50,100.

International Business Machines Corp., Washington, D. C., rental of IBM machines, equipment and/or devices for fiscal year 1959, project 19-AMC-2-26, $49,138.

Hughes-Simonson, Inc., Dayton, Ohio, installation of new rotary dustless unloader for ash silo, bldg. 271, Area "A", IFB-33-601-59-129, project 19-AMC-2-27, $33,331.

Star Equipment Co., Columbus, Ohio, modification of hangar fire protection, bldg. 145, Area "C", project 19-AMC-2-28, IFB-33-601-59-136, $35,450.

Aircraft Gas Turbine Division, General Electric Co., Cincinnati, Ohio, contract technical services, project 19-AMC-2-36, $173,700.

Philco Corp., Philadelphia, Pa., contract technical services, project 19-AMC-2-37, $42,530.

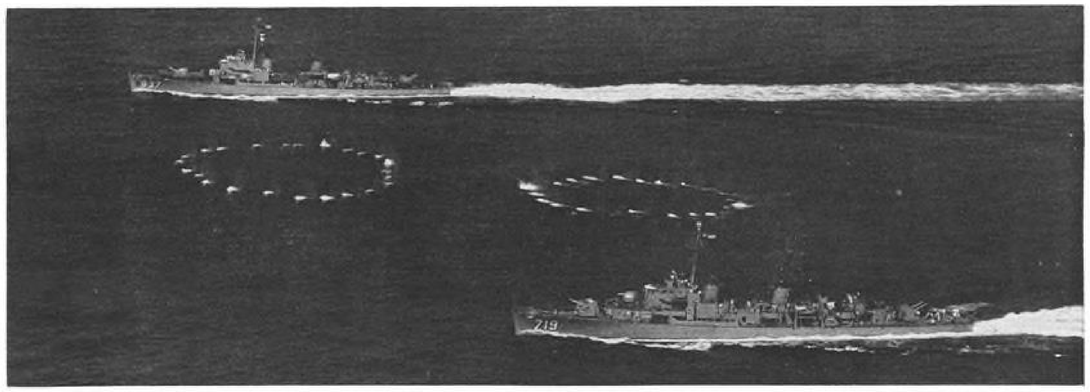
Aircraft Gas Turbine Division, General Electric Co., Cincinnati, Ohio, contract technical services, project 19-AMC-2-38, $38,900.

North American Aviation, Inc., Los Angeles, contract technical services, project 19-AMC-2-39, $26,800.

Aircraft Gas Turbine Division, General Electric Co., Cincinnati, contract technical services, project 19-AMC-2-40, $158,400.

Wright Aeronautical Division, Curtiss-Wright Corp., Wood Ridge, N. J., contract technical services, project 19-AMC-2-42, $168,100.

Westinghouse Electric Corp., Dayton, Ohio, contract technical services, project 19-AMC-2-43, $32,680.



USS SARSFIELD (DD-837) forms a hedge hog (bomb) pattern in ASW operations off Key West, Fla. USS Epperson is in foreground.

Fund Limit Sets Pace for ASW Progress

By Cecil Brownlow

Washington—Navy needs larger and faster search forces plus a major breakthrough in detection techniques if it is to counter effectively the threat of Soviet missile-bearing nuclear submarines. At the moment, prospects for the first apparently are slight, and the timetable for the second appears largely dependent upon the availability of funds and effort.

Rear Adm. Charles E. Weakley, anti-submarine warfare readiness executive in the Office of the Chief of Naval Operations, told a group attending a recent anti-submarine warfare symposium here that the time needed to achieve the necessary breakthrough would largely "depend upon the budget."

Funds presently allocated by the Administration for ASW in the Fiscal 1960 defense budget fall slightly below those provided in Fiscal 1959 when Congress appropriated $48 million above the original requests in an effort to accelerate research and development programs.

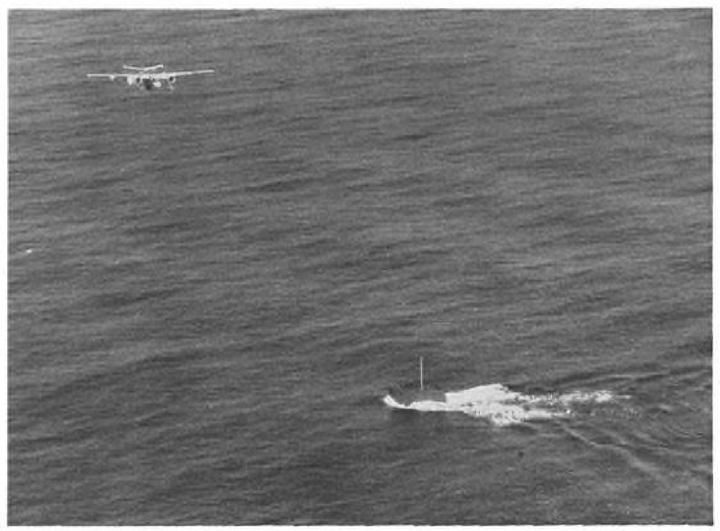
Fiscal 1960 research and development funds, Adm. Weakley said, will continue at approximately the same level as those of Fiscal 1959, including the supplemental appropriation, but requests for shipbuilding funds are below those of the previous year. Weakley added, however, that "once we find the necessary means of achieving a breakthrough, we'll get the money."

Vice Adm. Robert B. Pirie, deputy chief of naval operations for air, later said the Fiscal 1960 request for ASW research and development funds represents a "reasonable amount of the national budget . . . it's satisfactory."

Earlier, in referring to the over-all ASW budget in an aside from his prepared speech at the symposium, Adm. Pirie said: "Most of us wonder . . . if we are spending a commensurate amount of the national program on the vital problem of anti-submarine warfare."

Other developments at the symposium, sponsored by the Navy League in an effort to emphasize Navy's need for better ASW weapons and techniques, included:

- **U. S. now has no adequate defense** against the nuclear, missile-launching submarine. Vice Adm. William G. Cooper, commander of the Atlantic Fleet's Anti-Submarine Defense Force, said: ". . . our opponent, the submarine, is going through a period of dramatic development. ASW is trying to catch up. It is the old story of the offensive weapon getting a head start.
- **Major breakthrough in detection** has become imperative in view of decreasing U. S. forces plus the increased Soviet potential for launching air-breathing or ballistic missiles from submarines well at sea. Adm. Pirie said the Navy needs a system that will permit detection "from an area from 50 to 75 mi. from the aircraft to a depth of 1,500 ft. This would permit us to effectively cover the oceans against any class submarine."
- **Sonar, whose range** has been extended by a factor of three since World



GRUMMAN S2F Tracker makes run on USS Basher during ASW training.

War II, offers the best immediate potential for acquiring additional range through sophistication of present systems. Sonar capability, however, is limited by sound's distortion as it strikes the temperature ducts of the sea and by its limited capability for discrimination.

• **Non-acoustical system,** possibly some form of long-range electromagnetic detection, probably will provide the best long-range answer. Stromberg-Carlson Division of General Dynamics Corp. now has a study contract with the Office of Naval Research for development of such a technique.

• **Industry interest** in anti-submarine warfare has shown a marked increase during the past year, with a number of companies contributing their own funds to research and development projects in an effort to fill the Navy budget gaps and improve the state of the art. The official symposium brochure noted that "in an unprecedented peacetime move, industry is putting its own money into elaborate research programs to develop the necessary equipment" for an adequate anti-submarine force.

• **Soviet submarine contacts** have been made by Navy forces off the Atlantic coast relatively near the U.S. mainland, but never within the three-mile limit, despite conflicting reports to the contrary. Navy says no "positive identification" of Soviet submarines has been made in this area since, under Navy terminology, "positive identification" requires an actual visual observation of a surfaced vessel. Soviet submarine commanders apparently have orders to remain submerged at all costs while operating near the U.S. coast.

Opinion was divided among the top Navy officials attending the symposium as to the current Soviet missile capability and the probable length of time before Russian nuclear-powered submarines will make their appearance in operational service. There was general agreement with Adm. Cooper, however, that the "submarine missile threat is coming, and it's coming fast."

Adm. Cooper added that "we give the Soviets credit for having experimental air-breathing missile launching submarines, but we don't believe they have any operating operationally. . . . We think they could build up an operational force relatively fast."

Adm. Jerauld Wright, commander of the U. S. Atlantic Fleet, termed the submarine threat "commensurate in importance, though not yet in size, to that from the air. . . . I don't know how many missile submarines they have . . . but I assume that they do have (them)." He later added that there "is evidence" that the Soviets are concentrating on new types of submarines and that this explains the decline in the numbers of Russian submarines at sea from 464 last June to 450 at present. "We have strong and reasonably well established evidence that they are developing missile submarines, primarily air breathing, but my own belief is that they also are working on Polaris-type submarines."

Capt. Richard B. Laning, former commander of the nuclear submarine Seawolf and now attached to the Office of the Chief of Naval Operations, pointed to the Soviet cutback in production of conventional submarines and added that, if the usual five to seven year development and production cycle is followed, "an improved, possibly nuclear, submarine might soon go into production."

Whatever their current capability, the potential strategic threat of Soviet submarines to the U. S. industrial and military complex, coupled with their traditional tactical threat against shipping, has made anti-submarine warfare the top priority mission of the U. S. Atlantic fleet and the NATO navies.

Industry's accelerated interest in the problems involved in providing an effective ASW defense stems largely from Navy's public recognition early last year of its long-standing lack of effective anti-submarine detection and classification techniques.

Adm. Weakley told a symposium group that "many companies have been putting their own funds into ASW research since the problem's acuteness has been made known by Navy."

As an example, he cited one particular company which, he said, "hasn't had a naval contract for years." Now, he added, it "has had 25 of its finest minds working on anti-submarine warfare for the last nine months.

One concerted industry move cited by officials at the symposium was the establishment of an Anti-Submarine Warfare Committee by the National Security Industrial Assn. representing approximately 40 companies and formed in an effort to determine how Navy can best be helped in solving its problems. Member companies include Chance Vought, Douglas, Grumman, Lockheed, Martin, Goodyear Aircraft, General Dynamics, Hughes Tool Co., Radio Corp. of America and Western Electric.

Lack of adequate forces to cope with the Soviet submarine fleet, with its double threat as a strategic and tactical weapon, was conceded by Adm. Cooper, whose Atlantic command now has three special ASW task forces—Alfa, Bravo and Charlie—at sea with the assignment of precisely defining the problems at hand, present and future equipment needs and tactics to make best possible use of materials at hand.

At present, there are no such forces in the Pacific Fleet. "The Pacific Fleet," one top official said, "has been a little slow in catching on to the problem since most of the Russian submarines have been in the Atlantic. I think they've got the point now, though, and they're coming along pretty fast."

The need for large, available anti-submarine warfare forces also was emphasized by Adm. Weakley, who termed ASW a "national problem" as well as a "Navy problem" and said: ". . . until we can strip the concealment enjoyed by the submarine (by more effective means of detection) . . . the problem is manageable only by relatively large forces involving expensive and complicated equipment and highly trained men."

New ASW Center

Washington—U. S.-financed Anti-Submarine Warfare Technical Center will be formally opened at La Spezia, Italy, within the next few weeks to make use of available European scientific and engineering talent in the effort to find an effective ASW detection and classification technique. Center, under NATO cognizance, will operate on a basis similar to that of the Air Research and Development Command's European office in Brussels (AW June 9, 1958, p. 21).

SOLAR SAILING

EXPANDING THE FRONTIERS OF SPACE

SOLAR SAILING: Space travel with the aid of solar radiation pressure—an area of advanced research at Lockheed. Vehicle would employ a sail that would be raised and lowered in flight. The artist has depicted Magellan's ship "Trinidad" to symbolize man's great voyages of discovery.

TECHNOLOGY

Lockheed Missile Systems Division is engaged in all fields of missile and space technology—from concept to operation. Advanced research and development programs include—man in space; space communications; electronics; ionic propulsion; nuclear and solar propulsion; magnetohydrodynamics; computer development; oceanography; flight sciences; materials and processes; human engineering; electromagnetic wave propagation and radiation; and operations research and analysis.

The successful completion of programs such as these not only encompasses the sum of man's knowledge in many fields, but requires a bold and imaginative approach in areas where only theory now exists.

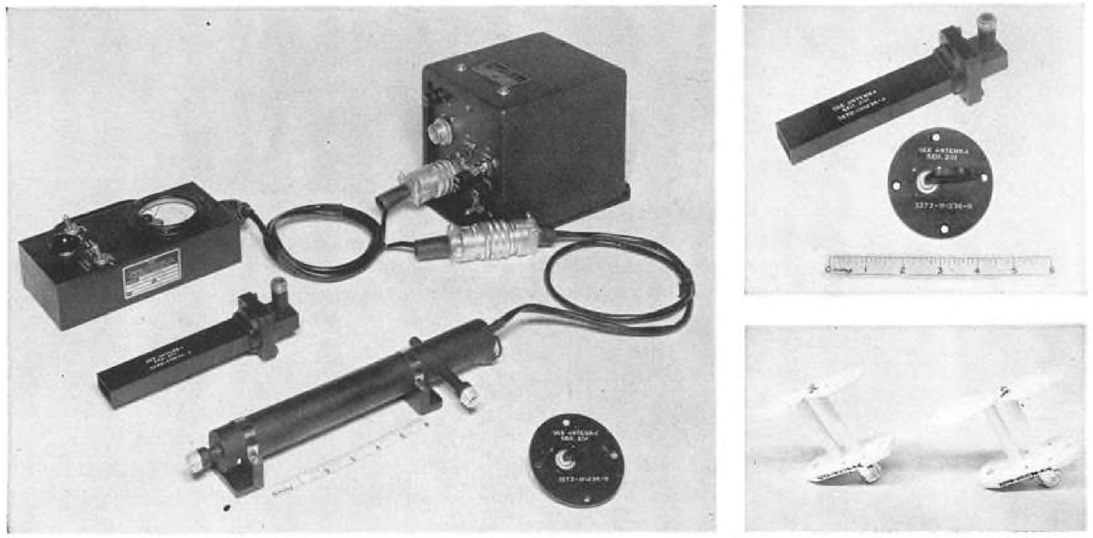
The Missile Systems Division programs reach far into the future. It is a rewarding future which men of outstanding talent and inquiring mind are invited to share. Write: Research and Development Staff, Dept. C4-17, 962 W. El Camino Real, Sunnyvale, California, or 7701 Woodley Avenue, Van Nuys, California. For the convenience of those living in the East or Midwest, offices are maintained at Suite 745, 405 Lexington Avenue, New York 17, and at Suite 300, 840 N. Michigan Avenue, Chicago 11.

"The organization that contributed most in the past year to the advancement of the art of missiles and astronautics."

NATIONAL MISSILE INDUSTRY CONFERENCE AWARD

Lockheed / **MISSILES AND SPACE DIVISION**

SUNNYVALE, PALO ALTO, VAN NUYS, SANTA CRUZ, SANTA MARIA, CALIFORNIA
CAPE CANAVERAL, FLORIDA • ALAMOGORDO, NEW MEXICO



SEE system, developed by Sperry Gyroscope Co., enhances radar echoes by means of traveling wave tube amplifier. Photo at left shows X-band system consisting of tube, power supply, transmitting and receiving antennas, and test multimeter. X-band and L-Band antenna systems are shown at right. X-band receiving antenna is crescent type; transmitting antenna is open-end waveguide. L-band system employs broadband dipoles.

Radar Echo Enhancer Simulates Bombers

By James A. Fusca

Great Neck, N. Y.—Drones used as targets for Bomarc surface-to-air missiles test-fired over the Atlantic Missile Test Range, Cape Canaveral, Fla., are being made to appear as radar targets varying in size from the smallest fighter to the largest Soviet intercontinental bomber.

The deception is achieved by means of a radar echo enhancing system called SEE, developed by the Aeronautical Equipment Division of the Sperry Gyroscope Co.

SEE, standing for Sperry Echo Enhancer, is a microwave traveling wave tube radar repeater system that basically functions as a radar beacon. The difference, however, is that the power of the transmitted signal is proportional to the power of the received signal over the normal operating range of the traveling wave tube. When the gain of the system is set to provide a return signal equivalent to the radar echo from a target of specific size, the augmented radar echo remains proportional to the desired target size as the target varies in range from the radar.

In addition to target drone applications, Sperry anticipates use of the SEE system for training of air defense personnel, radar calibration, and civil air traffic control. The system is not expected to compete with the ATC beacon for use in commercial aircraft but, because of its claimed simplicity and low cost, the company expects it to find use in business type aircraft.

Development of the system began late in 1956, with feasibility tests being flown in 1957, under company funds. Slightly differing systems have been designed to operate at L-band, S-band and C-X-band.

Use of the system at Cape Canaveral began with test flights conducted there last fall.

Sperry engineers say that the L-band systems being flown at the Cape have been operated successfully under actual countdown conditions in X-10 and QF-80 drones, and North American F-86 manned aircraft, at altitudes above 50,000 ft. and speeds approaching Mach 2. The equipment has operated reliably without pressurization or shock mounting.

Resembles ECM Equipment

The SEE system closely resembles electronic countermeasures equipment using traveling wave tubes to receive and reradiate enemy signals. Such countermeasures equipment, however, is more complex and more expensive, because the received signal must be processed before retransmission in some manner that will confuse or deceive the enemy.

The traveling wave tube of the SEE system functions only as a microwave amplifier, but the tubes that are being used by Sperry were originally developed by the company for countermeasures applications.

The SEE system consists of a family of three microwave amplifier devices which employ the simplicity, reliability and economy of traveling wave tubes to artificially but realistically simulate radar target area in a manner that provides easily adjustable area characteristics. The system was developed to fill the need for permitting drone target use in weapon system evaluations and training, so that small expendable drones could be made to exercise weapon system radars, operators and missiles as if these drones were actually larger (or a specific type of enemy) aircraft.

Radar target augmentation increases the level of the normal radar echo signal from the target by artificial means. Specifically, the impinging energy density must be increased on reradiation. This can be done either by energy focusing as with passive reflectors at the expense of angular coverage or by adding more energy in the case of an active linear amplifier where almost any desired spatial coverage can be obtained by suitable antenna design.

Additionally, to obtain a constant area—that is, a constant effective radar cross section—the ratio of the input and output power density must be constant with changes in radar range. This defines the radar target cross section parameter of the standard radar range equation.

For a reflector this infers a constant-sized surface; for an amplifier it infers a constant system gain. A triggered beacon or regenerative oscillator, whose power output is constant for any signal level above some minimum, cannot simulate a constant echo area at varying radar ranges.

The traveling wave tube of the SEE system basically is a very wide band microwave amplifier to which has been added an adjustable gain characteristic for a definite dynamic range of the input signal level. This level ranges from the input noise level to that required for output power saturation. The remaining system complement is a power supply and an input-output antenna system providing the desired spatial coverage.

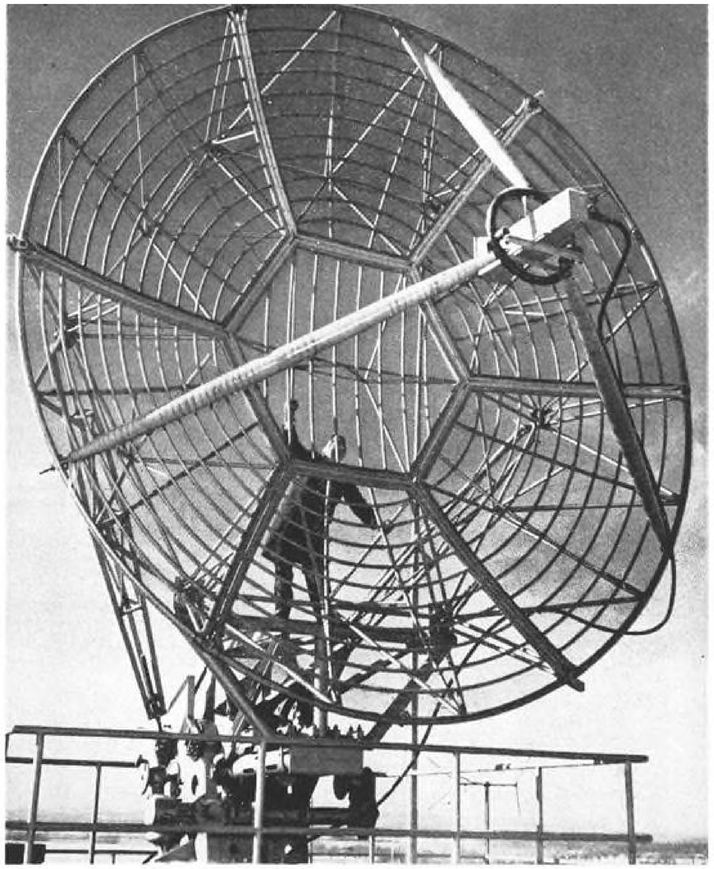
Operational Features

The operational features claimed for the SEE system of radar augmentation are:

- **True area simulation** as a function of net system gain.
- **Adjustable area simulation** in level and spatial distribution through attenuators and antennas.
- **Bistatic operation** for semiactive missile system operation. (Monostatic operation is where the target echo received by the transmitting radar is proportional to the simulated target area. In bistatic operation, the target echo received by a missile using semiactive homing—such as the Bomarc—also is proportional to the simulated target area.)
- **Simultaneous** multiple frequency operation.
- **On-off remote control** by radio command or manual relay operation.

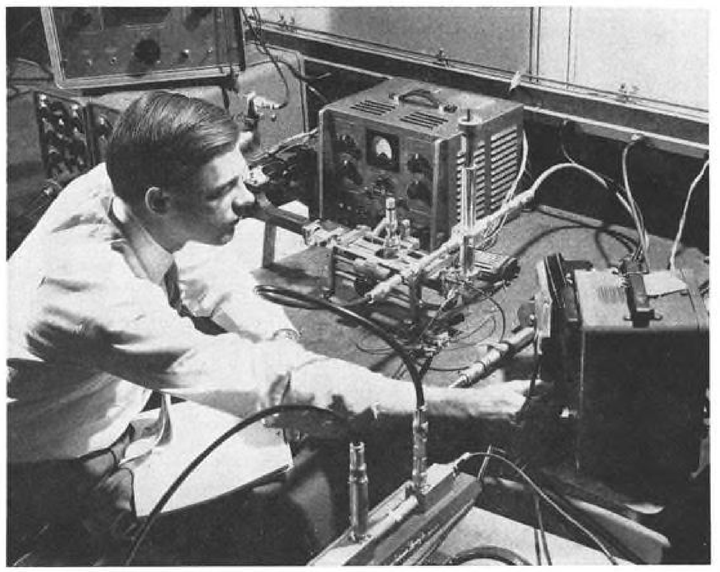
The saturating power level of the traveling wave tube determines the limit of linear operation and therefore the limit of true area simulation. In practice, this saturation level is matched to the level at which the radar automatic gain control becomes non-linear (saturates) or signal limiting begins. For this reason, the important region for augumentation is between detection and lock-on of the radar receivers, where the signal and the receiver noise levels are competing. These non-linear radar system effects usually come into operating at signal-to-noise levels of about 7-10 db.

One disadvantage of conventional radar beacons has not been encountered with the SEE systems—that of double target returns. This arises where the skin return from the aircraft is strong enough to appear on the radar's plan position indicator with the slightly delayed beacon return. Delay between



Pioneer IV Tracked by GE

Signals from the Army's Pioneer IV solar satellite were received to a distance of 410,000 mi. by General Electric engineers who mounted a parametric amplifier at the feed point of an 18 ft. parabola. Amplifier employs a silicon diode with a 1 db. noise figure operating at L-band with 100 kc. bandwidth. Pump frequency is X-band. Parabola (above) has approximately 32 db. gain. Amplifier is shown being checked below. System is operated by engineers from GE's Heavy Military Dept. and General Engineering Laboratory.



arrival and retransmission of the augmented return with the SEE system is sufficiently small, Sperry engineers say, so that the two echoes are superimposed.

Production of SEE systems by Sperry to date has been nine systems, eight L-band systems having gone to Boeing Airplane Co. for the Bomarc test program at Cape Canaveral and one X-band system to Ryan Aeronautical Co. for study as to its use with the Ryan Firebee drone. Additional L-band systems will be procured by the Air Force for use at the Eglin Gulf Test Range in conjunction with testing of the new, long range IM-99B Bomarc missile.

One of the reasons for the increasing interest in active radar repeating systems, according to Sperry, is the belief that passive reflectors cannot provide the echo augmentation required—either because of limited angular coverage, because of the size required for use with lower frequency radars, and because echo area cannot be varied.

Other companies that are believed to be active in this type of work are the International Telephone & Telegraph Laboratories and Temco Aircraft Corp. IT&T Laboratories holds contracts both with Ryan and Radioplane.

FILTER CENTER

► **Cruise Computer Payoff**—Use of a cruise control computer in a Boeing B-52, instead of empirical cruise control charts, improves fuel consumption efficiency sufficiently to permit a 9,000 lb. increase in airplane gross weight, recent flight tests indicate. The 9 lb. cruise control computer was designed by John Oster Manufacturing Co. from original development by Massachusetts Institute of Technology. The computer may see use in the Convair B-58. Program was sponsored by Wright Air Development Center's Flight Control Laboratory.

► **Selective Calling Evaluation**—Comparative flight evaluation of eight different types of air-ground selective calling systems currently is under way at Wright Air Development Center's Communication and Navigation Laboratory. Following tests, the laboratory will draw up specification for selective calling system incorporating best features of each type for subsequent procurement. System must be suitable for use in high frequency and ultra high frequency bands, both single and double sideband type operation.

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

• **International Business Machines Corp.,** Military Products Division, will provide ultra-high-speed digital computer to International Telephone & Telegraph Corp. for use in Strategic Air Command Control System which latter is building for Air Force.

• **Thompson-Ramo-Wooldridge Products Co.** has received order for rental of its RW-300 digital computer from Federal Aviation Agency. Computer will be used in simulation and studies of traffic control problems by FAA's Bureau of Research and Development in Atlantic City facility.

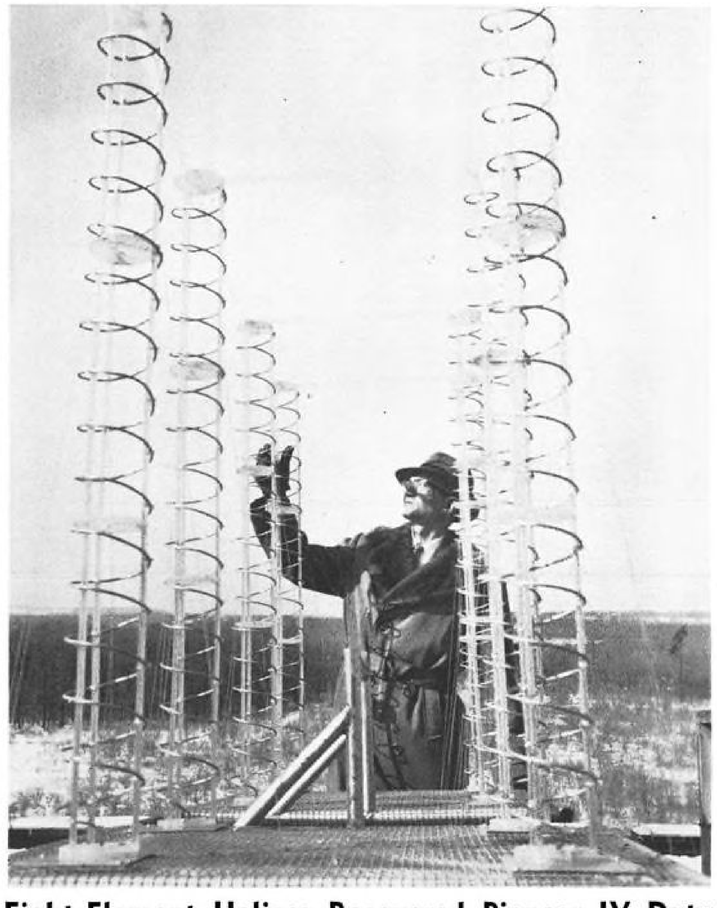
• **Stavid Engineering Inc.,** $500,000 contract from Army Signal Supply Agency for AN/FMS-3 Sferics Locating System which will be used to detect and locate atmospheric disturbances at long range to warn of formation of severe weather conditions.

• **Hoffman Electronics Corp.,** $3.3 million contract from Navy Bureau of Aeronautics, for modification and improvement of 4,000 AN/ARN-21 airborne Tacan sets.

• **Beckman Instruments Inc.,** $225,000 from Boeing Airplane Co., for high-speed analog computer to be used in simulation of Bomarc missile interceptions.

• **Sylvania Electric Products Inc.,** four contracts totaling more than $5 million, from Signal Corps for development and production of three additional MOBIDIC transportable digital computers.

• **Gabriel Electronics Division,** The Gabriel Co., Needham Heights, Mass., $250,000 from Navy Bureau of Aeronautics, for production of ruggedized version of high-gain omnidirectional UHF drone command antenna, AT-781/U.



Eight-Element Helices Recovered Pioneer IV Data

Tracking and telemetry signals from Pioneer IV, the Army's lunar probe fired on Mar. 3, were received for the first day by General Electric's space vehicle tracking station near Schenectady, N. Y. Antenna for the facility is made up of eight helices which feed double sideband, high frequency receivers. Facility is operated by engineers from GE's General Engineering Laboratory and Heavy Military Dept.

AMC Contracts

Wright-Patterson AFB, Ohio—Following is a list of unclassified contracts for $25,000 and over as released by the Air Materiel Command:

Continental Aviation and Engineering Corp., Detroit, Mich., facilities for the production of J69 engines, (PR BI-9-F-9098), $60,400.

North American Aviation, Inc., Los Angeles, Calif., T-39 jet utility trainer aircraft, (PR XR-9-1510-7025), $3,150,000.

Radiant Manufacturing Corp., Morton Grove, Ill., screen, projection, 40" x 40" type II; screen, projection, 102" x 102" BM-6, ground support equipment, IFB 33-600-59-32, (PR MO-9-6730-1231 and amendment no. 1, MIPR %59-22215-SC-24 and amendment no. 1), $71,856.

General Electric Co., West Lynn, Mass., indicator, rate of flow, fuel, type EFU-3/A Aerno. 6.-2492; indicator, rate of flow, fuel, type EFU-4/A Aerno 61-2493; indicator, rate of flow, fuel, type AFU-5/A Aerno 61-2494, used on Boeing KC-135 and B-52G aircraft, (PR PE-9-05D-4267 and PE-9-05D-4273), $158,844.

Aero Instrument Co., Cleveland, Ohio, type AN 5816-2 pitot static tubes for supply replenishment spares, IFB 33-600-59-49, (PR MA-05C-59-163), $37,229.

The General Tire and Rubber Co., Akron, Ohio, wheels, brakes and data, spares for F-100 aircraft, (PR EA-9-03B-4388), $33,-870.

Dearborn Electronic Laboratories, Chicago, design and construction of hermetically sealed metalized Teflon capacitors capable of operation over the temperature range −65C° to +200C with ability to withstand severe environmental conditions encountered in high speed aircraft and/or missiles, (PR PN-8-MMP-6209), $60,232.

Aero Flex Laboratories Division, The Aeroflex Corp., Long Island City, N. Y., flight test program and related data, (PR PE-8-ST-3741), $349,920.

Johnson Fare Box Co., Chicago, Ill., motor, alternating current, P/N JFB-B150, charger gun, 20 MM L.H. JFB-J059-7, charger gun, 20 MM R. H., JFB-J059-8, (PR WR-9-FSCI6-2056), $1,371,679.

Concordia Publishing House, St. Louis, Mo., procurement of materials and services necessary for the reproduction of the following motion picture prints: "Old Testament" series, RFP 33-600-59-5019, (PR EM-9-PP-6183), $30,016.

Aeronautical Division, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., indicators, P/N 435974 and calibrators P/N BG4-3C-4, components of AN/AJB5 LABS replenishment spares for F-100 series aircraft, (PR's WR-9-11A-714 and WR-9-FSC-1280-772), $77,870.

Small Aircraft Engine Department, General Electric Co., West Lynn, Mass., product improvement for J58 engines, (PR EP-9-2840-5457 and EP-9-2840-4553), $9 million.

Bendix Products Division, Bendix Aviation Corp., South Bend, Ind., 2,818 forged wheel assemblies and supporting data for KC-97 aircraft, (PR's 00-8-03B-2231 and 2637), $2,076,070.

Laboratory for Electronics, Inc., Boston, Mass., Doppler-radar system, AN/APN-105 used with F-105D and —E aircraft, (PR PE-9-16K1-4326), $3,627,535.

The Martin Co., Baltimore, Md., implementation program for TM-76B missiles, (PR TM-9-1410-7248), $900,000.

General Electric Co., West Lynn, Mass., transmitter, rate of flow, fuel, type MB-3, Aerno 61-2474, for use on KC-135A aircraft, (PR's PE-9-05G-4292 and MA-8-05G-807), $817,521.

Aircraft Division, McCauley Industrial Corp., Dayton, Ohio, propeller assemblies, fixed pitch, spares for L-19A aircraft, (MIPR R59-4062-TCSMC-A), $37,816.

Boeing Airplane Co., Wichita, Kans., B-52 MTU, (PR XE-9-6930-7095), $385,000.

Boeing Airplane Co., Wichita, Kans., B-52 airplanes and associated support items, (PR XE-9-1510-7012 and amendment no. 1), $15,000,000.

AiResearch Manufacturing Co. of Arizona Division, The Garrett Corp., Phoenix, Ariz., modification and overhaul of gas turbine compressor for C-130B aircraft, spare parts, ground support equipment and data, (PR PE-8-02B-3342, amendment no's 1 & 2, PR PE-9-02B-4198 and PR PE-9-02B-4118 and amendment no. 1), $252,813.

Collins Radio Co., Cedar Rapids, Iowa, high frequency radio communication set, type 618S-1A for C-130B and C-133B aircraft, (PR PE-9-16A-4085 and PE-9-16A-4085-1), $250,476.

Tayloreel Corp., Rochester, N. Y., reels and ground support equipment, (IFB 33-600-59-10), (PR MO-8-6760-2608 (complete) and MIPR R59-22230-SC-24 and amendment no. 1 (complete)), $34,507.

ELM Manufacturing Co., Inc., Hastings-on-Hudson, N. Y., projector, still picture, type AP-15 overhead, classroom training and ground support equipment, IFB 33-600-58-288), (PR MO-8-6730-1228 and MO-9-6730-1603), $329,052.

Foltron Co., Inc., Flushing, N. Y., development of quantity production techniques for 200C radio interference filters capable of continuous full-load operation over the temperature range of −65C through 200C and withstand environmental requirements peculiar to military aircraft and/or guided missiles, (PR PB-7-MMP-6335-1), $36,250.

Metal Products Division, Koppers Co., Inc., Baltimore, type I semi-portable noise suppressor for ground run-up (towable), (PR OD-8-4920-16587), $120,675.

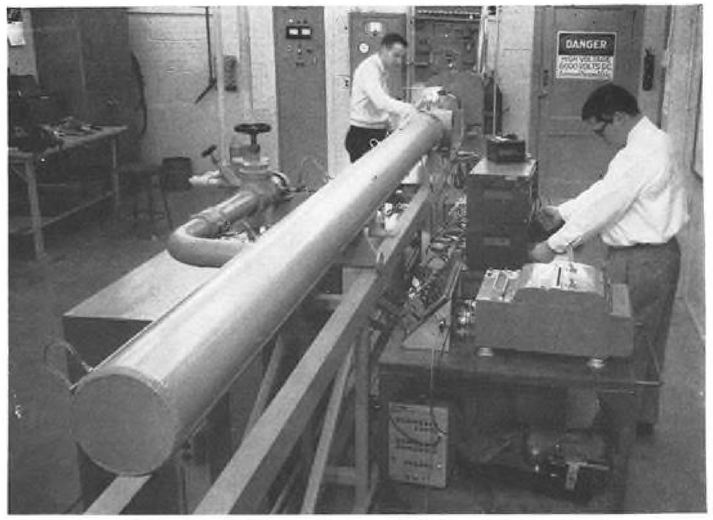
AC Spark Plug Division, General Motors Corp., Milwaukee, Wis., development of manufacturing techniques and equipment, inspection and testing equipment to facilitate the production of 107 gyros at rates of 150 to 200 per month, (PR PB-8-MMP-6024 and amendment no. 1), $637,500.

Fyr-Fyter Co., Dayton, Ohio, research, development and fabrication of a service test quantity of standardized fire extinguishers, (PR MP-8-4210-21157), $50,248.

Semi-Conductor, Components Division, Texas Instruments, Inc., Dallas, Tex., silicon crystal production refinement program, (PR PB-8-MMP-6237 and amendment no. 1), $211,819.

Delta Air Lines, Inc., Atlanta, Ga., group A modification of contractor-owned DC-8 jet aircraft to CRAF configuration while in production, (PR PM-8-S-5159), $42,160.

New Departure Division, General Motors Corp., Bristol, Conn., establishment of a program for development of improved manufacturing methods and finer gaging techniques to be used in the more economical and reliable production of spin-axis bearings for the 107 gyroscope, (PR PB-8-MMP-6195 and amendment no. 1), $563,953.



Boeing Tunnel Tests Reach Mach 10-27 Range

Boeing Airplane Co.'s 8-in. electric arc discharge pilot model wind tunnel has a testing capability in the Mach 10 to Mach 27 range. Company now is building a new 40-in. hypersonic tunnel which will enable model testing up to satellite Mach numbers. Although actual tests last only about 1/25th sec., high speed oscillograph recorders can record data at 160 in. of paper per second on 36 channels. Tunnel consists of a capacitor bank for storing electrical energy; arc-discharge chamber for containing high pressure; a nozzle; test section to hold the model, and a vacuum system for lowering pressure in the test section. Pressure differential between arc chamber and test section is maintained until moment of test by a plastic diaphragm. Compressed air, forced into the arc chamber, strikes the arc, ionizing the air. This high temperature-high pressure plasma ruptures the diaphragm, permitting high energy shock wave to pass through nozzle into test section; shock wave is followed by a hypersonic flow of air.

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.

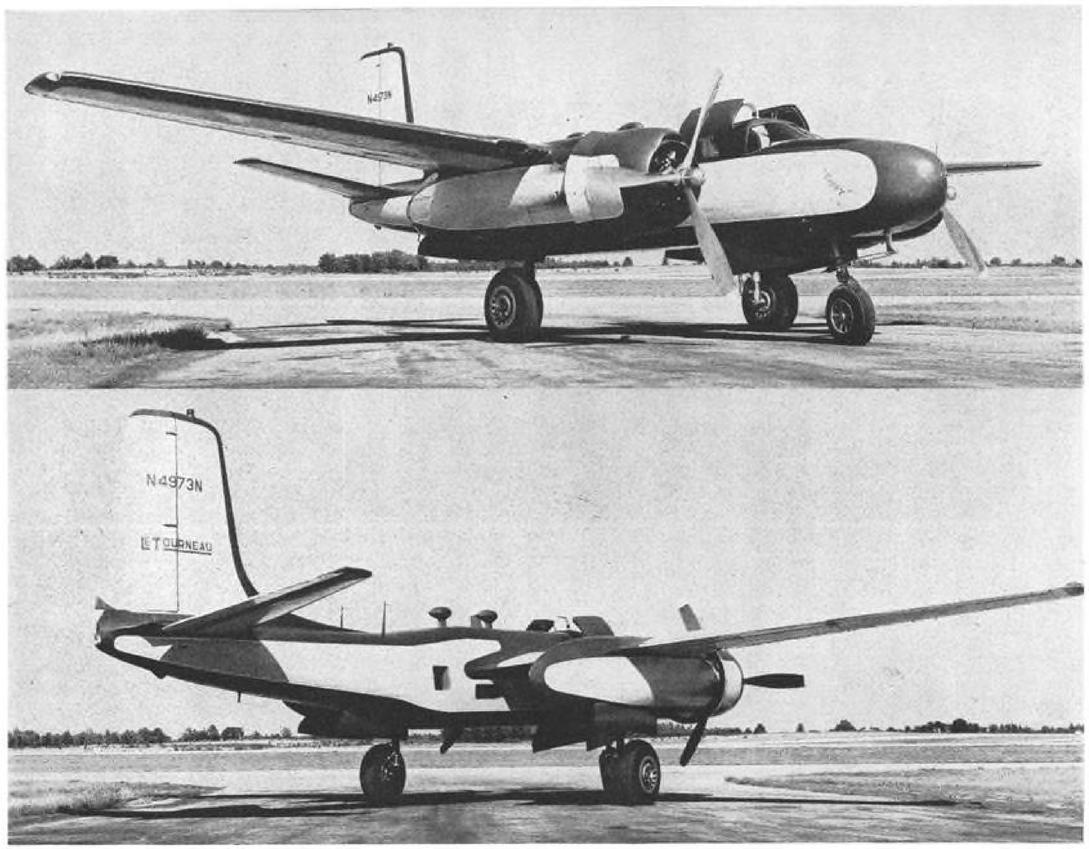
Bell Helicopter Corp., Fort Worth, Texas, 56 man-months of field engineering services for helicopters, NOas 59-4053-s(MA-60-760-59), $91,679.

Cornell Aeronautical Laboratory, Buffalo, N. Y., tests to determine negative longitudinal static margin effects on airplane flying qualities, NOas 59-6080-c(AD-32-4924-59), $74,023.

The Ryan Aeronautical Co., San Diego, Calif., fabricate and furnish AN/APN-67 model 114 converter kits, NOas 59-4082-f (AV-45-2734-59), $116,000.

Hoffman Laboratories Division, Hoffman Electronics Corp., Los Angeles, Calif., rework of An/ARN-21 equipments, NOas 59-0231-f(PD-32-1488-58), $3,075,181.

Burroughs Corp., Detroit, Mich., 120 man-months of field engineering services for aircraft electrical and electronic equipment, NOas 59-4062-s(,A-60-863-59), $77,203.



B-26 CONVERTED for executive use by R. G. LeTourneau, Inc. Note in front view insulated metal roof that has been installed in the cockpit hatch cover to protect the pilot. The conversion has a narrow cabin window under the wing (see rear view) and a square window aft of the wing which also serves as an escape hatch.

LeTourneau to Offer B-26 Conversion

By Craig Lewis

Longview, Texas—R. G. LeTourneau, Inc. marks a growing, diverse capability in the field of commercial aircraft overhaul and service here at LeTourneau Air Center by Offering business companies an executive version of the Douglas B-26.

LeTourneau's B-26 conversion is based on its own extensive operation of the World War II bomber as an executive transport. Company has converted three aircraft and still uses two of them to service LeTourneau activities in the U. S., as well as in West Africa and South America.

This conversion program is part of a growing aviation activity operated by a company that is basically a manufacturer of heavy equipment for construction, petroleum, logging and other industries. LeTourneau's fixed base operation here has developed gradually from the shops set up to service the company's executive aircraft, and it now does a wide variety of overhaul, maintenance and service jobs.

Weight Removal

LeTourneau's B-26 conversion program involves no basic structural changes in the military version. It is largely confined to removing armor and other unneeded military weight and to refining the basic airplane into a passenger configuration. LeTourneau B-26 retains the large rear wing spar of the military version.

After conversion, the B-26 has an empty weight of 22,000 lb. and a gross weight of 35,000 lb., providing a 13,000 lb. useful load. Maximum speed is 400 mph. and cruise speed is 315 mph. with the Pratt & Whitney R2800-75 engines and Hamilton Standard propellers which are standard on the B-26. Stall speed is 105 mph.

Absolute ceiling is 30,000 ft. and service ceiling is 25,000 ft. Normal flights cruise at altitudes lower than this, but LeTourneau needs the capability in its own operation in order to fly over the Andes in South America. Since the aircraft is not pressurized, oxygen masks are provided at each seat.

The company operates two different versions of its executive B-26. The long range version can fly 3,000 mi. with a 45 min. reserve, and the medium range airplane has a range of 2,100 mi. with a one hour reserve. Fuel capacity of the military B-26 has been increased by adding tanks in the wings. Medium range version carries 1,350 gal., and the longer range airplane, with a tank in the fuselage center section, carries 1,700 gal.

Interiors vary according to the airplane's range. Aft of the wing spar, the cabin is 10 ft. 4 in. long, 45 in. wide and 64 in. high. There are two seats across the back and two seats along one side. Each of these two side seats can be folded out to make a three-person couch in a high density configuration. With no fuel tank in the wing center section of the medium range version, space is available for a two-person couch forward of the rear wing spar.

Since the B-26 is a high mid-wing airplane, the rear wing spar cuts directly through the fuselage and splits the fuselage area available for cabin use. LeTourneau has decided to accept this space penalty in order to retain the strength originally designed into the wing structure.

A passenger seat is also available in the cockpit forward of the wing. Both of the two LeTourneau aircraft retain the single pilot cockpit configuration of the military version, although the company expects to install a copilot control station in future aircraft. Very little technical change has been made in the cockpit area, although the bare control, electrical and other systems have been covered with upholstered paneling. B-26 can be equipped with radar if a customer wants it.

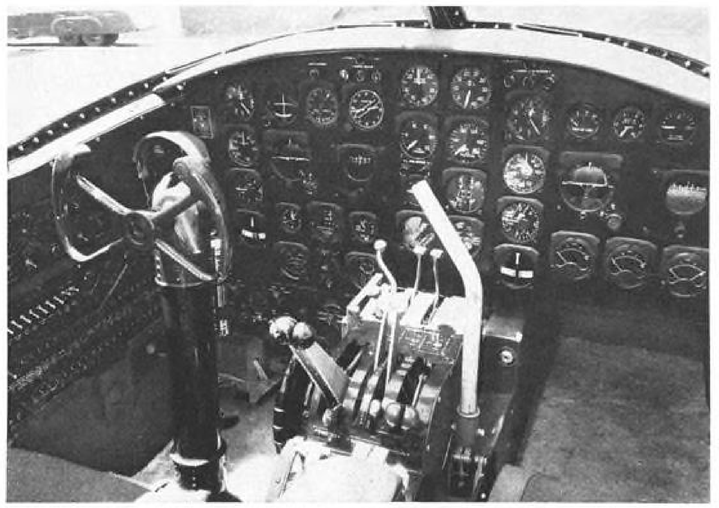
Cabin Stair

The cabin is entered through a hydraulic stair door which is in the fuselage floor under the wing, providing access to both the passenger cabin and the forward cockpit. The cockpit can also be entered through hatches which form the top and sides. Insulated metal roof has been installed in the cockpit hatches to protect the pilot.

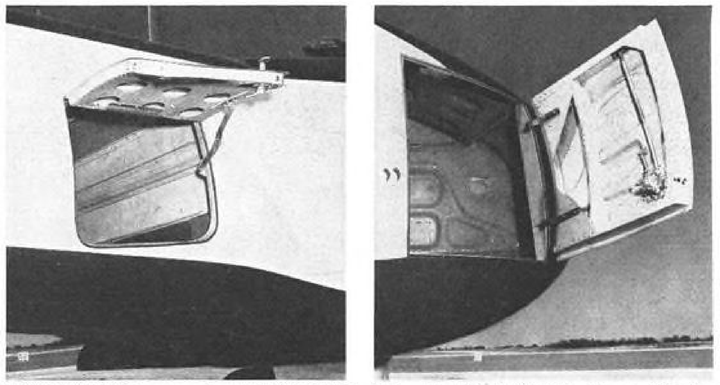
In converting the military airframe, LeTourneau cuts out unnecessary metal, lowers the floor in the old bomb bay area 3 in. to improve cabin headroom and moves the rear bulkhead back about 18 in. to increase cabin length. The fuselage is completely reskinned, and fuselage strength is maintained by increasing skin gage where changes have been made in the military structure, according to W. E. Myers, manager of the aviation division. Two windows are installed in each side, with the rear starboard window also serving as an escape hatch.

Baggage is carried in a nose compartment and in a compartment aft of the passenger cabin. Air conditioning system is aft of the rear baggage compartment. Since ram air is difficult to control at B-26 speeds, the LeTourneau airplane is cooled and heated completely by blowers, and there are no airscoops on the fuselage.

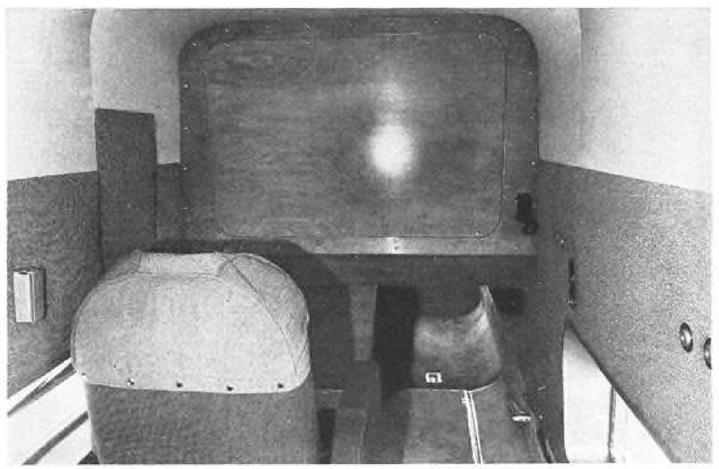
Cost of the converted B-26 can range



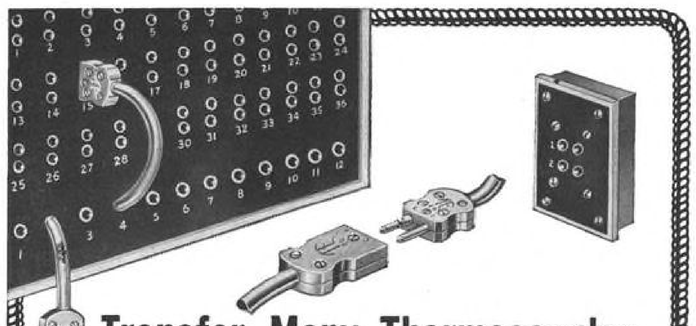
COCKPIT in the LeTourneau B-26 has the original single pilot configuration, but LeTourneau expects to install a copilot station in future conversions.

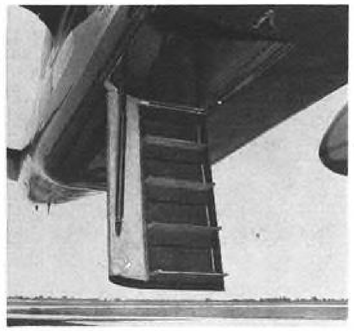


REAR BAGGAGE compartment (left) is behind the aft cabin bulkhead. Air conditioning system is behind this baggage compartment. Baggage capacity is also provided in this nose compartment at right.



REAR WING SPAR carry-through shown here covered by wood paneling, cuts into cabin space, but LeTourneau accepts the penalty in order to retain the strength originally designed into the wing structure.





HYDRAULIC stair hatch retracts into the fuselage under the wing center section.

from $125,000 to $250,000 or more, depending on the interior and equipment ordered. This cost is in addition to the price of the military B-26, but an adequate supply of the aircraft are reported available for $2,000 to $4,000. The conversion job will take a minimum of 60 days.

LeTourneau has two military B-26s available for conversion now. The company will take an order for a new conversion or will sell one of its own aircraft, probably for about $175,000, and start work on a new aircraft for its own use. Hobson E. Tune, LeTourneau aviation administrator, says the company is discussing conversions with several interested prospects and has now decided to offer the airplane generally to the executive aircraft market.

Aviation Activity

LeTourneau launched its aviation activity in 1935 when the company started using Waco biplanes for executive transports. Various aircraft have been used since then, and LeTourneau has developed its own capability for overhauling and modifying them.

The first B-26 was converted just after World War II, and LeTourneau operated the aircraft for three years to explore its possibilities before dressing the interior. The original conversion crashed a few years ago in a takeoff accident, but two other B-26s have been converted and are now in use by the company. Most of the work crew that did the original job is still working at LeTourneau Air Center.

Through this period, the company has established an airframe overhaul facility and does its own metal forming and painting. LeTourneau also has a radio shop and an upholstery shop, and the interiors for B-26 conversions will be done here. Lack of an instrument shop makes instrument work the only aspect of aircraft overhaul, maintenance and service that is subcontracted to an outside firm.

An engine overhaul shop has been developed, and LeTourneau overhauls the R2800s from the B-26s, as well as several smaller engines. Company has an engine test cell adjacent to its overhaul shop. Bids have been entered on some government engine overhaul contracts, and the award of a contract would mean an expansion program for the air center layout.

LeTourneau has been gradually moving into commercial aviation as a fixed base operator for the past year and a half. Now the company is thinking of setting up an aviation sales organization, although no final decision has been reached. Along with the overhaul, modification and service work, a charter service is operated with Cessna 172, Beech Bonanza, Lockheed 12 and Piper Apache aircraft, and a Lockheed Lodestar will joint the fleet later this year.

Another company activity, the LeTourneau Technical Institute, is now turning out A&E mechanics and is starting a flight school.

PRIVATE LINES

First of three Beech L-23F Twin-Bonanzas, featuring an enlarged fuselage having conventional airstair entrance door behind the left wing, has been turned over to U. S. Army for evaluation at Ft. Rucker. Third unit is expected to be delivered early in March.

Withdrawal of the American Association of Airport Executives from the General Aviation Council (formerly General Aviation Facilities Group) was made official by AAAE's board in a letter to the council, stating that the airport executives group felt that since its organization deals with scheduled airlines industry and military as well as general aviation, it should be in a position to deal directly and independently with FAA and other agencies.

Southwest Airmotive Co. reorganized its parts distribution system and expanded operations with opening of new offices in Houston, Texas, and St. Louis, Mo. Distribution now is split in two regions; Kansas City office is headquarters for the midwest region including Denver as well as the new office at Lambert Field, St. Louis. New operation at Houston Municipal Airport is included in the southwest region with headquarters in Dallas.

Supplemental type certificate has been granted Fulton Conversion Co.'s modification of Cessna 170A and 170B to 190-hp. Lycoming 0-435-C engine and Hartzell controllable pitch propeller. Field installation kits of the conversion have been developed by the Southbury, Conn., company.

Wisconsin Bank Buys, Operates Bell 47J

BELL 47J bought by First Wisconsin National Bank of Milwaukee is piloted by Robert Roth.

Ft. Worth—First Wisconsin National Bank has bought a helicopter for executive transportation which is also expected to speed services for member and correspondent banks served by the Milwaukee financial institution.

Bell Model 47J flown away from the Bell helicopter plant early this month by First Wisconsin National Bank's pilot Robert A. Roth is the bank's first move into the aviation field, and Roth said it is the first commercial helicopter to be operated in Wisconsin.

Primary reason for buying the Bell machine was to furnish efficient transportation for First Wisconsin executives in the territory served by the bank and to do other functional chores, such as surveying real estate.

Public relations impact on customers is another factor, and the helicopter may be used occasionally in such public services as helping the police unsnarl traffic jams.

Executive Transport

A bank spokesman said the Bell 47J will be primarily utilized for executive transport at first. Later uses may involve a check clearing service for the bank's five member banks and correspondent banks, but firm plans for this service have not been made.

The helicopter, he said, will be available for "emergency banking services," involving transportation of personnel, documents and, in some cases, cash. The bank, he added, serves nearly every community in Wisconsin. Such services can be coordinated with executive trips.

At times, other banks develop an unexpected need for bills of a certain denomination, and the First Wisconsin will be able to supply them quickly with the helicopter.

PILOT Roth was hired by the bank to set up an aviation department and to fly the 1959 model Bell Ranger.

Most of the banks served lie within a 200 mi. radius of Milwaukee, although some are more than 300 mi. away. With these distances, the bank can use the added range on the 1959 model 47J it bought. First Wisconsin machine was the first to be delivered with the larger tanks Bell has added as an option to extend range by about 40%. Usable fuel supply is 47.5 gal. New model also has metal blades.

When the bank was investigating the use of business aircraft, it decided the helicopter was the answer to its needs because its relatively limited service area didn't require the speed of a fixed-wing aircraft and because a lack of airports in certain areas makes the helicopter more practical. When the decision was made, the bank hired Roth, who has flown for Chicago Helicopter Airways and Helicopter Airlift, to set up its aviation department and fly the Bell machine.

First Wisconsin operation will have to use airports until heliports are available in the various communities served. Some missionary work will be needed to develop a heliport system in the area, but Roth said Milwaukee and state authorities are interested and "eager to help."

In Milwaukee, the helicopter will operate from a lakefront site eight blocks from the bank. There is no heliport in the city but the bank is thinking of building one on the lakefront site or, preferably, in the downtown area. If it does, a mechanic will be hired, and Roth expects to establish a Bell service station in anticipation of new helicopter operations that may come into the area. Meanwhile, Roth will do the running maintenance on the bank machine and will store it at Timmerman Field.

Pressurization Mod Developed for B-26

Pressurization modification for Douglas B-26 executive plane has been developed by Lockheed Aircraft Service, Inc. Program involves enlarging and strengthening the fuselage, adding airstair door, picture windows, lengthened nose, wingtip tanks and cabin interior. Modification provides empty weight of 24,892 lb., takeoff weight of 35,000 lb. and disposable load of 10,108 lb. With Pratt & Whitney R2800 engines of 2,400 hp., pressurized B-26 will have a cruise speed of 375 mph. and maximum range of 2,500 stat. mi.

WHO'S WHERE

(Continued from page 23)

Honors and Elections

Dr. Alan Lovelace, a senior project engineer at the Air Research and Development Command's Wright Air Development Center, has been named a recipient of the Arthur S. Flemming Award, presented annually to young men in the federal service in recognition of outstanding accomplishments, achievements, or distinctive work. . . . Also named recipients of the Flemming Award are **Wilson A. Maxim,** an Air Force supervisory meteorologist at ARDC's Wright Air Development Center, and **Douglas J. Wilcox,** head of the Underwater Ordnance Department of the U.S. Naval Ordnance Test Station, Pasadena, Calif.

C. N. Sayen, president of the Air Line Pilots Assn., has been appointed to the National Aeronautics and Space Administration's Committee on Aircraft Operating Problems and the Long-Range Planning Committee of the Radio Technical Commission for Aeronautics.

Changes

Dr. Robert E. Roberson, director of advanced space guidance, Systems Corporation of America, Los Angeles, Calif.

Long Beach Division, Douglas Aircraft Company, Inc., Long Beach, Calif., has named the following assistant chief engineers: **Lewis Teel** for military transports, and **John Ryan** for combat aircraft, missiles and support systems.

Ralph L. Bayless, director of engineering-California and Texas operating divisions, Convair Division of General Dynamics Corp., San Diego, Calif. **William W. Fox,** succeeds Mr. Bayless as chief engineer-San Diego Division, and **Richard P. White** succeeds Mr. Fox as assistant chief engineer of the division.

Jennings David, director of engineering, and **Philip A. Henning,** chief engineer, Summers Gyroscope Co., Santa Monica, Calif.

Harry R. Wege, general manager, newly established Missile and Surface Radar Division, Radio Corporation of America, Moorestown, N. J. **Arthur N. Curtiss,** manager of the West Coast department of the Missile and Surface Radar Division, Los Angeles, Calif.

Dr. George D. Sands, director of scientific requirements, The Martin Co., Baltimore, Md.

K. D. Garnjost, chief engineer, Moog Valve Co., Inc., East Aurora, N. Y.

W. H. Jaeger, corporate engineering and planning representative at Huntsville, Ala., for North American Aviation, Inc., Los Angeles, Calif.

Harold E. Brown, marketing manager, Aircraft Instrument Product Section, Instrument Department, General Electric Co., West Lynn, Mass.

William A. Statler, chief advanced systems research engineer, California Division, Lockheed Aircraft Corp., Burbank, Calif.

S. Paul Schackleton, staff scientist-preliminary design planning-radar and communications systems, Research and Development Division. The W. L. Maxson Corp.,

New York, N. Y. Also appointed to the Research and Development Division's scientific staff: **Norman Potter,** to lead systems and preliminary design programs-electronics warfare.

Kingsley C. Drone, chief engineer, Aircraft & Missile Division, Clearing Machine Corp., a division of U. S. Industries, Inc., Chicago, Ill.

Dr. Willard R. Sittner, manager, Sperry Semiconductor Division, Sperry Rand Corp., South Norwalk, Conn.

J. B. Cowen, manager of administration, Solid Rocket Plant, Aerojet-General Corp., Sacramento, Calif. **I. C. Sleight** succeeds Mr. Cowen as manager of manufacturing.

Robert T. Harding, assistant chief engineer, Product Design Department, Arma Division, American Bosch Arma Corp., Hempstead, N. Y.

Dr. Arthur C. Gilbert, assistant program director, AN/AMQ-15 Air Weather Reconnaissance Program, Bendix Systems Division, Bendix Aviation Corp., Ann Arbor.

Anton Johnson, assistant head, Weapon Systems Design Department, Cornell Aeronautical Laboratory, Buffalo, N. Y.

Eitel-McCullough, Inc., San Carlos, Calif., has announced the following appointments in the Marketing Division: **John R. Quinn,** manager-customer services department; **Fred A. Speaks,** assistant director, marketing; **William H. McAulay,** assistant director, marketing for application engineering; **George M. W. Badger,** manager, research and engineering.

D. M. McDowell, director of engineering, Roots-Connersville Blower Division of Dresser Industries, Inc., Connersville, Ind.

Albert W. Powers, manager of customer service, Del Mar Engineering Laboratories, Los Angeles, Calif.

William J. Seevers, director of defense contracts, Buffalo Hydraulics Division of Houdaille Industries, Inc., Buffalo, N. Y.

Jules M. Kleinman, unit supervisor-heavy ground radar systems, Hoffman Laboratories Division, Hoffman Electronics Corp., Los Angeles, Calif. Also: **S. W. Hedrick,** manager-field engineering, and **Keith S. Miller,** manager-service operations, for the Division's field service department.

Henry M. Taylor, manager-military marketing, Electronics Division, Stromberg-Carlson, a division of General Dynamics Corp., Rochester, N. Y.

E. T. Clare, support service manager, Convair (Astronautics) Division of General Dynamics Corp., San Diego, Calif. **Sam L. Ackerman** succeeds Mr. Clare as senior project engineer-Atlas airborne systems and the Azusa, Calif., office. **Donald F. Folland** succeeds Mr. Ackerman as senior electronics group engineer-trajectory measurement and radiation control.

Daniel R. McAuliffe, central section product manager, International Aerocoustics Division, Industrial Acoustics Company, Inc., New York, N. Y. Also: **Harold R. Mull,** Northeast region product manager.

Dr. William Bloom, manager of program planning, Link Aviation, Inc., Binghamton, N. Y.

Norman H. Holt, reliability coordinator, Aeronautical Division, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

W. R. Clay, assistant manager of engineering, Radioplane, a division of Northrop Corp., Van Nuys, Calif.

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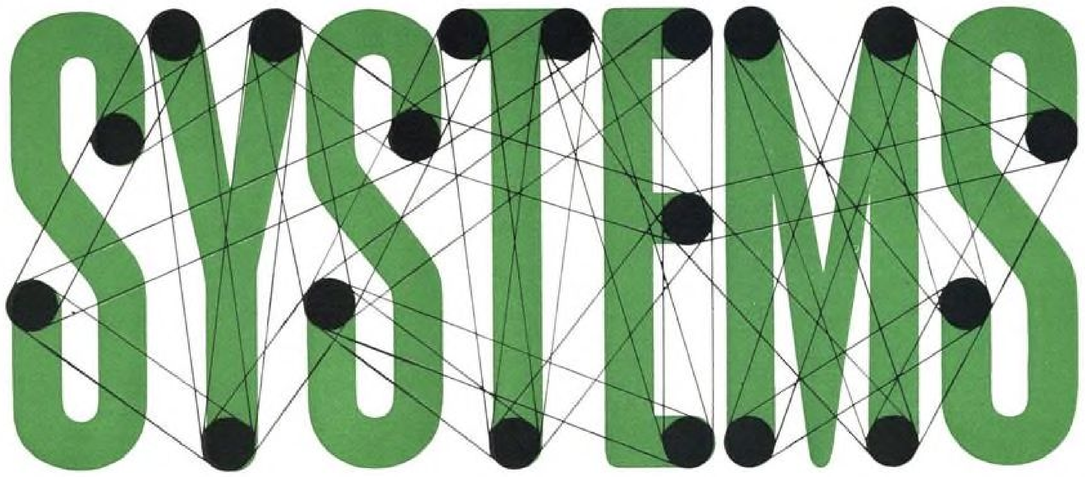

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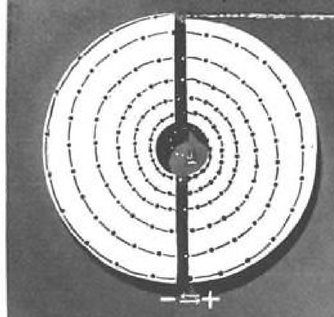

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ADVERTISERS INDEX

LETTERS

Pilot Responsibility

Boy, I'll bet you are braced for the brickbats (airline pilot editorial, "Rewards and Responsibility," Feb. 16). But from me you get only the "21 gun salute." You took the words right out of my mouth. I heard more "amen's" from that editorial than I did in church this morning.

EXPERIMENTAL TEST PILOT
Seattle, Wash.

I think R. Hotz has a hell of a nerve writing an editorial on pilot responsibility when he in turn is completely irresponsible in the language and facts he uses in said editorial. In reference to the CAA check of Northeast Airlines' pilots, one having only the "foggiest notion," another experiencing "extreme difficulty," and the other nine poor souls being "too deficient," etc., if my memory serves me correctly, being one of the company check pilots who assisted the CAA, not only was Mr. Hotz not present on these checks but nowhere on the check forms do these phrases exist. Consequently, I can't imagine where a supposedly responsible editor takes it upon himself to use irresponsible facts and language in describing a professional pilot's group ability or lack of ability. These "foggy," "shocking" and "deficient" men have many thousands of successful hours as pilots in command.

Now let's face it, a pilot's ability is a relative thing based upon the man's judgment who is checking him, which in turn is based upon a minimum standard set by both company and CAA. Now five of the nine Northeast pilots, mentioned in the editorial, were satisfactory to the CAA but were recommended for further training by company check pilots to increase their proficiency. We were also informed unofficially by the CAA that the Northeast Airlines' pilot check proved this group to be well above industry average as far as pilot proficiency is concerned.

So again, in trying to be cute and glib in making a point editorially, how about showing more responsibility and respect for both facts and language used.

CAPT. M. J. SHEEHAN
Northeast Airlines

I have just read your very excellent editorial "Rewards and Responsibility" (AW Feb. 16, p. 21). This is one of the finest editorials I have ever read and I should like to suggest that a copy be put into the hands of every airline pilot in the country for his sober consideration.

Congratulations.

B. J. VIERLING
Aircraft Supply Co.
Washington, D. C.

Your editorial "Rewards and Responsibility" (AW Feb. 16, p. 21) about pilot duties and pay, and Capt. Robson's article in the same issue (p. 43) about the Electra crash at LaGuardia, made me refer again to the Feb. 9 issue. I was looking for answers.

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.

The Feb. 9 AVIATION WEEK had your editorial "The Cost of False Economy" and Robert Stanfield's news story on the same accident (p. 38). I still have the questions.

You blast the pilots, their attitudes, state of their proficiency, and their union approach to their problems. Also, you broiled the CAA and FAA for inadequate facilities. However, you left management and regulations out of it. Some of the things you say about pilots may be justified, but I don't buy all of it.

Pilots are not apt to perform well on maneuvers and procedures which they do not practice. This has nothing to do with their pay, their union, their native ability, or their intelligence. It does, however, have something to do with the amount of training and practice that may be afforded them.

It is not my business to defend airline pilots, but I believe they are restricted by safety regulations not to practice hooded instrument flight or simulated emergency flight techniques with passengers aboard. It is possible for pilots to make several round trips on a transcontinental run and scarcely make a 180 deg. turn.

This can build flying time, but it can also lead to false security with regard to genuine proficiency in all phases of a pilot's profession.

So it is important that pilots have frequent opportunity to practice and be checked on phases of flying not encountered on routine flights. Sometimes I wonder if all airline pilots really have enough opportunity for this. The records can show many cases where pilots have brilliantly responded to emergencies. Then there are also the CAB accident reports with their conclusions of pilot error.

You recommend (Feb. 16) reading the CAB report about the Braniff accident at Miami, as an example. I had almost written to AVIATION WEEK, CAB, or somebody about what I thought to be an unfair slant and innuendo in that report.

Investigators had dug into the pilot's old flight check records to discover that the pilot had had a previous difficulty in holding altitude in performing instrument flight turns. However, that was corrected by rechecks (practice). Later on the report offered the thought that the pilot's earlier difficulty returned causing him to crash while preoccupied with a fire aboard.

Indeed, a reader might wonder if this 20,000 hr. pilot, with an otherwise good record, should ever have been allowed to remain in the business because of his difficulty with turns in some old flight check.

My thought about this is that pilots can get rusty on some things if they do not have frequent opportunities to practice the emergencies. Of course, the economics of operating large transports without payload so that pilots can practice could have something to do with it.

Capt. Robson's sincere and heartfelt comments on the Electra tragedy undoubtedly point to causes of the accident as it was allowed to happen. Also, Richard Sweeney's comment that "most crashes are the result of many little things reacting cumulatively" (AW Feb. 16, p. 37) speaks for itself.

However, a few facts from Robert Stanfield's story seem to stand out to point out why this accident should not have been allowed to happen. He mentions that the captain was a ". . . veteran with about 28,000 hr. of logged pilot time. He had slightly more than 40 hr. time on the Electra, including five scheduled New York-Chicago round trips."

Other organizations have discovered that a pilot's first 100 hr. in new type equipment are the most critical. This basic fact of a pilot's life should not reflect upon his ability. It should, however, put the airline, the FAA, and the pilots on their guard.

My question is why did management and FAA allow a pilot in the early stages of habit formation in new, fast equipment to operate in such a "dangerous hole" as the back course of LaGuardia ILS with such low minimums? The pilots getting the first 100 hr. could have been restricted. Later on other pilots could get their experience flying with ones that had already acquired it.

Also there is the question in my mind whether pilots are always to blame because management cannot afford more extensive and comprehensive training.

Perhaps someone should think up a way for the government to subsidize, guarantee, and directly provide airline pilots with proficiency practice and checks so that it would be a thing apart from the necessity to operate a business at a profit.

ROBERT E. TRIMBLE
Washington, D. C.

While I am a rank amateur, I've been very close to pilots and flying for many years, working with ALPA, with individual pilots, with the Flight Safety Foundation, with some of the members of the CAA including tower operators in Finland, Australia, New Zealand, etc., so I have more than the average interest and a wee bit more than the average knowledge of what's going on.

In view of this, I would like to congratulate you on your excellent editorial in the Feb. 16 issue of AVIATION WEEK. I know from personal conversation with pilots that the good dedicated pilot is just as concerned about the problem of some pilots with two jobs, one flying and one commercial, and pilots with too much time on their hands are liable to have a too casual approach, as you put it, to the task of operating their aircraft especially the new jets.

Is there any possibility of getting reprints of this excellent editorial which I would like to put in the hands of interested parties, not people who are "agin" the dedicated pilot, but people who are concerned. Again congratulations.

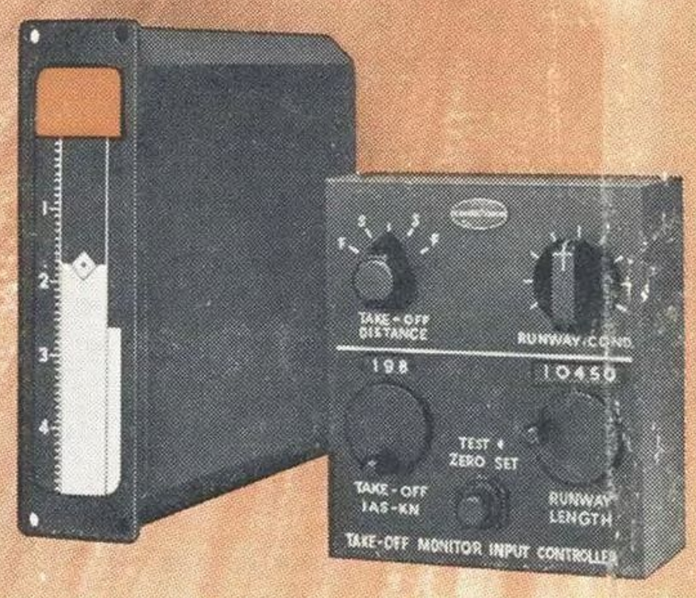
HEDIE S. KUHN, M.D.
Hammond, Ind.

THE KING OF AIR FIGHTERS

Spinning crazily, the S. E. 5a fell from the sky, followed closely by a German Pfalz. At 5,000 feet, the Hun flattened out to watch the crash. Instead, the S. E. 5a pulled out in another

(Continued on page 54)

COMMAND DECISION ON TAKE-OFF



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