Aviation Week

Including Space Technology

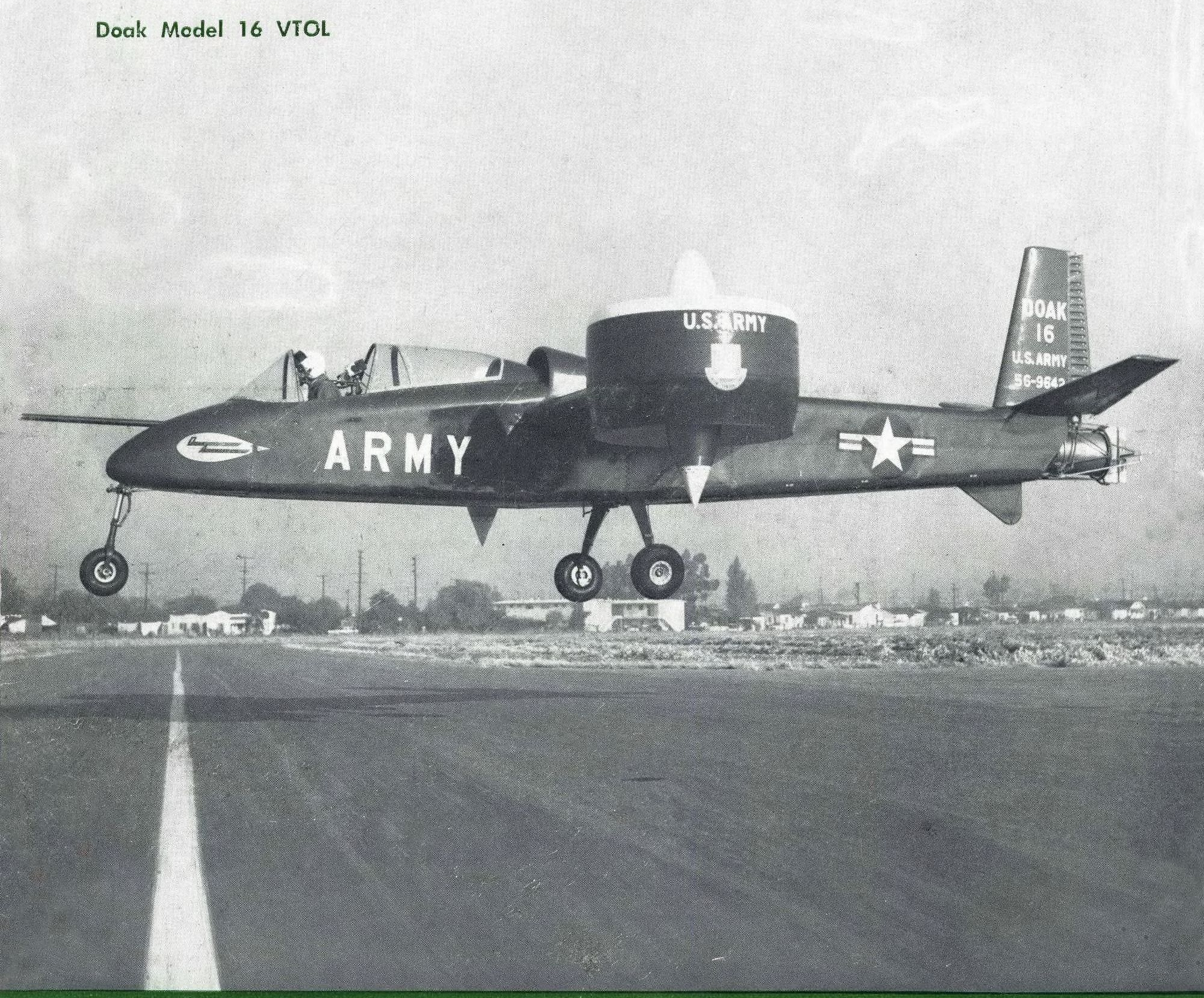
75 Cents

A McGraw-Hill Publication

November 3, 1958

Navy Unveils Low Cost Sounding Rocket

Doak Model 16 VTOL



Meteor-Burst Avionics Resists Jamming

ORDNANCE CAPABILITY

Today, the Ordnance Group at Rheem's Defense and Technical Products Division is hard at work on missile warhead systems, fuse systems, ballistic and lethality studies, explosives research, and mines and mining techniques. Current work for Redstone and Picatinny Arsenals, Army Ordnance, and the Navy Bureau of Ordnance includes research, development, production, loading and testing of missile warheads. To supplement ordnance engineering and production facilities at the Division's main plant at Downey, California, a separate Ordnance Loading Facility was built by Rheem in 1958.

Current work projects and expansion programs ensure that the Rheem Manufacturing Company will continue to maintain the leadership in ordnance research, development, and production that it has held for the past sixteen years. During World War II and the Korean Campaign, millions of shell cases, projectiles, anti-tank and anti-personnel mines, and depth-charge cases poured forth from Rheem plants to our far-flung front lines. New Rheem-developed manufacturing processes like the "hot cup cold draw" significantly increased production volume and decreased costs. For full particulars on Rheem ORDNANCE CAPABILITY, write for *Data File AW-587-1.*

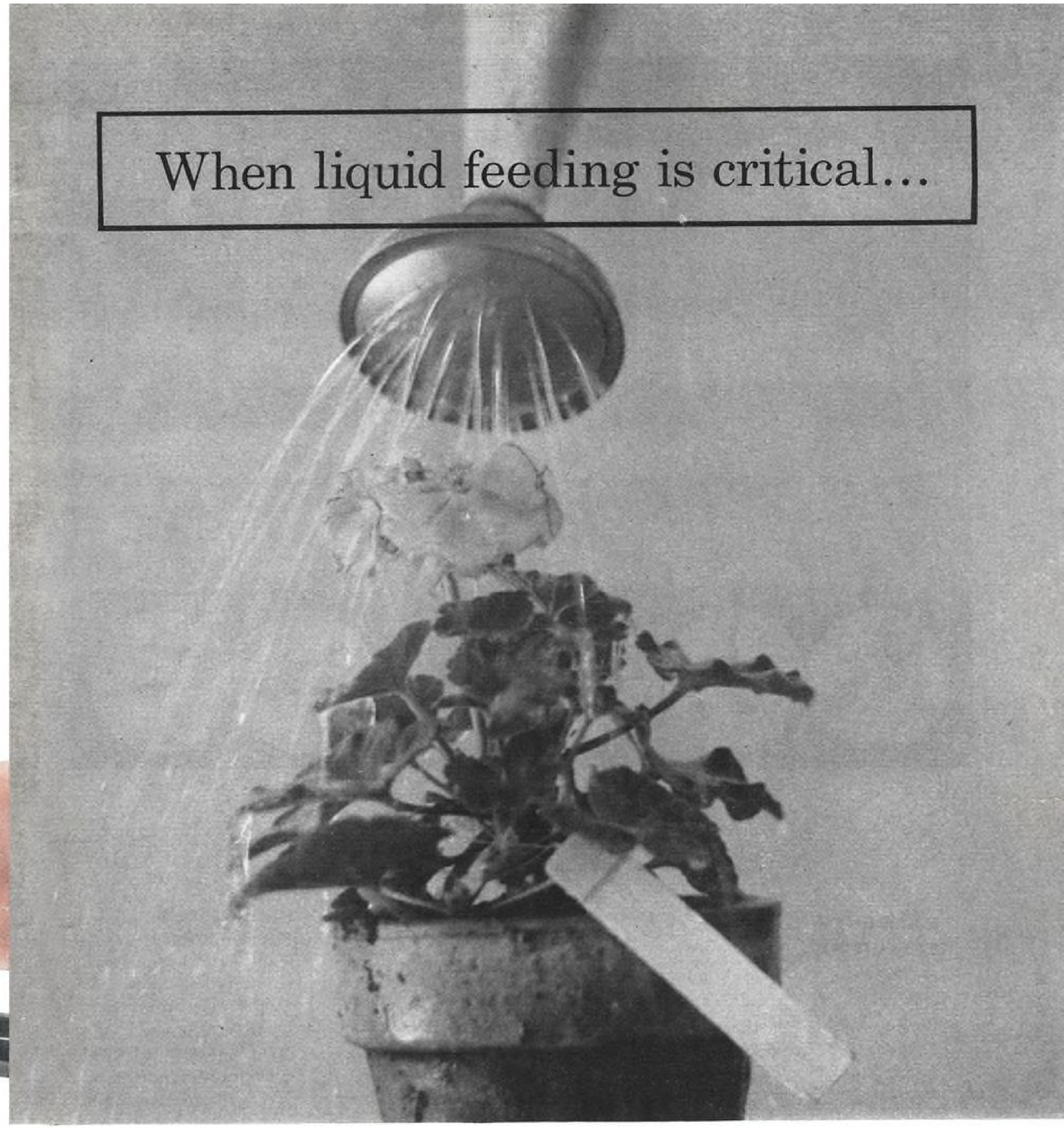
Typical example of Rheem's depth in ordnance: Rheem-developed Super Nike warhead system being tested on rocket sled also built by Rheem.

RHEEM MANUFACTURING COMPANY
Defense and Technical Products Division
11711 woodruff avenue, downey, california

Rheem

29-57

When liquid feeding is critical...



The flow of fluids, precisely controlled and regulated, means life or death...in an airborne system, too. LOX, Avgas, JP-4, alcohol, water—or-what-have-you—the right amount must reach the right spot at the right moment. To do this may require a valve, a pump, a regulator, a hydraulic or electrical motor—or a complex system requiring any or all of these components. Whatever the answer, it must be reliable.

At Hydro-Aire the liquid feeding of airborne systems has been food for thought for more than 15 years. Many a complex fluid control problem has been well digested by our outstanding test and development laboratories. Right now thousands of Hydro-Aire products are handling tons of operational fuel. How about feeding us *your* requirements?

HYDRO-AIRE
BURBANK, CALIFORNIA
Aviation Subsidiary of CRANE
Anti-Skid Braking Systems • Fuel System Controls • Pneumatic Controls • Actuation Systems Electronic Devices

PRODUCING CONTROLS FOR EVERY BASIC AIRBORNE SYSTEM

SARGENT

SERVO-SYSTEMS OF FORCE CONTROL

With 38 years acceptance Sargent builds precision linear and rotary hydraulic, pneumatic, mechanical and electronic systems of force control to meet successfully the increasingly high requirements of marine, aircraft, missile, petroleum and industrial use. From original idea to finished product – SARGENT.

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Testing	Inspection	Hydraulic Actuators	Pneumatic Valves
Qualifying	Assembly	Hydraulic Valves	Ball Screw Actuators
			Gear Actuators
			Gear Accessory Boxes
			Electronic Systems

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HUNTINGTON PARK, CALIF.

"GOOD WILL" is the disposition of the pleased customer to return to the place where he has been well treated.
– U.S. Supreme Court

AVIATION CALENDAR

Nov. 9-12—13th Annual Convention and Logistics Forum, National Defense Transportation Assn., Sheraton-Jefferson Hotel, St. Louis, Mo.

Nov. 10—Aviators' Post 743 Veterans Day Dinner, Advertising Club, New York, N. Y. Principal speaker: Lt. Gen. Samuel E. Anderson.

Nov. 10-12—International Conference, Physics and Medicine of the Atmosphere and Space, sponsored by the School of Aviation Medicine, San Antonio, Tex.

Nov. 10-13—11th Annual International Air-Safety Seminar. Flight Safety Foundation in cooperation with Airways Modernization Board's National Aviation Facilities Experimental Center, Atlantic City, N. J.

Nov. 10-14—32nd Annual Convention, National Electrical Manufacturers Assn., Hotel Traymore, Atlantic City, N. J.

Nov. 10-21—12th Air Transportation Institute of the American University, Washington, D. C.

Nov. 11-14—19th Annual Convention, National Aviation Trades Assn., Pfister Hotel, Milwaukee, Wis.

Nov. 12-14—Eighth Aircraft Hydraulics Conference, sponsored by Vickers, Inc., Park Shelton Hotel, Detroit, Mich.

Nov. 12-14—1958 Annual Meeting, Society for Experimental Stress Analysis. Hotel Sheraton-Ten Eyck, Albany, N. Y.

Nov. 16-21—Conference on Scientific Information, Mayflower Hotel, Washington, D. C. Co-sponsored by USAF Office of Scientific Research, National Academy of Sciences, National Science Foundation and American Documentation Institute.

Nov. 17-18—Sixth Annual Aircraft and Missile Division Conference, American Society for Quality Control, Biltmore Hotel, Dayton, Ohio.

Nov. 17-21—13th Annual Meeting and As-

(*Continued on page 6*)

AVIATION WEEK Including Space Technology

November 3, 1958

Vol. 69, No. 18

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for measurement, telemetry, and control

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- ACCURACIES TO 0.1 F.
- 5 VOLT OUTPUT
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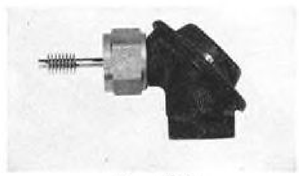
1300 Series



Type 2135

BULB TYPE for corrosive gases and liquids

1300 Series transducers are available in ranges from −400 F to +1832F, feature 1% accuracy, stainless-steel construction, and a time constant of less than 2.5 seconds in agitated liquid. Many standard and special bulb lengths are available.

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

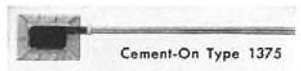
1350 Series

Type 1321

OPEN TYPE for non-corrosive gases and liquids

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

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



Cement-On Type 1375

Weld-On Type 1376

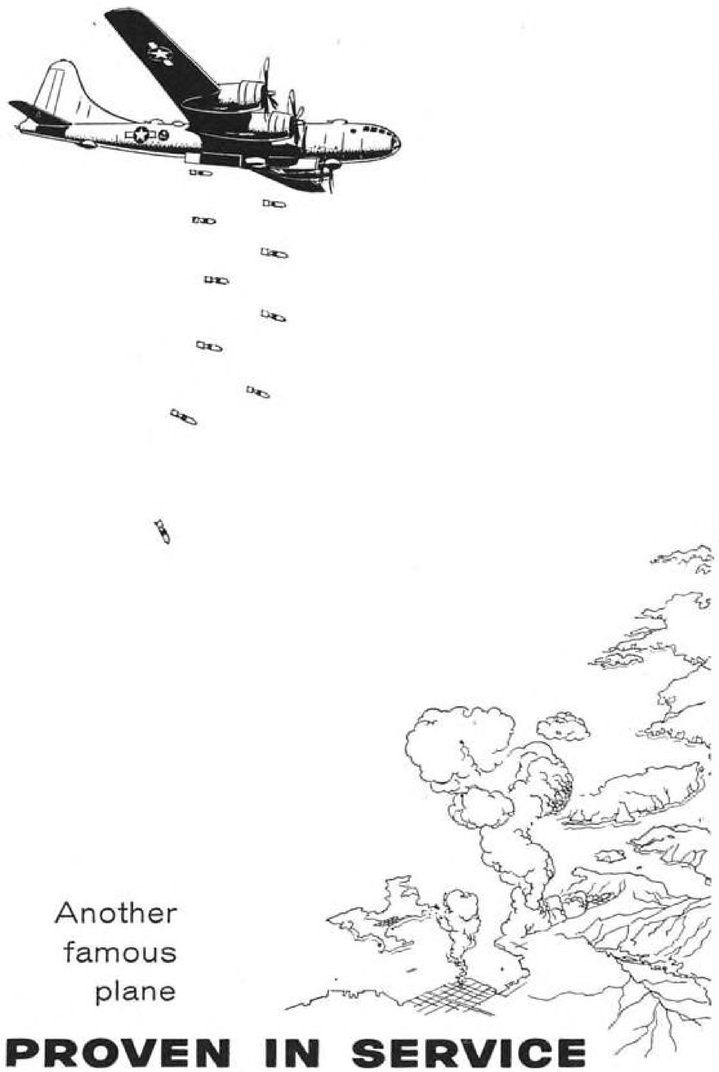
SURFACE TYPE for all kinds of surfaces

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

A five-point resistance-temperature calibration certificate at 0, ¼, ½, ¾, and full scale temperature is supplied with each transducer. Custom designs for all temperature transducers are available on special order with accuracies to 0.1 F. Write to Trans-Sonics, Inc., Dept. 7, Burlington, Mass. for Condensed Catalog on Platinum Temperature Transducers.

TRANS-SONICS

Precision Transducers



Another famous plane

PROVEN IN SERVICE

1944

Boeing B-29's Superforts begin strategic bombing of Japanese home islands, bombing 66 major cities, nine major seaport harbors.

Fourteen years ago, the B-29's bombing of Japan was headline news. Today, however, it is but one more memory of World War II.

Aviation has continued to make tremendous strides in the days since 1944.

And keeping pace with aviation's growth, Rockbestos high temperature wire and cable has earned a proven-in-service reputation.

ROCKBESTOS FIREZONE 101 WIRE

Typical of the many Rockbestos aviation wires which cover a temperature range from 257° to 750°F. is Rockbestos' FIREZONE 101, Fire Detection and High Temperature Low Loss Circuit Wire made in accordance with USAF specifications MIL-C-25038. Recommended for hot spot wiring for jet aircraft in and around the engine and after burner section of the ship, Firezone 101 is especially designed for high impedance circuits, making it ideal for guided missile usage.

For complete specifications on Firezone 101 and other Rockbestos aviation wires, write for catalog 56A. If you have a special requirement, please send us your specifications.

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AVIATION CALENDAR

(*Continued from page 5*)

tronautical Exposition, American Rocket Society, Hotel Statler, New York, N. Y.

Nov. 17-21—Eighth National Plastics Exposition, International Amphitheatre, and Plastics Conference, Hotel Morrison, Chicago, Ill.

Nov. 19-20—Northeast Electronics Research and Engineering Meeting, Mechanics Hall, Boston, Mass.

Nov. 19-21—32nd Meeting, Aviation Distributors and Manufacturers Assn., Statler Hilton Hotel, Dallas, Tex.

Nov. 21-22—Third Symposium on Magnetohydrodynamics. Lockheed Missile Systems Division's Research Laboratory, Palo Alto, Calif. Attendance by invitation.

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

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

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

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

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

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

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

Dec. 5-7—Annual Convention, Texas State Aviation Assn., Ft. Clark, Tex.

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

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

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

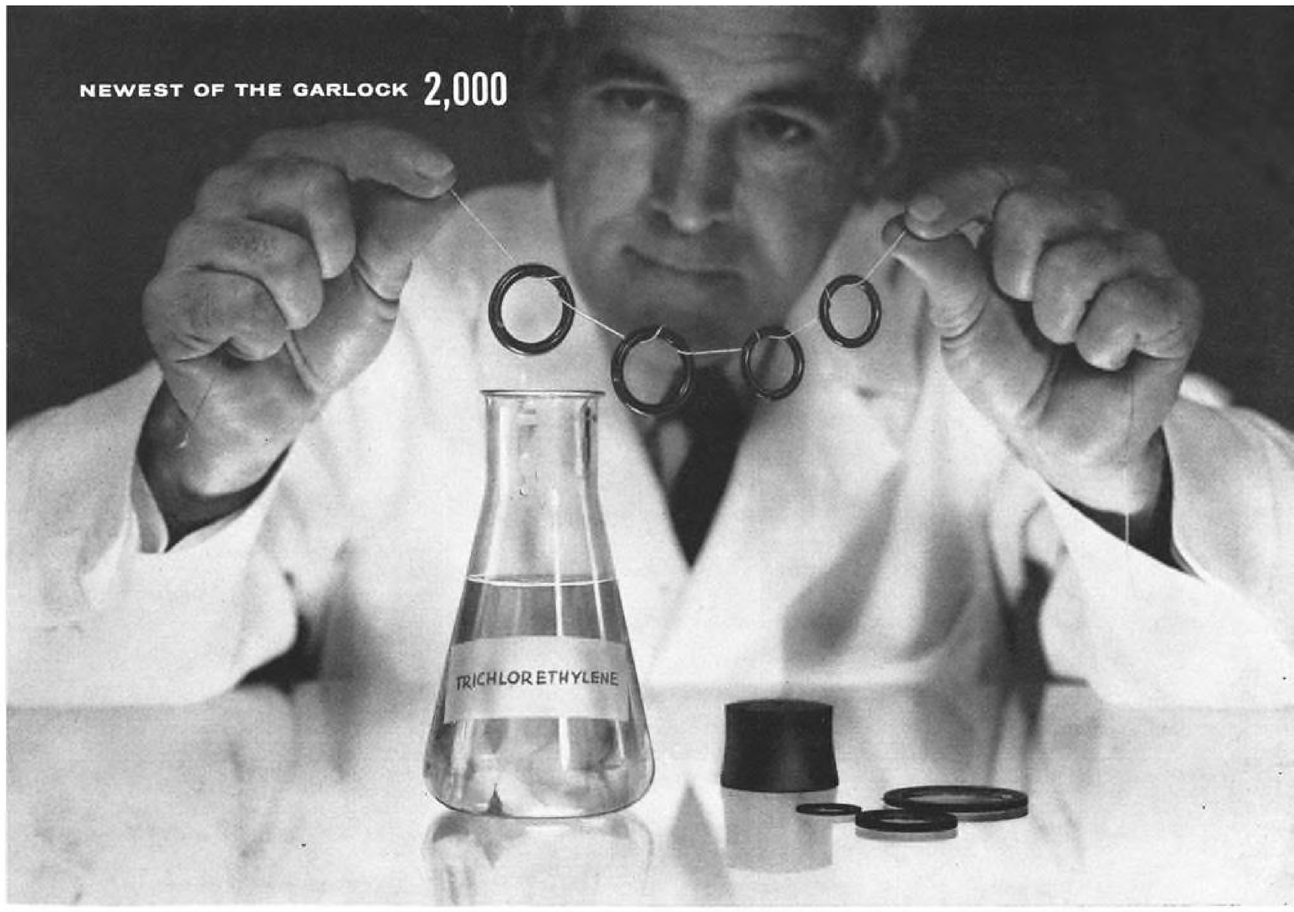
Dec. 27-30—Fifth King Orange International Model Plane Meet, Miami, Fla.

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

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

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

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



New Garlock Viton* Rubber Parts Offer You Low Swell in Solvents, Resistance to 600°F.

LOW SWELL, GOOD TENSILE STRENGTH DESPITE HEAT, SOLVENTS. Today's era of tremendous horsepower dictates that rubber be able to withstand not only corrosive fluids alone—nor high temperatures alone—but a combination of both. Garlock's new VITON rubber parts do exactly this. It's the only known rubber that will maintain low compression set, low swell, and good tensile strength in contact with most solvents at high temperatures.

IMMERSED FOR SEVEN DAYS. For example, Garlock VITON retains its duro, tensile strength, and elongation characteristics when immersed for one week in twenty of the most widely used—and perhaps harshest—solvents, lubricants, fluids, and acids on the market today. In the test illustrated two O-rings of ordinary Nitrile rubber and two rings of VITON were immersed in trichlorethylene; VITON (right) retained its original dimension—the Nitrile rubber (left) swelled almost 50%.

OVEN AGED AT 600° F. VITON can be oven aged in air at 600° F. for 24 hours, and at 400° F. for 2400. In both cases, it not only retains its excellent mechanical properties, but it remains usefully elastic, proving its value on either intermittent or continuous application.

OPENS MANY NEW USES. Jets and missiles are the more obvious applications for Garlock's new VITON (meets applicable military specifications for military aircraft, etc.). However, VITON is finding important new civilian uses as valve stem seals on truck engines, pump seals on automatic transmissions, and on gasoline pumps, thermostat bellows and domestic washing machines—practically any mechanical equipment where you need rubber parts which give maximum resistance to deterioration by liquid or heat.

VITON is also available as sealing elements in KLOZURE** Oil Seals, flexible members in MECHANIPAK** Mechanical Seals, "O" Rings, Cups, CHEVRON** Packing. VITON products are the newest of the Garlock 2,000 . . . two thousand different styles of packings, gaskets, and seals for every need. The only complete line. See your local Garlock representative, or write for further information.

THE GARLOCK PACKING COMPANY, Palmyra, N. Y.

For Prompt Service, contact one of our 30 sales offices and warehouses throughout the U.S. and Canada.

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GARLOCK

Packings, Gaskets, Oil Seals, Mechanical Seals, Molded and Extruded Rubber, Plastic Products.

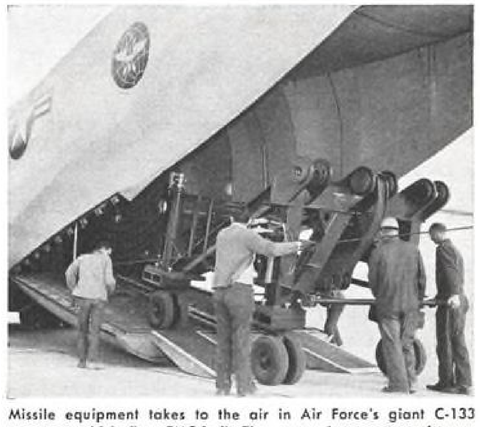
...speaking of
Missile Ground Support **MOBILITY**

NO JOB'S TOO TOUGH—WE DELIVER ON SCHEDULE

Take the case of the U.S. Air Force's (IRBM)—THOR missile project. FMC's design engineers developed the transporter-erector and launcher portion of the ground support equipment with Douglas Aircraft Company, Inc., prime contractor. The first units were engineered, manufactured and delivered in just eight months—2 months ahead of schedule.

FMC is not looking for "crash programs," but when the need arises, we go all out to meet deliveries. The delivery deadline for the THOR transporter-erector, launching base, and power-pack trailer was met because FMC handled the complete project—design, engineering, and production—with experienced people, at a single facility devoted exclusively to military equipment production. *Consult with FMC at the initial stage of project planning.* Contact us today for full information.

Creative Engineers: Find stimulating challenge at FMC's Ordnance Division.

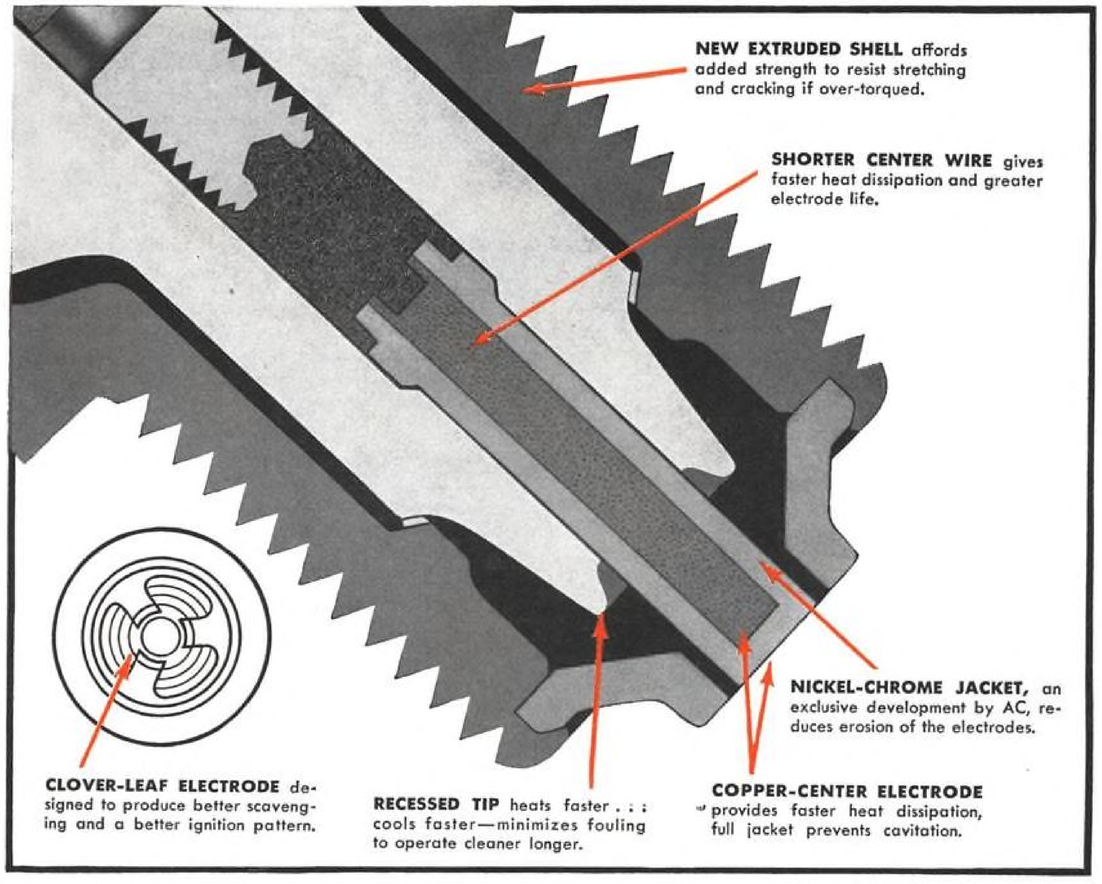


Missile equipment takes to the air in Air Force's giant C-133 transport which flew FMC-built Thor ground support equipment from West Coast to test site at Cape Canaveral, Florida. First load (upper) takes 65' launcher-erector section. Launching base and power-pack trailer (above) were flown in a second shipment.

Putting Ideas to Work

FOOD MACHINERY AND CHEMICAL CORPORATION
Ordnance Division
Missile Equipment Section 3-F
1105 COLEMAN AVENUE, SAN JOSE, CALIF.

HERE'S BIG NEWS ABOUT THE "BUSINESS END" OF A SPARK PLUG



NEW AC-275-D AIRCRAFT SPARK PLUG FOR THE "HOT SPOT" IN P&W 2800 ENGINES

When AC designs a product for a particular application—BIG THINGS RESULT! As illustrated above, the new AC-275-D is six ways better!

Other types of AC Aircraft Spark Plugs, of equal quality, are available for all applications in both commercial and private planes. Contact your AC Supplier for the *proper* plug for your particular application!

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Vibration and Shock

ENGINEERING REPORT

A Case History of Environmental Control...No. 3

PROBLEM

TO PROTECT VERTICAL GYROSCOPE in jet fighter radar fire-control systems from shock and vibration of combat maneuvers, gunfire recoil, and rough landings.

SOLUTION

ENGINEERED MOUNTING SYSTEM
MODEL 1995 safeguards vital aircraft performance and equipment reliability.

Robinson MET-L-FLEX resilient cushions of specially fabricated stainless steel wire provide a greater damping factor—actually 5 times that of rubber. Lasting performance of the all-metal mounting system is assured regardless of exposure to oil, dirt, moisture, ozone, and temperature extremes.

SPECIAL FEATURES:

Angled resilient elements add to equipment stability, reduce space requirements, and contribute to excellent rotational stability characteristics.

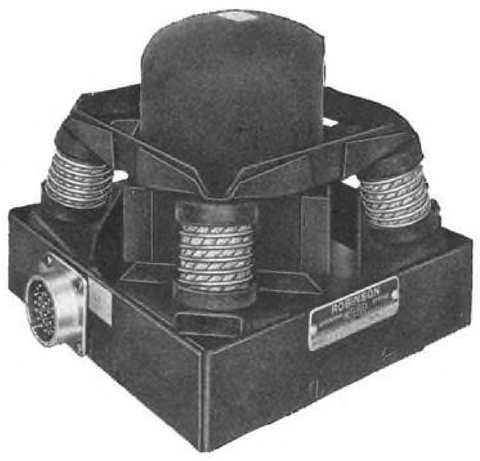
PERFORMANCE:

With a vibratory input acceleration of 10 G, Model 1995 provides 94% isolation efficiency in the 200-350 c.p.s. frequency range allowing only .6 G to reach the equipment. Vertical and horizontal natural frequency is 13.7 and 8.6 c.p.s. respectively. Due to high damping, peak acceleration force to which equipment is subjected is limited to 1.4 G at mounting system resonance.

Rotational displacement of gyro, a critical factor affecting performance, is controlled to a fraction of a degree even during resonant conditions.

RESULT:

More dependable operation of the radar fire control system, hence greater operational reliability of the aircraft through application of a Robinson shock and vibration control mounting system.



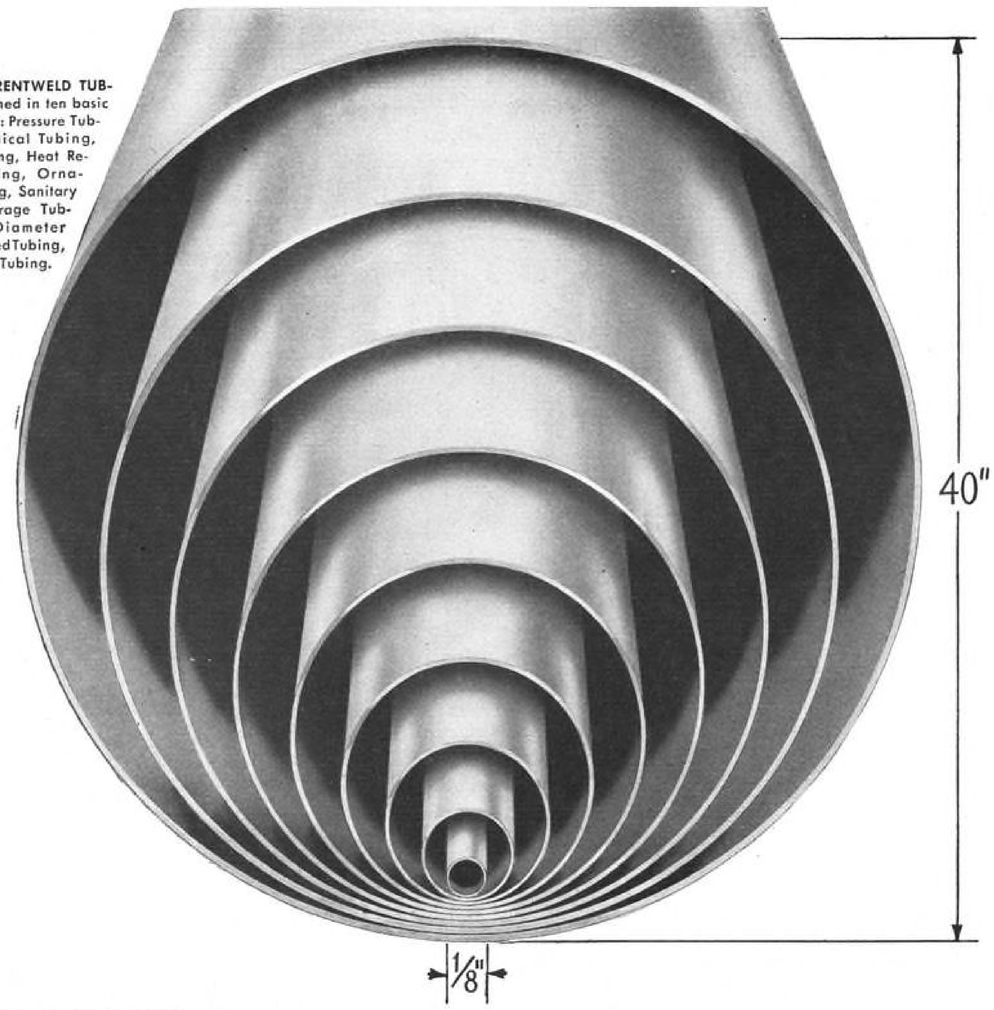
MODEL 1995
MOUNTING SYSTEM

By applying Robinson's concept of controlled environment in the design of MET-L-FLEX suspension systems, more than thirty-seven different gyro mountings have been successfully developed and produced in quantity.

ROBINSON CONTROL IS RELIABILITY CONTROL

ROBINSON AVIATION INC.
TETERBORO · NEW JERSEY
West Coast Engineering Office: Santa Monica, Calif.

CONTOUR TRENTWELD TUBING is furnished in ten basic classifications: Pressure Tubing, Mechanical Tubing, Aircraft Tubing, Heat Resistant Tubing, Ornamental Tubing, Sanitary Tubing, Beverage Tubing, Large Diameter Tubing, Shaped Tubing, and Formed Tubing.



TRENTWELD tubing is equal in strength and has more uniformity than tubing made by any other method of manufacture

Trent offers tubing in sizes ranging from ⅛" to 40" O.D. and in a wide range of grades. These include: Hastelloy,* Zirconium, Zircaloy, Titanium and 19-9-DL grades. All are made by an exclusive welding process—Contour Trentweld®—which virtually eliminates the bead. Furthermore, by cold working and annealing after welding, Trent makes the weld equal in strength and corrosion resistance to the parent metal.

To insure that Trentweld tubing is of the highest quality attainable, a rigorous quality control program is carried out. Samples of each lot are tensile tested. Periodic tests — flattening, reverse bend, flare and flange, coil, and pressure — are conducted. Rigid corrosion tests are made on all lots intended for corrosive applications. When requested, a unique "single-wall" X-ray inspection is made as your final assurance of a sound, uniform product.

Why not take advantage of Trent *quality* when you order stainless or high alloy tubing? For further information, write for the Trent tubing handbook, Trent Tube Company, East Troy, Wisconsin.

*Trademark of Haynes, Stellite Co.

CONTOUR TRENTWELD

TRENT TUBE COMPANY

Subsidiary of Crucible Steel Company of America

GENERAL OFFICES: EAST TROY, WISCONSIN
MILLS: EAST TROY, WIS.; FULLERTON, CALIF.

SAYS JOHN G. GLENN, Superintendent of Communications and Electronics, Bonanza Air Lines, Inc.:

"G-E 5-Star Tubes Like This Help Us Link 21 Cities with Fast Air Service!"

"Communications—air navigation—both are vital to Bonanza in maintaining on-time schedules in the west and southwest.

"Many of our flights, such as Salt Lake City to Phoenix, and Las Vegas to Reno, cross the main east-west traffic flow — are made over sparsely-settled mountain areas. Our pilots must have height, course, weather, and other vital information at their fingertips.

"Here General Electric 5-Star Tubes give us the extra dependability we require of our radio and navigation instruments. We use 5-Star Tubes in all critical sockets, both in our airborne equipment, and in the network of transmitters and receivers Bonanza maintains at twenty-one airports.

"With still faster flight schedules coming, made possible by our new F-27 Silver Dart turbo-prop planes, General Electric 5-Star Tube reliability will mean still more to us. Bonanza's faith in these specially-built tubes comes from many years' experience. They're a superior product, and give superior service."

* * *

Your nearby G-E distributor stocks 5-Star high-reliability tubes. Phone him! *Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Kentucky.*

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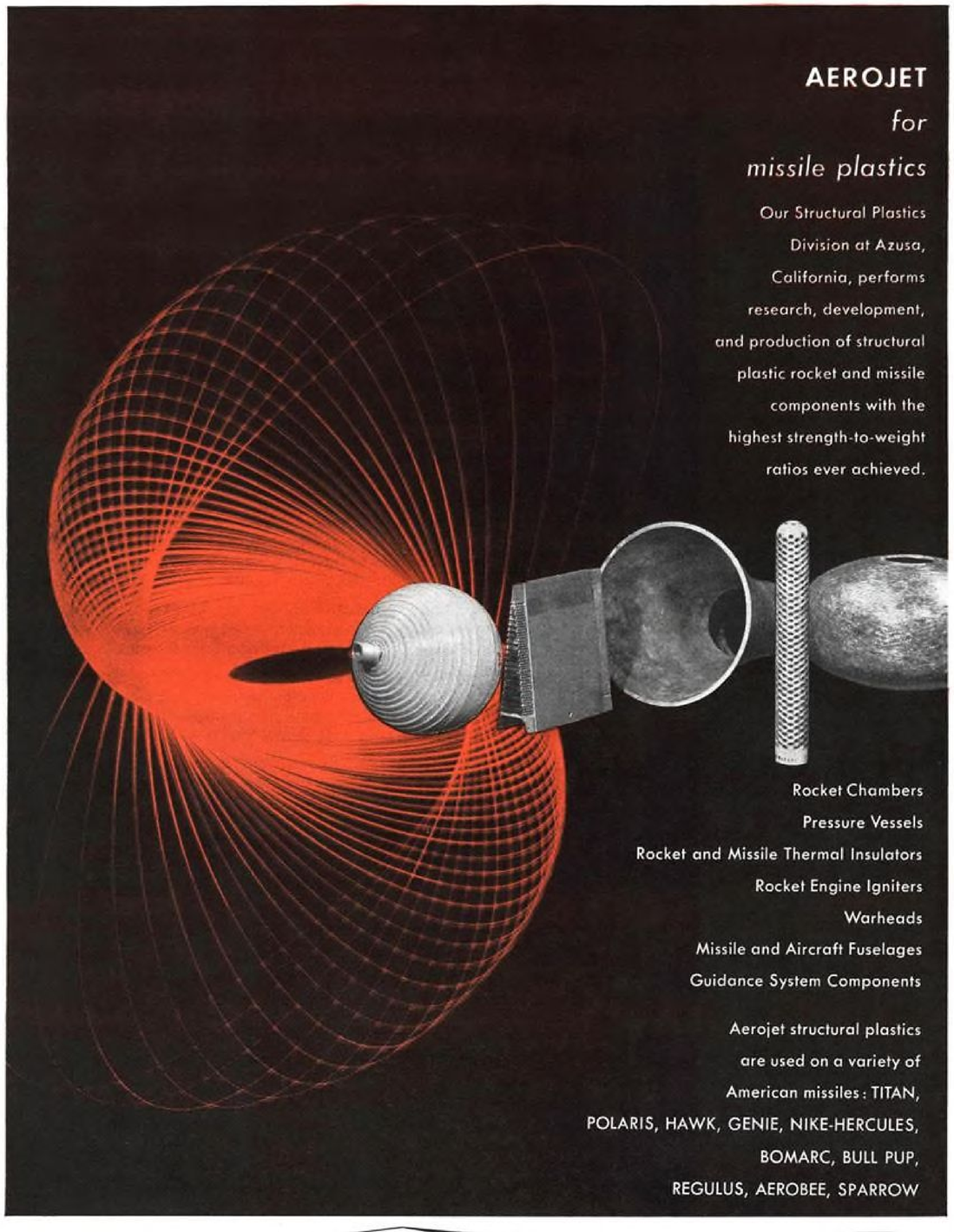
GENERAL ELECTRIC

11-11-205



AEROJET-GENERAL CORP.

THE GENERAL TIRE

A SUBSIDIARY OF THE GENERAL TIRE & RUBBER COMPANY

Engineers, scientists—investigate outstanding opportunities at Aerojet. (Plants at Azusa and near Sacramento, Calif.)

Raytheon Missile Projects

SPARROW III—the Navy's tenacious, lightning-fast, air-to-air missile—is intended for extensive use by Navy fighter aircraft in fleet air defense. Sparrow III is a Raytheon prime contract.

HAWK—the Army's defense against low-altitude attackers—carries out its destruction in the blind zone of conventional radars. Hawk development and production is under Raytheon prime contract.

TARTAR—A substantial contract for vital electronic controls for this Navy destroyer-launched missile is held by Raytheon. This equipment—a tracking radar and associated units—enables it to "lock on", cling to target's path, despite evasive tactics.

ADVANCED PROJECTS in aeronautical structures as well as missile guidance and control are now underway in Raytheon laboratories. New facilities are continually being added for this work.

PRELIMINARY NEW DESIGNS of tomorrow's missiles will result from the advanced work being done by today's missile engineers. Raytheon plays an important role in this area.

Raytheon diversification offers

JOB STABILITY FOR CREATIVE MISSILEMEN

Here is an opportunity to free yourself of worry about a job that's here today, gone tomorrow.

Diversified assignments—only possible in a company with Raytheon's wide range of missile activities—means security not found in one- or two-project companies. You apply your creative energies to the many projects you work on, and they in turn are your "insurance" against falling into a rut.

Individual recognition comes quickly from Raytheon's young, engineer-management—men who are keenly aware of the engineer's needs and contributions to missile progress.

Dynamic Raytheon growth—the fruit of this management's progressive policies—is best illustrated by the fact that Raytheon is already the only electronics company with two prime missile contracts—Navy Sparrow III and Army Hawk.

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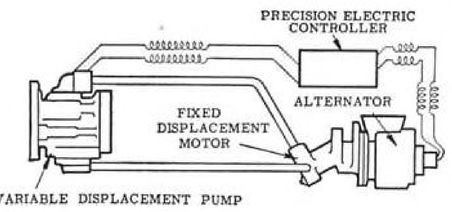

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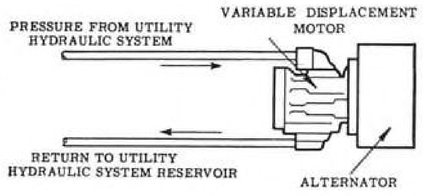

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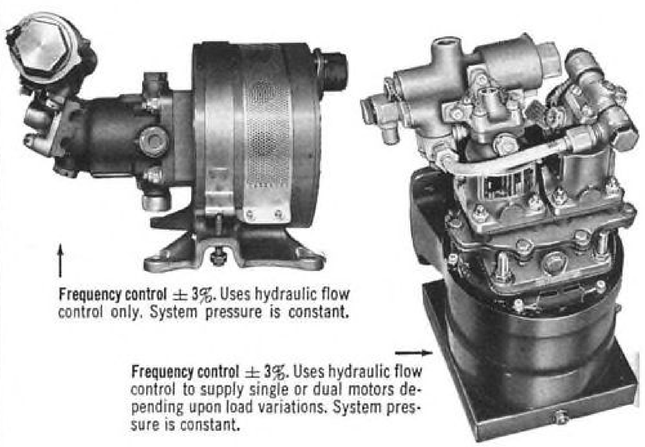

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COVER: Doak Model 16 vertical takeoff and landing research vehicle, under development for U. S. Army, hovers at Torrance Municipal Airport, Calif., in this first flight view. Aircraft is in full-skin configuration, will start a transition program at Edwards Air Force Base, Calif. Wingtip-mounted ducted fans are used for vertical takeoff and landings, rotate 90 deg. for high speed forward flight (AW Mar. 10, p. 20). After transition tests, Doak 16 will move into normal airplane category for tests at higher speeds, according to Doak Aircraft Co. engineers at Torrance.

PICTURE CREDITS

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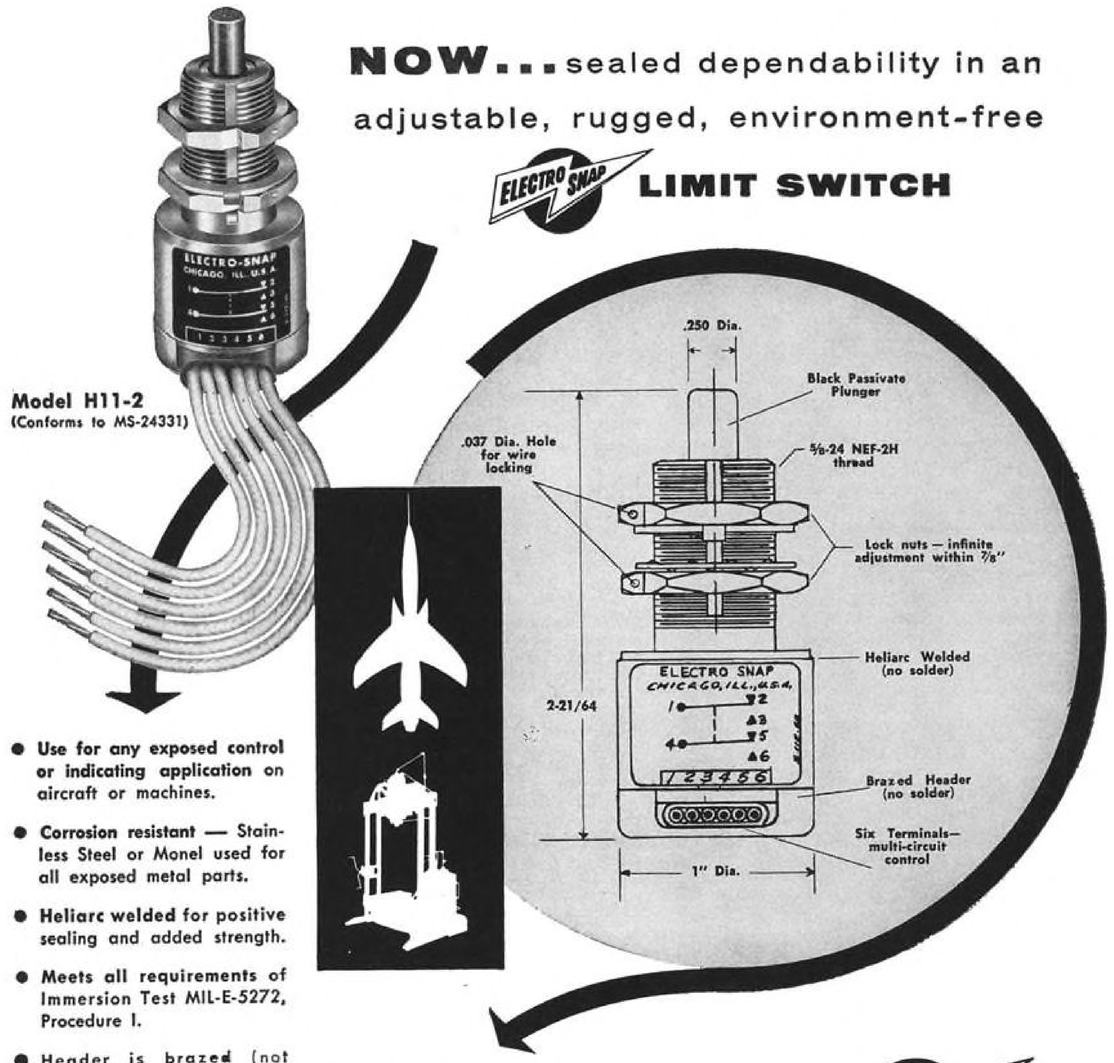

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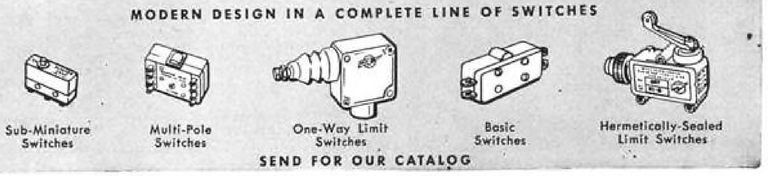

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EDITORIAL

Reflex in Spain

Not long ago we spent some time on the arid, sun-baked Castillian plateau near Madrid where the 16th Air Force of Strategic Air Command is now in the megaton delivery business. There, at Torrejon, stretches the largest paved runway in Europe—13,800 ft. of concrete flanked by an enormous cement parking area a mile and a half long and a quarter mile wide. On this parking apron surrounded by long coils of barbed wire stands a perpetual vigil of a half dozen or more Boeing B-47s loaded with megaton weapons, full tanks of JP4 fuel, clusters of JATO bottles clamped to their silver flanks and crews already dressed in flying gear never more than two minutes from the flight line.

This is what SAC's "Operation Reflex" looks like as it is poised on a tightly coiled system than can fling these megaton-loaded bombers off the runways bound for Soviet targets within 15 min. from the sound of the alert klaxon. Operation Reflex is the carefully-forged, training-tempered spearhead of Strategic Air Command's retaliatory capacity and the bedrock foundation on which United States military power and foreign policy rests today and for the immediate future. The sight you see at Torrejon is also repeated at other SAC bases in Spain—Zaragoza in the north and Moron in the south near Seville. The SAC bases in French Morocco and England are also dotted with Reflex bombers poised on the 15 min. hair trigger.

The B-47s of Reflex are rotated from stateside SAC bases to the perimeter of advanced bases such as Torrejon only a few hours flying time from the Soviet Union. Aircraft and crews are rotated through the Reflex complex as single units so as never to impair the main operational efficiency of their combat wing at its home base. While they are on their week of Reflex-duty, the trio of B-47 crewman never leave each other's sight. They work and play together within the limits of their alert confinement, always with a red-painted Reflex jeep within a few strides. They live in their flight gear.

Even when swimming at the base pools, they must have their flight gear draped over the jeep at the poolside and, when the alert klaxon sounds, they dive into their flying clothes and drive toward the flight line with a foundation of wet trunks. All of the roads on the Torrejon base are painted with an orange stripe leading Reflex crews by the shortest route to the flight line and their parked bombers. When the alert klaxon sounds, red lights blink on all the base road intersections. Normal traffic pulls over to the roadside, leaving a clear path for the hurtling jeeps of the B-47 crews.

Within two minutes of the klaxon blast, the crews are scheduled to hit the flight line perimeter. Within four minutes, they must be at their flight line check point and, within eight minutes, they are installed in their bombers ready to start engines. Maintenance crews for Reflex give the aircraft a constant check to keep them in instant readiness. Flight crews are briefed once every 24 hr. on their specific target in the Soviet Union.

At the end of 14 min., engines have been started, the aircraft taxied to the end of the runway and, at 15 min., the first B-47 is rolling toward takeoff. There are three kinds of practice alerts for Reflex crews, and there may be several called during each 24 hr. period.

In an Alpha alert, the crews merely man their aircraft. For Bravo, they start engines and begin taxiing. For Cocoa, they taxi to the end of the runway, pull engines to full power and start rolling before chopping throttles and returning to their parking stand.

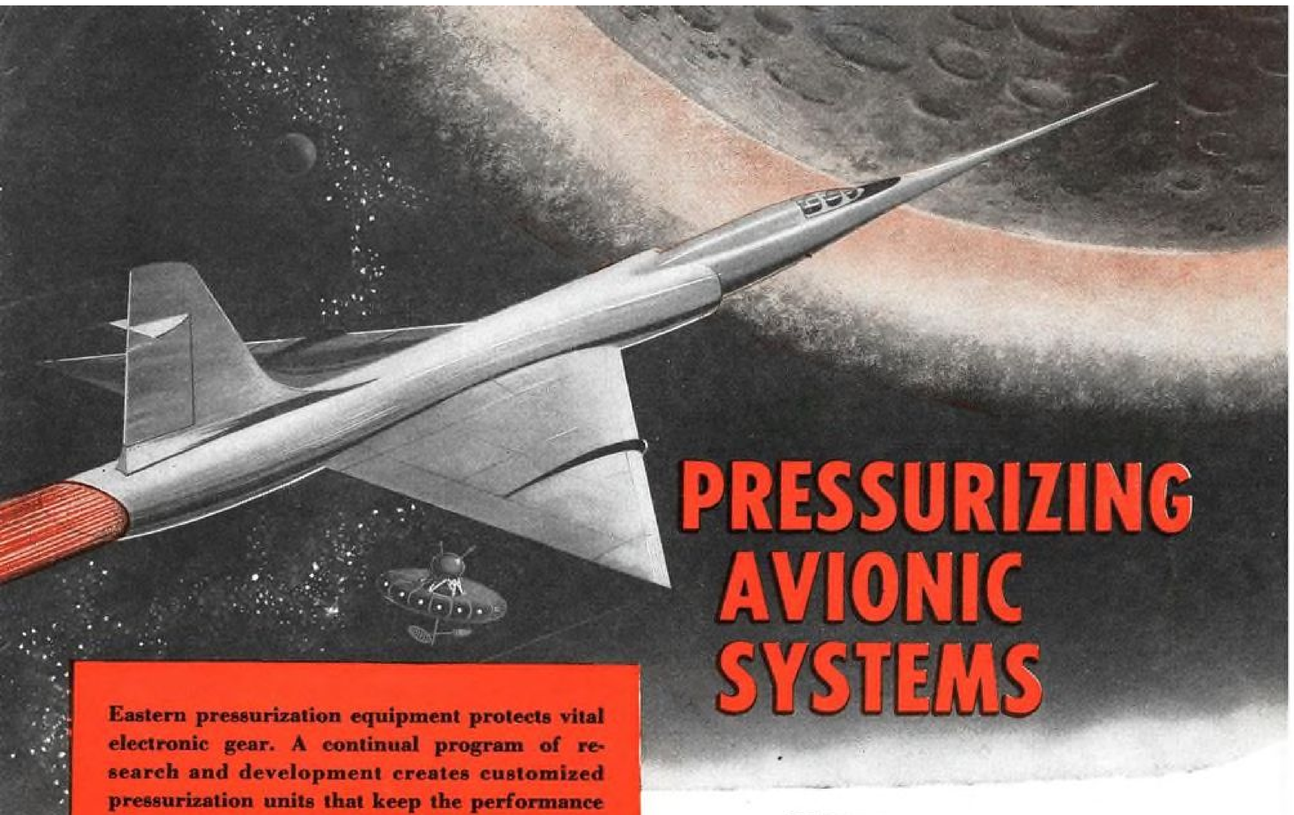
No crew knows whether it is a practice alert or the real thing until the code word is flashed to them at each stage of the alert. When they open throttles at the runway's end, they don't know until they get the proper signal whether they are taking off into the third World War or returning to the flight line.

Reflex was developed under Gen. Thomas S. Power, SAC commander, to prevent the spearhead of his retaliatory striking force from being caught on the ground by any array of Soviet weapons, including ballistic missiles. The Reflex detachments are purposely kept sufficiently small to be able to get off any single runway within the 15 min. span. Their bases are widely dispersed to require a major effort to neutralize them.

There is little doubt but that a rain of Soviet IRBMs now operational in Russia and being emplaced in Soviet satellites farther to the west such as Poland, Albania, and Rumania, could eventually knock out the advanced SAC bases in Europe and North Africa. But with Reflex, they would find it virtually impossible to do this task before the B-47s were in the air with megaton loads destined for Soviet targets.

SAC makes no secret of its Reflex capability, which is growing with its dispersal program. It feels the Soviets should know in detail and positively the retaliation they face for any future aggression. When crises such as Lebanon and Quemoy develop and the world spins again toward the brink of major war, the power of Reflex is reinforced. The shadow of its B-47 and B-52 wings grows longer over those who might engineer aggression. This is what Strategic Air Command means by its dynamic deterrent. This is what is keeping the world away from major war today.

—Robert Hotz



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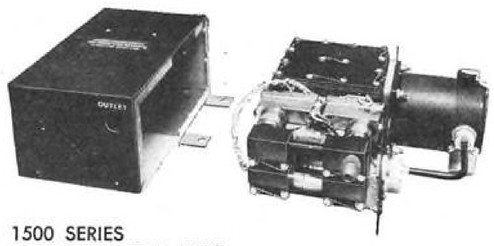

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Rear Adm. James A. Thomas (USN, ret.), vice president, Kaman Aircraft Corp., Bloomfield, Conn. Also: **Robert A. Strieby**, director of military relations, Kaman Nuclear Division, Albuquerque, N. M.

Boone T. Guyton, sales manager, Missiles & Space Systems Division, United Aircraft Corp., East Hartford, Conn. Also: **Charles F. Miller**, divisional auditor of Missiles and Space Systems.

Harry Wetzel, Jr., a director, the Garrett Corp., Los Angeles, Calif. Mr. Wetzel is vice president and manager of Garrett's AiResearch Manufacturing Division.

Maj. Gen. Frank O. Carroll (USAF, ret.), a director, Stanley Aviation Corp., Denver, Colo.

Maj. Gen. Hugh J. Knerr (USAF, ret.), board chairman, Southeastern Airways, Inc.

Donald R. Spotz, president and general manager, Pesco Products and Wooster Divisions, Borg-Warner Corp., Bedford, Ohio.

Richard C. Crouch, president and treasurer, Cal-Tronics Corp., a division of Acme Precision Products, Inc., Los Angeles, Calif. Also: **Robert J. Calvert**, general manager, and **Arthur J. Jennett**, secretary and general counsel.

Honors and Elections

Walter H. Johnson, Jr., Capital Airlines' vice president-marketing, has been elected board chairman of all three New York Airline Terminal Corporations.

Arvin H. Saunders of Releigh-Durham, N. C., has been elected president of the Southeastern Airport Managers' Assn. **Frank J. Sakser** of West Palm Beach, Fla., was elected vice president, and **Matt V. Pilcher** of Sarasota-Bradenton, Fla., elected secretary-treasurer.

Dr. Charles S. Draper, head of the Aeronautical Engineering Department of the Massachusetts Institute of Technology, has been awarded the Adm. William H. P. Blandy Gold Medal by the American Ordnance Assn. for his "contributions to the progress of aeronautical engineering and . . . the development of infrared signaling devices."

Changes

Ralph R. Lovering, Chief, General Safety Division, Office of Flight Operations and Airworthiness, Civil Aeronautics Administration, Washington, D. C.

Robert Adams succeeds **Commodore A. J. Spriggs** (USN, ret.) as manager-eastern operations, Washington, D. C., Packard-Bell Electronics Corp., Los Angeles, Calif. Commodore Spriggs, Packard-Bell vice-president, has been granted a leave of absence to act as adviser to the director, Electronics Division, Business and Defense Services Administration, U. S. Department of Commerce.

Gerald C. Schutz has joined the general manager's technical staff, Systems Division, Bendix Aviation Corp., Ann Arbor, Mich.

(*Continued on page 97*)

INDUSTRY OBSERVER

► Soviet Bounder delta wing bomber (AW Oct. 27, p. 23) has a wingspan estimated at about 75 ft. and a fuselage length close to 200 ft. Its turbojet engines are buried in thick leading edge of the delta wing close to the fuselage. Bounder has a bicycle-type gear with the main landing gear folding into the fuselage and outrigger wheels folding into the wing from the wingtips. Auxiliary powerplants of an unidentified type also are located in pylon mounted pods swept forward from the wing on both sides of the fuselage.

► **Accidental detonation of a destruct package in first stage caused ignition and runaway flight of second stage of Navy's Polaris fleet ballistic missile (see p. 63) in recent test at Cape Canaveral, Fla., (AW Oct. 20, p. 28). Earlier failure of a Polaris test vehicle at Canaveral has been attributed to failure of the radio command guidance programmer since the missile lifted off the pad properly but failed to follow its planned trajectory.**

► Royal Canadian Air Force is looking for a new type fighter to replace its Canadair-built Sabre wing now on duty with NATO. New plane will switch Canadian NATO mission from air defense to low level attack. Preliminary planning indicates a two seater subsonic aircraft capable of delivering nuclear and conventional weapons over a range of less than 1,000 mi.

► **Several promising ideas for satellite interception and destruction conceived by Radio Corp. of America scientists reportedly have aroused considerable interest in Advanced Research Projects Agency. RCA is one of two companies working on satellite interceptor problem under Air Force contract.**

► Pilotless version of Lockheed F-104 as a missile system is under study by the Defense Department. Lockheed has proposed surface-to-surface, surface-to-air and air-to-surface missile versions based on the F-104 airframe.

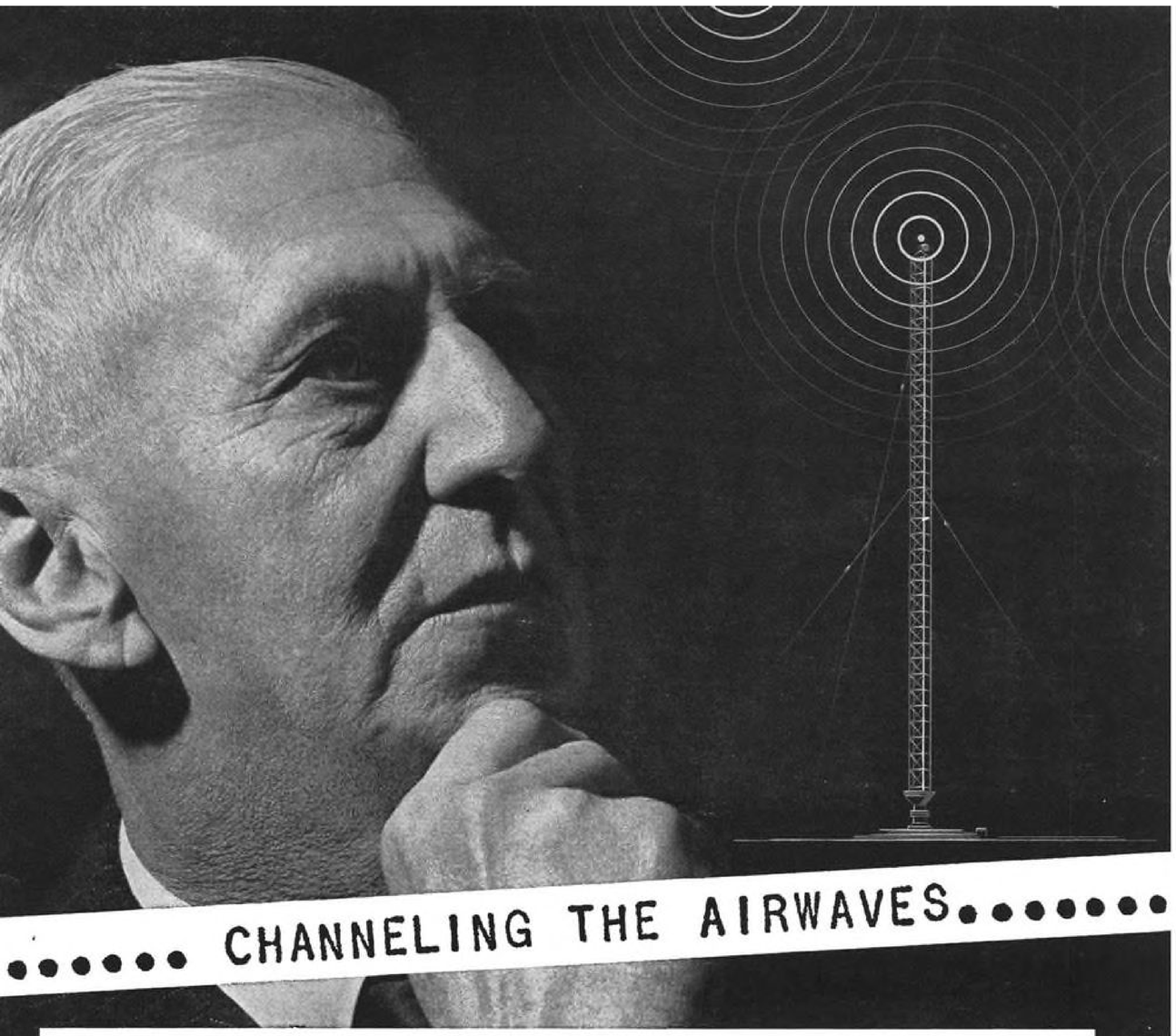
► **Number of firms, including General Electric, Lycoming, Hughes and Firestone, are bidding for the contract to supply ground power units for North American's B-70 bomber. Support units, known as alert pods, would be required to supply continuous power as well as extra power for starting purposes; probably be built around a shaft turbine engine in the 1,000 hp. category.**

► Chance Vought is making a quiet bid to move into the Army missile program, with its top management earmarking $1 million in company funds on various Army projects. Initial hardware includes a pair of 40-mi.-range missiles scheduled for firing on a limited range at Redstone Arsenal in January. Chance Vought approach is development of a family of basic missiles whose capabilities can be varied by installing any of several different quick-attach rocket powerplants. Missiles to be test fired at Redstone utilize a North American Rocketdyne motor on a gimballing mount for controlling the flight path.

► **Ryan Vertiplane vectored slipstream VTOL and Doak Model 16 ducted fan aircraft have begun their test programs. Vertiplane has made brief flights and is undergoing full-scale tests in National Aeronautics and Space Administration's Ames Laboratory wind tunnel. Doak Model 16 (see cover) has been undergoing taxi runs, brief hops off the ground at the start of its 50-hour ground test program. Vertol 76 tilt-wing VTOL/STOL has made some 15 successful transitions, has had its flight program contract extended to cover 20 hr. for stability investigations.**

► Rheem Manufacturing Co.'s SD-2 combat surveillance drone and Republic Aviation Corp.'s SD-3 system are now in competitive Army Signal Corps trials at White Sands, N. M.

► **Douglas cargo cost studies on shipping military materiel in its large C-133A turboprop freighter as compared with surface transit methods indicate that $8.59 per unit can be saved by airlifting a Bell H-13 helicopter transmission to Japan; $7,790.45 per Cessna L-19 delivery and $7,157.57 per Sikorsky H-34 shipment.**



A project of Colonel Edward A. Allen (USA Ret.)
Senior Staff Engineer, Stavid Engineering, Inc.

In 37 years of military service, Colonel Allen has contributed greatly to the evaluation and development of all types of communications equipment for the Army Signal Corps. Currently assigned to Project Monmouth III, Colonel Allen serves on a board to resolve communications and spectrum interference problems associated with the modern dispersed field army. Like other outstanding scientists and engineers at Stavid, Colonel Allen is working on advanced concepts ... years ahead of actual systems development.

In Stavid's objective engineering atmosphere, scientific, development and manufacturing teams are producing a wide range of electronic systems for the Services. A current project, for example, calls for the development and manufacture of the Mark 70 Gun Fire Control System.

OTHER STAVID PROJECTS INCLUDE:
- LANCE Weapon System
- Infrared Search and Track Equipment
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- Missile Guidance Systems
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Washington Roundup

Nuclear Plane Competition

Review by Defense Department of Navy and Air Force aircraft nuclear propulsion programs is imminent but competition between the two services may mean still more delay in a field already plagued by delays. Some observers say the problem is that the two programs are technically compatible but not politically so. If the services got together and supported each other's efforts, they might gain enough financial and administrative support to ensure technological advances for both. Instead, they are drawing further apart in the competition for funds, and more delays are the prospect for both, observers say.

'Defense in Depth'

Both Army's Nike-Hercules anti-aircraft missile and Air Force's longer range Bomarc interceptor missile definitely will be used as a part of the "defense in depth" concept, although details as to numbers and location of sites still are under study, according to Acting Defense Secretary Donald A. Quarles.

Congress, charging duplication of defensive systems, cut 20% from the military construction fund for each weapon and directed Defense to decide on the division of funds. As a result both systems were re-evaluated and many observers expected that one might be eliminated.

Talos, meanwhile, is still alive, but barely so. It is undergoing limited studies, but there is no plan now to deploy it on land, Quarles said. Developed for Navy, the Talos ramjet anti-aircraft missile was at one time planned for Air Force use to protect Strategic Air Command bases. A re-definition of roles and missions two years ago gave it to Army for continental defense, and it has been undergoing studies ever since.

World Congress of Flight

Air Force Assn.'s giant World Congress of Flight, scheduled for next April 12-19 at Las Vegas, Nev., and co-sponsored by four other organizations, will bring together conferences on civil jet aircraft, missiles and the space age. It also will include a large industrial exhibition, military flying and fire-power demonstrations and meetings of aviation and space organizations.

Astronautics symposium, sponsored for the past two years by the Air Force Office of Scientific Research and planned for Washington, D. C., next April, has been killed. Less technical aspects of it will be incorporated into the Congress' Space Age Conference. Question of whether more technical aspects can be squeezed into the ambitious program still is pending. Co-sponsors for the Congress include Air Transport Association, National Aeronautic Association, Flight Safety Foundation and the Space Education Foundation. The 8-day meet incorporates AFA's annual Jet Age Conference.

Week of Change

Other top-level shifts also were in the making in Washington last week. They included:

• **Dr. Paul D. Foote** retired as Assistant Secretary of Defense for Research and Engineering after a year in the post. Foote's office probably will be abolished when, and if, the Administration finds a suitable and willing candidate to fill the new post of Director of Research and Engineering. The new office, slated to have much broader powers than Foote's shop, was authorized earlier this year by Congress under the Defense Reorganization Law. Foote, 70, had spent a total of 15 years in government service. His early career was spent with the National Bureau of Standards. He later was vice president of Gulf Oil Corp.

• **Lt. Gen. Donald L. Putt,** retired Air Force deputy chief of staff for development, was named to replace Dr. James H. Doolittle as chairman of USAF's Scientific Advisory Board. Doolittle is retiring from the chairmanship because of his heavy workload as a member of six other government committees and work in private industry but will continue to serve as a member of the advisory board. Putt is now president of United Research Corp., a recently formed subsidiary of United Aircraft Corp. (AW Oct. 20, p. 37).

• **Milton W. Arnold** resigned as vice president operations-engineering of the Air Transport Assn. Discount, however, reports that Arnold will join the Federal Aviation Agency, or any other government agency, in an executive capacity. Instead, look for Arnold to become president of an aviation firm, probably outside the transport field.

Subsidy Proposal

Members of the Assn. of Local and Territorial Airlines meeting in Honolulu on Thursday and Friday of this week will begin a study of a new proposed plan to streamline methods for determination of subsidy to be paid local-service lines. The basic plan, prepared by the Civil Aeronautics Board staff and submitted to the carriers for review, is to pay each carrier on a monthly basis a predetermined portion of a standard cost of operation per plane mile for a given number of frequencies over each route segment.

NASA-ABMA Progress

Despite official indications to the contrary, bid by NASA to take over a major share of the space activities now held by Army Ballistic Missile Agency and Army's Jet Propulsion Laboratory, which is managed by California Institute of Technology, may actually be settled before the next meeting of the National Aeronautics and Space Administration Council scheduled for late this month.

New USAF Scientist

Watch for Dr. Joseph V. Charyk, general manager of the Space Technology Division of Aeronutronic Systems Inc., a Ford Motor Co. subsidiary, to step in as chief scientist of the Air Force. Charyk, who will take over his new post around Jan. 1, succeeds Dr. George Valley. Valley already has completed his term as chief scientist and has joined Melpar Inc. of Arlington, Va., as director of development planning.

Strike Tension Grows

Tension continued to mount in airline labor disputes last week with the spotlight still on the Capital Airlines-International Assn. of Machinists strike, which is regarded as a possible pace setter for IAM negotiations with five other major carriers.

As the Capital strike pushed past the two-week mark, after union negotiators declined a company offer six cents above the 20 cent raise figure recommended by an earlier presidential emergency board meeting (AW Oct. 27, p. 34), Trans World Airlines announced plans to lay off 19,000 employes as a result of an Oct. 31 strike date by the local IAM negotiators.

—Washington staff

Confusion Clouds German Fighter Choice

European reports that German Defense Ministry has chosen F-104 either premature or inaccurate.

By David A. Anderton

Bonn—European reports that the West German Defense Ministry has chosen the Lockheed F-104 Starfighter are either premature or inaccurate, AVIATION WEEK has learned here.

The only firm German decision to come out of the miasma lying low in the Rhine valley is two-fold:

- **Both the Grumman F11F-1F** Super Tiger and the F-104 fighter are still in the running for the prospective order, with the Starfighter officially stated to be leading by a small margin. Major factor in the final choice will be the terms imposed by Lockheed for license production of the Starfighter in Germany.

(U.S. sources regarded German emphasis on the decisive importance of the licensing agreement as an effort to win still further price concessions from one or both contenders. Both Lockheed and Grumman are reported down to the rock bottom level.)

- **Dassault's Mirage 3A** has been eliminated as "not meeting tactical and technical requirements at this time."

This is the status as of the end of last week. It is confirmed in an official statement of the German Defense Ministry. It is further supported by unofficial views of industry and military representatives of the United States close to the Bonn scene.

Germany Defense Ministry spokesman denied last week that a decision had been made. He refused comment on the implication of a Ministry statement that the Starfighter was favored slightly over the Super Tiger. He was asked if the Defense Ministry would recommend purchase of Starfighters if Lockheed agreed to favorable license conditions and again refused to comment.

"If the Germans have ordered anything, we don't know about it," said a high USAF officer.

Neither did technical and sales representatives of General Electric, manufacturers of the J79 engine which will be used in either airplane. Grumman and Lockheed sources also had no official word on a final decision.

To add further evidence, the itinerary for the sixth German team visit to the United States still includes Grumman as one of an enormous number of stops to be made in what struck most observers as a too-short time interval.

The official German announcement came as a bitter shock to the French, as a major disappointment to the English and Swedes who had been hoping to the last to make the grade, and as further confusion to the American representatives in Bonn.

Most foreign technicians in Bonn had been led to believe that the Germans would buy about 100 airplanes off the shelf, buy perhaps another 50 or so as components for German assembly, and then produce about another 100 under license. But the German statement, in one of its few lucid sentences, said they planned to buy only six to 10 machines off the shelf, and to produce 300 under license in Germany in three types: fighter-bomber, interceptor and reconnaissance.

Approximately 450-500 General Electric J79 turbojets are involved in any prospective order of such magnitude. These would, according to the latest data, be produced in Germany jointly by heavy industry and the automobile industry, with over-all management contract and final assembly most likely to go to the Bayerische Motoren Werke (BMW). Actual license for the J79 will be taken by the West German government rather than by industry.

There is basis for believing that the current train of events started when a story of the German vacillation appeared in AVIATION WEEK (Oct. 13, p. 34). Most military and industry sources agree on one thing: they are annoyed at the Germans for their continued shying from a decision, but none of them is in a position to say so. Industry representatives are afraid to insult a prospective customer, and military officials realize it is not their place to do so.

First report of the alleged order for Starfighters appeared following a leak to a German newspaper two weeks ago. This was almost immediately followed by an official denial appearing in the West German government's press and information bulletin on Oct. 22.

This statement said in part that the decision on re-equipment had not yet been made.

The German Defense Ministry called a conference for German press only on Oct. 24, and passed out a release stating that both the Super Tiger and the Starfighter were being considered, that the Mirage was out, and that one of the major remaining factors was determination of the conditions under which Lockheed would license F-104 production to the Germans. This implied that the decision would favor the Starfighter; but the release was so poorly worded, ambiguous and even inaccurate in spots that it was difficult to place much credence on any of it.

Later in the day, the Defense Ministry called a second press conference for foreign reporters; they were read the release and not permitted to ask any questions, according to information told to AVIATION WEEK.

The German release said that 14 types of airplanes, three English, one Swedish, two French and eight American—had been evaluated on a technical and tactical basis, and that out of this had emerged three for final consideration. They were the French Dassault Mirage 3A, and the two American contenders, the Starfighter and the Super Tiger. According to the German announcement, deliveries are expected around 1961 or 1962, by which time the pilots will be available.

The release also added that the German firms chosen to produce the airplane under license should receive a large part of their "preparations" and tooling from the United States.

"I can sympathize with the Germans if I try to be objective," said a USAF officer. "They have to re-arm fast enough to satisfy our demands and our pressures, and not fast enough to scare the daylights out of the Belgians, the Dutch and the French. That's not easy."

"And of course, every day they delay, they stand a better chance of getting a better airplane", added another person.

"Remember they junked a World War II type of air force, and then waited out a gap of 13 years before trying to start in on a modern basis with a brand-new air force. That's a rough assignment. I hate to think what we would have done in the same position."

"Yeah, I agree," said the first officer. "But you can bet we'd have done something!"

To this every American technical salesman in Bonn would agree. They have spent a fruitless vigil there for the past 18 months, waiting for the decision often promised but never made.

They may still be there next spring.

Soviet Science Fiction

Moscow—Unqualified writers are using Soviet rockets and Sputniks as vehicles for unguided literary flights into outer space, Sovietskaya Aviatsiya has complained.

The official Soviet Air Force newspaper said "Interplanetary Space Ships" by Yu. S. Kryuchkov is an example of such writing. It contains many factual errors, scientific absurdities and awkward terminology, the paper said.

The embarrassing part is that the book carries the imprimatur of DOSAAF—the huge, state-sponsored Voluntary Society for Cooperation with the Army, Air Force and Navy of the USSR. The newspaper suggested more careful editorial examination of spacebound manuscripts in the future.

Japanese Order Delay

Tokyo—Japanese government has put off a formal decision on the choice of a fighter for the Japanese Self Defense Air Force. The Japanese Defense Agency last April announced it would buy the Grumman F11F-1F Super Tiger, but formal ratification, expected last month, is bogged down by political skirmishing.

Grumman still expects a favorable decision soon, but Lockheed has not given up on selling the F-104C Starfighter. Convair is reported making a new effort for the business with the F-102.

Ostensible roadblock is the charge of Japanese Socialist Party that the choice was made by the Japanese Defense Council without proper evaluation, a move designed to embarrass the Kishi government. Some price cutting has been reported, (AW Sept. 8, p. 23), although the purchase would be under a U.S. mutual security pact.

French Bitter Over Mirage Fate; Ire Centers on Germans, U.S.

By Robert E. Farrell

Paris—French newspaper comment plus privately expressed opinion among French aviation circles reflects surprise and bitterness over complete rejection of the Dassault Mirage 3A. In French eyes, the Mirage order by Germany was a key test as to whether Bonn was really interested in West European arms cooperation, or whether Germany intends to follow an American lead on such matters. Rightly or wrongly, in Paris many French officials are interpreting the German F-104 Starfighter order as a clear sign that Germany places its American ties ahead of European cooperation.

What bothers the French most of all is not that the Starfighter was ordered—they expected either Lockheed or Grumman to get the bulk of German business—but that the Germans completely rejected the Mirage. After the recent de Gaulle-Adenauer meeting, there was a good deal of optimism in French circles that the Germans would place "a political order" for at least 100 Mirage interceptors.

The French also say the German rejection probably will have effects on other Mirage export possibilities. It is no secret that nations like Belgium, The Netherlands, Luxembourg and Switzerland and also Israel and India have been waiting to see what the Germans would do.

To date only the French Air Ministry has ordered 100 Mirage 3A interceptors. There is some talk in Paris that the cost of aircraft as a result of a lack of orders may result in a cut in the French order, or at least Air Ministry reluctance to place follow on orders. Air Ministry plans originally called for 300 Mirage interceptors.

Effect on the French aircraft industry of the German rejection could be serious. Snecma, for example, would have become the largest turbojet engine builder in Europe, had the Germans ordered the Mirage. The company now will be forced to lay off workers. If the lack of foreign orders means the Mirage will cost the Air Ministry more than planned, then the thin French air budget could mean rejection of prototype projects now in the works.

A good deal of French criticism also is being directed at the French Air Ministry. This is because Dassault was never officially permitted to represent its aircraft in Bonn. French Air Ministry kept this chore to itself and as a result, French observers say the Mirage case was badly argued before the German Defense Ministry.

The Mirage failure in Germany by itself wouldn't have stirred up so much reaction among the French except for the fact that it comes on top of several other incidents which all together is resulting in conjecture in French circles vis-a-vis the U.S. and Europe.

For example the French are annoyed over what they consider to be a vacillating American and NATO policy on the lightweight fighter program. Last January, despite their disagreement, the French swallowed a NATO decision on the lightweight fighter competition. This decision gave the nod to the Fiat G.91 fighter as a NATO first generation ground support fighter but also stated that the NATO second generation ground support aircraft would be the French Breguet Taon, powered by the Bristol Orpheus 12.

Since January, however, NATO has been talking about a third generation fighter which would be a VTOL type and might obviate the need for a second generation Taon type. Third generation VTOL, it was rumored, would be built by the Hawker Siddeley Group.

Thus the French felt that having agreed against their will in January, they were led into a situation in which everyone is getting orders except them. The Taon still seems to be in the running as a VTOL ground support fighter.

The second incident bothering the French is the current NATO competition for an anti-sub aircraft in which the Breguet group appears to hold an edge. This competition is presently being held up because the French claim American companies want to get into the race. In French and other NATO eyes, particularly British, the implication that only American companies have sufficient know-how to develop an anti-sub weapon system rubs very much the wrong way.

One high French official put the current situation this way to AVIATION WEEK: "It is becoming increasing clear to us that American companies regard NATO equipment programs as their exclusive prerogative. We can't accept this and don't intend to."

De Havilland Defends Firestreak Missile

London—Acknowledging rumors that Britain's Ministry of Defense might order the U.S. Sidewinder air-to-air infrared guided missile, Sir Ralph Sorley, deputy chairman and managing director of de Havilland Propellers Ltd., asserted last week that de Havilland's Firestreak infrared missile was a much better weapon.

A film revealing production and firing details of the Firestreak showed that much specialized production equipment had been developed for the missile and suggested that a quantity production program was well established.

Over 100 rounds have been fired from North American F-86 Sabres in acceptance trials still proceeding at Woomera, Australia. The weapon is destined for the English Electric P. 1B Lightning, Gloster Javelin and de Havilland Sea Vixen aircraft, but no date was given when the missile was likely to go into squadron service.

According to Sir Ralph, range of the missile is between one and four miles depending on the pursuit conditions. Minimum safe firing range was "well under three-quarters of a mile." Launching was effective over a wide angle in the rear hemisphere and could accommodate a difference in pursuit-target aircraft ceilings of as much as 10,000 ft.

In comparing the two missiles, Sir Ralph said the Sidewinder warhead is smaller and it unlikely to have the same degree of maneuverability as the Firestreak, although he admitted the Sidewinder is a much cheaper weapon.

Genies, Falcons Fired in Gunnery Meet

By Philip J. Klass

Tyndall AFB, Fla.—Air Force interceptor teams, firing unarmed Falcon air-to-air missiles, Douglas Genie (MB-1) atomic rockets and Mighty Mouse 2.75 in. FFAR rockets for the first time in competition against small, 600 mph. Ryan Q-2A Firebee drones, were credited with hits against 85% of the drones during the interceptor phase of Air Force's sixth world-wide weapons meet here. Hits are figured on the basis of avionic and photographic scoring techniques.

More than 50% of the Firebees attacked by unarmed Falcons or Mighty Mouse rockets were knocked down or sustained physical damage, testifying to the effectiveness of these weapons against a 600 mph. target which is only one-tenth as large as a bomber.

Still another indication of the effectiveness of USAF's top interceptor crews and weapons was the fact that most of the hits were scored by the lead plane of the two or three aircraft that made up each team, with the result that subsequent aircraft did not fire. For missions flown by F-89Js, a team consisted of two aircraft, each armed with one Genie. For F-102As, three aircraft made up a team, each armed with four Falcons. The F-86D/L teams consisted of three aircraft, each outfitted with 24 of the 2.75 FFAR rockets.

Perfect score was gained by Florida Air National Guard team, the 125th Fighter Interceptor Group, headed by Col. Robert E. Dawson (regular Air Force) in the F-86D/L category when Dawson as lead man scored hits on each of six missions, and the group managed to get all three of its aircraft airborne for every mission.

Competition was set up according to aircraft type, with no attempt to compare scores achieved by different types of aircraft and weapons. Entered in the meet were three teams of F-89Js, four teams of F-102As and five teams of F-86Ds and F-86Ls.

F-102, F-89 Winners

Winner in the F-102 category was the 326th Fighter Interceptor Squadron of the Central Air Defense Force based at Richards-Gebaur AFB, Mo. Winner of the F-89 competition was the 465th Fighter Interceptor Squadron of the Eastern Air Defense Force based at Griffiss AFB, Rome, N. Y.

This year's interceptor competition, nicknamed Operation William Tell, is the first time that most of the pilots had ever fired against a drone, even in training, and all were extremely enthusiastic over the realism it provides.

Although the Firebee was flown on a straight course during the firing run, with no attempt at evasive maneuvers such as a bomber might be expected to employ, pilots agreed that it makes a far more effective target than the towed sleeve targets which have been used in past competitions. The Firebee was launched from a B-26, controlled by radio from ground stations near the Gulf of Mexico firing range.

Weapons meet conditions are established to duplicate tactical usage as nearly as possible. Interceptor pilots are given a 30-min. alert, scrambled by the team's own ground-controlled intercept (GCI) operator when he picks up the newly-launched Firebee on his ground radar scope.

The GCI operator then vectors his team's aircraft, using voice radio, toward the target until they are within range where their own airborne intercept radars can lock onto the target. GCI operator is considered a vitally important member of the team because his skill determines whether the aircraft can maneuver into correct position to intercept the target.

The F-102As and F-86Ds and Ls run broadside attacks on the Firebee, while the F-89Js employ head-on attacks. The head-on attack is used because the Genie rocket has a large lethal radius, need not score a direct hit under combat conditions.

The high degree of reliability achieved by the complex fire control systems used on the three aircraft types and the high percentage of hits scored by the Falcon, indicate that the Air Force has begun to master the problems of avionic unreliability—at least in its present generation of aircraft.

Conversation with representatives of competing teams indicates that the Falcon, developed and produced by Hughes Aircraft Co., has become a reasonably reliable weapon and one which Air Force maintenance personnel can handle. Air Force maintenance personnel get a major assist from an elaborate test console developed by Hughes which is now installed at nearly every base that uses the Falcons. With this console, USAF maintenance personnel can quickly check out each Falcon to factory standards and isolate troubles to the major sub-assemblies.

Reliability of the fire control system used on all three interceptors, which was developed by Hughes and produced by Hughes and Radio Corp. of America, has shown major improvement in the past 18 months, all teams reported. However, it is considerably more complex than the Falcon and requires more maintenance.

During the 72 missions flown by 12 teams in this meet, there were only two or three reports of fire control system malfunctions. Most teams concede, however, that performance of systems in aircraft used here is somewhat better than the normal "back home" performance. For example, with their best maintenance personnel working on the aircraft entered in the meet, airborne radars are able to lock onto the target at nearly 50% greater range than under usual operating conditions, most teams report.

The rugged Firebee, which packs a parachute that enables it to be recovered and re-used, has flown as many as 19 missions before being destroyed and usually averages around five missions. Previous survival average has been hard hit at this meet, although damaged drones are recovered wherever possible by boat or helicopter and scavenged for usable parts and avionic assemblies. To record miss-distance of the Falcon or Genie in order to determine whether to credit a nondirect hit, the Firebee carries an avionic scoring system known as PARAMI, short for Parsons Active Ring-Around Miss Indicator. System operates somewhat like the familiar distance measuring equipment (DME).

Falcon, Genie Scoring

Each Falcon or Genie carries a small transponder in place of a warhead. As the missile or rocket approaches the target, an interrogator in the Firebee transmits a pulse, which actuates the transponder in the missile or rocket, causing it to transmit a reply pulse. Time between transmission of first pulse and receipt of reply indicates the distance between the weapon and target.

For scoring Mighty Mouse rockets, which are too small to carry a transponder, Firebee is outfitted with a motion picture camera. Film is subsequently analyzed to determine miss distance, unless drone is knocked down by direct hit.

For the Mighty Mouse rockets, any one that comes within 15 ft. of the drone is considered a hit since the normal bomber target is considerably larger. For Falcons, which can be equipped with a proximity fuze, a missile that comes within 20 ft. is scored as a primary hit, while one that comes within 20 to 40 ft. is considered a secondary hit, rating slightly fewer points. For Genie, up to 500 ft. is considered a primary hit, while 500 to 1,000 ft. is a secondary.

Perhaps the most impressive of the many innovations at this year's meet was the use of television to enable thousands of visitors and team members on the ground to view the GCI radar scope at periodic intervals during each mission, to listen to radio conversations between the operator and pilot and to actually watch the interceptor make its attack via a chase plane carrying a television camera.

Two F-102s outfitted with miniature transistorized TV cameras, developed by Dage Television Division of Thompson Products, served as chase planes. Signal was transmitted to the base here, then rebroadcast by means of a low-power Philco transmitter to dozens of Philco TV receivers located around the base in individual team trailers, at the officers' club and other sites.

Another television camera mounted near the runway caught the interceptors at takeoff and lands, alternately viewed the scoreboard as new results were tallied. An Air Force narrator presented a running commentary that would have done credit to a major network as the viewer was switched from the runway, to the GGI radar scope, to the chase plane over firing range 150 mi. away.

This is believed to be the first time that television has been used to monitor interceptions and the interest it spurred suggests it may find increasing use for tactical operations as well.

Two Radiation Bands Indicated

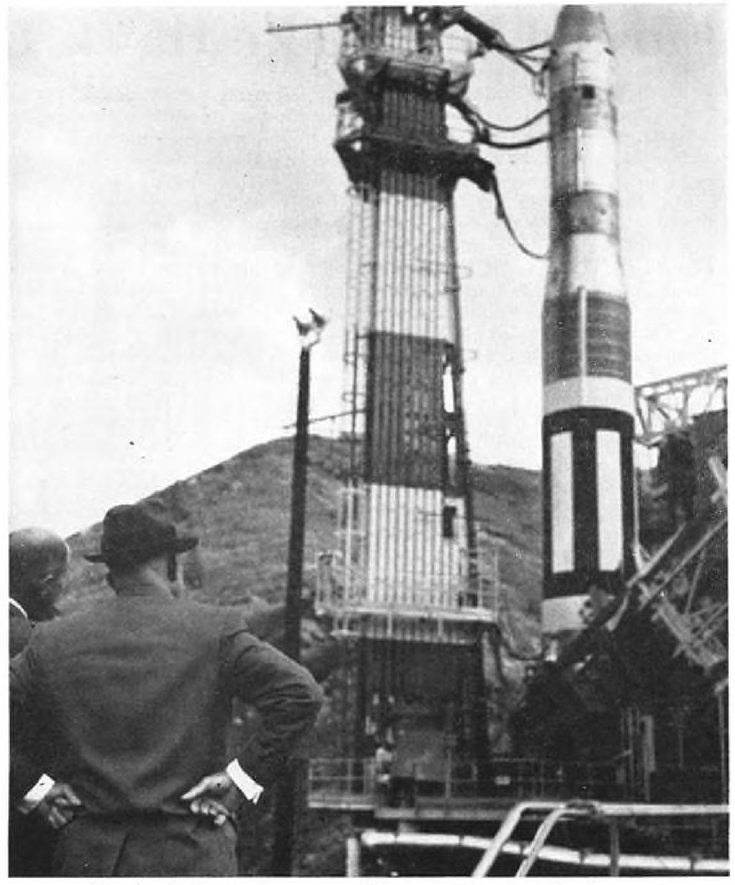
Washington—Limited radiation data obtained by National Aeronautics and Space Administration-Air Force from the Pioneer moon rocket (AW Oct. 20, p. 30) has raised the possibility that there may be two bands of high intensity radiation encircling the earth, Carl McIlwain, a University of Iowa physicist working on the project, reported last week.

McIlwain said that all of the data telemetered from the Pioneer's radiation instrumentation below an altitude of 11,000 mi. has been rendered suspect by a high incidence of noise. Data from about 11,000 mi. showed an average radiation intensity of about 10 roentgens per hour as a rough approximation. This reading fell off rapidly until, at 19,000 mi., the level was less than a few tenths of a roentgen per hour, which was the lower limit of the instrumentation's sensitivity.

The high noise level below 11,000 mi. is believed to be due to an error in aiming the telemetry receiving antennas which have to be pointed almost precisely at the transmitter to obtain clear signals.

A band of radiation has been predicted at a lower altitude by several scientists, including Dr. Fred Singer of the University of Maryland. Most of the predictions place the maximum intensity of the lower band at about 5,000 mi. altitude over the equator. The maximum intensity altitude would decrease toward the poles and reach a minimum there.

The Pioneer carried an ion chamber instrument as compared with the Geiger counters carried by Army's Explorer satellite vehicles. Comparison of data taken with these instruments is difficult. The Geiger counters register an equal signal for each particle of radiation striking them regardless of their energy. Ionization chambers show the average energy of the impinging radiation through the degree of ionization of the gas in the chamber, but it does not provide a means of classifying the type of radiation.



Ike's Visit Brings Titan Photo Release

First official photograph of Titan intercontinental missile was taken during President Eisenhower's recent visit to the Martin Co.'s Denver plant and test site, although the external configuration of Titan was declassified last March. This photo was released last week with White House approval. The 90-ft. missile is due for launching from Air Force Missile Test Center in Florida within the next few weeks. Despite the release of this picture, Defense Department said its policy of refusing to release pictures of the missile until after the first launching still holds. Earlier Titan pictures have appeared in Aviation Week on July 21 (p. 19) and Sept. 1 (p. 21).

Sikorsky Cuts Force By 1,100 Employes

Stratford, Conn.—Sikorsky Aircraft Division of United Aircraft Corp. announced plans last week to reduce its work force by 1,100 employes before April primarily because of declining production schedules.

The cuts will reduce Sikorsky's work force from approximately 9,500 to 8,400.

The division's peak employment reached last year totaled about 11,000.

Lee S. Johnson, Sikorsky general manager, said, "the decline in the volume of business for 1959 is the result primarily of the austerity program initiated by the Department of Defense several months ago."

Europe May Make Hawk Under Aid Plan

By Katherine Johnsen

Washington—Negotiations for production of the Army-Raytheon Hawk low-altitude air defense missile in Europe have reached an advanced stage. Production of the Hawk is expected to be the first project under a program the U.S. is beginning this year to develop manufacturing facilities for advanced weapons in allied countries and lessen their need for U.S. aid.

Under present plans, various components of the Hawk will be produced in various countries, which, in turn, would purchase the missile for their military forces. Countries expected to participate in the program are France, Italy, Germany, Belgium and the Netherlands.

U.S. has earmarked $20 million for the "facilities assistance" program to help Europe with the production of advanced weapons it needs for its own defense.

U.S. plans to supply such items as machine tools, jigs, dies, mechanical engineering drawings. Most of the projects will be for either missiles or late-model aircraft. Later projects are expected to include Japan.

U.S.'s defense aid program for Fiscal 1959, directed by Charles H. Shuff, Deputy Assistant Secretary of Defense for Military Assistance Programs, reflects an increase in advanced weapon systems as well as the introduction of advanced facilities.

Here are the highlights of the Fiscal 1959 program:

• **Missiles.** There will be between $200 million and $250 million to finance new orders. The Jupiter intermediate-range ballistic missile—which probably will go to Italy—is in the program. Thor IRBMs for Great Britain already have been financed. Defense Department originally projected a $233 million missile procurement program. This included $17 million for tactical Corporal or Sergeant missiles; $19 million for Lacrosse tactical missiles; $98 million for Hawks; $48 million for Terrier surface-to-air missiles; $43 million for Sidewinder air-to-air missiles; $10 million for French SS-10 anti-tank missiles. A revised program is now being reviewed by State Department.

Fiscal 1958 funds financed orders for Nike anti-aircraft missiles ($222 million), Honest John tactical missiles ($56 million) and Sidewinder, Corporal, Sergeant, and SS-10 missiles ($34 million for the four types).

• **Aircraft.** New orders will be approximately $235 million. North American F-100 supersonic fighters and Grumman S2F anti-submarine warfare aircraft are in the program. A scheduled $147 million funding for F-100s in the Fiscal 1958 program was postponed to finance Thor purchases. Negotiations are now under way to include the Fiat G.91 lightweight fighter in the program.

• **Avionics.** New orders will amount to approximately $80 million—about 50% to finance improvements in USAF ground control approaches, airborne radio equipment and aircraft control and warning systems. About $20 million will be used to reimburse the Air Force for aircraft control and warning systems and airbase communications equipment which is being turned over to Japan for operation by Japanese forces.

• **Weapons development.** A total of $40 million is tentatively earmarked for this cost-sharing program, under which the G.91, SS-10 and a number of other weapons have been developed. U.S. is expected to continue contributions to development of a British intermediate range ballistic missile by de Havilland Aircraft.

• **Offshore procurement.** This program of foreign purchases, largely to bolster the economies of allies, is declining rapidly. Orders during Fiscal 1959 will drop below $100 million as compared with $1.6 billion in Fiscal 1953. The decline, according to Shuff, is due to changing materiel requirements and "the vital need for retaining orders in the U.S. to sustain the domestic military production base." Offshore procurement is now primarily restricted to items which must be of foreign types to support foreign equipment and items no longer produced in the U.S. It is now official policy that no offshore procurement is to be undertaken if it will: "(1) have serious adverse effects on the U.S. production base or (2) result in unjustifiable price differentials in comparison with U.S. supply of similar items. . . ."

• **Foreign sales.** U.S. expects to stimulate $100 million in weapon sales to foreign countries in Fiscal 1959 with its credit extension program. Thus far, most sales of military equipment by 60 countries and international organizations have been for cash. Almost two-thirds of the sales have been to Canada and Germany. However, Defense Department estimates that extension of credit will make possible $100 million in potential sales during Fiscal 1959 to such countries as Australia, New Zealand, Venezuela and other Latin American countries. Approximately $97 million in Fiscal 1958 defense assistance funds already have been set aside for credit to allies who want to purchase U.S. material to meet the objectives of mutual security.

Defense Department reports on the over-all mutual military security program from Calendar 1950 through Calendar 1957 include:

• **U. S. military contributions** to other countries totaled $19.7 billion. Cost for U. S.'s own defense forces amounted to $277 billion. Total U. S. allocation to mutual defense was $296.7 billion.

• **Allies receiving U. S. aid** spent $105 billion on their own defense. Canada and Australia, which have not received U. S. assistance, spent another $17 billion. This brings the total cost of mutual defense against the Soviet bloc for the eight-year period to $418.7 billion.

Navy Plans Increase In Polaris Range

Dallas—Range of the U. S. Navy submarine-launched Polaris intermediate range ballistic missile eventually will be increased beyond its present 1,500 mi. limit, Rear Adm. William F. Raborn, Polaris program chief, told a Navy Day meeting of the Navy League here.

Describing the missile's capabilities, Admiral Raborn said "1,500 mi. is but a first step. This range, like almost any other missile, will be improved."

Recent operations of nuclear-powered submarines under the polar ice pack have demonstrated that missile-firing submarines can maneuver close to the northern shoreline of the Soviet Union.

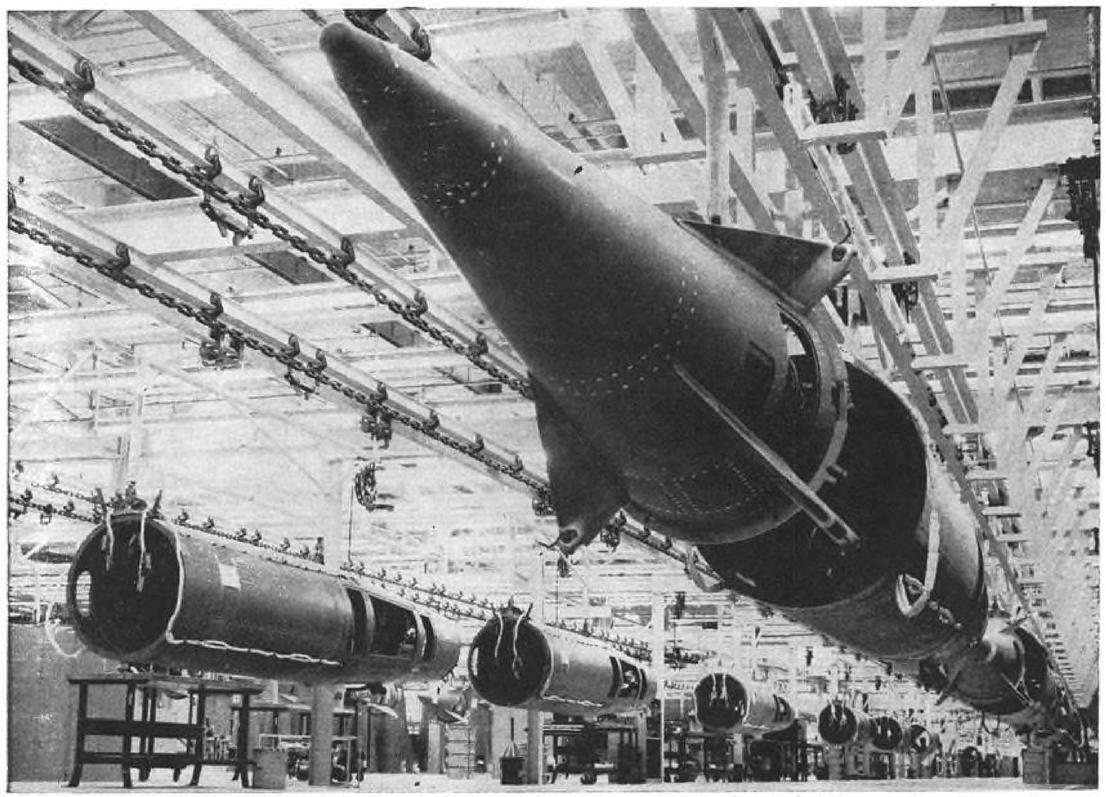
Commenting on an observation that these operations were conducted in the summer months, Admiral Raborn said he is "not discouraged" over prospects for a polar area missile launch under the more difficult conditions of the winter period.

The Admiral observed that the Russians have a highly developed submarine capability and have intermediate range ballistic missiles, and that they are presumably planning to mate the two systems.

But he said he believes the U. S. is ahead of the USSR in development of long range solid propellant missiles and in the job of combining them with nuclear-powered submarines.

Polaris has had two spectacular failures recently at Cape Canaveral, Fla., but Admiral Raborn reported that out of 23 test firings, 21 have been successful.

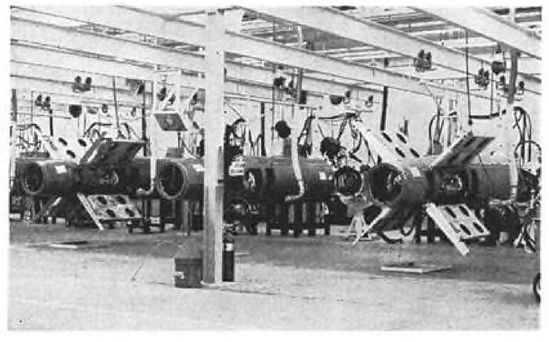
Components which caused the failures were relatively minor, he said, and can be corrected by re-engineering certain features.

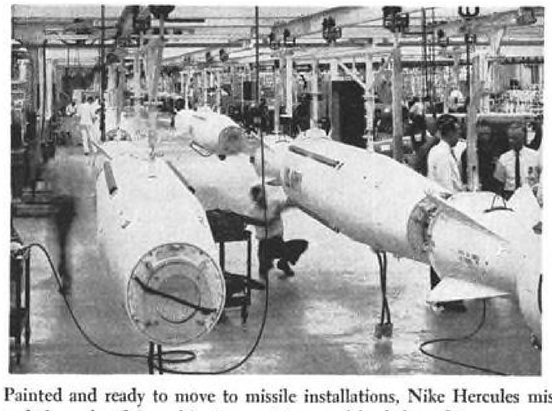


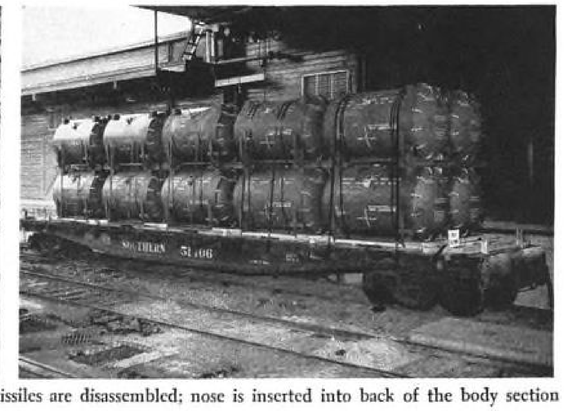
Nike Hercules on final assembly conveyor line is complete except for booster and warhead section which goes in gap (above) between nose and body. Hydraulically actuated control fins are checked out (below, right) and then removed as missile moves through assembly.

Nike Hercules Assembly Shown for First Time

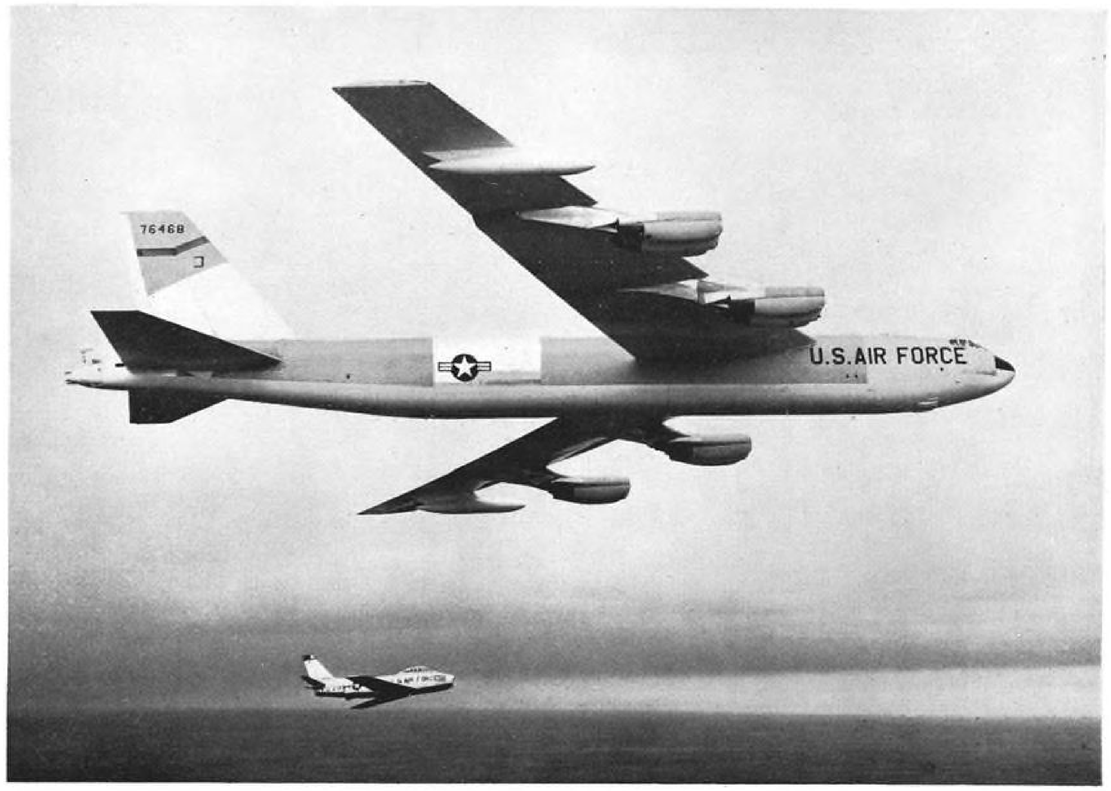
Douglas Aircraft Co. is now near full utilization of its Charlotte facilities for the production of Nike Hercules. Actual production figures are classified but other than the smaller air-to-air missiles, Nike Hercules output here is believed to be the greatest of any major missile production in the U. S. At present, the Charlotte Division employs more than 2,000 people on a one-shift basis. On a two-shift basis, capacity could be doubled, according to Donald Douglas, Jr.; and on a three-shift basis, it could be increased by a factor of 2.3.







Painted and ready to move to missile installations, Nike Hercules missiles are disassembled; nose is inserted into back of the body section and then placed in a shipping container and loaded on flat cars.



B-52G Missile Carrier Makes First Flight

Boeing B-52G, now in quantity production at Wichita, Kans., will soon enter service with USAF Strategic Air Command. Missile platform bomber made first flight at McConnell AFB, Wichita, flying 4 hr. 7 min. on a mission which included an aerial refueling hookup.

Industry Wins U.S. Property Tax Round

Los Angeles—Attempts by California counties and cities to levy personal property tax on U. S.-owned equipment and inventory in aviation industry factories have not been ended by a ruling of the California Supreme Court that such taxes are presently illegal.

The court has ruled that no California statute specifically authorizes local governments to assess and tax the possessory interest of private parties in federal personal property such as tools and work-in-progress inventory which they are using or which is kept in their plants.

Bid for Rehearing

Local government tax authorities hold little hope that their bid for a rehearing by the State Supreme Court will be granted since the first decision was unanimous.

Their next move will be to seek the passage of a law by the California Legislature authorizing the tax. There appears to be no legal obstacle to the law since the U. S. Supreme Court ruled in the case of the City of Detroit vs. Murray Corp. that no constitutional right is violated when a local government taxes a private corporation's beneficial interest in personal property to which the federal government holds naked title.

A California law already exists which enables local governments to tax the private possessory interest of contractors in U. S.-owned real property which they use. Another U. S. Supreme Court decision supports this law.

When the local governments take their proposed law to the legislature, they can expect a major fight from industry, since many existing contracts make no allowance for an increase in the price of the product due to the imposition of a new tax after the contract signing.

Los Angeles, San Diego and Alameda counties and the cities of Long Beach, Azusa and Pomona were among the earliest to claim the tax. It was first applied in 1953. The recent decision by the California Supreme Court that the tax is illegal was the final outcome of companion lawsuits brought in 1954 by Aerojet-General Corp. against Los Angeles County and the City of Azusa and General Dynamics Corp. against Los Angeles County and the City of Pomona.

Los Angeles Decision

The tax was first called illegal in a decision on the case handed down by the Los Angeles Superior Court on June 10, 1957, and later appealed by the defendants to the State Supreme Court. When the plaintiffs originally filed suit, taxes collected on the disputed basis were impounded awaiting the decision of the courts. However, in Los Angeles County for the years 1954 and 1955 the taxes were released and partially spent in 1956. The impound was restored after the Superior Court's decision, and the county was later reported to be setting aside money at a reported rate of $3 million per year to rebuild the impounded fund.

In Los Angeles County, alone, total amount of the refund to industry is expected to be between $60 million and $65 million. By 1957, several hundred companies, including small avionics firms and other subcontractors, were being taxed for their U. S.-owned inventories and equipment. Most of the taxes were actually paid by the Department of Defense which allowed them as reimbursable costs on defense contracts, and most refunds will go back to the government. Department of Defense has always held the tax illegal and instructed contractors to file for refund of the taxes paid in fiscal years 1954, 1955 and 1956. After the 1957 Superior Court decision, the Department of Defense stopped reimbursement of companies for personal property tax on government property but unreimbursed collections are a relatively small part of the total.

Until the Supreme Court decision, local governments also were taxing defense contractors on the U. S.-owned inventory and equipment kept in the plants of their subcontractors.

The U. S. Supreme Court last week refused to review a ruling of the highest court in Kansas which denied the state the right to tax government-owned equipment and machinery which General Motors used under a USAF contract. The courts held that the property was owned at all times by the government and was therefore immune from direct state taxation, even though General Motors used the equipment.

Space Technology

NASA Invites Bids on Capsule

Washington—Bids leading to the first U. S. manned satellite capsules have been opened to industry by National Aeronautics and Space Administration. Bidders' conference is set for Nov. 7 at Langley Research Center, Langley Field, Va. Proposals are due by Dec. 4.

Project will be managed by Robert R. Gilruth and done with the assistance of Defense Department's Advanced Research Projects Agency. Its goal is to put a man into orbit, study his flight and return him safely at "the earliest practicable date."

This project, along with other new NASA work and projects that have been transferred from the Defense Department will be handled in accordance with the Armed Services Procurement Act.

Procurement and Contracting

NASA Director T. Keith Glennan said last week that his agency is developing procurement and contracting regulations that "will conform in every practicable way" with Armed Services Procurement Regulations. This will, he said, avoid the necessity for a changeover on transferred projects and the necessity of operating under two different sets of regulations for contractors doing business with both the National Aeronautics and Space Administration and the various military services.

The space agency plans a major procurement and contracting program Although it will continue to buy services, materials and equipment from laboratories of the old National Advisory Committee for Aeronautics, Glennan said it "will also seek to develop and use contractual sources capable of designing, developing, producing and testing space vehicles and the supporting services and products related to the successful launching and operation of such vehicles."

The agency said it will do the following:

- **Advertise for competitive** bids whenever requirements can be clearly defined, and award contracts on a fixed price basis to the lowest responsible bidder.
- **Use the competitive negotiation** method with qualified firms when product or service requirements cannot be precisely defined, and award contracts on a fixed price or cost plus fixed fee basis. Most of these negotiations would be for research or development contracts.
- **Negotiate contracts with** educational and other non-profit organizations for specified research and development.
- **Give small business firms** as much opportunity to participate in contracting as practicable, consistent with NASA's goals.

High-Density Trend Emphasized in An-10

Moscow—Russian trend toward higher-density seating arrangements in commercial transports is emphasized by the new An-16, an advanced version of the four turboprop An-10 Ukraina.

Latest version of the Antonov designed aircraft reportedly accommodates 130 passengers as compared with 100 for the An-10A and 84 for the original An-10.

Soviet progress in developing higher density aircraft has been most significant with the Tu-104 series. First of the Tu-104s carried 50 passengers, while later designs of the 104A carried 70 and the 104B carries 100.

SC.1 Pure-Jet VTOL Makes Free Flight

London—First free vertical take-off and landing was made Oct. 25 by the Short SC.1, Short Bros. and Harland Ltd.'s pure jet research aircraft sponsored by Ministry of Supply.

PanAm Completes Jet Financing

New York—Pan American Airways last week obtained a $130 million revolving line of credit under highly favorable terms from a group of banks in 17 cities, completing the financing necessary for its jet aircraft on order.

Pan American can draw on the line of credit from now until June 30, 1961, at prime 90-day interest rates existing at the time the loan is made. After the cutoff dates, loans outstanding will be repaid in semi-annual installments over a period up to five years. The revolving feature permits Pan American to borrow, repay and then reborrow. Thus Pan American could actually obtain more than $130 million in loans over a long time even though the total loans outstanding at any one time could not exceed $130 million.

Pan American's jet orders for 17 Boeing 707-321 Intercontinentals, six 707-121s and 17 DC-8s total about $240 million. Four more DC-8s on order for Panair do Brasil add $20 million for a total of $280 million. Pan American has $90 million in long term loans from insurance companies in addition to its line of bank credit, and deposits of $25 million have been paid.

Several factors influenced bankers in granting the liberal terms. One was Pan American "has always treated its bankers well" in the past. Another is the large cash throw-off from rapid depreciation of equipment. Cash breakeven points are considerably lower than bookkeeping breakeven points. Thus airlines could be in the paradoxical position, if operating revenues fell, of reporting large deficits because of the high depreciation deductions they must make and still have ample cash to pay their creditors.

Another possible factor in the banks' attitude may have been American Airline's leasing of engines rather than borrowing for purchase. Some bankers have been critical of this move and competitive reasons may have prompted a drive for Pan American's business.

Little Change Shown In Financial Pattern

New York—Pattern set earlier in the year by major aviation firms showed little alteration in nine month financial reports appearing last week. Marked improvements for some companies were offset by earnings declines for others.

• **Chance Vought Aircraft** carried on its sharply increased sales and earnings results, almost doubling its 1957 figures. Net income of $7,235,892 or $6.18 a share on sales of $240,927,097 for the first three quarters of this year compared with profits of $3,672,054 or $3.13 a share on sales of $145,474,079 last year.

• **Douglas Aircraft Co.** reported nine months sales up from $828,417,314 last year to $888,766,637 this year but earnings down from $24,710,406 or $6.47 a share last year to $16,546,190 or $4.34 this year.

• **Bell Aircraft Corp.**, reversing a trend in the industry, reported a decline in sales but an increase in earnings. Sales dropped from $151,366,136 for the nine months last year to $140,841,591 this year. But earnings rose from $3,089,271 or $1.15 a share to $3,386,936 or $1.26 a share.

• **Republic Aviation Corp.** reported improved third quarter earnings, including a non-recurring item amounting to 98 cents a share for settlement of incentive provisions of F-84 production contracts from prior periods. But nine months earnings were down from $4,890,418 or $3.32 a share last year to $3,918,363 or $2.66 a share this year. Sales declined from $220,744,918 last year to $133,545,062 this year.

• **McDonnell Aircraft Corp.** for the first quarter of its 1958 fiscal year ended Sept. 30, reported small declines in sales and earnings. Comparative quarterly figures were: 1958 sales, $109,003,509; for 1957, $110,163,973: earnings, $2,012,071 for 1958 and $2,149,331 for 1957. Per share earnings dropped from $1.36 to $1.27.

Douglas blamed the earnings decline on phase-out of piston engine transports and heavy DC-8 jet transport write-offs. Research and development write-offs and inventory write downs for this project totaled, respectively, $37,190,000 and $11,047,000 in the ninth month period compared with $32,095,000 and $3,700,000 last year.

Third quarter research and development write-offs declined to $9,351,000 from $13,532,000 in the previous quarter, Douglas said. However, inventory write-offs will increase as the new transports come off the line prior to certification when deliveries can begin.

Other financial results:

• **Thiokol Chemical Corp.** reported nine month net sales of $54,607,976 and earnings of $1,317,219 or $1.38 a share, a 32% increase over 1957 nine-month figures of $1,735,581 or $1.09 a share. Sales for the 1957 period were $39,026,522.

• **Rohr Aircraft Corp.** sales and earnings for its fiscal year ending July 31 set a company record. Sales totaled $147,538,056 compared with $115,765,923 the previous year. Earnings rose from $3,727,737 or $3.97 a share to $4,022,474 or $4.28 a share.

The Rohr report commented on the increasing amount of bank borrowings needed in defense production. Its bank borrowings rose from $15 million to $27 million and interest charges from $773,895 to $1,556,000.

A striking note in a similar vein can be found in the Douglas report. Its interest payments for the nine months period rose from $1,335,400 last year to $5,639,344, a 330% increase. Though Douglas's total debt does not appear unduly heavy by credit rating standards, the interest charges amounted to 31% of its nine-month earnings.

Thor-Atlas Schedule

Washington—Scheduled firing of an Air Force-Douglas Thor intermediate range ballistic missile from Cape Canaveral, Fla., this week will be the first Thor to be launched with an IOC (Initial Operational Capability) engine.

Engine incorporates all the improvements fed into the system up to the time the design was frozen and will be used in the Thor missiles sent overseas.

Next Air Force moon shot using a Thor as its first stage is scheduled for Nov. 7, but will not incorporate the IOC engine. First 6,000 mi. firing of a Convair Atlas intercontinental ballistic missile was scheduled to be made from Canaveral late last week.

Solid Propellant Plan Launched by ARPA

Washington—Major integrated research program in solid propellants was launched last week by the Advanced Research Projects Agency and the military services.

ARPA funds of $20 million will be used in Fiscal 1959 for research by government agencies, chemical companies, research firms and universities.

First step was authorization for the Army, Navy and Air Force to begin negotiations with American Cyanamid, Dow Chemical, Esso Research & Engineering and Minnesota Mining & Manufacturing Co. for contracts of between one and two million dollars each.

These four firms were among some 30 bidders. Bids were received and screened by the three services, and eight bids were recommended to ARPA for final selection.

Remainder of the $20 will be spent for in-house work and studies to be made by special chemical or other research firms and universities.

The contracts grew out of studies made early this year, which recommended "a vigorous increase in advanced research on solid propellants" as part of ARPA's responsibility.

Direction of the program is under a Solid Propellant Technology Panel headed by Dr. John F. Kincaid of ARPA. Companies were given end objectives rather than detailed specifications, ARPA said.

The agency called the four contracts "an initial step in fulfilling a desire of the Department of Defense to set up a solid propellant supply business to service the rocket engine industry of the U. S."

News Digest

Air Force has ordered North American Aviation T-39 Sabreliner into production. Quantity of the twin-jet utility airplane ordered was not disclosed. Airplane has a cruising speed of 500 mph. and 1,400 mi. range and will be used as a jet proficiency trainer, cargo plane for high priority spare parts, navigator trainer, tow target or chase plane.

Production contract for five Hiller Aircraft Corp. one-man Rotorcycles has been awarded to the firm by U.S. Navy Bureau of Aeronautics. Helicopters will be delivered to U.S. Marine Corps for field evaluation, with delivery scheduled for September, 1959. Company also said the Rotorcycle will be manufactured in Europe under license.

Avco Manufacturing Corp. has acquired Pre-Flite Industries Corp., Paramount, Calif., makers of hydraulic test stands and ground starting units for turbojet and turboprop aircraft.

Cessna Aircraft Corp. has received a $12,345,000 contract from U.S. Air Force for additional twin-jet T-37 intermediate trainers. New contract will extend Cessna T-37 production into 1960, according to Robert L. Lair, general manager of Cessna's Military Division.

First Convair F-106 accident was recorded last week when Capt. E. Jones, Air Force acceptance pilot, crash landed the aircraft on Rogers Dry Lake, Edwards AFB, Calif. The aircraft was on a routine acceptance flight from Convair's Production Flight Test Center at USAF Plant 42, Palmdale.

IATA Emphasizes Jet Impact, Traffic

New Delhi delegates told new traffic sources must be developed; debate over jet fares continues.

By L. L. Doty

New Delhi—Competitive impact of turbojet transports on airline profits during the next year and the urgent need to develop new traffic sources set the pace as major issues of the 14th annual general meeting of the International Air Transport Assn. which ended here last Friday.

Difficulties met by carriers in reaching accord during the IATA conference in Cannes emphasized the economic problems the industry faces in making the transition from piston engine aircraft to turbine powered planes. Most officials here agreed that the economic issue being raised by the industry's jet program poses a threat to the survival of some companies and puts strong pressure on the earnings power of others.

Disagreements carried over from the traffic conference to the general meeting suggested to most airline heads that the economic problem was the real reason behind the growing conflict between small and large carriers (AW Oct. 27, p. 26). However, most of these officials admitted that such a conflict between the haves and have-nots, so far as jets are concerned, is inevitable as long as the competitive factor dictates individual airline policy.

One airline spokesman said the competitive impact of jets "is bound to force some airlines against the wall." He added that government subsidy is probably the only way of tiding over some carriers, whose transition period may run into 1960 or later, unless they can introduce promotional and sales campaigns that will develop new sources of traffic.

Another concern of the airlines, also stemming from the traffic conference, is that, if carriers fail to reach agreements on their own within the IATA traffic conference structure, future conferences will be taken over by the governments involved while, as one delegate put it, "airline representatives sit in corridors waiting for the diplomats to make their decisions for them."

Such a situation was compared here to the position of U.S. international carriers in the handling of bilateral air transport pacts. U.S. carriers are the severest critics of this system which calls for the State Department to negotiate all agreements with foreign flag carriers without direct U.S. airline representation. IATA members left here determined to prevent a similar move on the part of other governments and to ensure that "airline business will always be handled by the airlines."

User charges drew considerable attention during the course of the meeting as one of the chief causes of a mounting expense level that has hit airlines throughout the world. The IATA financial committee reported that the carriers already pay about $12 million yearly for ground facilities and services including charges remitted to certain governments.

Since no agreement was reached by the 27 governments represented at a recent International Civil Aviation Organization conference on air navigation facilities, each country will now set its own level of user charges for international carriers. As a consequence, the committee expressed anxiety over the user charge situation and warned that the airlines may be faced with serious problems in this connection in the near future.

Fee Planning

IATA has urged the governments involved to follow a reasonable policy on planning fees for the use of route facilities as well as airport landing charges and has pointed out the serious effect heavy fees can have on the economic condition of the industry.

The committee reported some success in reaching an equitable tax system with some governments through joint actions of the airlines but warned that "taxation problems are cropping up literally from one end of the world to the other with almost montonous regularity."

IATA's taxation subcommittee pointed out that any attempts to create a universally taxable formula to be used by the industry were not practicable at this time because of the wide variety of taxing systems used by the governments throughout the world. The group stressed that the chief aim of IATA was to work out a taxing program that would at least ensure a treatment equal with that of competing forms of transportation.

Concern also was expressed over the strong possibility of an increase of premiums on aircraft hull insurance to give still further impetus to rising costs.

The committee supported a resolution designed to eliminate certain aspects of transport insurance which restrict international trade.

The committee reported that, during 1957, the IATA clearing house in London handled airline accounts totaling $639 million, an increase of 30% over settled accounts in 1956. Unit costs to users of the facilities dropped during the period from 19 cents per $1,000 of gross receivables to less than 16 cents. During the year, elapsed time between the closure of monthly clearances and their settlement was 11 days for dollars and 12 days for sterling accounts.

The technical committee told delegates that, since the last IATA meeting in Madrid, two major technical conferences have been held as a means of pooling the knowledge of airlines, manufacturers and civil and military agencies on all phases of jet transport operations.

The committee urged that the "see-and-be-seen" system of air traffic control is eliminated as soon as possible and that the introduction of a positive control system is completed within five years. It also said it had decided that the "right of way" rules must be replaced by "giving away" rules so that both aircraft in proximity would be required to give way as a means of reducing the midair collision threat with high speed aircraft.

The committee strongly recommended further studies designed to accelerate turn-around maintenance of jet transports because of the economic penalties of delays in ground handling of the larger and faster planes. It suggested that manufacturers establish depots at central locations for aircraft spares and parts to reduce the size and cost of an airline's spares facilities.

Fuel suppliers were asked by the committee to "take a hard second look" at their fueling procedures equipment and techniques. It noted that the main job of cleaning fuel must be done on the ground by the fuel suppliers in order to eliminate the necessity for complex and heavy airborne equipment. The committee also emphasized the importance of keeping fuel free from water and dirt as one means of reducing maintenance and overhaul costs.

The committee recommended research into the development of a simple airborne vibration indicator to facilitate trouble shooting en route. It said that further development of maintenance recorder techniques could feasibly create a new concept of engine overhaul

and extend engine component life.

Warning that icing of turbine engines needs more study was made by the group, although it said there has been ample evidence that hail and rain have no adverse effect on performance. In other tests, the committee found that neither polar nor tropical conditions present special problems in the performance of jets. It added, however, that for certain takeoff conditions, traditional coolants such as water methanol may be required but are considered undesirable.

The committee praised the Doppler radar navigation system which it termed of "great significance to operators" and added:

"While Doppler systems must undergo further evaluation, it has already been possible to evolve a new navigational philosophy, based on its availability, and taking into account the advantage—economic and otherwise—of self-contained aircraft navigation without cooperating ground stations."

The committee found that turbine powered aircraft operations will create no new communications problem but "will aggravate existing ones." It reported a need for improved quality for voice communications and for automatic data transmission for routine communications.

Continued research into jet streams and clear air turbulence was urged by the committee, which emphasized the close relationship between finding the optimum flight path and the accuracy of forecasting weather elements. This relationship calls for improved accuracy in weather forecasting and new elements of information, the committee told the assembly.

On airport buildings and aprons, the committee made these recommendations:

• **Maneuvering of turbine** aircraft on the apron should be carried out under their own power.

• **Hydrant refueling is desirable** where large quantities of fuel are to be supplied to turbine-powered aircraft in a short time.

• **Pier finger systems best meet** airline requirements when aircraft cannot be parked next to terminal buildings. The committee strongly recommended against an open apron system.

• **Use of passenger-carrying vehicles** will be even more unsuitable with jets than with propeller planes.

IATA members were given a report of progress made toward eliminating red tape in crossing borders as a major step toward the encouragement of more tourist travel.

Of major assistance in relieving the burden of customs, immigration and public health paperwork, has been the gradual elimination of the passenger manifest, the report said. Savings to the U.S. governments and airlines alone as a result of dropping the manifest requirement is estimated to be $1 million annually, the report said.

Airline presidents heard a summary of the technical committee's report on its conference held in September in Monte Carlo. Forthcoming problems associated with the introduction of turbojets was the local point of discussion during the entire conference proceedings.

United's Earnings Rise

United Airlines reported increased earnings last week for the third quarter and for the first nine months of the year. The figures:

• Nine months—$10,500,718 or $3 a share this year compared to $7,918,374 or $2.41 a share last year. Of this, $312,215 this year was a non-recurring item from sale of aircraft compared with $1,549,634 for a similar category last year.

• Quarter—Earnings were $6,361,204 this year, or $1.78 a share, compared with $4,965,182 last year.

Nine months revenues rose 10%, to $236,479,571, while operating expenses rose 7%, to $213,914,960. United reported a continued resurgence of traffic in October, after the end of the third quarter, as business conditions improved.

United President W. A. Patterson said that the improved position still did not remove the need for higher fares to bring earnings to levels to meet United's needs and give investors a fair return. He pointed out one source of increased earnings—$2,495,765—was a Civil Aeronautics Board accounting policy. This sets residual value of aircraft at 15% instead of the previous 10% and thus reduced United's depreciation expense by that figure.

Fatigue Test Dispute

It was generally accepted by manufacturers that pressure checking of aircraft could be confined to checks for leakage and not necessarily for structural strength except in cases where repairs of a major nature had been carried out.

One airline said it believed that the fuselage should never be tested to maximum permissable pressure, adding that it was prepared to make operational sacrifices in altitude of normal flights rather than conduct testing which might lower the fatigue life of the airplane.

Some delegates, however, suggested that testing to maximum pressure might pre-stress the structure and actually improve fatigue life. One manufacturer recommended that aircraft should be subjected to proof pressure at least once a year.

Sharp difference of opinion apparently exists among manufacturers on the effects of testing components rather than complete assemblies in fatigue inspections. Airlines held no opinion on this subject but urged the manufacturers to resolve their differences as soon as possible. Airlines also called for guidance from the manufacturers on developing inspection periods for the jet transports.

Airlines favored paint coverings on top surfaces of aircraft as a skin protection against heat and exhaust gases. Manufacturers urged full skin protection but warned against the use of paint strippers on aircraft using redux structure.

On the point of skin corrosion, the group discussed extensively the problems of new aluminum alloys and magnesium used in structural components. Airlines were in general agreement that they did not like magnesium under any circumstances but said they recognized an alternative would create a weight penalty. Manufacturers said that magnesium in new aircraft was being used only in sections readily accessible to inspection and away from areas prone to condensation. A new anodizing process for magnesium has proved to be successful but has not yet prevented the possibility of bolt holes becoming a starting point for fatigue corrosion.

On turbine engine power deterioration and restoration, the technical committee found that outside influences such as starting techniques, operating conditions and procedures will have a major influence in creating deterioration. Power deterioration is the loss of efficiency of one or more components of the engine causing a reduction of power below the initial engine power under standard conditions.

Airlines with some turboprop experience indicated that power deterioration can reach serious proportions although there has been some improvement in this area within the past year.

One airline said it used the following technique as a means of spotting power deterioration: closely monitor the rpm., fuel flow, jet pipe temperature and torque readings. In this connection, one manufacturer reported some experience of power deterioration up to one or 1½% after 1,000 hr. of engine running in desert conditions. Such deterioration had proved to be difficult to detect by flight instrumentation reference since such small losses in power are not likely to show up under present instrument accuracies.

Tow main approaches were recommended as a means of restoring power deterioration—liquid washing at short intervals for smaller engines and cleaning of larger engines with a special soft grit.

One manufacturer indicated that a small deterioration in power at maximum rpm. with a two spool axial engine would cause a power loss of 5%. Loss was detected by means of a total pressure probe in the tail pipe. Generally, it was agreed that, while deterioration due to contamination had been a limiting factor in engine life up to now, it was difficult to predict how much effect contamination would have on engines with more than a 2,000 hr. life. It was suggested that eventually it might be less expensive to accept some power deterioration than it would be to create new overhaul costs to clear the contamination.

Other points reported by the technical committee as requiring urgent attention:

• **Need for full anti-icing** of aircraft wings during takeoff.

• **Requirement for a more accurate** artificial horizon. The committee reported that present artificial horizons can lead to serious pilot error during takeoff. During acceleration, the instrument in present aircraft has a three degree error. The committee warned that this will be increased to four degrees with turbine-powered aircraft.

• **Need for data from engine** manufacturers on the amount and size of solid foreign matter that is considered acceptable to turbine engines. Manufacturers were asked to establish cleanliness standards for each engine.

• **Airlines agreed that thrust** augmentation by water injection will improve engine performance and payload but urged that manufacturers take no steps that will create such new problems as the need for exotic and expensive fuels, corrosion and smoke on takeoffs.

• **Manufacturers should be requested** to equip large turbojets with anti-skid brakes. Airlines learned that considerable progress had been made in the development of thrust reversers and that the United Kingdom airworthiness authorities are planning to reduce landing distance requirements when the thrust reversers are used. No credit is given in determining landing runs for aircraft equipped with propeller reverse thrusts.

CAB Counsel Urges Cuts in Fares

By Robert H. Cook

Washington—The Civil Aeronautics Board's Bureau counsel last week recommended airline fare cuts totaling 9.67% over the next two years in his brief on the General Passenger Fare Investigation.

The counsel's stand was directly contrary to airline demands for fare increases ranging from 12 to 17% which they consider necessary to attract the financing needed for the jet re-equipment program. It also reflects recent CAB statements that lower fares are the only means of filling the seat increase provided by the new jet transports.

As presented in a brief to CAB Examiner Ralph L. Wiser, the bureau counsel urged a 3.28% fare cut as the first decision in the two-year old case and a second reduction of 6.39% by July 1, 1960, when the bulk of jet transports now on order will be placed in service.

Interim Increase

A February interim fare increase of 6.6% should be dropped to only 4% and the Oct. 20 increase of 3.4%, resulting from the elimination and reduction of many discount plans, should be repealed, the bureau counsel said. The combined reductions would still place airline fares 4% above those of last year, the brief added.

Urging CAB approval of fare raises, attorneys for the Air Transport Assn. termed the industry's financial position critical. They said the recent 6.6% interim fare increase was a "palliative and not a cure" and had failed to attract the necessary investment capital needed to finance the $4 billion airline jet equipment program.

Referring to what it termed the "abysmal" earnings of the industry, the brief said that, although the airlines carried three times as much traffic in 1957 and grossed three times as much revenue, the net income of $27 million that year was 57% below that of the two previous years.

The brief reported that second quarter net income for this year dropped 18.2% below that of the same quarter of 1957, and that, coupled with losses suffered before the interim fare increase, left the industry with a mid-1958 six-month income of only $8.2 million, or 66% less than the first six months of 1957.

Final outcome of the jet re-equipment program hinges on the matter of higher fares, the brief said, citing financial testimony on "conditional" credit agreements signed with the airlines. ATA reported that one of the largest financial institutions with credit agreements totaling more than $251 million has said no airline presently has sufficient equity to meet the debt-equity ratio tests for bank loans for the full amount of its commitments. A spokesman for the institution further observed that the "belief that many airlines have already successfully arranged for the money they will need to pay for their jet airplanes is fallacious since they have only arranged for it if they acquire during the years 1958 through 1960 substantial additional equity capital."

Failure of the Board to grant the requested increases in face of impending large scale jet operations and the problem of inflation, will only compound an already critical situation, the ATA brief stated. It added that evidence of the inflationary impact on the industry and how it may become more acute was illustrated by the cost of purchase and installation of electronics in a 1948 propeller driven aircraft compared with present costs.

In 1948, the cost was $12,000, as compared with $97,000 for the same job now. Initial cost per horsepower of engines has advanced in a like manner, ATA said—$10 for the DC-3, $12 for the DC-4, $19 for the DC-6 and $28 for the DC-8.

ATA Brief

The ATA brief, while agreeing that jet economy is hoped for, warned that, "it is quite conceivable that jets may prove more expensive to operate, at least for a time." The attorneys added that the next few years would be years of "turmoil" as the new equipment is shaken down, piston engine fleets are phased out and operational skills for optimum performance are perfected to the required degree.

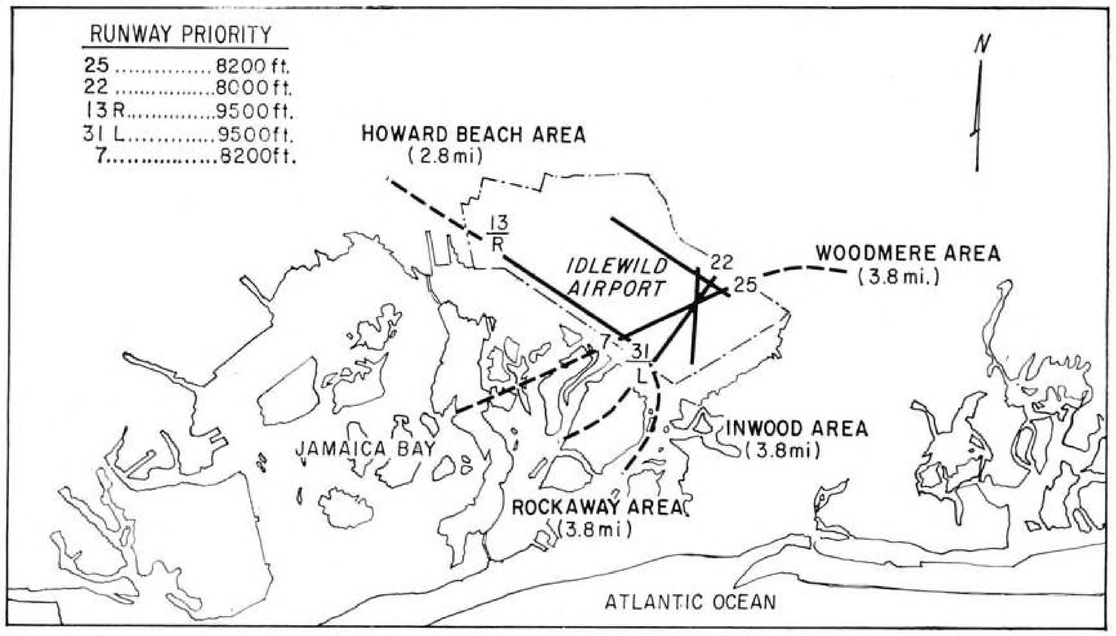
"In short," the brief stated, "there is no rational basis for assuming that the needed earning power can be realized without authorization to adjust fares upward."

Answering a further request of the CAB examiner for an opinion of the feasibility of "automatic adjustment" of airline fares by a pre-determined formula, ATA said such a proposal appeared "unrealistic." As an alternative, the brief suggested that trunklines be allowed "considerable latitude" in pricing their services, subject to ultimate supervision by the Civil Aeronautics Board. The individual judgments of 12 different carriers, ATA said, would thus lead to appropriate fare adjustments and resolve any attendant problems more quickly than through a formal Board proceeding.

PanAm Personnel Cut

Washington—Pan American World Airways last week announced a 5% cutback in Miami personnel, attributing the cut to the runaway competitive situation developing in Latin America (AW Oct. 13, p. 39). There are now 5,400 Pan American people employed in the Miami area.

The airline said the situation resulted from a big increase in the number of U. S. and foreign airlines serving Latin America over the past few years and the low fares now being offered by some carriers.



JETS at N. Y. International Airport are confined to above runways except by special N. Y. Port Authority permission. Dotted lines from runway ends approximate where turns are called for after takeoff. Extension of runways 7-25 and 13R-31L will be completed soon.

Operating Snags Figure in Jet Service

By Glenn Garrison

New York—Opening of the U. S. jet age last week with the first Pan American Airways commercial Boeing 707 flight was marred by restrictions and problems still facing the airline and other operators hoping to make the most of their expensive, modern turbine fleets:

• **Pan American's daily** New York-Paris Boeing 707 schedules, billed as nonstop, actually are stopping for fuel because of runway limitations and anti-noise regulations of the Port of New York Authority. Situation will improve greatly during the next two months as runway extensions are completed at Idlewild, but won't be solved until the Intercontinental 707 is delivered.

• **Unsettled crew disputes are** forcing Pan American to use supervisory pilots on the transatlantic schedules. Unless agreement with pilots is concluded before Nov. 16, New York-London service will be postponed or reduced from daily flights. Eastern Air Lines, planning introduction of turboprop Lockheed Electras next month, and American Airlines, set for January introduction of 707s and Electras soon after, face the same unresolved problem with their turbine pilots.

• **Surcharge at Rome** has been imposed on jet operations, causing Pan American to temporarily abandon jet service to that city and substitute piston aircraft between Paris and Rome. British Overseas Airways Corp., holder of the transatlantic jet first through inauguration of de Havilland Comet 4 service on Oct. 4, ran into labor difficulties and has cancelled most of its weekly New York-London jet roundtrips. The airline hopes to get its delayed crew training program completed in time for daily Comet service beginning Nov. 14.

Pan American's 707-121 is not, of course, a true transatlantic nonstop airplane, as the airline is ready to admit. Pratt & Whitney JT4 (J75) powered Intercontinental Boeing 707-321s, with initial deliveries expected next summer, will fill this requirement.

Runway Restriction

But the JT3 (J57) powered 121s will be able to make it eastbound in winter temperatures a respectable percentage of the time within the next couple of months, when two Idlewild runway extensions are completed. Meantime, the planes are limited by a combination of runway length and noise restriction factors which will permit very few nonstop operations, those only when all conditions are favorable.

Here is the breakdown of Idlewild's runway situation, considering each strip in the order of priority laid down by the Port Authority for its use by jet aircraft:

• **Runway 25 is mandatory** first choice, 8,200 ft. long and pointed out over Jamaica Bay with no communities under a takeoff flight path. To take off from this runway at full gross weight of 247,000 lb., the 121 would need 35 kt. of headwind on a 32F day. Transatlantic nonstops require a gross weight, generally speaking, in the neighborhood of 242,000 lb., allowing a full load of 111 passengers, little cargo and mail, and approximately 90,000 lb. of fuel on the average. For takeoff at more than 240,000 lb. on a 32F day, 21 kt. of headwind would be required. This runway is being extended to 10,000 ft., and under zero wind conditions, full gross takeoff will then be possible when temperature is below 50F.

• **Runway 22 may be used** in lieu of 25, in which case a right turn is called for "as soon as practicable" to avoid flying directly over communities. This runway is only 8,000 ft. long, is close in wind direction to 25, and when 25 is extended, will be used only when the airplane is taking off light anyway.

• **Runway 13R is the only** real nonstop runway at present for the 707. Even with a slight tailwind, the plane can get to 1,200 ft. at 242,000 lb. gross by the time it reaches Inwood. That community is 3.8 mi. from the point where takeoff roll starts, and is in an area including other local hotspots such as Cedarhurst and Lawrence. Runway 13R-31L is being extended to 11,200 ft. Right turn after takeoff is specified by the rules.

• **Runway 31L is out** for full-load nonstops, because the airplane can't get to 1,200 ft. by the time it reaches Howard Beach, 2.8 mi. from start of takeoff. The 1,700-ft. extension will help a little, but not much. Right turn is called for after takeoff.

• **Runway 7 is restricted** to about 10,000 lb. less than its opposite end, Runway 25. Extension won't improve the situation at the 7 end, because climb for 1,200 ft. over the Woodmere area, 3.8 mi. from start of takeoff, will impose the same weight limitations. A right turn is required after takeoff.

On a press flight Oct. 23 before start of scheduled service, Pan American made it nonstop to London with 115 people aboard, time six hours, 42 min. Circumstances happened to be such that Runway 13R could be used under the preferential system.

The first scheduled flight would have been nonstop but for the Port Authority rules. Runway 31L was in use by other traffic at the field, and if the 707 could have used the 9,500 ft. strip with unrestricted climb conditions it could have made it. Airline hoped for a last minute wind shift that would have allowed it to use 13R, but was finally forced to use 25 as the mandatory jet runway with existing wind conditions.

So it took off light at 212,000 lb., including 65,200 lb. of fuel, and stopped at Gander. Elapsed time: 8 hr., 55 min. block to block with 1 hr., 7 min. on the ground at Gander.

Second and third revenue eastbound flights also took off from 25, at weights at 211,000 lb. and 206,400 lb. respectively. Second flight stopped at Gander, while Tuesday's flight stopped both at Goose Bay and London.

First westbound scheduled flight stopped at Keflavik after taking off from Le Bourget's 7,874-ft. runway, reached Idlewild in an elapsed block time of 10 hr., 23 min. including ground time of 1 hr., 5 min.

Ground times at intermediate stops are being improved with practice, and the airline hopes to get the time down to 30 min.

As an indication of the economic penalty of stopping, PanAm estimates the direct costs of putting down at Gander at $1,500, including landing changes and fuel used in letting down and climbing out again. Intangibles such as changing routes add considerably to this penalty.

Another penalty imposed by the need to climb to 1,200 ft. quickly is the extra water that must be carried for engine injection. For example, at 32F and 240,000 lb. gross, with zero wind, 1,860 lb. of water normally would be used during takeoff and initial climb. On any jet runway but 25 at Idlewild, this requirement would go up to 2,800 lb. under the same conditions. On a 50F day at the same weight, 4,595 lb. of water would be used in the quick climb operation.

Pan American plans to add daily service to London Nov. 16, but if no contract is signed with its pilots, this won't be possible. Alternatives in such a case would be to serve both London and Paris with fewer schedules, or only one city with daily flights.

Problem at Rome is a surcharge the Italian authorities have decided to put on commercial jet flights. According to Pan American, the surcharge is in the form of a percentage of total fares of each flight. The airline says it is not negotiating the point because it doesn't feel there is any justification for a surcharge. The fee reportedly suggested by the Italians was 15%, and if it came down to something like 2%, perhaps PanAm might weaken.

The pilot problem is haunting American and Eastern as well as PanAm. Eastern's dispute with the pilots has gone back to the National Mediation Board, with the third crewman issue of pilot-qualified vs. mechanic-qualified engineers the stumbling block. The airline has received two turboprop Lockheed Electras, which are now at Miami. But the rank and file Eastern pilots are not taking flight training until the dispute is settled. Airline hopes to start Electra service Dec. 1, at which time it will have received about eight Electras according to present plans. First schedules will be between New York and Miami, New York-Houston-San Antonio, and Washington-Newark-Montreal.

American's first 707 arrived Oct. 25 at New York after a 4 hr., 43 min. off-to-on time nonstop flight from Los Angeles. Flight suffered air traffic control delays forcing a 125 kt. reduction of cruise speed about 100 mi. out of Idlewild.

The airline plans to inaugurate jet service Jan. 11 and Electra service a few weeks later. It has a little more time than PanAm or Eastern to resolve its pilot problem, but doesn't know at this point whether initial operations will require supervisory pilots or not. Pilot negotiations were broken off last month.

American probably could introduce both aircraft in limited service for a while if the situation had not improved, or possibly could concentrate on one plane and delay inauguration of service with the other. It is going ahead with plans, hoping the issue will be settled.

BOAC's transatlantic scheduled jet operation, begun the same day the Port Authority cleared the Comet and 707 and announced the restrictions, has amounted to two flights each way so far. Both eastbound schedules flew nonstop, one westbound flight stopped at Gander and the other at Keflavik. The British carrier uses Comet 4 as a de luxe and first class Monarch flight, passenger total 48. Same configuration, 16 de luxe and 32 first, will apply when daily service is started.

BOAC now is optimistic about starting daily service on schedule Nov. 14. It had feared that a strike of engineering and maintenance personnel at London Airport, which began Oct. 13 and ended Oct. 21, would delay the new schedules. The airline now feels that if nothing happens to interfere with a stepped-up training schedule it could come close enough to the goal of 10 full crews by starting day to go ahead with the service. The strike cost BOAC an estimated $2.8 million including loss of revenue and shuttling of passengers in chartered planes and on other airlines.

Pilots with Comet 2 experience—the only ones being trained—require 12 to 14 hr. in the Comet 4. Training flights are being held every day with all of the four Comets BOAC presently has received. Training has priority over weekly transatlantic flights, and it seemed unlikely last week that the weekly service would be resumed.

Wage negotiations with the personnel who struck have not been resumed, pending completion of a court of inquiry investigation into the general question of labor-management relations at London Airport.

Pan American's daily flights departing New York are being handled from regular gates in the domestic terminal at Idlewild. Best gate is north at the end of a finger 350 ft. out from the terminal in the normal Pan American ramp area. Jet is taxied in and swung around back to the terminal, loaded, and taxied out again. Airline has suggested to the Port Authority that blast fences be installed along the walkway.

American is completing special boarding rooms for its jet flights at Idlewild, located along a finger considerably out from the terminal.

First American 707 has a provisional certificate, only about half of its seats being installed so that test equipment can be put aboard for training and familiarization flights. Configuration will be 56 first class two abreast, 56 tourist three abreast, in the forward and aft sections of the airplane respectively. Interior of the present aircraft that arrived last week, without seats in its rear half, dramatized the size of the 707 compared with piston aircraft.

Service aircraft will be equipped with forward and aft lounges. New wrinkle in American's interiors: passenger service pods above seats contain miniature "no smoking" and "fasten seat belt" signs, visible to passengers in the seat behind, replacing conventional signs.

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Los Angeles Jet Operating Plan Detailed

Los Angeles—Details as to just how jet transports will be handled when they begin operating from International Airport here were outlined last week by representatives of American Airlines, which will introduce Boeing 707 service to Los Angeles at the start of the year, the Civil Aeronautics Administration and airport management.

Donald E. Pearson, chief of the Air Traffic Control Planning Branch for Region IV, described the traffic procedures and new facilities that will be part of jet operations.

Inbound jets will have three holding patterns at 20,000 ft. in view of turbine fuel consumption problems when holding time becomes significant. From the holding patterns, they will be fed into the regular IFR approach patterns with standard procedures. Reason for standard procedures, Pearson said, is that, from current patterns, the airport's acceptance rate is 30 aircraft per hour, while, if jet penetrations from high altitude are used, acceptance falls to 24 aircraft per hour.

Holding patterns will be one and two minute types and will be located to accept inbound traffic from the east and north. One area will be located 15 nautical miles north of the Fillmore Omni, 56 nautical miles from Los Angeles, at the intersection of 302 DWG radial of Fillmore and 073 radial of the Santa Barbara Omnis on a standard pattern holding to the north on Victor 107 airway.

Another area will be at the Edgemont intersection, 16 nautical miles east of the Ontario Omni, 45 nautical miles from Los Angeles, at the crossing of 076 radial of Ontario and 355 radial of Oceanside Omnis, a standard pattern to the east on Victor 16 airway. The third area will be at the Fontana intersection, 16 nautical miles northeast of the Ontario Omni and 45 nautical miles from Los Angeles, formed by the crossing of 121 radial of the Palmdale Omni and 032 radial of the Ontario Omni, a standard pattern holding to northeast along Victor 8 airway.

Using a CAA Martin B-57, a flight check of these areas and procedures was to be initiated last week.

New equipment needed for jet handling includes a long-range radar which is well along in installation and will be operational about Jan. 1. Additionally, a radar display that can be used in ambient daylight conditions is scheduled for installation.

Standard equipment already operational includes precision approach radar, airport surveillance radar, ILS and sequence flashing lights for approach lights in the instrument runway, 25L.

Complementary equipment to the terminal area is in the planning stage and includes a terminal VOR near the east end of the airport, use of runway visual range, a peripheral communications system feeding into Los Angeles air route traffic control center from four areas which will enable direct pilot-controller communication. Additionally, long-range radars, plans for which envision operational ranges of 150 to 200 mi. are to be placed at locations such as Paso Robles, Las Vegas, Needles and Phoenix.

Another aid to jet flight will be installation of weather teletype equipment for main transcontinental routes which will be capable of from 600 to 1,000 words per minute transmission, Pearson said.

Using this, New York weather will be available for flight plans in Los Angeles within 10 min. of the observation. Trunk lines, operating at slower speeds but faster than those of today, will disseminate the data to stations off the main line.

Other aspects Pearson cited were use of ramp delay departure technique, by which taxi time will be held to a minimum. In this, the pilot will inform the tower of his expected departure time and clearance will be initiated. As the plane is buttoned up, but prior to engine starts, final clearance will be obtained with estimated time off, engines will be started and taxi and takeoff initiated.

Departure from Los Angeles will utilize the jets' high climb rates. Following takeoff to the west, climb will be maintained to a "fish intersection" (an overwater point), after which a teardrop-shaped track will be followed using a climbing turn until the aircraft is back over Los Angeles at a higher altitude. For north and southbound flights, climb tracks will keep aircraft over the ocean for the early climb stages, with south and southwest-bound aircraft re-entering land areas near Long Beach or Oceanside, northbound near Oxnard.

Speaking for American Airlines, F. J. Mullins, the western region's operations officer, pointed out that American is constructing a jet transport ramp at the outer end of its loading finger which will be capable of handling two jets at one time.

Present construction is built around plans to taxi the plane in after landing, unload the passengers, service the aircraft and depart. Departures will have the airplane loaded, the ramp delay clearance obtained, then two engines started to furnish power, after which heavy Hough tractors will push aircraft backwards out to taxiways where the other two engines can be started and taxi initiated.

Ramp facilities include a fixed 125 kva. power source, plus water service for the plane. Ground start carts will furnish air for starting the first two engines; third and fourth will be started off first two.

As the airplane prepares to move away, ground power will be disconnected, but a 12.5 kva. generator on a tractor will furnish power for the airplane's lights and communications between cockpit and tractor until the plane's two other engines are started.

Refueling will be by pressure system from tank trucks, using aviation kerosene. Primary reason for using kerosene is taxes. Kerosene is not taxed while JP-4 is taxed two cents per gallon as an aviation fuel. Los Angeles will be the 707's line maintenance base, Mullins said, although major overhauls will be done at Tulsa.

For the passenger, American has ordered preloading baggage bins for all its turbine transports which will expedite loading and unloading baggage from planes. Inside the terminal, where American has completed some expansion and has more under way, additional check-in positions have been added to almost double capacity in order to handle the larger passenger loads.

Dutch Tu-104 Critics Attacked by Soviets

Moscow—Russian aviation circles are showing serious concern over reported attacks against Aeroflot's Tu-104 Moscow-Amsterdam service in the Dutch press and Parliament.

Sovetskaya Aviatsiya, official publication of the Red Air Force, has condemned Dutch "reactionary circles" for suggesting that the USSR agreed to the air route primarily to strengthen its strategic military aims and further complaints that the twin engine Tupolev can hardly be distinguished from an atomic bomber.

The Soviet military paper criticized an official Dutch Air Force organ which recently printed an article "full of absurd, slanderous fabrications" in which the Dutch are alleged to have pointed to the possibility of an atomic attack on the Netherlands by Soviet planes disguised as Tu-104s. In addition the Russians criticized a Dutch member of Parliament, whom they contend, used the article as a basis for new demands that the Netherlands re-examine its position on Aeroflot's Tu-104 service to Amsterdam.

Plan Sought to Avert Used-Plane Surplus

By Ford Eastman

Washington—Prospects of flooding the used-plane market with hundreds of piston-engine aircraft, now being replaced on major airline routes by jet and turboprop aircraft, is pushing airline, aircraft, banking and government officials into a search for ways to avert a possible economic disaster within the industry.

Surveys and studies are now being conducted by a number of groups in an attempt to find an answer, or combination of answers, to prevent an estimated 1,000 to 3,000 piston engine aircraft throughout the world from being placed on sale in a used-plane market already nearing the saturation point. This estimated figure includes military transports, U. S. and foreign, which may be declared surplus within the next few years.

Although airlines have not placed heavy reliance upon sale of piston planes to help finance jet equipment, the industry finds itself short of the cash necessary to support its planned jet program (AW July 7, p. 26), even before many of them have taken delivery of their first turbine aircraft.

In addition to the cost of new jet equipment—more than twice that of present piston planes—there also is the need for new ground equipment and facilities, which is often more costly than the jets themselves, greatly increasing the airlines' need for cash to cover their commitments.

As a result, airline economists predict that failure to dispose of piston aircraft at prices at least equal to book value will cause a contraction in airline re-equipment plans which, in turn, could have repercussions on the national economy as a whole.

Airlines agree that there is no single and simple solution to the disposal problem and that efforts will have to be expended along several different lines and that, even then, some government assistance probably will be needed. To keep prices of used-planes stabilized, the following steps have been suggested by industry spokesmen:

- **Piston engine aircraft** must be made available for sale gradually, keeping the supply and demand roughly equal.
- **New foreign markets** for used aircraft must be found and financial encouragement given potential buyers in foreign markets.
- **Airlines must make every effort** to keep piston engine aircraft operating even after they have been replaced by jets in regular service, thereby reducing the supply of used equipment on the market. The equipment could be utilized for passenger charters, all-cargo, planes or for the carriage of low priority mail and parcel post.

Another suggestion that has been offered by some sources, and one that is strongly opposed by Congress and government officials, is that the military buy all surplus equipment from the airlines at a fixed price and place the planes in mothballs for an emergency. This, its supporters contend, would give airlines a good price for the aircraft and, at the same time, remove the equipment from any possible competition which might result if it is sold to foreign lines or domestic supplemental carriers and ensure sufficient airlift to the military in the event of an emergency. Cost to the government would be staggering, however.

At present, the most serious effort is being made to develop a market for aircraft in foreign countries. According to one independent survey, there are still underdeveloped areas of the world that can be opened by the formation of new airlines.

Such pioneer airlines do not necessarily need the latest turbine-powered aircraft but would demand types not obsolete or becoming obsolete in the U. S. These new lines could feed directly into the world-wide network of major international airlines which are now buying new production U. S. airliners or the latest foreign types, thereby possibly expanding the market for new aircraft to the larger carriers.

These new airlines, or extensions of existing ones, the survey reported, also would create a further market for surplus ground equipment, overhaul shops and other items for piston engined aircraft that are becoming obsolescent in the jet age.

It added, however, that many small foreign airlines which have a definite need for used airplanes do not have ready cash with which to make full payment, although they generally have some cash plus a good credit rating. Therefore, in order to take advantage of this potential market, considerable financial assistance would be required.

Commercial banking firms at this time probably would be unable to handle the financing program required alone, but they have expressed a willingness to participate to the extent of 40 to 50% of the loans if the Export-Import Bank or similar government agencies would carry the balance.

The Export-Import Bank has extended millions of dollars in credit to assist exporters in the sale of new equipment but has not been faced with the problem of extending credit to assist in the sale of used aircraft. It is now studying the situation and may soon reveal its policy in this respect.

Current demand for second-hand transports at all price levels appears to be the heaviest in South America, Central America and the Far East, although there is a limited demand for used planes in most other areas. The strongest demand is for medium twin-engine transports, with the heavier four-engine planes further down the list.

Domestic markets for used aircraft are somewhat limited, but sales could be expanded providing the prospects of the potential buyers are boosted through legislation or the relaxing of government restrictions.

Supplemental air carriers also might become potential buyers of used piston engine planes, but their future prospects are too uncertain. One of the biggest drawbacks to the supplementals' long-range planning is the uncertainty of their status until after the long-drawn-out Large Irregular Air Carrier Case is finally decided by the CAB.

Another domestic market is the airplane broker who will buy aircraft from airlines and convert the planes into executive aircraft, cargo planes or modify to fit the needs of any potential buyer throughout the world.

One broker, Frederick B. Ayer & Associates of New York, already has contracted to buy 24 American Airlines Convair 240's for lease and resale in the U. S. and abroad (AW Sept. 2, p. 43).

Ayer told AVIATION WEEK that he feels there will be a good world market for the used long-range transport such as the Douglas DC-7, if they are not dumped on the market when they become surplus. He said that if the airlines hold onto a good reserve of DC-7s until the new jets and turboprops are fully integrated into operations and then released gradually, the market price should hold up.

One method some airlines have employed in disposing of the large transport planes is to trade them in to the manufacturer on new jets. However, an airline spokesman said this is not the answer to the long-range problem because the manufacturer would merely offer the planes for sale rather than the airline.

Regardless of the steps taken to create a stable market for used commercial aircraft, the market still could become glutted if the armed services, which will have large number of piston engine transports for sale, dump them on the market all at once. Industry spokesmen say that only through close coordination between the military and commercial airlines can the disposal of aircraft be carried out in orderly fashion.

Peking Institute Designs, Builds Light Transport

Twin-engine light transport designed and built by teachers and students of the Peking Aeronautical Institute has been successfully test flown (AW Oct. 13, p. 32). Aircraft seats eight passengers and is suitable for STOL operation on short-range interprovincial flights. Maximum range is approximately 666 mi., maximum speed is approximately 186 mph. and maximum altitude is about 15,750 ft.

As Maine Goes

As Maine goes this winter so the nation may go in the future. No, not politics—all-weather visual landing aids. The Strategic Air Command, beginning this November, will conduct a test program at Dow AFB, Bangor, Me., to investigate the merits of narrow gage runway lighting.

This is a continuation of the program begun last year at March Field, Calif. in which SAC made exhaustive studies of approach lighting.

The Dow Field experiment will advance this all-weather work a notch further. In addition to Cutrell approach lights, the Dow installation will utilize 3,000 ft. of narrow gage runway lighting.

Vexing Problem

This visual aid program is intended, of course, to provide SAC with some answers to the eternally vexing problems of all-weather landings although other military commands and the Airways Modernization Board as well as various interested government and civil agencies will be invited to cooperate.

It is expected that the program will provide conclusions and recommendations regarding the operational suitability of this complete visual system (Cutrell approach lights plus narrow gage runway lighting) under actual severe weather conditions.

With any cooperation from State of Maine weather this should indeed be a severe test. (This author hopes to take part in some of this testing.)

In addition to flight questions, SAC wants to study the ground operation and maintenance difficulties encountered in this installation. Specifically it wants answers to such things as operation during snow and ice precipitation conditions, problems of removal of ice and snow, the possibility of aircraft damage caused by striking lighting equipment, adverse aircraft reactions such as yawing porpoising, etc., due to installation of lights in the runway surface. (These lights are spaced 100 ft. longitudinally along the runway, the two "lines" of lights being 30 ft. on either side of the runway centerline; that is, a 60 ft. gage.)

Navigational Radio System

For instrument approaches a complete navigational radio aid system will be used. Provisions will be made for test instrumentation, including photography, to substantiate the results and provide a filmed record of the landing aid equipment. As in the March Field evaluation, this new test will utilize a large number of pilots in order to get reactions from a broad experience base flying all available types of currently operational aircraft.

There is no reason to believe that the Dow experiment will be one whit less honest, or less exhaustive or conclusive, than the masterpiece at March which forced military and civil authorities to adopt the Cutrell approach lights as National Standard. For more than a decade a small group of pilots had fought for this important safety item, at times waging fights against factions in the Civil Aeronautics Administration, USAF, Navy, Bureau of Standards and elsewhere. But time after time non-operational persons were allowed to make decisions regarding tools for pilots.

The approach light test flying done at such places as Arcata, Indianapolis and Patuxent River, if not deliberately misconstrued by analysts, was at least highly slanted. Honest testing simply could not have arrived at the stated results. So we kept on losing aircraft because of poor approach lights.

Now we are in need of equivalent runway lights. As pointed out here previously (AW Sept. 29, p. 31) there are those who would sabotage the runway as they did the approach lights. Fortunately organizations such as the Strategic Air Command do not scare easily nor do they write reports in the name of expediency. With SAC's honest thoroughness, and an assist from Maine weather, we may soon have some real information on a complete visual system for dependable all-weather landings.

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SHORTLINES

► **Lockheed Aircraft Service Inc.** reports that it sold more than 100 of its flight recorder units during the first six months of its sales effort. Eight commercial carriers have placed orders for the equipment, mandatory on aircraft certificated to fly above 25,000 ft., which measures and records basic conditions of flight over long operating periods.

► **Mohawk Airlines'** system flight headquarters control was scheduled to be switched from Utica and Ithaca, N. Y., to Oneida County Airport last week. Mohawk's executive offices, which also have been moved from Utica to the airline's new maintenance and headquarters building at the airport, is scheduled to reopen for business today. The new headquarters features 139,000 sq. ft. of floor space and a full cantilevered reinforced concrete roof which Mohawk claims to be the largest of its type in the world. The building will house up to 14 Convair type aircraft and can accommodate the largest airliners in service today.

► **Seattle-Tacoma International Airport** reports 132,496 inbound and outbound passengers used its facilities during September, to bring the total to 1,107,595 passengers during the first nine months of 1958. A total of 1,877,090 lb. of airmail, off and on, was 20% greater than that for September, 1957 with air freight and air express gaining 13% and 5% respectively

► **Trans World Airlines** plans to use the new Lockheed 1649 Constellation aircraft on all transatlantic and international passenger flights this winter. By Dec. 26, TWA will equip all these flights with the 1649 except one Super-G Constellation flight overseas to be used on the New York-Boston to Lisbon-Madrid-Rome trips on Sundays, returning Thursdays. TWA also will begin new international all-cargo Lockheed 1049-H aircraft into operation Nov. 6 on its New York-Shannon-Paris-Rome and Rome-Milan-Geneva-Paris-Shannon-Gander-New York routes.

► **United Air Lines** is now operating its flights into Akron-Canton and Youngstown, Ohio, exclusively in Douglas DC-6 or DC-6B aircraft. Four daily services are being operated into the New York area with two daily flights going into Chicago and Cleveland. United also is beginning new nonstop first-class four engine service between Oakland and Los Angeles. On Oct. 26, the airline began nonstop air coach service between Boston and Cleveland, using Douglas DC-7 equipment.

AIRLINE OBSERVER

► Pressure for a merger of British European Airways with British Overseas Airlines Corp. is growing in Britain, although most observers feel that strong opposition to such a proposal from BEA Chairman Lord Douglas and BOAC Chairman Sir Gerard D'Erlanger will kill the plan. However, high operating and maintenance costs of BOAC, estimated at twice the costs of other carriers of similar size, has caused the airline to lose heavily and could force the issue.

► **Lockheed Aircraft decision to demonstrate its turboprop Electra in Europe and Asia may pay off with new sales. At least three foreign flag carriers are withholding decisions on new equipment until they see the Electra operate on their own grounds and under their own route environments. Biggest roadblocks to American sales campaigns overseas are the high cost of new aircraft and difficulty in obtaining financial backing.**

► Pilots of most European carriers are demanding a third crew member on all aircraft. However, they contend that their stand differs from that of the Air Lines Pilots Assn. since they insist that the third crewman remain on flight engineer status at a pay scale not to exceed 60% of a captain's pay. Because of these demands, Air France is forced to operate the Viscount with three crew members in the cockpit.

► **U. S. aircraft manufacturers are being criticized by European airlines for their small representation at the September technical conference of the International Air Transport Assn. in Cannes, France. For example, one U. S. engine manufacturer was represented by its Lisbon salesman. As a consequence, British manufacturers dominated the conference in discussions of turbojet and turboprop problems. The U. S. avionics industry, in contrast, was well represented.**

► International Air Transport Assn. traffic conferences have been conducted entirely in the English language for the past three years, but delegates from foreign flag carriers probably will move to renew a system of simultaneous translation of proceedings into at least two languages. These delegates say they object primarily to the strain of discussing technicalities in a language other than their own and are concerned over the possibility of misinterpretation or the chance of getting tripped up by idiomatic expressions.

► **Watch for Misrair, Egypt's nationally owned airline, to buy three Russian Tu-104 jet transports despite the fact that the aircraft ranks third on the carrier's preference list. European financial backers say Misrair would like to buy Caravelles as ideally suited to its routes and would accept de Havilland Comets as second choice. However, the French and English firms would expect payments in hard money; Russia will accept Egyptian currency. As a result, Egypt probably will buy the Tu-104s even though the airline considers the price "very, very high" and still knows very little about the plane's operating costs. Misrair will open routes to Frankfurt next June, has just about reached final agreements with England for a route to London but still has been unable to settle on terms for a bilateral pact with France.**

► Air India International is campaigning to reduce customs and immigration red tape in India as a means of encouraging tourist travel. Spokesmen for the carrier concede that most Asian countries continue to burden tourists with detailed paperwork before granting entry privilege but say India's desire to relax entry requirements is also shared with such countries as Pakistan, Burma, Thailand and the Philippines.

► **Middle East Airlines is developing new traffic by placing emphasis upon a regional type operation within the Middle East and Europe. The carrier feels there is a profitable and untapped traffic market immediately available by offering a feeder service within the two areas to connecting long-haul passengers.**

► International airlines are asking for a system that would record and broadcast in-flight weather reports from transports flying over areas where upper air reporting stations are scarce.

WILLGOOS TURBINE-ENGINE TEST FACILITY—(top picture). Here tomorrow's power plants are "flown" under conditions of simulated altitude, speed, and temperature often impossible to attain in actual flight. It is the most complete privately-owned turbine-engine test facility in the world.

FLORIDA RESEARCH AND DEVELOPMENT CENTER, a completely air-conditioned plant with 17 acres under roof, is specially equipped for development of new propulsion systems of almost any type. This facility supplements Pratt & Whitney Aircraft's research and development installations in Connecticut.

PROVING A PAIR OF THOROUGHBRED JETS

Whether the 30,000-pound thrust class J-58 . . . or the small, highly efficient JT12, aviation people know these newest power plants by Pratt & Whitney Aircraft are thoroughbreds.

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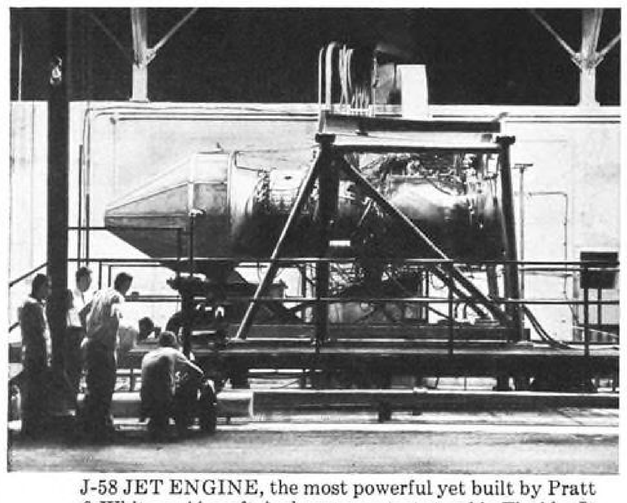
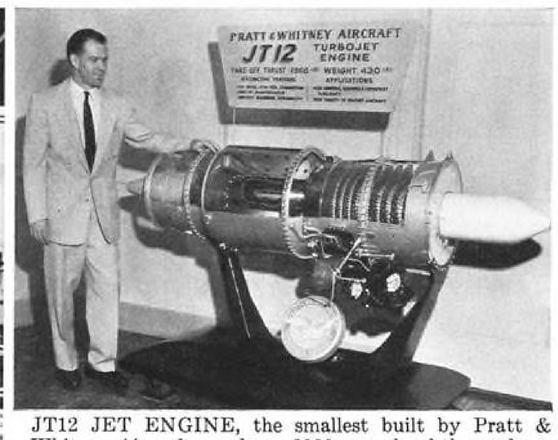
Beginning with matured design, and backed by unequalled experience, Pratt & Whitney engines are tested and re-tested, developed and refined in facilities second to none. Principal among them are the Willgoos Turbine-Engine Test Facility, heart of Pratt & Whitney's complex of research and development installations in Connecticut, and the new Florida Research and Development Center. The Florida center is specially equipped to develop and test advanced propulsion systems, and here the J-58 first roared into life.

Born thoroughbreds, Pratt & Whitney Aircraft's new J-58 and JT12 engines before long will take their place as dependable power plants for new generations of American aircraft.



J-58 JET ENGINE, the most powerful yet built by Pratt & Whitney Aircraft, is shown on a test stand in Florida. It is designed for operation at very high Mach numbers.



JT12 JET ENGINE, the smallest built by Pratt & Whitney Aircraft, produces 2900 pounds of thrust for a total weight of only 430 lbs. With a single spool and fixed geometry, the JT12 promises outstanding performance, reliability and ease of maintenance for many possible applications.

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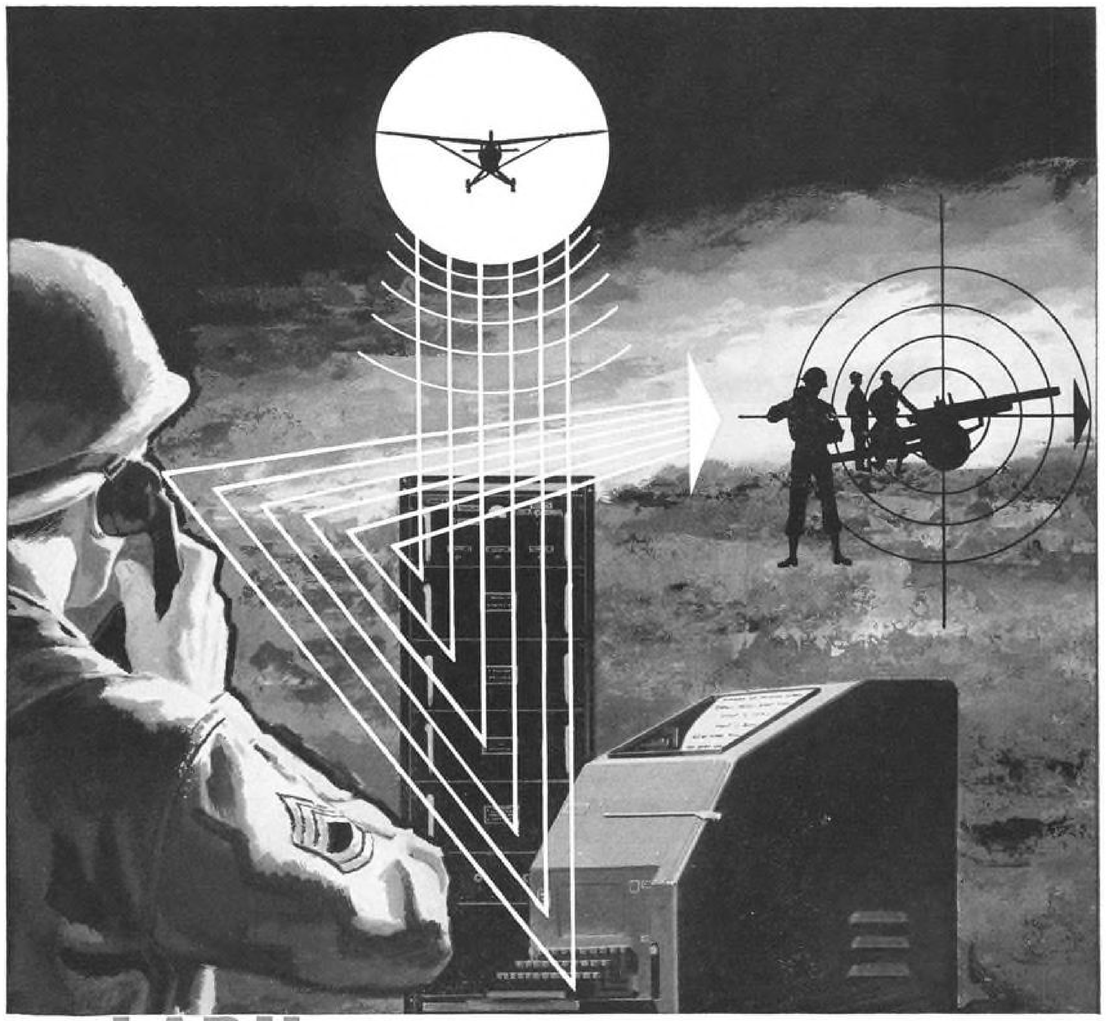

Why LABIL is a powerful link in the communications chain

Speed and reliability make LABIL, Stromberg-Carlson's new data link, ideal for automatic transmission of flight information from light aircraft to ground receiving and control locations.

Into the link the pilot or observer can enter 13 types of data regarding flight and target. When the ground control group wants the information, a lamp on the panel of the airborne equipment lights. The pilot or observer presses the transmit key, and the entire stored message is automatically transmitted over his *existing voice communications equipment.*

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Complete technical data on Stromberg-Carlson's Light Aircraft Binary Information Link is available on request.

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Navy Unveils Low Cost Sounding Rocket

By Craig Lewis

El Paso—New, low-cost meteorological sounding rocket called ARCAS was unveiled at the First National Conference on High Atmosphere conducted here at Texas Western College by the El Paso branch of the American Meteorological Society in conjunction with the New Mexico-West Texas section of the American Rocket Society.

Details of the ARCAS rocket were revealed at sessions which included discussion of both rocket and balloon techniques for measuring conditions in the upper atmosphere, along with discussions of current research and experience in that area.

Designed specifically as a low-cost meteorological research rocket, ARCAS is a solid propellant vehicle being developed by Atlantic Research Corp. The program is sponsored by Office of Naval Research with the support of the Bureau of Aeronautics and Air Force Cambridge Research Center, according to Lt. Cmdr. W. S. Houston of Office of Naval Research. ARCAS is expected to help satisfy the need for a flexible, low-cost unit for use in atmospheric research programs at universities and colleges, he said.

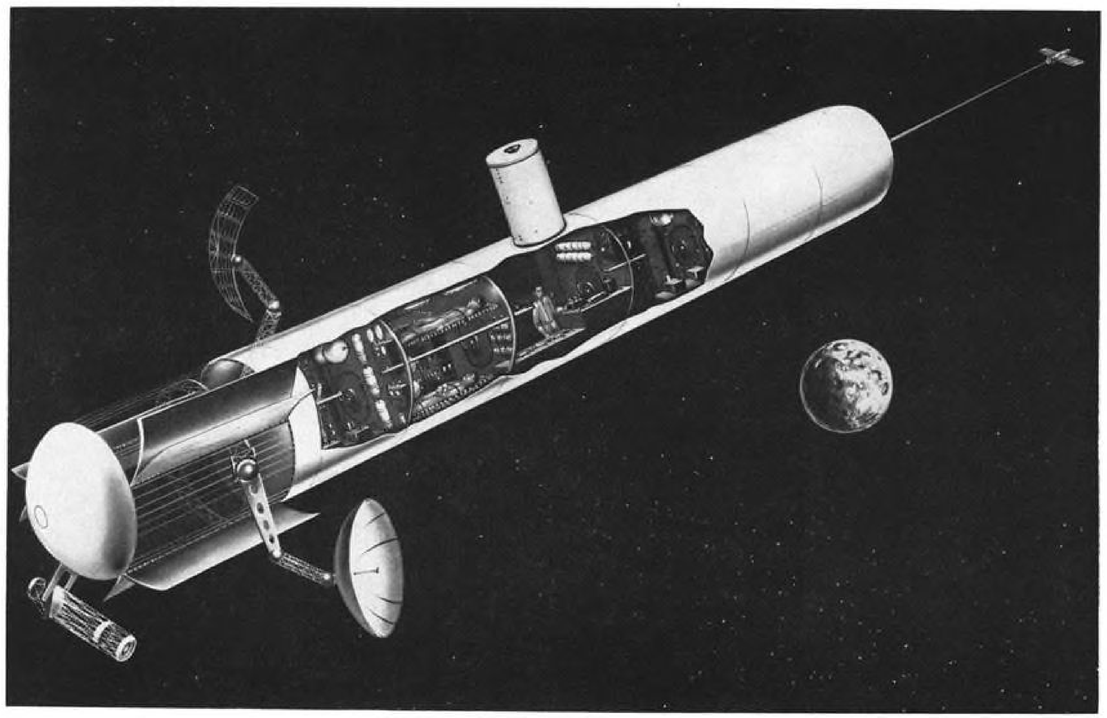
To meet ONR requirements, Atlantic Research has produced an end-burning, single-stage solid rocket which is 4.45 in. in diameter, 78.5 in. long and weighs 71 lb. ARCAS provides 292 cu. in. of space to handle a payload of 12 lb. including parachute and nose cone and has a maximum altitude from sea level of 206,000 ft.

In flight, the ARCAS motor burns out after 26 sec. when the rocket is at 40,000 ft. and maximum velocity is 3,500 fps. ARCAS then coasts to peak altitude, which it reaches about 100 sec. after launch. Maximum acceleration is about 20G.

ARCAS is fired from a closed breech launcher which weighs 392 lb. and can be assembled by two men within two hours. Launcher tube and free volume cylinder can be pivoted down to a horizontal position for loading, and it can be aimed within a 20 deg. vertical cone for firing. To meet a 100 fps. exit velocity requirement, a follower plate is placed around the rocket exhaust nozzle to serve as a gas seal.

Separation system has a 75 sec. delay between burnout and separation. When ARCAS reaches altitude, a propellant charge boosts the nose cone away from the spent rocket motor at a relative velocity of 10 fps. A 50 ft. lanyard connected to the motor case pulls pins from the parachute container can and allows the parachute to deploy.

There is very little experience with parachutes at 200,000 ft., according to Houston, but estimates indicate that a 24 ft. diameter 0.5 mil Mylar ex-



Space Station Would Orbit at 22,300 Mi.

Five-man space station envisoned by Rocketdyne Division of North American Aviation, would be 35 ft. long and 7 ft. diameter. It would require a launching booster vehicle developing about 6 million lb. thrust and would orbit at an altitude of 22,300 mi. Rocketdyne, which is developing a million-pound thrust engine (AW Aug. 18, p. 53), said the space station could be used for astronomy, solar and ionosphere studies or as communications relay station, navigation aid or weather forecast station. Anti-radiation shielding might account for as much as 20,000-40,000 lb. of vehicle's total weight of 65,000 lb., according to Rocketdyne scientists.

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tended skirt-type parachute will give a stable descent rate of about 300 fps. at 200,000 ft., slowing to 200 fps. at 175,000 ft. This rate is acceptable for initial testing, and changes are expected during the program which will produce a lower descent rate.

Parachute is made of Mylar and is coated with aluminum to make it radar reflective. Scale model tests in altitude chambers indicate that the chute can be opened by inflating a donut-type sealed hem around the perimeter of its throat. Full size parachute has a two inch sealed hem, and the hem contains a few cubic centimeters of methanol which will vaporize at altitude and provide the necessary inflation pressure.

Although the rocket didn't even exist on paper at the beginning of 1958, all the ARCAS components have now been built, and the rocketsonde is entering the flight test stage. Data gathering flights to obtain temperature wind profiles are expected to begin early next year, Houston said.

In quantity production, the price of ARCAS is estimated in the range of $500 a round, not including the instrument package. Since the rocket is a research tool, no standard instrument pack has been designed for it. Various combinations are under development, and all will be mounted on a standard base plate for easy installation in the rocket. All packages requiring telemetering will use either standard or modified weather bureau radiosonde transmitters operating on 1,680 mc. so existing installations can be used.

Various ground installations will be used with ARCAS, depending on the nature of the experiment. One type being planned is a mobile unit which will have an MPQ-12 or similar tracking radar with a light weight directional antenna for receiving the 1,680 mc. telemetry data fastened to the back of the radar dish. Other equipment will include a GMD-1 receiver/recorder, magnetic tape recorder and WWV receiver.

Much of the impetus and information for development of a rocket like ARCAS came from a study completed about a year and a half ago by Stanford Research Institute for the Federal Civil Defense Administration. I. G. Poppoff of SRI said the study was made to determine feasibility of developing a rocketsonde system for routine meteorological use. Rocketsonde was to provide wind data and, if possible, temperature, pressure and humidity data for altitudes up to 150,000 ft. and was to be capable of integration with weather bureau facilities at minimum expense.

Rocketsondes which can provide detailed data on upper atmosphere wind and temperature profiles are useful in a number of ways, including forecasting of probable radioactive fallout patterns from nuclear tests. The data is also useful for military aircraft operating at high altitudes, as well as for evaluation of test results from missile launchings.

Stanford Research Institute found that the simplest system would be a single-stage solid rocket which would carry instruments to altitude, then release them to parachute down and provide meteorological information. Wind velocity and direction can be obtained by tracking the drifting and parachute-sonde, and temperature data from a reflective thermister can be telemetered to the ground. Report found the state of development in pressure and humidity sensors unsatisfactory for rocketsonde purposes at the time, but recommended that such elements be developed for later use.

According to the Federal Civil Defense Administration study, the rocket should be able to attain 160,000 ft., allowing 10,000 ft. for nose cone separation, and should carry a payload of 12 lb. in a volume of 300 cu. in. It should have sufficiently low acceleration that instruments would not have to be too rugged, but enough acceleration to provide stability. A maximum acceleration of 25G was suggested.

For routine use in daily weather work and missile firings, Naval Ordnance Laboratory has developed a sounding rocket called HASP which makes use of the Army-developed LOKI system to carry a 40 in. Dart containing sampling gear aloft, and eventually the program will produce rocketsondes which will go to 200,000 ft., according to M. J. Parker of Naval Ordnance Laboratory.

HASP is designed to integrate with present shipboard equipment for sampling the upper atmosphere, and the rocket is fired from a standard 5 in. gun. Naval Ordnance Laboratory is currently releasing metallic chaff for radar tracking. An instrumented HASP round is now under development.

Navy Bureau of Aeronautics is expected to order several hundred HASP rounds for use at Pt. Mugu and on shipboard, and large volume production is expected. In lots of 1,000, HASP will probably cost less than $500 complete. There is still a large stockpile of LOKI parts which can be used to keep unit costs of the rocketsonde low.

Discussing a larger category of sounding rocket, C. E. Roth of Aerojet-General Corp. described a family of four Astrobee rockets his company is working on to add to the proven Aerobee series. These new rockets are based on the present state of development using off-the-shelf engines, and do not require large scale research and development programs.

In sampling the upper atmosphere, researchers often have to rely on converted weapon rockets because of cost and availability problems. A new sounding rocket called EXOS which will carry 40 lb. of useful payload to an altitude of 300 mi. was described by L. M. Jones of the University of Michigan Research Institute. EXOS uses Honest John, a Nike Ajax booster and Recruit rocket engines for its three stages.

Means of photographing weather phenomena from high altitudes will be provided by Project HUGO, a program sponsored by Office of Naval Research in conjunction with the weather bureau. Charles F. Mozer of the Physical Science Laboratory at New Mexico College of Agriculture and Mechanic Arts told the AMS-ARS meeting that the HUGO system was originally intended to photograph hurricanes off the Atlantic coast and thus is designed for sea recovery.

HUGO System

System developed under the HUGO program uses two GSAP 16 mm. movie cameras taking color and black and white pictures through ports in the base of their case. A Nike Cajun rocket boosts the package to altitude, separating from the nose cone at 50 mi. Cameras run as the payload coasts up to a peak altitude of about 75 mi. and back down to the 50 mi. level. Parachute lowers the camera package into the water where it is located by homing on a Mytymouse beacon on top of the floating package.

Balloons have long been in routine use for high altitude meteorological measurement, and the use of plastic balloons for research in the regions about 100,000 ft. where they are relatively untried was discussed by J. R. Smith, general manager of Raven Industries, Inc. Observing that the record altitude for a balloon is about 145,000 ft., Smith said that balloon activity in the 120,000-135,000 ft. area has become commonplace in the past two years.

Defining high altitude capability, Smith said a 3 million cu. ft. balloon will carry a load of 100 lb. to 136,000 ft. He forecast that in a few months a 5 million cu. ft. vessel may carry 100 lb. to 143,000 ft. or a 12 million cu. ft. balloon may carry the same load to 155,000 ft.

Lt. Cdr. E. A. Basquin of Office of Naval Research commented on the role of the balloon in measuring atmospheric conditions. He pointed out that balloons have considerably longer flight durations than rockets and said that the balloon is complementary rather than competitive with satellites since the operational altitudes are vastly different. Basquin described the Navy Strato-Lab system as a "man's satellite" and observed that at 100,000 ft. or lower there are many observations that can be made

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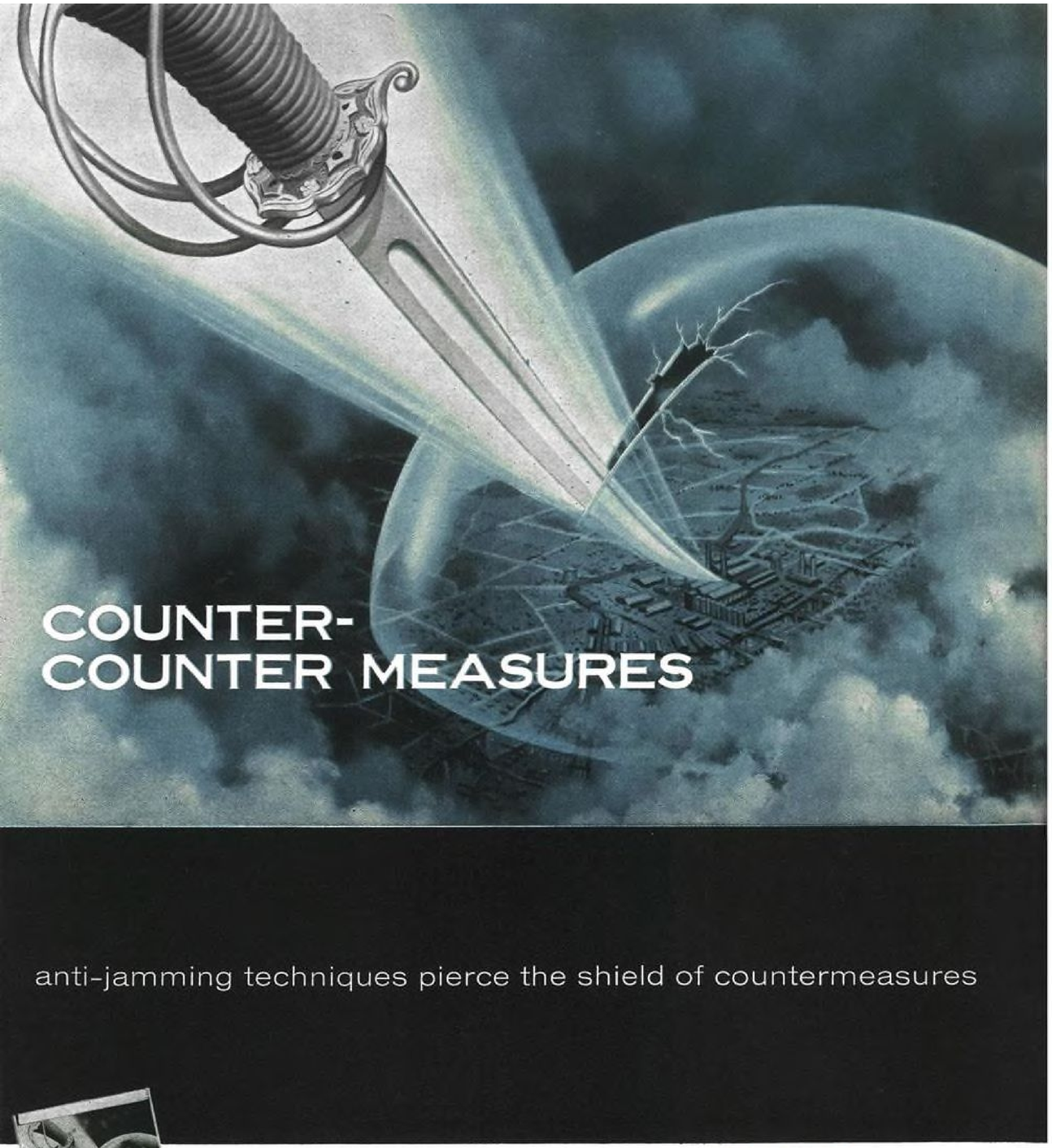

In the silent world of electronic defense, there are two ways to move and observe—unobserved. One involves the airborne jamming equipment LMED is currently producing for the B-52. The other is the new Anti-Jamming techniques LMED is currently developing for the Air Force to give future weapons systems a high degree of countermeasures immunity. Tomorrow's airborne weapons systems will need secure detection and reliable countermeasures. LMED is intimately experienced in both. For brochure: "Moves and Countermoves in an Unending Struggle for the Electronic Spectrum," **write Dept. 5A.**

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as well from a balloon as from a satellite since the balloon would be above 99% of the atmosphere.

Basquin said it is safe to say that no balloon will go above 200,000 ft. and that probably the altitude limit is considerably below that level. He pointed out that maintaining altitude is a problem because of contraction of the inflating gas at night and said that the answer may lie in the use of a new plastic or a laminate of existing ones.

Indication of progress in this problem came during the conference when a sealed balloon made of Mylar by the G. T. Schjeldahl Co. floated at a constant altitude of 68,000 ft. for four days.

This experiment came under a joint Office of Naval Research-Bureau of Aeronautics program designed to find a balloon to use with a transosonde system. The Mylar cell maintains a constant volume and the pressure varies inside it as the gas expands or contracts with temperature changes. With such a constant altitude balloon, no ballast would be needed to maintain altitude and the payload package could be reduced from 600 lb. to the less than 100 lb. instrument pack.

Directability is also a problem with balloons, and Basquin said Office of Naval Research is making preliminary studies of applying power to them. Studies are in a very rudimentary stage, but among propulsion possibilities are rockets, boundary layer systems and a dirigible approach. Probably the first attempts will be a dirigible system in the 30,000 ft. area.

On Sept. 25, 1957, a Navy balloon carried a telescope to 80,000 ft. to photograph the sun. The work was done for Dr. Martin Schwarzschild who is now developing a television link which will allow him to adjust the focus of the telescope from the ground. This new model is scheduled to fly next summer. A larger telescope with a 36 in. mirror in place of the 12 in. mirror now used is planned with a flight target date in the early 1960s.

Discussing Project Strato-Lab, Basquin said that the gondola that made a manned flight to 86,000 ft. last year has been remodeled to accommodate a 16 in. Schmidt telescope and spectrograph and will fly in November. It will observe oxygen content and possibly the water vapor content on Mars and, if the experiment is successful, other planetary investigations will follow.

Remodeling of the Strato-Lab gondola made it unsuitable for other than astronomical work, Basquin said. "In order to provide the most efficient space-equivalent laboratory, we have recently begun a study program which is designed to survey all fields of science to determine what experiments can and should be performed on this floating platform."

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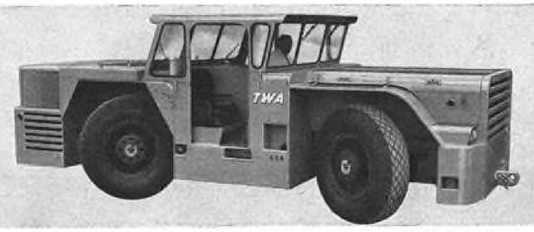

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Space Cooling System Demands Reliability

By Richard Sweeney

Los Angeles—A cooling system for manned and unmanned versions of an orbital vehicle was described to the Society of Automotive Engineers by Jay S. Tupper, Hamilton Standard Division of United Aircraft Corp.

Vehicle dealt with was one with a mission time up to 4 hr., with about 3.2 hr. spent out of atmosphere. Vehicle would be divided into a manned compartment and one or two unmanned equipment compartments. Parameters calculated envisioned the vehicle accelerating to almost orbital speed, circling the earth several times in unpowered flight, then re-entering into the atmosphere, concluding with a controlled landing. Criteria were:

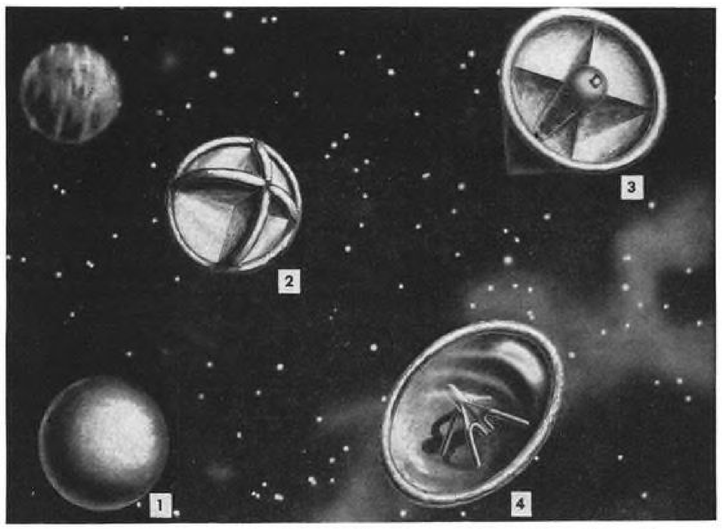
- **Specified performance** must be met at all conditions.
- **Reliability is prime consideration** in selecting system, has precedence over weight and other factors.
- **System weight** must be the minimum consistent with the two foregoing criteria.
- **Ground handling** must be simple and flexible.
- **Initial system** and maintenance costs must be kept to a minimum.

Assuming the vehicle would spend all but a small portion of flight time out of atmosphere, a stored refrigerant was called for, with water as a preliminary heat sink, with additional means of meeting performance at altitudes where boiling temperature of water at ambient saturation pressures is too high, i.e., ammonia, Freon.

Operation would be in a weightless condition as well as in high accelerations. Design included means to circumvent both circumstances to keep the vehicle heat transfer area saturated with coolant, and simultaneously propel coolant through the refrigeration cycle during its use, to make provisions for minimum coolant loss in use.

Stored coolant was preferred over mechanical refrigeration since rotating machinery is minimized, although larger bulk coolant storage is a penalty. The control system is also simpler, even to the extent of having a backup control system for the stored refrigerant at little additional weight penalty in view of the increase in reliability.

System envisioned called for a refrigerant storage system separate from the operating portions of the system, with controls appropriate to minimizing refrigerant loss.



NASA Proposes Inflatable Satellite Applications

Inflatable satellites, made of thin plastic covered with aluminum foil, have been proposed for space technology uses by scientists of National Aeronautics and Space Administration. Deflated satellite is ejected into orbit from a rocket carrier, is automatically inflated by a nitrogen gas cartridge. Gas is allowed to escape after inflation to prevent the satellite from becoming propulsive in the event it is punctured by a micrometeorite. Simplest configuration (1) is a sphere, proposed in diameters up to 100 ft., which would be a good visual or radar target for sighting. Improved radar target (2) is shaped to form a corner reflector. Large solar energy collector (3) could be used with space vehicles for electric power generation. Parabolic reflector (4) could be used as a space communications antenna.

Tupper noted that use of a separate or integral storage system and control system would greatly depend on the application at hand, and that what would be justified for one would not necessarily hold for another. For the particular semi-orbital vehicle, however, the proposed separate storage was judged adequate to meet reliability standards plus providing the performance level required for the comparatively short-term flight.

Vehicle equipment compartments would be pressurized by nitrogen, which also could be the pressurizing agent for a separate refrigerant storage type system.

Assuming water as a primary heat sink at all altitudes of flight, Tupper said an ammonia or similar supplementary cooling system might be constantly used to cool guidance equipment at low altitudes, or water alone at all altitudes with a boost when and where necessary by the supplementary cooling system.

Aircraft Escape Systems

A study of aircraft escape systems was described by Arnold I. Beck and George Hildebrand of Republic Aviation Corp.

Tomorrow's aircraft escape systems must be capable of safe, effective performance at ground level or at altitudes in excess of 100,000 ft., and from standstill or supersonic speeds.

It was pointed out that before a choice can be made between an open ejection seat or a capsule escape system, more knowledge and data concerning human capabilities must be secured.

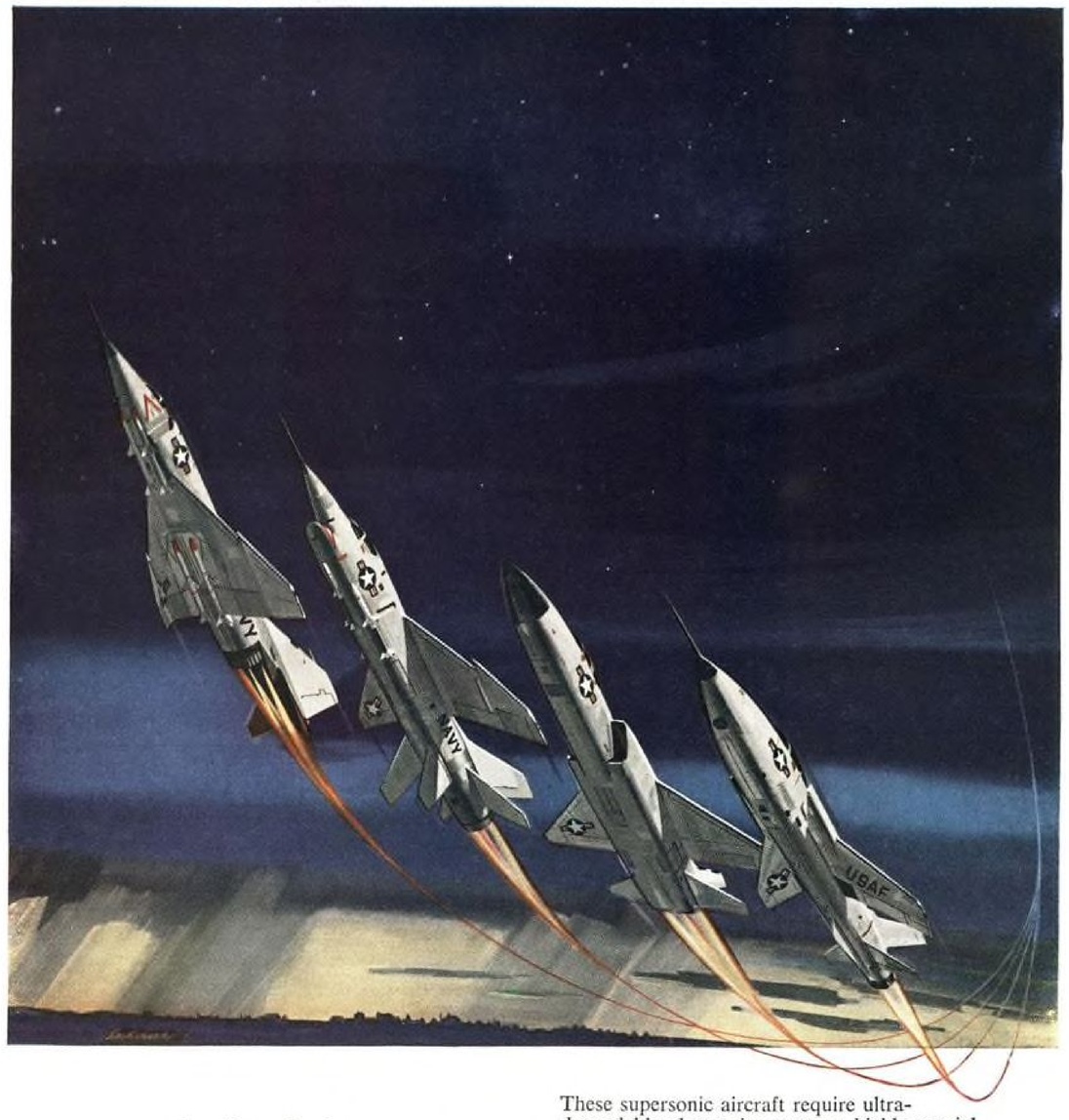
Much can be read and heard about the advances being made in flying higher, faster and further, but it has become obvious that only by designing toward the maximum performance of the most advanced aircraft can escape system designs avoid obsolescence.

The designer of tomorrow's escape system must produce a system capable of safe, effective performance in a range of requirements which staggers the imagination:

- **Ejection immediately** following crash landing or under water.
- **Escape from aircraft** on the ground at stand-still or in motion.
- **Low level flight** patterns, below 1,000 ft.
- **Escape from altitudes** between 2,000 and 45,000 ft.
- **Escape from altitudes** between 45,000 and 100,000 ft.
- **Escape from altitudes** in excess of 100,000 ft.
- **Escape at subsonic** and supersonic speeds.

Newest concepts of escape capsule

COLLINS SYSTEMS ARE NOW IN PRODUCTION FOR (LEFT TO RIGHT) THE NAVY'S McDONNELL F4H-1 AND CHANCE VOUGHT F8U-3 FIGHTERS AND NORTH AMERICAN A3J-1 ATTACK BOMBER, AND THE AIR FORCE'S REPUBLIC F-105 FIGHTER-BOMBER.



why America's newest jets use COLLINS ELECTRONICS

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Collins integrated electronics systems achieve building-block flexibility through modular design of all basic units. Designed *into* each aircraft, a space-saving *custom* Collins system retains the economy of standardized production and simplified maintenance.

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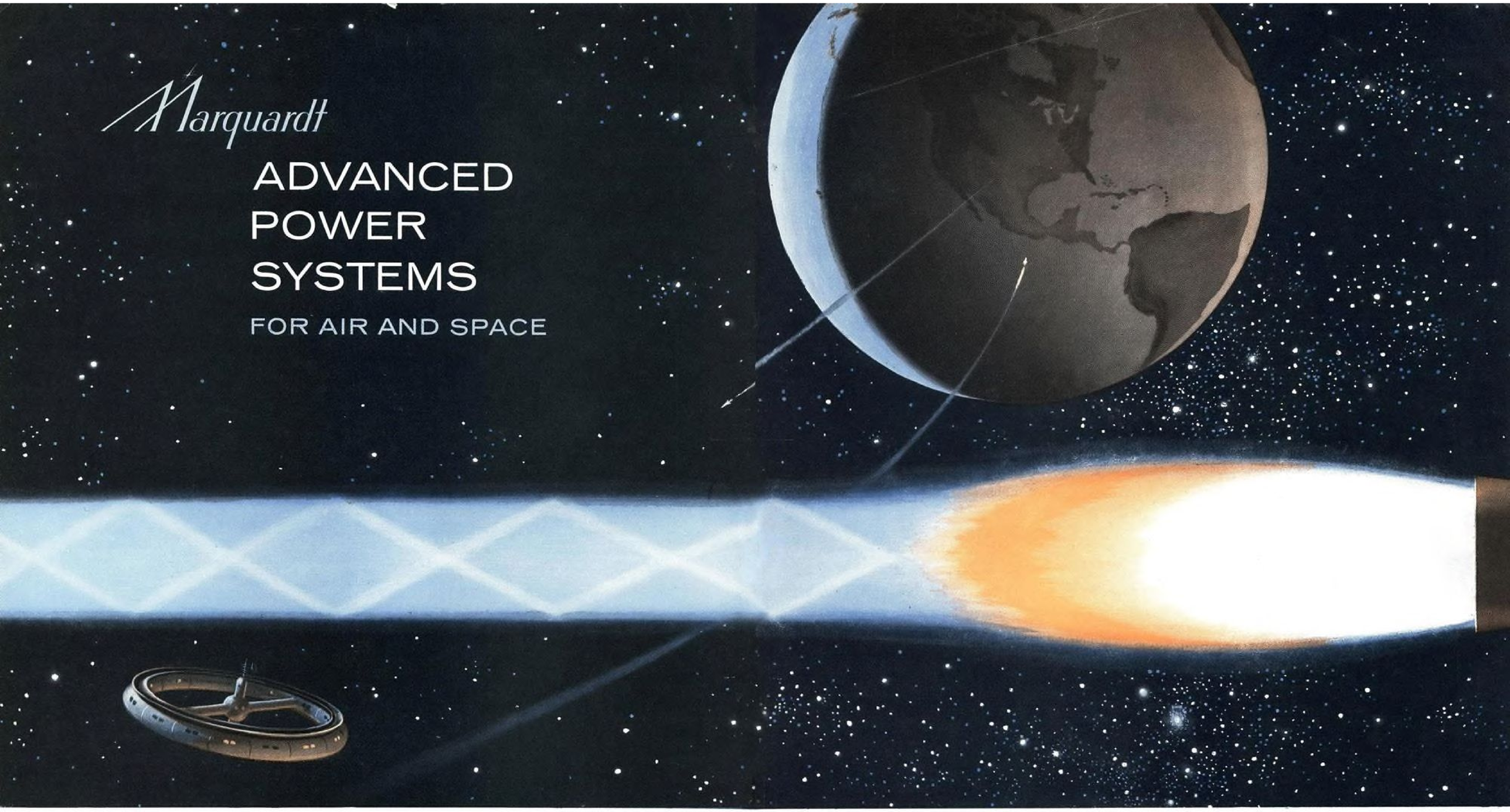

Projects meeting the ever increasing needs of Advanced Power Systems for Air and Space operations are currently under way at Marquardt. Here, in an environment that stimulates creative hypotheses, Marquardt engineers and scientists are engaged in the following diversified areas:

ADVANCED PROPULSION CYCLES

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- Electrical Propulsion—Plasma Jets, Ion Propulsion and Magnetohydrodynamics
- Nuclear Ramjet

EXOTIC FUELS

- Evaluation—Energy, Compatibility and Logistics

CONTROLS & ACCESSORIES

- Hot Gas Servo Systems
- Accessory power for Space application
- Variable geometry Inlet Controls

In addition, current application projects include supersonic ramjet power for Bomarc, Super Bomarc, X-7 (test vehicle), Q-5, and Kingfisher.

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Roy E. Marquardt
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SPERRY INTRODUCES...

New portable radar safety meter for survey of microwave power fields

Like many technical developments, the high-power microwave systems now coming into wide military use present an unexpected problem. Medical and military leaders alike are concerned with the safety of personnel working with these "super radars" which generate tremendous microwave energy fields in their transmitters and antennas.

Current information indicates the surest methods for establishing safe working conditions near powerful microwave devices involve survey measurements of microwave power density in the area. But, until now, application of this principle has been restricted because engineers have lacked suitable portable equipment for making these measurements.

As a leading producer of advanced radar systems, Sperry has devoted extensive research to the problem of assuring safety in their operation. Result of this investigation is the new Microwave Power Density Meter. Weighing only 6 pounds, the meter provides a simple but highly accurate method of exploring the existence of concentrated energy or "hot spots" close by high-power microwave antennas, transmitter tubes and plumbing. It is completely portable and contains its own power supply.

Utilizing the presently accepted safe energy level of 10 mw/cm², the Sperry meter quickly registers the relative power density above or below the acceptable level. The meter is scaled to read in mw/cm². A single knob operates the meter, permitting its use by nontechnical personnel.

If you'd like more information about the new Sperry Microwave Power Density Meter, write for Microline 646 data sheet.

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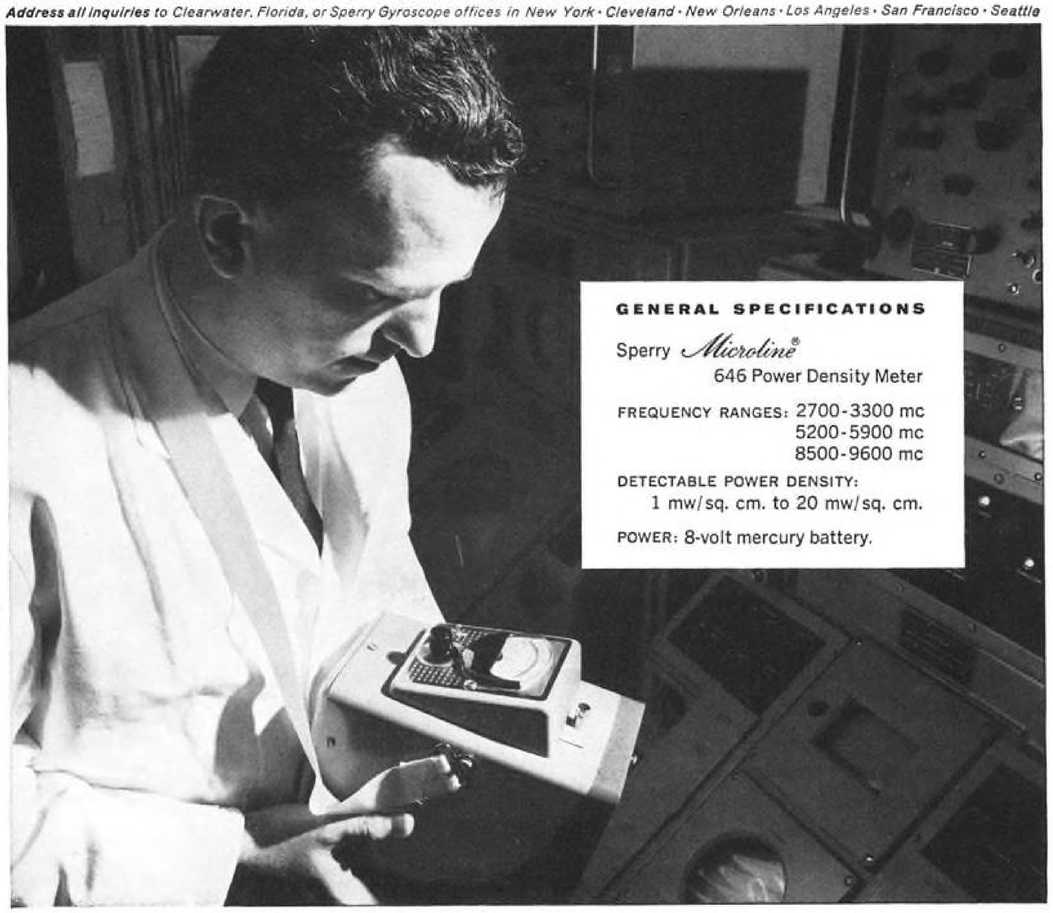


design, according to Beck and Hildebrand, envision a "minimum size configuration" of what amounts to an enclosed ejection seat. The effect on aircraft gross weight has been reduced considerably. While the ejected weight, including occupant, of the supersonic ejection seat has grown to about 500 lb., the equivalent weight of the capsule will be about 850 lb.

Minimum size offers advantages of:
- **Installation within normal** cockpit ejection envelope.
- **Favorable weight** drag/ratio.
- **Comparatively low rocket** catapult thrust requirements.
- **Reduced vulnerability** to aircraft fire or battle damage.

A comparative analysis between ejection seat and capsule may be made with regard to similar design conditions such as ejection acceleration and separation where the capsule requires considerably larger separation forces and in the case of large size capsules the thrust requirements may become critically high.

Stability device complexities are similar to both seat and capsule. The capsule, being completely enclosed, has the advantage of better configuration and center of gravity control, thus perhaps, simplifying stabilization requirements.

Inherent Stability

Bluff (very blunt) shaped capsules tend to offer certain advantages of inherent stability minimizing need for stabilization devices, perhaps avoiding the need entirely.

They also are subject to higher deceleration forces, but for short durations only. Designed to not exceed human tolerances to decelerations, their rates of onset and durations will provide capability for a low level high ejection sequence.

High fineness ratio capsules have reduced deceleration loads which act over a much longer time period. This may be an offsetting factor.

Enclosed seat type capsule may be used for emergency fly-down from high altitude due to pressure loss in cockpit, and the stabilized capsule provides excellent pressure/oxygen environment for the occupant during free fall from altitude.

Capsule provides greater protection against adiabatic temperature rise, especially bluff shapes which have low heat transfer characteristics. The capsule provides a protective environment when enclosed within the aircraft upon failure of the cockpit refrigeration systems at high speeds.

At low altitude, high or low speeds, escape capsule low altitude capabilities are compromised by increased complexity and resultant time lag function.

For landing and post-landing conditions, the capsule must shield the pilot against ground impacts up to 40F, and must incorporate a suitable energy-absorbing structure, as well as automatically deployed flotation gear for water landing. Jam-proof escape provisions must be provided the pilot for egress from capsule after touchdown. Auxiliary escape hatches may be required. The capsule can offer a degree of protective shelter in extreme climates and environments

Principal advantage of the enclosed capsule escape system is that secondary provisions are available to the pilot in event of pressure loss or refrigeration system breakdown.

This makes possible the so-called "shirt-sleeve concept" of aircraft operation. It must be remembered, however, that pilot comfort not withstanding, these secondary systems are not nearly as reliable as the pressure/vent suit combination.

The secondary means may fail simultaneously with the primary means since they are a portion of a larger and more complex system than the pilot's personal equipment. Also, doors and hatches which are part of the enclosed capsule system may offer equally serious restrictions to mobility and access within the cockpit.

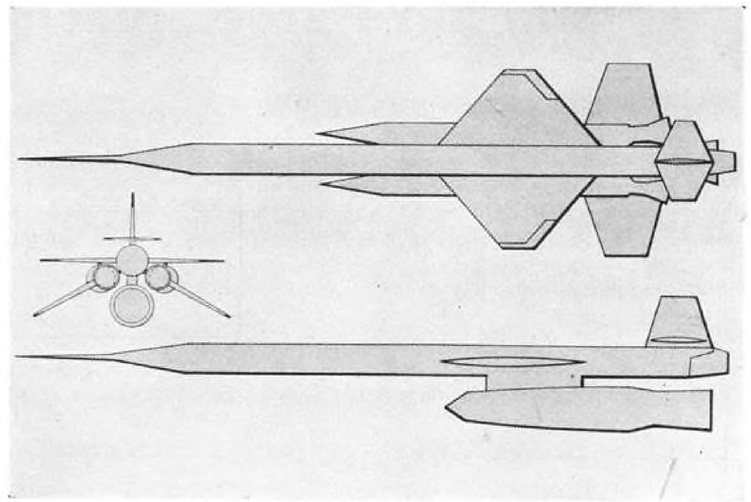
It must be pointed out also that the capsule is more susceptible to battle damage of a type that can be survived by the aircrewman who then needs an escape system for an escape system, according to Beck and Hildebrand.

Fundamental considerations in selection and design of escape capsules were discussed by Donald M. Root of Northrop Aircraft, Inc., who took the view that escape systems should be designed for operation in the areas where the large majority of escapes are made, rather than at the level of a high performance aircraft operating at its maximum dynamic pressure limit.

Root pointed out that statistical evidence indicates that if the escape system is designed for maximum dynamic pressure conditions of flight, relatively few lives may be saved in the areas where very few, if any, escapes are made, while many lives will be jeopardized in the areas where many escapes are made.

Dwelling on escape at low altitudes and speeds, Root said the ground level capability of a system is enhanced if the main parachute is forcefully ejected upward, reducing total impulse required of the capsule ejection rocket when minimum height required to effect parachute opening at low speed is a determining factor.

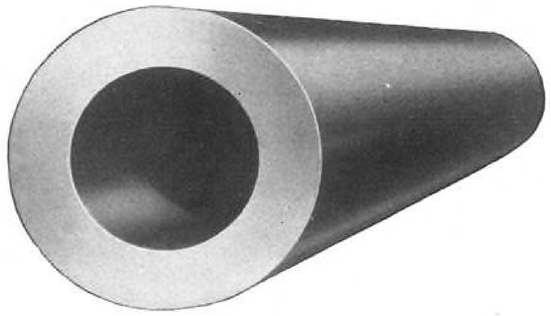
He urged consideration of a multistage parabraking device which would be sufficient for escapes at dynamic pressures approximating 2,134 psf. and Mach 1.2 and at very low speeds and altitude as well. Root acknowledged that very careful consideration must be given to such design parameters as delay times, operating sequences, seeking and optimization of all factors to obtain the highest order of reliability and operating capabilities consistent with the speed and altitude spectra where statistics show the greatest number of escapes are attempted.



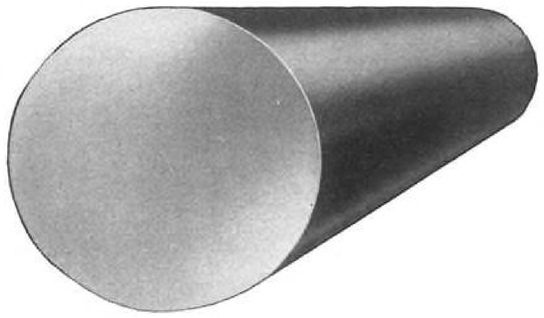
Lockheed Q-5 has Rhombic Wings

Three-view sketch of Army-Lockheed Q-5 supersonic target drone has rhombic wings as opposed to slightly tapered wings of early versions of its predecessor, the Air Force X-7 re-entry test vehicle (AW Aug. 18, p. 63). The Q-5 is instrumented to score near misses and theoretical hits, and has a parachute for recovery. The drone's ramjet booster is manufactured by Marquardt Aircraft Co.

Start with a hole...



instead of a headache



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RUSSIAN dog (left) is subjected to vibration test. Dogs are placed in rocket cabin (right) after completion of laboratory tests.

Soviets Recover Research Rocket Dogs

Washington—Russian scientists have fired two dogs to an altitude of 279.63 mi. in a single stage research rocket carrying a payload that weighed 3,726.45 lb.—greater than the weight of Sputnik III—according to Soviet sources translated here. The dogs were recovered safely and are in good condition, the report said. This was the second launching of such a rocket.

The weight figure includes "total weight of the geophysical scientific apparatus, radio telemetering devices, power sources, the hermetic cabin with the experimental animals and auxiliary systems, together with the instrument section," the Soviet newspaper Izvestia said.

The felt-lined cabin contained "a regeneration system, a self-contained system for recording the biological functions of the animals and a special motion picture camera" with a speed of 24 frames per sec., holding 300 meters of film for 11-12 min. of photography. Dogs were secured in special cradles "using individual clothing."

Izvestia mixed details of the 280-mi. flight with details of other flights to 68.35 and 131.74 mi. and discussed a "globular ventilated space suit made of Plexiglas with a detachable helmet and an oxygen feed system." It said this "maskless space suit guarantees the necessary conditions for the life of the animals" in non-hermetic rocket cabins fired to 68 mi.

Dogs used on the 280-mi. flight had been trained for several months. They were named Belyanka and Pestraya. Dogs for the shorter flights have weighed from about 11 lb. to approximately 15½ lb.

Launching occurred Aug. 27 from "the middle latitudes of Soviet European territory," Izvestia said. No mention was made of the results of the

OSCILLOGRAPH records respiration rate, blood pressure after dog's second rocket flight.

AERO-THERMODYNAMICISTS EXPLORE HIGH-SPEED RE-ENTRY

A report to Engineers and Scientists from Lockheed Missile Systems — where expanding missile programs insure more promising careers

Advanced weapon system technology has brought to the forefront problem areas requiring attention to interaction between aerodynamic and thermodynamic phenomena. Typical of these is the problem of high-speed atmospheric re-entry.

Expanding research and development activities have coincided with acceleration on top priority programs like our Polaris IRBM. At the same time, positions for qualified engineers and scientists have opened up that are unequalled in responsibility or in opportunities for moving ahead.

Positions in **aero-thermodynamics** include such areas as: aerodynamic characteristics of missiles at high Mach numbers; missile and weapon system design analysis; boundary layer and heat transfer analyses in hypersonic flow fields; and calculation of transient structural and equipment temperatures resulting from aerodynamic heating and radiation.

In addition, openings exist at all levels in **Gas Dynamics, Structures, Propulsion, Test Planning and Analysis, Test Operations, Information Processing, Electronics,** and **Systems Integration.** For these and other positions, qualified engineers and scientists are invited to write Research and Development Staff, Dept. 1711, 962 W. El Camino Real, Sunnyvale, California.

Lockheed / **MISSILE SYSTEMS DIVISION**

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Maurice Tucker, Aero-Thermodynamics Department Manager, right, discusses combined aero-thermodynamic re-entry body tests being conducted in Division's new "hot-shot" wind tunnel. Others are Dr. Jerome L. Fox, Assistant Department Manager, Thermodynamics, left, and Robert L. Nelson, Assistant Department Manager, Aerodynamics.

SPACE suit protects dog in rocket flight.

earlier launching of the large one-stage rocket, or if it carried animals.

The rocket was fired at a small angle to the vertical in a fixed direction. The rocket was stabilized "during the entire flight, including the inertial part of its flight," to ensure the necessary conditions for the experiment. Cabin landed "in a selected area," Izvestia said.

Rocket carried instruments for measuring:

- **Concentration of free electrons.** Instrument was an ultra-short wave dispersion radio interferometer.
- **Ion composition of** the atmosphere.
- **Concentration of positive ions.**
- **Electron temperature.**
- **Air pressure.** Instruments were ionization and magnetic manometers.
- **Micrometeorite impingement.**
- **Ultraviolet region of** the solar spectrum.
- **Infrared radiation of the earth** and the earth's atmosphere. This instrument was not described.

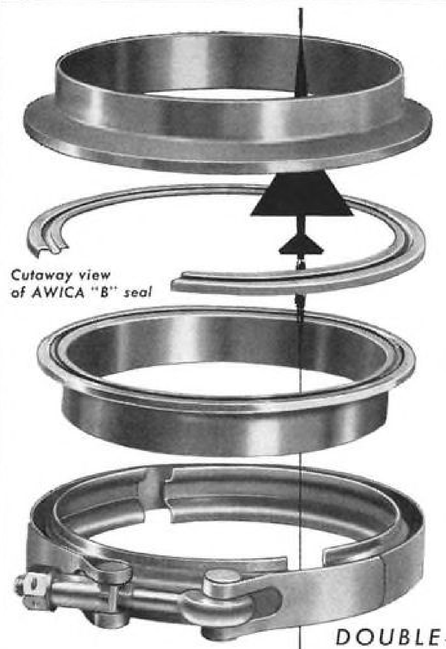
Izvestia referred to recent publication by Russia's International Geophysical Year committee of preliminary results of rocket and satellite investigations.

Rockets used in flights up to 132 mi. attain an ascending speed of 1.06 mi. per sec. and a descending speed of 1.08 mi. per sec., according to the IGY report. Nose cone is separated from the body of the rocket at the top of the trajectory and a braking parachute is opened at an altitude of about 2½ mi. At just above a mile, "the main parachute system goes into operation." Nose cone lands in 605 to 606 sec., and the period of dynamic weightlessness lasts for 360-370 sec.

The report said the parachute system had worked without failure in all launchings. It also said, with regard to the space suits designed for lower flights, that "all the calculations and designs of Soviet scientists and designers have proved correct."

Polaris Second Stage

Polaris fleet ballistic missile second stage ignited prematurely during test at Cape Canaveral, Fla., and was destroyed after rising a few hundred feet above the launch pad (AW Oct. 20, p. 28).



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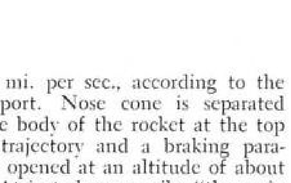

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How an electronic engineer from St. Louis found a better job and a better life in cool, clean, clear-sky San Diego

It was the last day of our wonderful vacation in San Diego two summers ago. We were sitting on the terrace at the home of a couple we'd known pretty well back in Missouri, looking out over the bay.

"It must be wonderful to live here," said my wife. She sounded wistful.

"That it is," agreed our host, and his wife chimed in with "When can we expect you?"

"We've just about decided to come out when I retire," I told them.

"When you *retire?*" snorted Tom. "Why wait all that time? Make the move *now!*"

"There's a little matter about a job," I retorted. "I'm doing pretty well where I am."

"Maybe you can have your cake and eat it too," said Tom. "San Diego's got a tremendous aircraft industry. Growing fast in electronics, too. Lots of opportunities. Why don't you check a few companies tomorrow morning before you start back. Ryan especially. I hear they're going like a house afire."

HERE WE ARE in our new home—in mid-winter. Outdoor living must have been invented in San Diego.

So I did—and the people at Ryan had a place for me. It carried more responsibility than my old job—and it gave me a chance to plunge into a brand-new phase of electronics. I guess I hadn't realized that I'd been getting into a rut... that I was ready for a bigger assignment.

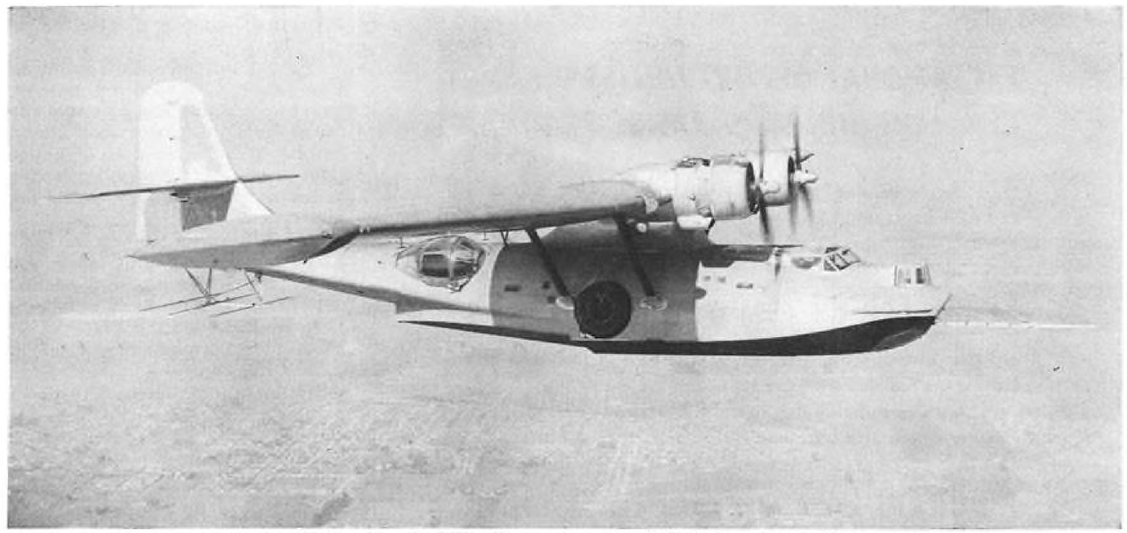
That's how it all began. Coming to Ryan was the soundest decision I ever made. I'm getting a real sense of personal satisfaction out of the advanced work we're doing in continuous-wave radar. The company has recognized my progress, too—in a tangible way.

Meanwhile, my wife and I feel that for the first time we're really living. We love our new home... the kids can play outdoors every day of the year... we're close to the beaches and the bay and just a short drive from the mountains or the desert.

San Diego's a cosmopolitan city. Lots of interesting people who've come here from all over the U.S. Fine stores and restaurants and theaters. Excellent schools, including a four-year state college and a new branch of the University of California.

But the topper is our climate. Never hot, never cold, always delightful. So far as I'm concerned, those Midwest summers and winters are just history.

Any electronic engineer who knows that his ability and experience have fitted him for a bigger job ought to talk to Ryan. We're growing faster than ever—and we need men who can grow with us. We now have many full-fledged career jobs waiting to be filled



GROUND-AIR communications for 1,200 mi. using VHF frequencies normally limited to line-of-sight ranges have been achieved by a PBY using meteor-burst technique. Tests were conducted by Stanford Research Institute under USAF sponsorship.

Meteor-Burst Avionics Resists Jamming

By Philip J. Klass

Washington—Relative immunity of meteor-burst communications to enemy jamming and direction-finding, plus its ability to transmit voice, teletype and facsimile at VHF frequencies over distances greater than 1,000 mi. with extremely low power, makes new technique extremely attractive for military use, it was reported here during the National Symposium on Extended Range and Space Communications.

With meteor-burst technique, the message is stored on magnetic tape, transmitted at a greatly speeded-up rate during frequent brief intervals when a meteor trail exists to serve as reflecting surface (AW June 17, 1957, p. 96.)

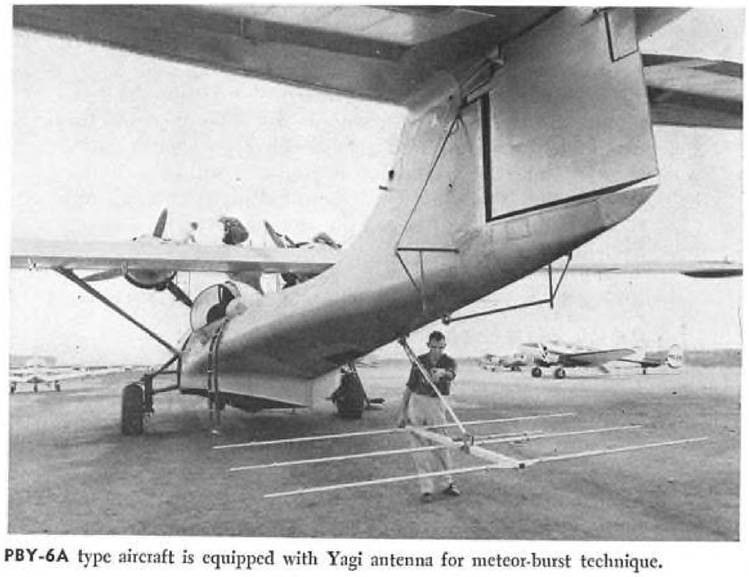
New developments in meteor-burst as well as tropospheric and ionospheric scatter communications reported during the symposium included:

• **Meteor-burst teletype circuit,** operating over 600 mi. path in Canada, now exhibits an error rate which is "comparable to any other radio teletype," G. W. L. Davis of Ferranti-Packard Electric Ltd. reported. Canadian "Janet" system, operating at frequency of 40 mc. with 500 watts radiated power is experiencing error rates of 0.2% at one terminal, less than 1% at the other where there is multipath interference, Davis reported.

• **Wideband facsimile pictures** have been successfully transmitted over a 900-mi. path using meteor-burst techniques, using bandwidths up to 110 kc., G. S. Wickizer of Radio Corporation of America told the symposium.

• **Ground-to-air communication** out to distances of 1,200 mi. using meteor-burst techniques appears feasible, based on tests conducted by Stanford Research Institute. Major problem, however, is design of high gain antennas suitable for high-speed aircraft. Stanford Research's Wilbur R. Vincent maintained.

• **Meteor burst communications** might profitably be used to complement existing long-range communications to increase the reliability of high frequency radio, extend the range of tropospheric scatter or increase the capacity of ionospheric scatter, accord-



PBY-6A type aircraft is equipped with Yagi antenna for meteor-burst technique.

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SENIOR ENGINEERS FOR:

- Static Aeroelasticity and Flutter
- Advanced Aerodynamic Design
- Flight Control Systems Analysis
- Aerodynamic Testing
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GROUP LEADERS FOR:

- Flight Control Systems
- Stability and Control
- Performance

SENIOR ENGINEERS FOR:

- Performance
- Stability and Control

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BELL AIRCRAFT CORPORATION

Buffalo 5, New York

Bell Aircraft Corporation is a member of the Martin-Bell industry team developing the Dyna-Soar hypersonic glider for the U. S. Air Force. Other team members are the Martin Company, Bendix Aviation Corporation, Minneapolis-Honeywell Regulator Company, Goodyear Aircraft Company and American Machine and Foundry Company.

BELL Aircraft CORP.

ing to Edward E. Reinhart, of The Rand Corporation.

Other symposium speakers, describing developments in the field of tropospheric and ionospheric scatter, reported the following:

- **Error rates in ionospheric scatter teletype** circuits have been reduced to less than 0.05% under severe sunspot storm conditions by means of an "automatic request" (ARQ) technique of automatically repeating "garbled" characters, S. Browne, SHAPE Air Defense Technical Center, reported.
- **Anti-multipath equipment** has slashed circuit outages of North Atlantic ionospheric scatter circuits due to multipath delays from 27% to 2½% according to J. L. Hollis of Rixon Electronics, Inc. and Gail E. Boggs of Page Communications Engineers, Inc.
- **Relationship of received power** and frequency for ionospheric scatter was reported by R. C. Kirby of National Bureau of Standards, based on recent Bureau tests conducted over a range of 30 to 120 mc., using scaled antennas with identical gain at each frequency. Tests indicate that received power falls off 4½ db. for every 10 mc. increase in operating frequency.

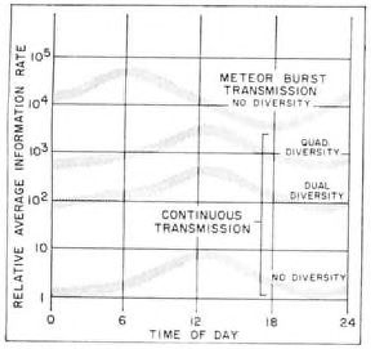
Meteor Burst Advantages

Characteristics of meteor-burst technique make it both a competitor and potential partner for conventional ionospheric scatter for transmission ranges of 600 to 1,200 mi. Although ionospheric scatter can be used on a continuous basis, the rapid variation in received signal strength and multipath problems limits it to narrowband teletype applications.

Meteor-burst communications has sufficient bandwidth to handle voice and teletype, but is necessarily intermittent which gives low average data handling capacity. Combination of the two techniques could double or triple capacity of present ionospheric scatter systems, Vincent told the symposium.

Much of the inherent security (privacy) of meteor-burst stems from the intermittent transmissions whose time of occurrence cannot be predicted in advance. (Each station transmits its pre-recorded teletype, voice or facsimile message only when it receives a signal from other station indicating that a continuous-wave pilot carrier has been received, showing the presence of a meteor trail of sufficient intensity to support communications.)

A discontinuous system such as meteor-burst necessarily includes elements of storage and feedback required by error detection and correction techniques, Reinhart pointed out. By coding the interrogation and response exchange between stations that necessarily precedes the start of burst transmission, and by using parity checking to detect



RELATIVE data handling capacity of meteor-burst system based on 1% duty cycle is compared with capacity of conventional ionospheric scatter systems operating on a continuous basis for systems using no, dual or quadruple diversity (multiple antennas or operating frequencies). Diurnal variation of each system capacity with time of day is shown. Capacity varies during year.

errors and stop transmission, the effect of an interfering signal can automatically be made to cause only a reduction in channel capacity rather than an increase in error rate, Reinhart said.

So long as signal enhancements over the opposing paths are uncorrelated, this reduction in capacity will be roughly proportional to the duty cycle of the interfering signal relative to the meteor-burst system threshold, Reinhart added. For a system operating with a 2% duty cycle, the threshold is about 25 db. above the median, which means that the system will still provide at least half its normal capacity in the face of an interfering signal whose median value is 15 db. higher than the median signal from its own transmitter.

In comparison, a continuous ionospheric scatter system faced with the same ratio of interfering to desired power at the receiver, would be practically unusable, even with error detection and correction circuits, Reinhart indicated.

Even if an enemy jamming station could synchronize its transmissions with those of the station it sought to jam, they would not be too effective unless the enemy were located close in to the station. In fact, tests indicate that two meteor-burst transmitters can both operate at the same frequency without serious interference providing there is a relatively small geographic spacing between the two, Reinhart reported.

However, for short-range meteor-burst communications links, reflections from aircraft can produce interference between two nearby co-channel stations, particularly if there is heavy air traffic.

Average information rate capacity of intermittent meteor-burst system is considerably more than that of a continuous ionospheric scatter system, unless diversity techniques are used for the latter (multiple antennas and/or frequencies). With quadruple diversity, an ionospheric scatter system approaches the capacity of meteor-burst per radiated watt power at 50 mc., Reinhart said. At higher frequencies, the relative capacity advantage of meteor-burst increases.

However, because of the impossibility of predicting when each meteor trail will occur, the variation in usable trails with season and time of day, Reinhart emphasized that meteor-burst technique is best suited to transmission of record type messages that can tolerate delays of a few minutes under adverse conditions.

Both Vincent and Reinhart stressed that considerably more investigations are required to fill out present knowledge of meteor-burst propagation characteristics. This includes measurement of the characteristics of meteor trails themselves, determination of the relationship between propagation quality and operating frequency, latitude, and direction of transmission. Multipath limitations and techniques for overcoming them also require study.

(Paper by Vincent was co-authored by Dr. Allen M. Peterson, also of Stanford Research Institute. Delmer

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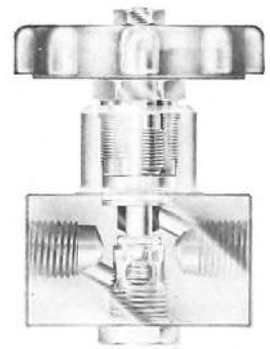

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C. Ports of Jansky & Bailey, Inc. co-authored paper with Reinhart.)

Wickizer reported that tests to date on a 900-mi. meteor-burst link between Long Branch, Ill., and Riverhead, N. Y., indicate that good facsimile pictures can be transmitted with 20 kw. power at 40 mc. Multipath delays have not been a limitation, he added.

RCA is using a 1,050 ft. long rhombic antenna, with 18 db. gain over a half-wave dipole, giving a 6 deg. beamwidth. Transmitted carrier is modulated with three levels of frequency shift keying, one corresponding to white, one corresponding to black and the third for a horizontal synchronizing pulse. Some improvement in quality may be possible through use of synchronized line-sweep frequencies derived from accurate standards at each terminal, Wickizer said. (Paper was co-authored by W. H. Bliss and R. J. Wagner, Jr., also of RCA.)

Substantial improvement in circuit performance and economics on both initial installation and subsequent operating costs of ionospheric scatter systems can be achieved through use of automatic request (ARQ), SHAPE's Brown reported.

The ARQ technique, which enables an ionospheric scatter system to operate through periods of low signal-to-noise ratio when it might otherwise be forced to shut down, employs a special seven-unit code instead of the standard five-unit code for each teletype character. Code is so designed that each character has an identical 3:4 mark/space ratio, Brown said.

As each character is received over the ionospheric scatter circuit, it is tested to see if this 3:4 ratio exists. If so, it is printed out. If not—an indication of transmission error—the system does not print out the character, but initiates a repetition signal which asks transmitting station to repeat the character.

By this means, a high proportion of printed errors are avoided but there is a consequent reduction in average information rate, Brown pointed out, under adverse propagation conditions. For signal-to-noise ratio above 15 db., there is negligible slow-down due to use of ARQ, and with S/N ratios above 12½ db., there are practically no printing errors. Below this value, however, errors tend to rise sharply as S/N ratio drops off.

Multipath propagation between two teletype stations using binary coded characters can produce a catastrophic rise in teleprinter error rate when the difference in delay time between the different paths becomes appreciable compared with the duration of a bit length. Commonly used four-channel multiplex system employed in ionospheric scatter teletype circuits has a bit length of 6.7 milliseconds, thus is seriously affected by differences in path delay of more than about three milliseconds, Hollis, Rixon Electronics, told the symposium. Multipath delays of as much as 80 milliseconds are occasionally encountered in ionospheric scatter circuits.

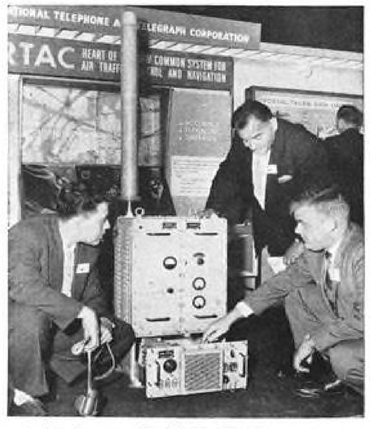
Technique for preventing increase in errors when multipath propagation exists, by synchronously shifting the frequency of the transmitter and receiver following transmission of each bit, was described by Hollis and Boggs, of Page Communications Engineers, Inc. Using this anti-multipath technique, receiver is only responsive to the signal element propagated by the shortest path and rejects the longer path signals.

Installation of such equipment reduced outages resulting from multipath propagation errors from a peak of 27% of total time to a maximum of 2½%, Boggs reported.

Another new development in ionospheric scatter antennas is a simple "piggy-back" corner-reflector, requiring three towers, which can be operated simultaneously at two different frequencies, R. C. Kirby, of National Bureau of Standards, reported. Antenna was designed by Page Communications.

Kirby predicted that meteor-burst systems were more likely to supplement ionospheric scatter than to replace it.

During a question-and-answer ses-



Midget DME-T Station

Small, low-cost DME-T distance measuring equipment, unveiled by International Telephone & Telegraph Co. at recent Vortac Symposium in Indianapolis (AW Oct. 13, p. 43), can be added to existing VOR station or ILS instrument approach facility. Small DME-T station, originally developed for possible use in Navy submarines, is expected to sell for less than $20,000 in production quantities of 200.

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sion, a representative of Air Force Cambridge Research Center revealed that what appears to be an ionospheric scatter signal was received at a frequency of 220 mc., considerably above the normally accepted frequencies for ionospheric scatter, at distances out to 1,000 mi. Measurements were made for AFCRC's tropospheric scatter study.

Tropospheric Scatter

Although tropospheric scatter systems are in fairly widespread use, "we still do not know for sure just what the propagation mechanism is," said Kenneth M. Bullington of Bell Telephone Laboratories. Summing up the present status of tropo scatter, Bullington said they can provide relatively wide bandwidth, sufficient for black and white television, at distances greater than 200 mi. and narrow-band signals out to 600 mi. or more, with another 15% gain if quadruple diversity is employed.

Unlike ionospheric scatter, which generally operates in lower portion of VHF spectrum, tropo scatter can operate from frequencies less than 100 mc. to more than 5,000 mc., Bullington said. If it is possible to use 120 ft. diameter antennas, optimum frequency for tropo scatter is less than 200 mc., while with 30 ft. antennas the optimum is in the 800 to 1,000 mc. range, Bullington said, assuming constant power, bandwidth and reliability.

New tropo scatter system between Miami and the Bahama Islands, planned by American Telephone & Telegraph Co., will provide 72 telephone circuits with an expected service availability of 99.99%. Performance is expected to be superior to the present conventional radio-telephone circuits which operate at a frequency of 2 to 7 mc., Kenneth P. Stiles of AT&T reported. System will operate over a distance of about 190 mi., at 2,000 mc., using 30 ft. parabolic antennas and 10 kw. transmitters.

Tests conducted by Lincoln Laboratory indicate that improved tropo scatter performance can be obtained by splitting radiated beam into two or more beams which are separated by a small angle, according to J. F. Roche. This approach is called "angular diversity," since each beam strikes troposphere at a different angle. Tests were conducted at 2,290 mc., using 28 ft. diameter antenna with beam separations of up to 1.2 deg.

Roche concludes that a single large antenna employing angular diversity should provide better performance than two separate small antennas (space diversity). On the question of relative merit, Roche indicated that angular diversity would be less costly but frequency diversity might give slightly better performance.

Navy Carrier Evaluates Lens Landing Aid

By Russell Hawkes

Aboard USS Ranger—Under trial aboard the carrier USS Ranger in the Pacific is Fresnel Lens Landing Aid System designed by Control Instrument Corp. which the Navy hopes will be an improvement upon the British-devised Mirror Landing Aid now in general use on U. S. carriers. If the Lens Landing Aid proves out, it will be the first U. S. hardware contribution to the science of flight deck operations in some time. Canted deck, steam catapult and deck edge elevator as well as Mirror Landing Aid are British ideas.

Prototype Lens Aid was installed in May and is being informally evaluated by the Ranger's air department. It will have to face formal evaluation later. Ranger's experts say they are pleased with the usefulness and general operation of the system. They criticize some of the subcontracted supporting machinery on grounds of unreliability and complexity. They feel much of this can be relieved in a production version and report that the Lens Aid has performed better than would be expected of a system undergoing its first trials.

Information on the position of the approaching airplane with respect to the ideal glide slope is presented the pilot by the Lens Aid in much the same form as it is presented by the Mirror Landing Aid. Each shows the pilot an amber spot in the center of a horizontal datum line of green lights.

If the amber reference spot appears to be above the datum line, the pilot knows he is high. If it appears below the line, he is low. Two vertical rows of red "wave-off" lights and a horizontal row of green "cut" lights above the unit can be flashed at will by the Landing Signal Officer.

Lens Landing Aid is intended to make possible somewhat more precise approaches because the reference spot is shown as a comparatively sharp-cut horizontal bar of light, while the Mirror Aid shows it as a less well defined elliptical or circular blob. Result would be quicker pilot reaction to any departure from the ideal approach angle. A carrier approach is undoubtedly the most critical landing operation in aviation and the Navy would be glad to get any slight improvement in precision.

Chief advantage of the new system in the eyes of many naval officers is that it takes the landing aid device out of the middle of the flight deck and puts it in the deck-edge catwalk where it will not interfere with the movement of airplanes and service vehicles. To compensate for differences in the distance between tailhook and cockpit between aircraft of different sizes, a carrier landing aid must provide means of adjusting the height of the glide slope above the end of the flight deck without altering the angle of descent. It is done with Mirror Landing Aid by changing the height of the mirror above the deck.

This fact, combined with the necessity of keeping clear the line between the mirror and the reference light which it reflects, requires that the system be placed above flight deck level, thereby restricting the choice of locations.

The mirror is too tall to be placed off the edge of the canted deck because of the hazard to the wingtips of aircraft being launched and recovered. Since the mirror must also be reasonably close to the centerline of the canted deck, it is located out in the middle of the axial deck area where it is an obstacle to crowded, fast-paced flight deck operations.

Three identical Lens Landing Aid

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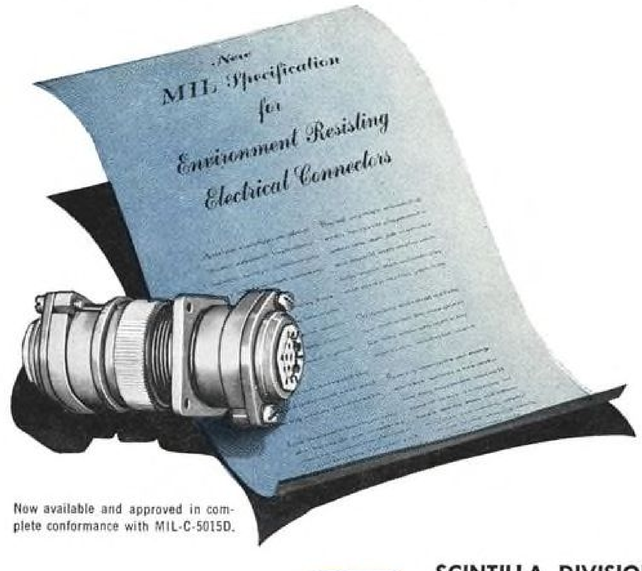

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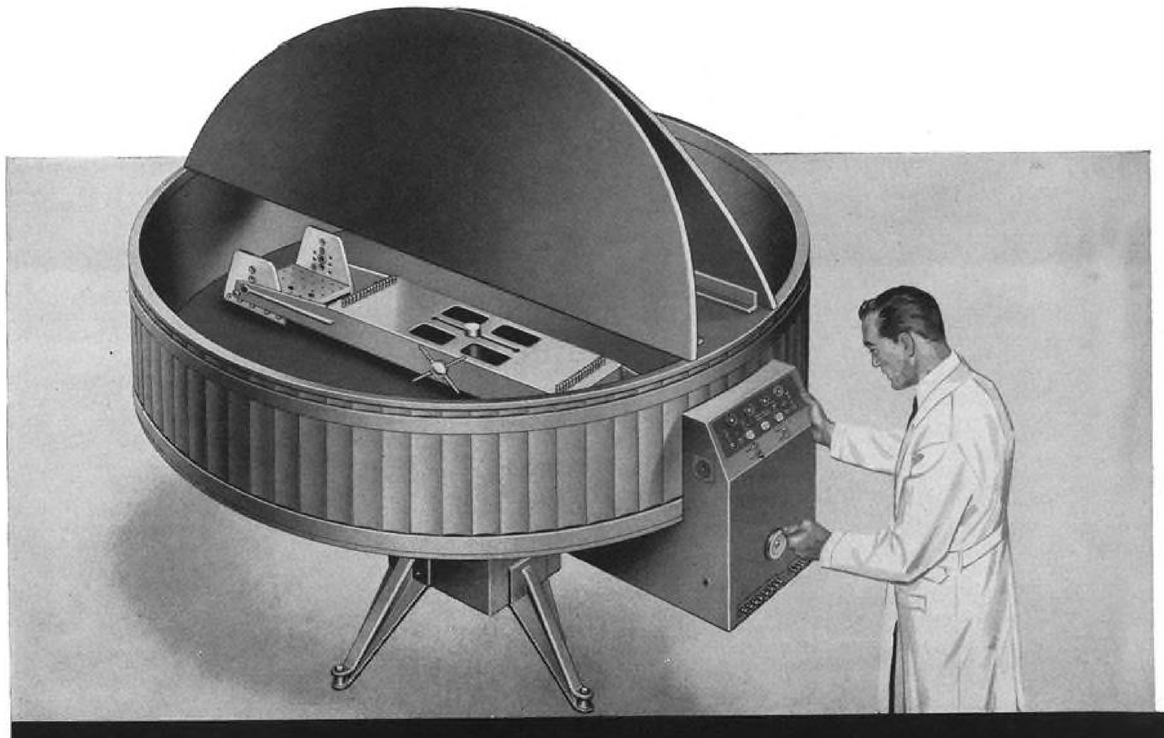

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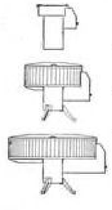

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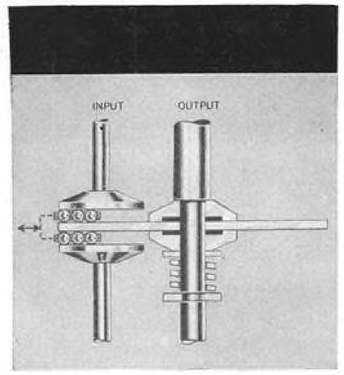

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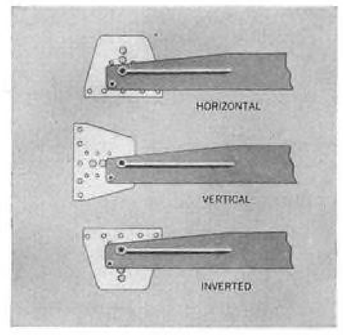

Basket-type mounting platforms, available on Model A-1020 and A-1030, may be oriented from the horizontal to the vertical or to the inverted attitude for multiple-axis testing without demounting the test object. Baskets may be raised or lowered to achieve an optimum dynamic balance and minimum angular deflections when extreme accuracies are required. When the basket is inverted the outside surface of the platform may be used to mount bulky, lightweight packages.

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units are spaced longitudinally along the catwalk at the edge of the canted deck. Height of the ideal glide slope over the aft end of the flight deck can be increased for big airplanes by using the forward Lens Aid unit or decreased for smaller ones by using the aft one.

A continuous range of cockpit height values can be provided by making variations of a degree or less to the standard four degree carrier approach glide slope on one unit or another with a Basic Angle Selector control.

Approach angle references which the three units provide overlap to some extent. If one unit fails, the aircraft types which ordinarily use it can be given a reference to a usable glide path by one of the other units with an appropriate adjustment to the Basic Angle Selector.

Each Lens Landing Aid unit consists of three vertical rows of five rectangular amber plastic Fresnel lenses placed edge-to-edge. The Fresnel or echelon lens consists of a series of cylindrical lens segments appearing as steps or corrugations on one face of the transparent plate.

Each lens segment has the property of collecting light into a single beam. Behind each lens in the landing aid there is a lamp to transmit the necessary light through the lens.

As the pilot moves from one beam of light to the next, there is an apparent movement of the reference light across the face of the lens and the light sources behind the other lenses are invisible since their output is directed away from the pilot's eye.

Intensity of the light sources must be carefully matched to background light intensity by a Brightness Selector switch.

If intensity is too high the light beam spreads, causing the reference spot to appear to the pilot as a large diffuse glow which is not as indicative of errors in the approach path as the small clear-cut light bar.

Temperature of the lenses must be held constant. If they become too cool, thermal contraction causes the lenses to distort and apparent travel of the reference bar from one lens to the next becomes uneven and jerky. To prevent this, a thermostatically controlled hot air blower holds lens temperature constant at 110F.

Two servo loops based on a gyroscopic stable element compensate the Lens Landing Aid unit for ship motion. Pitch error loop tilts the unit in a longitudinal plane to hold the glide slope steady on the selected angle. Roll error loop rotates the unit in a lateral plane to hold the reference light bar and datum lights horizontal and parallel. If the angle between reference bar and datum line was allowed to vary in response to ship roll, the problem of interpretation would be made difficult or impossible for the pilot.

The Lens Aid control panel contains error indicators to show whether or not the units are responding to signals from the stable platform and the Basic Angle Selectors.

The Lens Landing Aid system is supplied with 60 cps., 70 amp., 115 v.a.c. power for lights and drives and 400 cps., 25 amp., 15 v.a.c. power for the electronic servo circuitry.

First Sidewinder Production Photo

First Sidewinder (AW Oct. 6, p. 35) production photo shows final check being made of guidance and control units at Philco Corp.'s Government and Industrial Div. plant, Phila.

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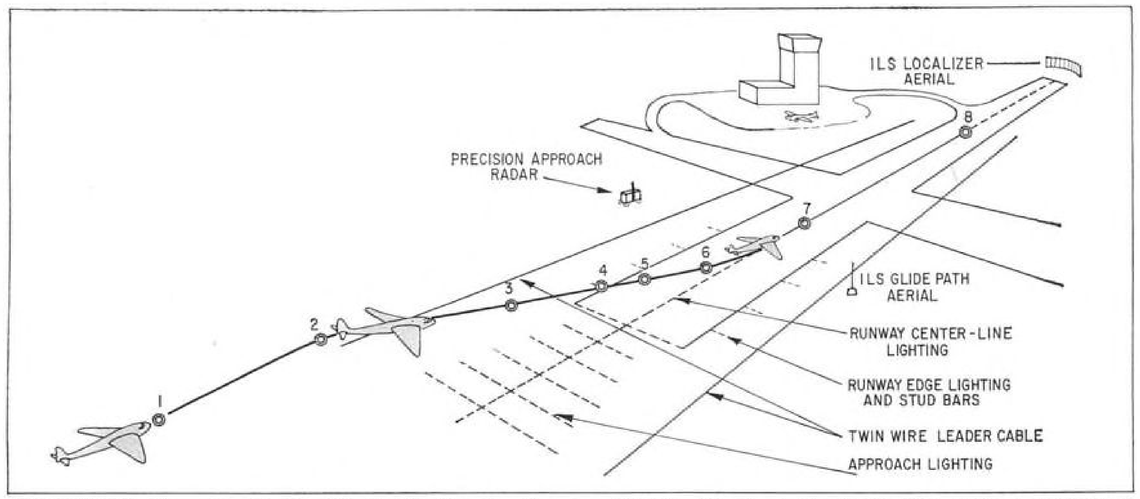


AUTOMATIC landing system developed by the Blind Landing Experimental Unit of the Royal Aircraft Establishment is depicted above. Numbers indicate: 1—Automatic approach (track) using ILS localizer and compass for azimuth control, barometric height for elevation. 2—Automatic approach (glide) using ILS localizer for azimuth, ILS glide path for elevation. 3—Automatic land (leader cable) using leader cable for azimuth, ILS glide path for elevation. 4—Automatic land (attitude) using leader cable for azimuth, fixed attitude for elevation. 5—Automatic land (flare) using leader cable for azimuth, radio altimeter for elevation. 6—Automatic land (kicking off drift) using compass for azimuth, radio altimeter for elevation. 7—Manual ground run using leader cable compass for azimuth control.

British Test Automatic Landing System

By John Tunstall

London — Automatic blind landing equipment is likely to become a standard installation in Britain's V-bombers within the next 18 months, according to scientists from Royal Establishment's Blind Landing Experimental Unit.

Automatic approach and flareout, it is understood, have already been specified by British Overseas Airways Corp. and British European Airways for the Vickers VC-10 and de Havilland DH-121 jet aircraft. Full automatic landing facility could be completed later.

British system uses magnetic leader cables for azimuth guidance and derives height information from a radio compass. Initial approach guidance is obtained from standard ILS localizer and glide path installations. An automatic speed control coupling controls the throttles automatically to maintain a constant preset approach speed and closes the throttles during flareout to an idling setting. During the last five seconds, the system automatically kicks off drift.

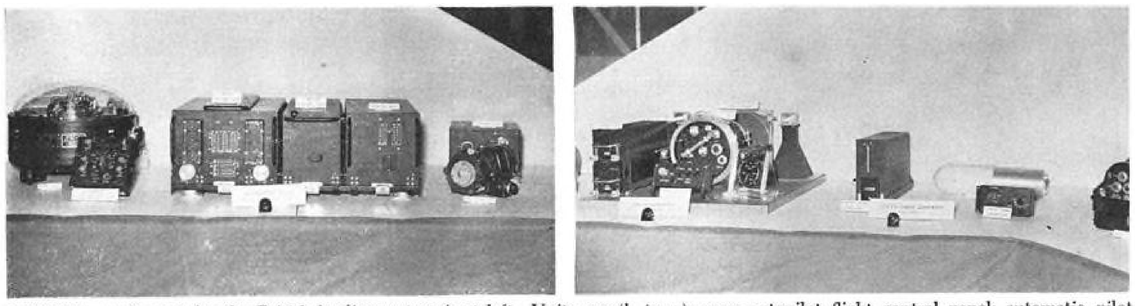
Blind Landing Experimental Unit was formed in 1945 at Martlesham Heath, Suffolk, from specialists groups working at Telecommunications Research Establishment, Malvern, and the Royal Aircraft Establishment, Farnborough. It moved to the new airfield at Bedford last year.

British scientists admit there is little to choose between the landing performance of the British and the principal United States system—the Bell radar system (AW March 4, 1957, p. 32).

Total weight of the additional equipment involved, which includes a control box, the leader cable receiver and aerial and the low level radio altimeter and aerial, does not exceed 100 lb. for a single-channel equipment.

Bedford scientists believe that the need for leader cables may prove only temporary as improved ILS systems known to be at an advanced design stage promise satisfactory azimuth guidance to touchdown.

The main disadvantage of the leader cables is the need for 5,000 ft. undershoot coverage when used in conjunction with most ILS installations. This distance is not generally available. One leading scientist sees the later improved ILS equipment being used almost down



CONTROL equipment for the British landing system is at left. Units are (l. to r.): gyro; autopilot flight control panel; automatic pilot including (l. to r.) servo control unit, platform control unit and locking unit; pressure unit with servo motor in front of it. Guidance equipment is at right. Units are (l. to r.): radio altimeter; leader cable receiver; leader cable controller; gyro unit.

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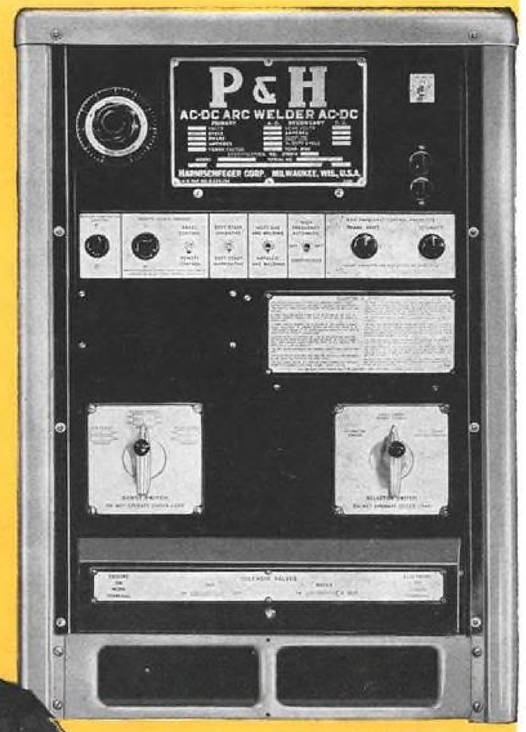

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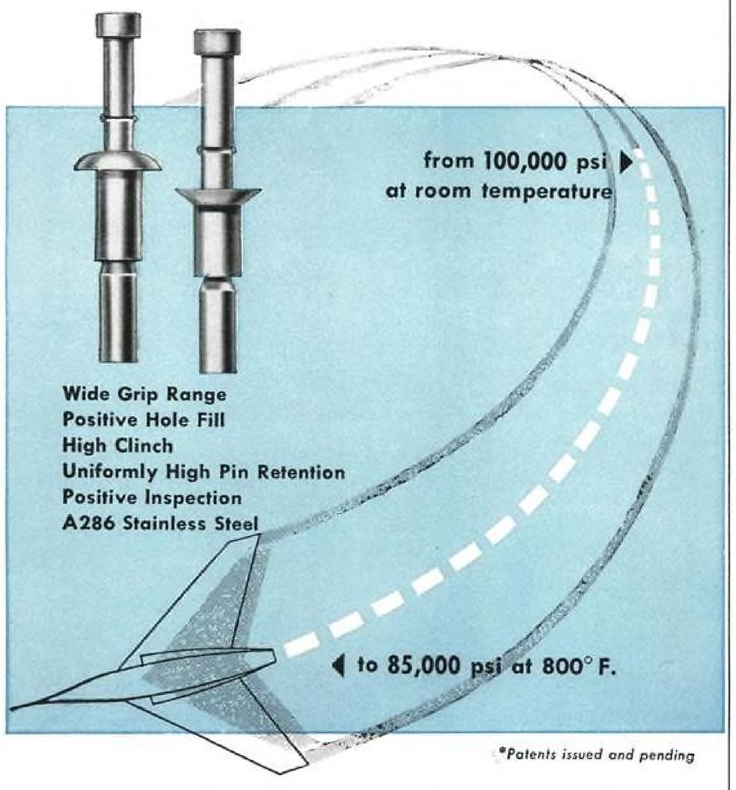

*Patents issued and pending

To meet the design requirements imposed by extremely high-speed aircraft and missiles, the Cherry Rivet research and development department has introduced the "600" A286 stainless steel blind rivet.

Data on the strength capabilities of the "600" rivet is available from Townsend Company, Cherry Rivet Division, P.O. Box 2157-N, Santa Ana, California.

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to the strip, and the use of much shorter lead cables retained for flareout and ground run.

Consistency, accuracy, smoothness of the British system, in spite of a 15 kt. wind and associated turbulence, impressed this writer who logged several hundred hours instructing on wartime ILS and British Standard Beam Approach blind approach equipment.

During three touchdowns in the copilot's seat of an English Electric Canberra bomber aircraft, two were smooth and level, the G-recorder showing only 1.6G. The third, coinciding with a gust, clocked 2.3G and felt slightly nosewheel-down which is a rare occurrence.

The drift appeared to be about four degrees, but touchdown in each case was roughly in view of the runway and in about the same longitudinal position. Drift is automatically kicked off during the last 8 ft. Approach speed to flareout was 120 kt. Only after the aircraft was well established on ground run did the pilot intervene in the touch-and-go circuits.

Azimuth guidance to the autopilot servos is switched automatically at 300 ft. from the ILS localizer to the magnetic field generated by two leader cables. These are placed 250 ft. either side of the center runway line and are fed with a 4 amp. current at 1,000 cycles per second and 1,700 cps. frequencies respectively from a 31-kva. alternator. The magnetic field developed accurately defines the runway center and by using a small rotating loop to compare the two frequencies in a simple receiver the aircraft is able to determine its position with respect to the runway center to within five feet.

Switch from the ILS glide path to the radio altimeter is made at a height of 150 ft. In this second phase the mean approach altitude is maintained down to a height of 60 ft. when flareout and throttle closure commence. Radio altimeter reads absolute height and rate of change of height extremely accurately, and a simple coupling unit instructs the autopilot servos to change the aircraft pitch so that height and rate of change of height are proportional, the flareout (Phase 3) following an exponential path to touchdown. In the last airborne phase which is triggered at a height of 20 ft. and precedes touchdown by about five seconds (Phase 4), the drift is measured and zeroed by a computed rate application of rudder, bank induced by the yaw is inhibited, and leader cable guidance ignoring throttle closure during flareout is automatic but after touchdown the landing run is concluding under manual control with the assistance of the leader cable cockpit and gyro compass.

A statistical analysis of over 2,000 landings gives an average longitudinal scatter of 250 ft., lateral scatter 10 ft., heading scatter ½ deg. and a mean rate of descent at touchdown of 2 fps. No damage has ever been inflicted on the development Canberra, Vickers Valetta or de Havilland Dove aircraft.

The Pye instrument landing system developed as a military system in conjunction with the Blind Landing Experimental Unit team at Bedford, is now installed at a number of Royal Air Force air fields, and at Geneva and Prague. It is soon to be installed at Moscow and Budapest, and first Ministry of Civil Aviation orders were placed this month.

The makers claim that it is accurate down to an altitude of 70 ft. and to within 150 ft. of the bar lighting system. Superiority of the installation over American ILS equipment derives from the use of a parabolic aerial system, according to Pye Telecommunications Ltd.

The azimuth aerial assumes its correct shape automatically when assembled which obviates setting up of the complex phasing network involved with omni-directional systems, and offers greater gain and stability. Being restricted to an arc of plus and minus 70 deg. from the course line imparts directional properties giving increased range as well as reducing beam distortions caused by irradiation reflecting objects in the vicinity of the aerial.

Avoidance of bends introduced by these reflections is one of the main factors behind the company's claim for more system accuracy.

All the courses are fully stabilized by negative feedbacks from course monitors. Electronic modulation used on both transmitters frees the system from mechanical losses as well as increasing the reliability.

The localizer transmitter radiates two amplitude modulated signals at 90 cps. and 150 cps. in the VHF band (108-112 mc.) using two horizontal dipoles placed on opposite sides of the axis. Aerial uses the principle that a beam produced by a parabolic reflector can be deflected from the axes by lateral movement of the feed. The carrier is modulated to a depth of 20% by each tone and the aircraft receiver compares the difference with the depth of modulation. Output of the transmitter is 50 watts.

The glidepath transmitter operates the same modulated frequencies as the localizer with the beam directed vertically. The transmitter operates in the UHF band and high power output in this band of 12-15 watts has been achieved. Recent modifications have replaced the dipoles with slot transmitting aerials which has led to reduced coupling between the upper and lower aerials, reduction in vertical polarization, reduction in back radiation from the lower aerial and an improvement in the amplitude compensation necessary to maintain a linear glide slope at low altitudes.

The radio altimeter developed by Standard Telephones and Cables Ltd. is of conventional design. Its improved performance stems from extensive detail modifications. A. E. Outen, who led the development of the instrument, said that the latest version now being readied for production is fully transistorized and employs a printed microwave strip in place of waveguides. These two features cut the weight of the current version from 45 lb. to 25 lb.

The instrument was developed for a 5,000 ft. low-level bombing requirement. For civil blind landing applications an instrument with a range of only 500 ft. could be satisfactory. While this would not improve the accuracy, the circuitry could be relieved of much complexity which would lead to increased reliability.

Altimeter Sensitivity

Sensitivity of the altimeter is approximately 120 cycles per foot of altitude. "All we have to do," said Outen, "is to measure this frequency within an accuracy of 240 cycles, which isn't difficult."

The display is calibrated to read either 5,000 ft. or 500 ft. in one revolution. Absolute accuracy of the instrument is two feet. Zero datum is set to match the aircraft height and landing attitude and remains stable when set to within one foot.

Accuracy of the putput to the autopilot exceeds that of the display which can be read only to about five feet.

Height signal output from the altimeter is converted in a coupling unit to an exponential flare term.

Leader cable installation was developed by Murphy Radio Ltd. and uses a partially transistorized receiver weighing, with its loop, 16 lb. The cables can be buried or slung along the ground and the circuit controlled remotely.

A Smiths EP-2 autopilot and Smiths flight system instruments are used with little modification. The automatic throttle control was developed specially for the system by Smiths which also makes the coupling units.

Another coupling unit is responsible for kicking off the drift which forms the last five-second phase of the landing. In this phase the coupling compares the aircraft heading with the runway direction preset on the gyro compass and computes the most suitable rate and extent of rudder correction. This correction has to be compatible with minimum overshoot and induced bank conditions.

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"ECLIPSE" a recent painting by Simpson-Middleman, gifted artistic interpreters of the physical sciences. About this new expression they write: "Eclipse was painted as a result of watching an actual eclipse of the sun. We were particularly struck with the curious light that was both dim and glowing and the unusual pattern of the shadows on the leaves of the trees around us. We had never seen anything like it before." Painting courtesy of John Heller Gallery, Inc.

Space projects at Boeing

Engineers and scientists at Boeing are at work on advanced projects that include a space weapon system based on a manned orbital vehicle capable of re-entry into the atmosphere and normal landing. This major contract-supported program is a result of recognition of Boeing's space-age orientation, its tremendous technical and research capability and its extensive weapon system management experience.

Among other space efforts at Boeing is a study for an unmanned Martian reconnaissance vehicle powered by an ion accelerator. The vehicle would escape at low continuous thrust to an Earth-Mars transfer orbit, then descend to a Martian orbit where it would optically observe the surface of the planet. The controllable-thrust capabilities of ion propulsion would permit correction of flight-path deviations from a "memory" electronically pre-programmed into the vehicle. Fine corrections would be made possible by an optical star-tracking system.

These and other rapidly expanding space flight programs have created exceptional career opportunities at Boeing for scientists and engineers of all categories. For complete details, drop a note now to Mr. Stanley M. Little, Department C-81, Boeing Airplane Company, Seattle 24, Washington.

BOEING

FILTER CENTER

► **Sperry Develops Helicopter Computer**—Lightweight dead reckoning computer and pictorial cockpit display for helicopter use, which can use Doppler radar ground-speed or Tacan signals when available, has been developed by Sperry Gyroscope Co. under Navy sponsorship. Pilot sets in destination, point of takeoff and wind information. Computer uses Doppler radar signals to continuously compute wind direction, velocity, uses the latter if and when Doppler radar signals are unavailable. Pictorial display shows direction to destination, magnetic course and bearing to Tacan ground facilities. Computer itself weighs 25 lb., employs modular construction.

► **Transistors for 400C Operation**—Radio Corporation of America will develop diodes and transistors for operation at 400C using new semiconductor materials such as gallium arsenide and indium phosphide under $3 million contract from Wright Air Development Center. Contract calls for development and production refinement of a computer diode, power rectifier, general-purpose transistor and power transistor. RCA reports it has already developed a gallium arsenide rectifier that operates at 350C.

► **Electronic Materials for 500C**—Report on Armour Research Foundation study, under Wright Air Development Center sponsorship, of materials suitable for use in electronic components capable of operating at temperature of 500C is now available. The 110-page report, identified PB 131815, is priced at $2.50 and can be obtained from Office of Technical Services, Commerce Department, Washington 25, D. C.

► **Missile Shock, Vibration Data**—Information on the shock and vibration environment encountered aboard 10 operational missiles is contained in new report by Barry Controls, Inc., made under Wright Air Development Center sponsorship. Report also recommends specific vibration and shock tests intended to simulate actual environmental conditions. The 145-page report, identified PB 131047, priced at $3.75, is available from Office of Technical Services, Commerce Department, Washington 25, D. C.

► **Transistor Sales Peak in August**—Semiconductor industry sold 44 million transistors during August, highest number ever sold, to bring 1958's eight-month total to 25.3 million units, nearly twice the 14.6 million sold in same eight months of 1957. Reduction in unit prices is reflected in the total dollar value for first eight months of 1958 of $59.4 million vs. $42 million for half as many units last year.

► **Novel Superconductors Discovered**—Four new intermetallic compounds, alloys of uranium and one other metal, discovered by Westinghouse Electric Research Laboratories, exhibit unusual superconductivity at extremely low temperatures near absolute zero. Unlike most alloys, resistance of new compounds increases as temperature is reduced until temperature reaches within one or two degrees of absolute zero at which time resistance drops practically to zero. Another surprise: two of the compounds contain manganese and iron which were thought to preclude superconductivity. Others contain molybdenum and niobium.

► **JETEC Becomes JEDEC**—Joint Electron Tube Engineering Council (JETEC), originally formed by Electronic Industries Assn. and National Electrical Manufacturers Assn. to serve electron tube industry in registering tube types and specifications to assure interchangeability, has changed its name to Joint Electron Device Engineering Council (JEDEC) to reflect its work in field of semiconductors.

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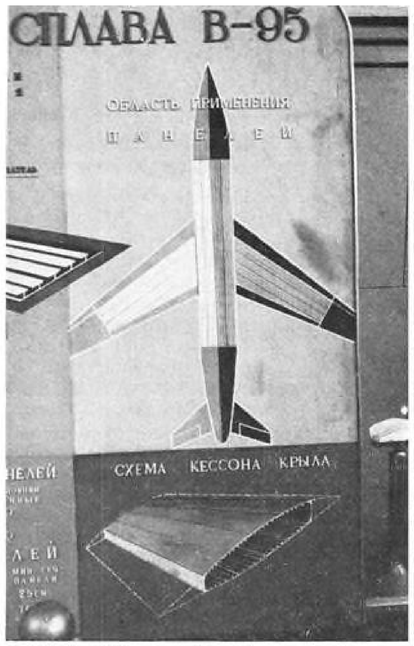
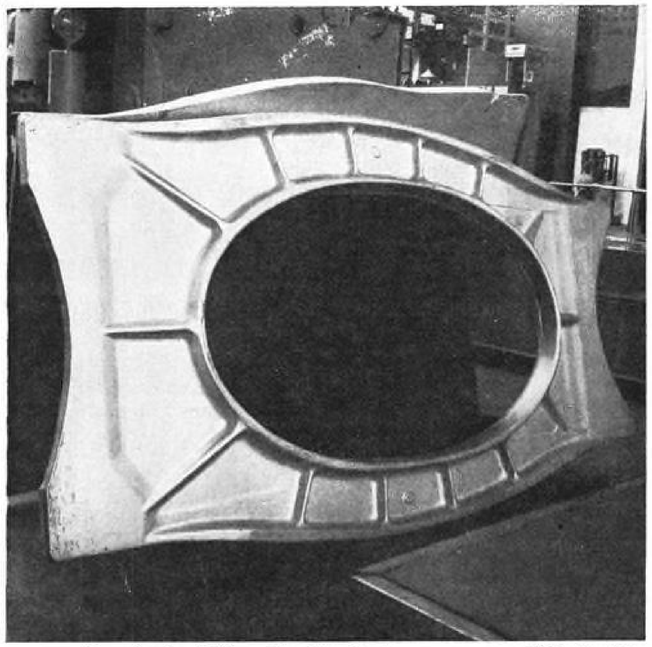
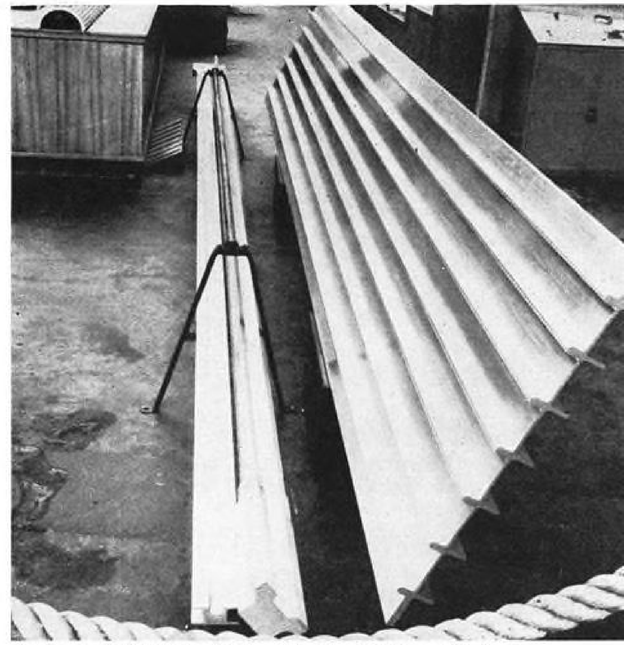


Signboard (left) beside model of the extrusion press at bottom of page shows full-scale press installed and in operation. Press can produce panels 36 ft. long which might be used as integral skin and longeron sections for aircraft as shown in illustration at right.

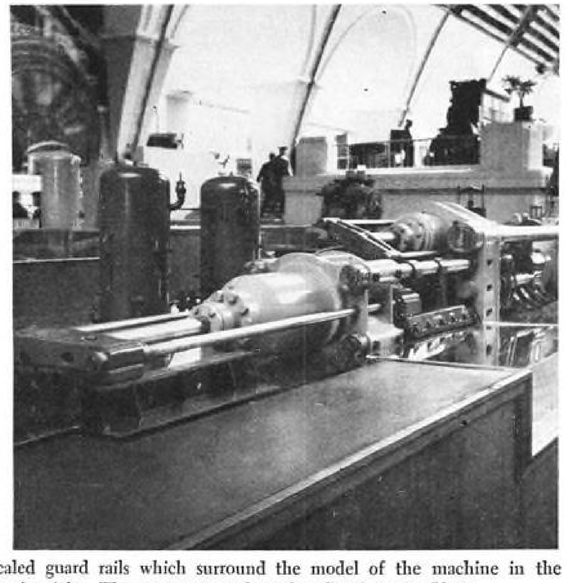




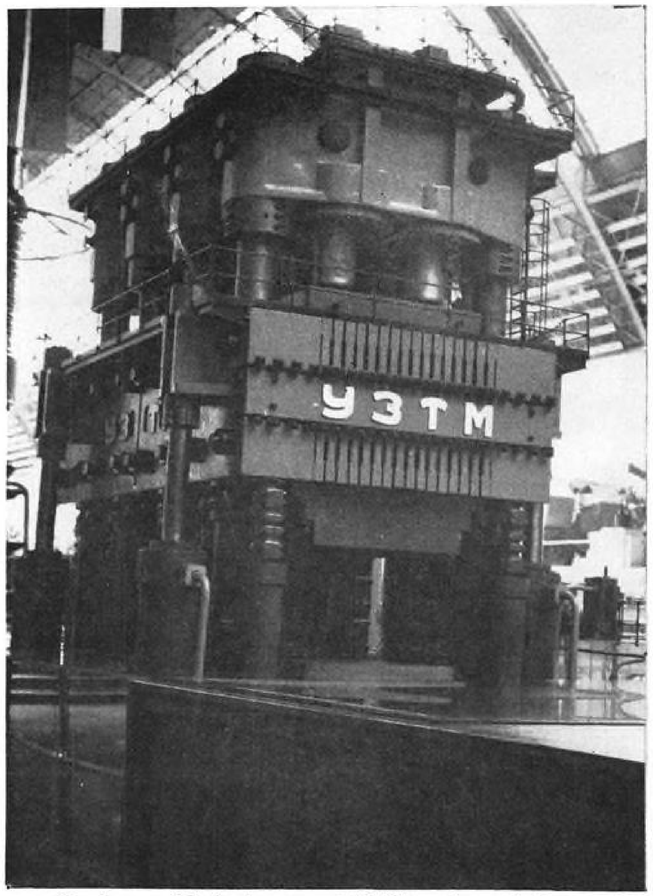
Large forging (left) produced by Russian presses was exhibited in Moscow by the Soviet Ministry of Heavy Machine Building. The forging is apparently the support structure for a turbojet engine in an aircraft. A display of Russian extrusions is shown at the right.

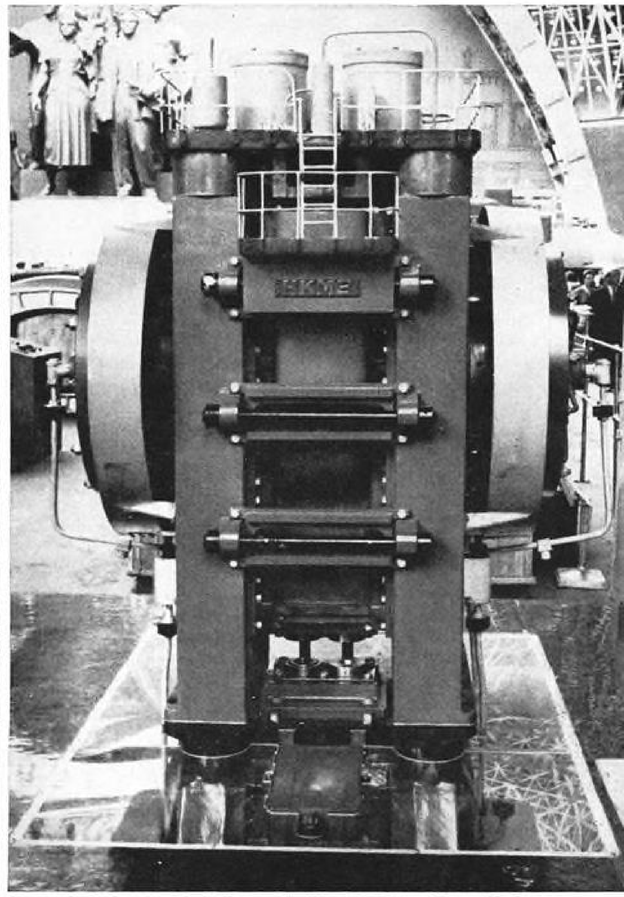
Soviets Exhibit Models of Industrial Equipment

Models of some of the latest heavy forge, stamping and extrusion presses in operation in the Soviet Union were shown at a recent industrial exhibition in Moscow. The Russians have ambitious plans for the construction of heavy production equipment of these types. Included in the plans are 30 forge presses similar to the World War II German Schloemann, the largest of which could exert a force of about 33,000 metric tons. One of these presses was able to form all the parts for a Junkers Ju-88 wing in one motion. The U. S. and the Russians dismantled several of these machines and took them out of Germany after the war. The Russians as well as U. S. production people consider such large presses essential for the production of large, lightweight, high-strength parts needed in modern aerial weapons. These large parts and panels with integral stiffeners and spars require a minimum of riveting and attachments, reducing the assembled weight of a vehicle. The Ural Heavy Machine Building Plant (Uralmash) at Sverdlovsk, which apparently is Russia's largest machinery plant, has been assigned the job of constructing most of the 30 heavy presses called for in Soviet plans. It has been reported that models of at least one of these 30,000 metric ton presses are now in operation at Moscow, Komsomolsk, Tomsk, Kiev, Leningrad, Kuibyshev, Irkutsk, Krasnoyarsk, Voroshilovgrad, Khabarovsk.



Large size of 12,000 metric ton extrusion press is evident from the scaled guard rails which surround the model of the machine in the Moscow industrial exhibit. Front view is on the left; rear view is on the right. The press was made at Sverdlovsk in the Urals.





Very large model of a forge press of 30,000 metric tons is shown at left. It was built by the Ural Heavy Machine Building Plant (Uralmash) at Sverdlovsk. The smaller forge press (right) was made by the Novo-Kramatorsk Heavy Machine Building Plant in the Ukraine.

NEW AVIATION PRODUCTS

Jet Aircraft Carrier

Model indicates appearance of proposed jet aircraft carrier vehicle designed to eliminate taxiing under jet power.

Vehicle will be driven by four electric motors powered by a diesel-driven generator. Speed with aircraft aboard will be 15-18 mph. Transporter will weigh 25,000 lb.; footprint loads on outrigger tires will be 13,000 lb. when carrying a 247,000 lb. aircraft. Price of basic unit is estimated at $70,000; leasing arrangements are also planned.

General Airways, P. O. Box 48-1271, Miami International Airport, Fla.

Rescue Radio Beacon

Emergency rescue radio beacon is designed to inform emergency rescue facilities of the existence of an aircraft incident and provide signals suitable for fixing the location through ground direction-finding networks.

Radio, designated AN/ART-31, will emit coded signals for 24 hr. after being turned on. The set may be stored in aircraft, life rafts, and can be dropped by parachute.

A flasher light is incorporated to aid in night time location. Radio weighs under 50 lb., is 32 in. long, 9 in. wide and 9 in. deep.

Sylvania Electric Products, Inc., 1740 Broadway, New York 19, N. Y.

Rocket Thrust Controller

Hydromechanical controller is said to be capable of sensing and correcting small errors in thrust chamber pressure in liquid propellant rocket engines. Actuator can be used to govern the flow of propellant to a gas generator or the flow of hot gas from the generator to the turbine, controlling turbine speed and propellant flow to the main rocket thrust chamber.

Controller has a two-stage pressure regulator for obtaining an accurate reference, a pressure error sensing diaphragm, and a two-stage hydraulic amplifier. Accuracy and load insensitivity are obtained by servomechanism techniques such as degenerative actuator velocity feedback. A torque motor incorporated in the control permits changing the engine thrust level as a function of a remote electrical control signal.

Aircraft Engine Equipment Section, Bendix Aviation Corp., South Bend, Ind.

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George L. Nankervis Co., 15300 Fullerton Ave., Detroit 27, Mich.

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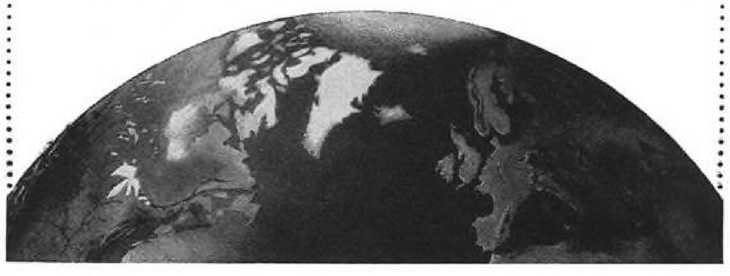
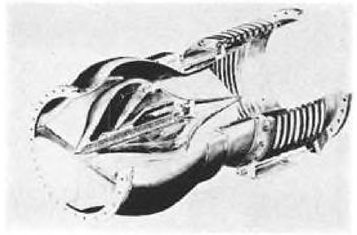


shaft speed of 24,000 rpm., an inlet pressure of 80 psig., and a pump rise of 725 psi. pumping 75F ethylene oxide. Input shaft speeds up to 24,000 rpm. are reduced through a 3:1 gear set for continuous pump operation. Flexible-type mechanical shaft seal separates pump cartridge from pre-lubricated gear section. Unit incorporates a "pressure-clamping" design, which, the maker states, provides for a fixed running end clearance throughout pressure and temperature operating ranges. Design is said to provide favorable volumetric efficiencies while pumping low viscosity fluids.

Lear-Romec Division, Lear, Inc., Elyria, Ohio



Missile Disconnect Valves

Combination check valve quick-disconnect unit is designed for cryogenic, corrosive or conventional fluid service. Flow rate is said to be up to 6,500 gpm. of liquid oxygen at 70 psi. with pressure drop of less than 4 psi.

Valve fore section can be used alone as a check valve. In certain applications fluid flows in either direction and the check valve comes into play only after valve and nozzle sections have separated. Largest current unit, 11 in. line size, is 3½ ft. long and weighs less than 50 lb. Other size units can be provided.

Reaction Motors Division, Denville, N. J.

WHAT'S NEW

Reports Available

The following reports were sponsored by the Office Of Technical Services, United States Department of Commerce, Washington 25, D. C.

Application of Atomic Engines in Aviation (Primeneniye Atomnykh Dvigateley v Aviatsii)—by G. N. Nesterenko, A. L. Sobolev and Yu. N. Sushkov, and first published in 1957 by the Military Press of the Ministry of Defense of the USSR. Translated by Technical Documents Liaison Office, Wright-Patterson Air Force Base. $3.00; (PB 131908T).

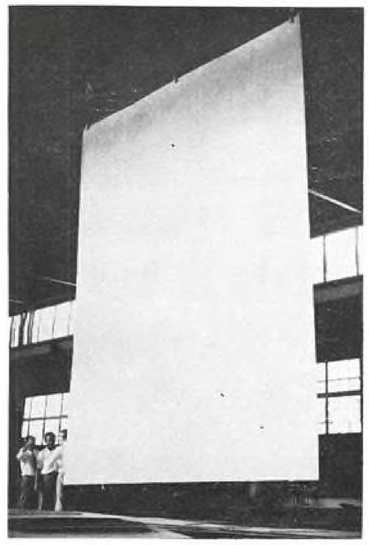
Bacterial Activity in JP-4 Fuel—by S. Bajanauskas, Wright Air Development Center, U.S. Air Force. March, 1958. $.75; 20 pp.; (PB 131813).

A Single Generalized Chart of Detonation Parameters for Gaseous Mixtures—by R. C. Dunn and B. T. Wolfson, Wright Air Development Center, U.S. Air Force. August, 1957. $.50; 16 pp.; (PB 131458).

Measurements of the Viscosity of Gas Mixtures—by W. A. Strauss and R. Edse, Ohio State University Research Foundation for Wright Air Development Center, USAF. August, 1957. $.75; 21 pp.; (PB 131573).

Development of an Improved Corrosion Inhibitor for Water-Alcohol Solutions—by D. B. Conklin, B. G. Peacock and J. E. Cole, Wyandotte Chemical Corp. for Wright Air Development Center, U.S. Air Force. July, 1956. $2.25; 82 pp.; (PB 131781).

Development of Improved Titanium Alloys For Application at Elevated Temperatures—by B. S. Lement, Manufacturing Laboratories, Inc., for Wright Air Development Center, U. S. Air Force. Mar. 1958. $2.00; 73pp.; (PB 131749).



Wide Sheet Steel

High strength steel sheet, measuring 160 in. wide, will be used in fabrication of solid propellant rocket motor casings. Use of the wide sheet will strengthen rocket casings by reducing number of weld seams. Sheet, "pack-rolled" at Lukens Steel Co., is said to be the widest ever produced. Dimensions are 160 x 192 in.; thickness varies from .082 to .088 in. Steel sheet will be displayed at American Rocket Society meeting in New York City, Nov. 17-21.

Publications Received:

The Ships and Aircraft of the United States Fleet: Seventh Edition—by James C. Fahey, Associate, United States Naval Institute—Pub. Ships and Aircraft, P. O. Box 548, Falls Church, Va. $2.50; 64 pp.

Detailed information pertaining to U. S. vessels, active and reserve, building and authorized; also naval aircraft and guided missiles.

The Army Air Forces in World War II: Services Around the World: Volume VII—edited by W. F. Craven and J. L. Cate—Pub. University of Chicago Press, 5750 Ellis Avenue, Chicago 37, Ill. $8.50; 666 pp.

History of the American air strategy and operations during the war years. This seventh volume is the final volume dealing with services around the world. The other six dealt with combat operations.

Looking at the Stars—by Michael W. Ovenden, Philosophical Library, Inc., 15 East 40th St., New York 16, N. Y. $4.75; 192 pp.

This book is of value to those who have had an interest in astronomy, since it starts with the story of astronomy and works through the solar and stellar systems.

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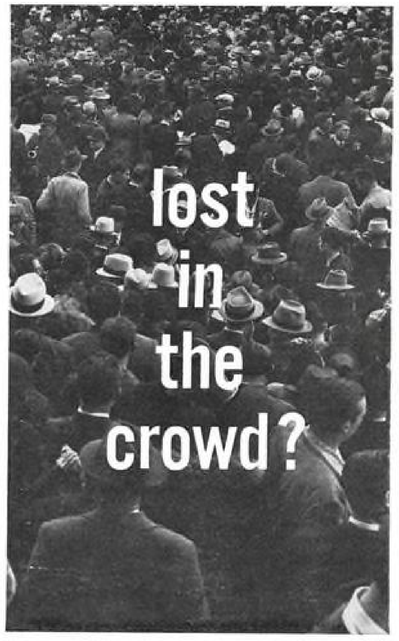

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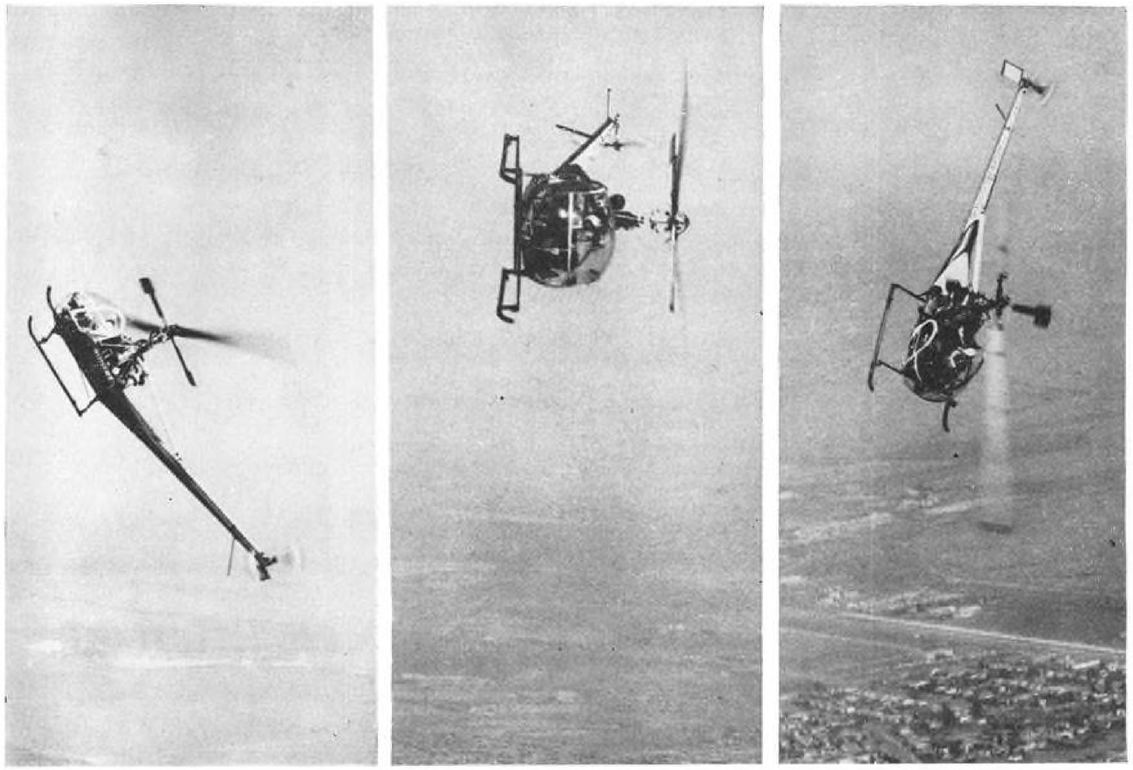


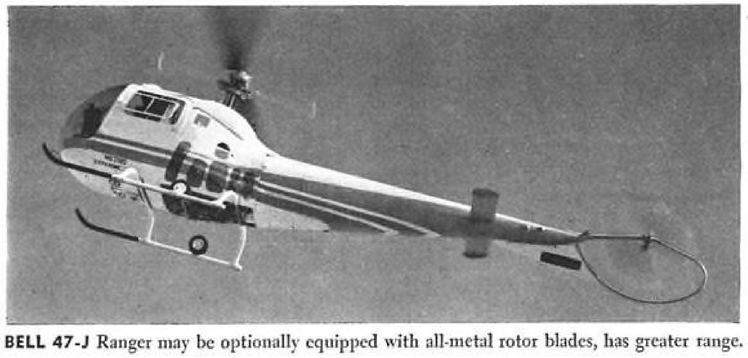
HILLER UH-12E is powered by a new Lycoming VO-540-A1A six-cylinder engine delivering 305 maximum continuous horsepower.

Bell, Hiller Demonstrate 1959 Versions

Latest versions of the Bell 47-J Ranger and Hiller UH-12E, representing 1959 models of these light helicopters for the executive and utility market, were demonstrated during National Business Aircraft Assn.'s recent annual meeting in Philadelphia (AW Sept. 29, p. 21).

Latest Bell 47-J Ranger features all-metal rotor blades available as optional equipment, bringing the basic price to $68,500 and empty weight to 2,850 lb. Gross weights with wood blades are 2,565 lb. and 2,800 lb. Useful load with metal blades is 1,210 lb. compared to 950 lb. and 1,183 lb. with wood blades.

New 47-J also has an hour's greater endurance than earlier models through use of an optional fuel system providing 48 gal. replacing the standard 35 gal. This boosts Ranger's range, with metal blades, to 239 mi. at 75% power at 5,000 ft. without reserve, compared to 175 mi. with standard tanks under the same conditions.



BELL 47-J Ranger may be optionally equipped with all-metal rotor blades, has greater range.

Lycoming VO-435, derated from 260 hp. to 240 hp., is fitted in a Navy Bell HTL-7-type mount which has a life of 2,500 hr. compared with 600 hr. of the earlier mount.

Bubble canopy of the 1959 Ranger is completely blue-tinted to reduce eye strain. Other improvements include improved door window and door latches and larger rain troughs over the cabin doors. Company currently has approximately six 1959 Rangers on its backlog.

Latest Hiller helicopter, which lists at $59,950, is powered by the new Lycoming VO-540-A1A six-cylinder engine delivering 310 hp. on takeoff and 305 for maximum continuous power. New UH-12E picks up many improvements incorporated in the H-23D Army helicopter and adds the higher-powered engine to provide a maximum cruise speed, at 75% power, of 87 mph. Gross weight is 2,700 lb., providing 528 lb. for passengers or cargo. Range at best cruise speed, including five-minute warm-up, is 185 mi.

UH-12E incorporates a more rugged transmission system developed for the H-23D, which provided for a 40% increase in power over previous models at a weight saving of 20%. Tail rotor system has simplified drive couplings and a revised gear box, relocating tail rotor to the left side and a new rotor with zero-offset flapping hinges to eliminate tail rotor buzz.

Hiller has started on an initial production run of 50 UH-12Es and already sold 10, with five of these going overseas. Initial production model will roll out this month.

PacAero Proposes D-18S Modification

A modification program on the Beech D-18S, designed to increase its speed by 21 to 24 mph., elevate gross weight to 9,000 lb. and raise critical takeoff altitude to 3,900 ft., in addition to other benefits, has been developed by PacAero Engineering Corp., Santa Monica, Calif.

The D-18S modernization program has been developed by PacAero in kit form so that it may be installed at the firm's facility or by any authorized fixed base chosen by a customer. Installation is said to take as little as five days. A PacAero representative told AVIATION WEEK that the firm has rolled out its fourth D-18S containing the modifications.

Program can comprise four major basic steps:

- **Kit 1**, consisting of powerplant modernization, utilizes new stainless steel "Siamese" short stack exhausts to reduce back pressure and provide higher useful power output at given manifold pressures and rpm. Stacks are designed to exit through two stainless steel troughs in the lower engine cowl. Improved cooling permits an increase in maximum except takeoff (METO) power from 400 hp. to 450 hp., with cylinder head temperatures being reduced 18C. Carburetor air intake is a ram air scoop on the lower cowling directly below the carburetor, enabling a reduction of thrust horsepower to operate the supercharger. Up to 1¾-in. more manifold pressure is available than with the original system, PacAero reports. New oil cooler duct is placed atop cowl to reduce drag and design of the duct is stated to lower operating oil temperatures 29C below standard configuration performance. Price of Kit 1, including installation, is $5,830.
- **Kit 2** consists of installing a 20,000 Btu. Stewart-Warner combustion heater in each engine nacelle. This costs $2,325 installed. An electric fuel pump can be added for $171.50 to per-

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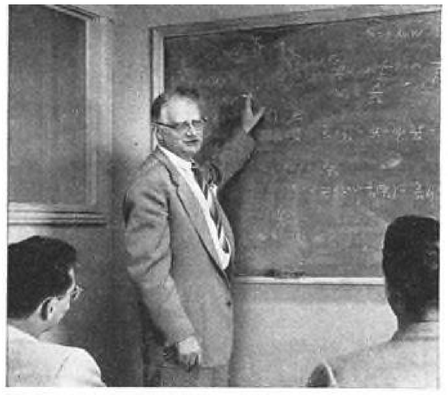
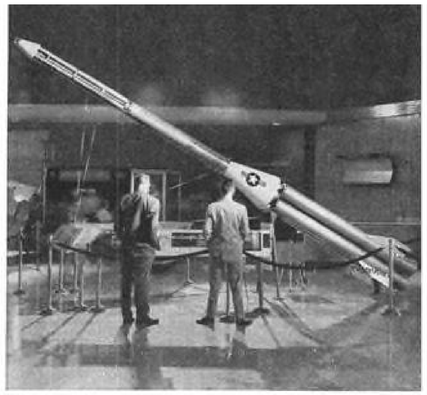
Progress Report on Aeronutronic Systems, Inc.



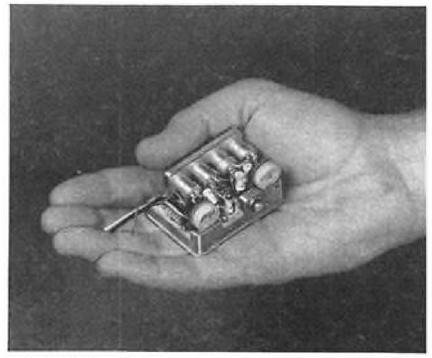
Dr. Montgomery H. Johnson, Director of Aeronutronic System's Advanced Research Staff, discusses problems related to lunar research flights. Other Advanced Research Staff interests include the study of air opacity, infrared missile emissions, and high altitude and free space nuclear explosions.



Far Side Missile developed by Aeronutronic for USAF Office of Scientific Research. Four-stage rockets like this were balloon launched and fired to record breaking altitudes where they measured the Earth's magnetic field and cosmic radiation intensities.

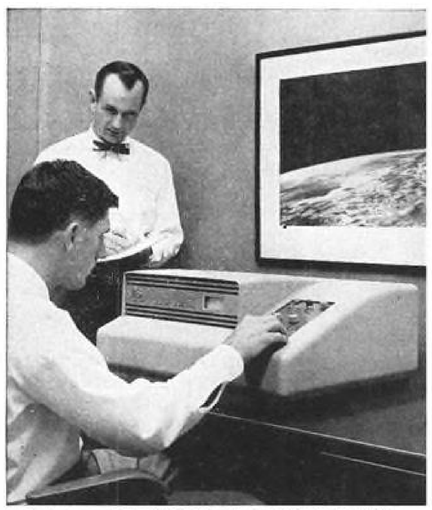
How Aeronutronic is meeting the needs of advancing science and technology

The Ford Motor Company established Aeronutronic Systems, Inc. to engage in the development and manufacture of highly technical products for military and commercial purposes. In a time of expanding science, Aeronutronic is meeting the technological needs of the Nation. A few of Aeronutronic's broad interests and activities are illustrated here.



ASI Model IL-101 Subminiature Transmitter provides exceptional frequency stability under high acceleration space conditions. Size of unit: 1.1 x 1.4 x 2 inches. Weight: less than 5 ounces. Output: 150 ± 10 mw.

Aerial view of Newport Beach, California, where Aeronutronic Systems, Inc. is building modern, new facilities to carry out military and commercial programs involving the most advanced research, development, experimentation and production. Aeronutronic's new facilities are located 40 miles south of Los Angeles on a mesa overlooking Newport-Balboa Harbor and the Pacific Ocean.



Prototype model of ASI Digital System Simulator. Unit is designed to give direct check of reduction of logical equations, to study a system's operations prior to construction, and to study alternate logical designs.

AERONUTRONIC SYSTEMS, INC.

a subsidiary of ***Ford Motor Company***

For information and booklets about Aeronutronic's interests, facilities or products, address: Aeronutronic Systems, Inc., Building 12, 1234 Air Way, Glendale, California.

mit ground operation of the heating system. Cabin heat thermostat controls are $61.40 additional.

• **Kit 3** comprises a set of wrap-around landing gear doors on each nacelle, fitting snugly around the gear when retracted and said to provide an increase of four to five miles per hour true airspeed. Doors are designed to permit landing gear extension at speeds up to 160 mph. for braking purposes. Price of wheel well doors, installed, is $1,795.

• **Kit 4** includes altering the angle of incidence of the stabilizer to allow the airplane to be trimmed properly at the higher speeds made possible by the modernization program. A Fiberglas saddle is fitted to the horizontal stabilizer to improve fairing. Total cost of Kit 4 is $1,097.

PacAero also has developed a wing modification kit which provides for carrying all fuel in the wings outboard of the engine nacelles. The new wings can carry a total of 350 gal. and increase weight by 80 lb. Installation obviates the need for a nose tank, freeing this area for radio or radar or baggage. Owners can have D-18S wings modified at a cost of $7,875, or can trade wings for modified zero-time wings costing $8,640. PacAero will install a leading edge light kit for a charge of $975.

Safer Visual Flying Foreseen by AMB

Greater latitude of operation by see-and-be-seen type traffic in areas designated for visual flight rules (VFR) flying should be possible as Airways Modernization Board's development programs achieve higher degrees of precision in instrument flight rules (IFR) navigation and traffic control. AMB representative Lt. Col. Carl B. Fisher stated during recent 11th Airport Development and Operations Conference, Syracuse, N. Y.

Col. Fisher noted that the trend toward more positive control thus far has not always reflected requirements of users of U. S. airspace; he intimated that the major reason for this has been the need for AMB to adapt available, although inflexible, equipments and techniques in the immediate phase of its long-range program. He pointed out that the agency now is at a point where it can consider plans covering a more extensive time span. And in developing future equipment and methods, greater cognizance can be taken of requirements of various airspace users, including general aviation.

As new systems come into use and provide improved management of IFR traffic, VFR traffic can be made safer and more efficient, even though the latter is equipped with a minimum of

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In one practical instrument, CEC's 6-201 Primary Pressure Standard offers an extended range of precise pressure measurements available in no other similar equipment. Operating as a pneumatic dead-weight tester, the 6-201 offers the advantages of air rather than oil as the pressure medium, extreme accuracy of 0.015% of full range even at pressures of less than one psi, cleanliness and portability regardless of the pressure range. Because this flexible gage or absolute-type instrument depends only on mass and length measurements for its accuracy, it is a true primary pressure standard. It will calibrate any pressure-measuring device. Simple combinations of piston-cylinders and weights provide six pressure ranges within the limits of 0.3 to 500 psi, each with increments of 1%, for both gage and absolute measurements. For additional information, call your nearest CEC sales and service office, or write for Bulletin CEC 1581-X14.

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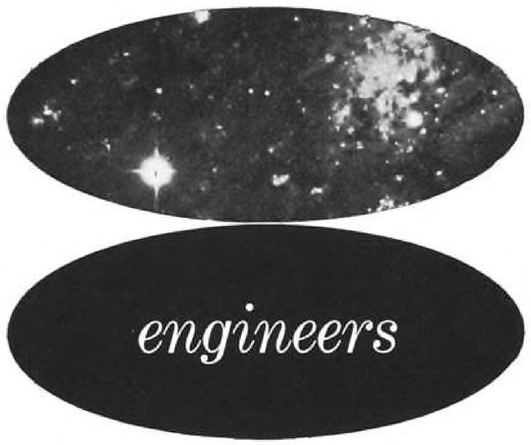

The Boeing Airplane Company's Wichita Division offers engineers a number of long-range career opportunities in connection with advanced flight projects. These openings offer all the scope needed to employ your creative powers to the fullest.

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Openings are for high-level positions in the fields of high-speed aerodynamics, VTOL-STOL research, and design. Requirements are a BS or advanced degree, with four or more years of experience in aircraft or missile design, plus the ability to plan and direct development programs.

STRUCTURAL DYNAMICISTS

Aeronautical and civil engineers with BS or advanced degrees will find stimulating assignments in connection with hypersonic aircraft. Work includes compilation and evaluation of vibrations, flutter and dynamic load data related to design, development and research.

An outstanding senior research position is also available for an aeronautical or civil engineer with a Ph.D. and five to ten years of experience in structural dynamics and aero-elasticity.

STRESS ANALYSTS

Openings are for mechanical, civil and aeronautical engineers with a BS or advanced degrees, to perform analysis of aerodynamics and structural loads in relation to production, design and research programs. Applicants should have from one to five years of aircraft experience.

* * *

In each of the above positions you'll be associating with outstanding men in your field, and have at your disposal some of the most up-to-date equipment and laboratory facilities in the industry. In addition, you'll enjoy many benefits including insurance and retirement programs, relocation allowances and help in getting settled.

For further details, drop a note to R. J. B. Hoffman, Dept. CW3, P. O. Box 3822, Boeing Airplane Company, Wichita 1, Kansas.

BOEING

airborne equipment, he stated. As yet it would be unrealistic to predict the standard airborne equipment package required in all aircraft, he noted. In any event, AMB's program does not foresee a system that would require all aircraft to be fully equipped, but rather one that will leave the operator with the prerogative of equipping his airplane to handle the type of flying in which he is most interested.

Among several equipment developments under study by AMB mentioned by Col. Fisher, was an electronic billboard display on the airport surface which would present pilots with routine information regarding weather, clearance and other data to relieve the voice communications circuits of excess traffic. Display would be tied to a computer for rapid data processing.

PRIVATE LINES

Total sales exceeding $95 million are reported by Beech Aircraft Corp., Wichita, Kans., for Fiscal 1958, ending Sept. 30, compared with $103.9 million for same period last year. Current backlog is $93 million. Company is paying quarterly dividend of 40¢ on common stock on Nov. 6 to holders of record on Oct. 27. Dividends paid this year, including extra 30 cents cash dividend, totals $1.60 per share compared with $1.20 last year.

Newly formed Helicopter Services will provide lease and charter operations using a Bell 47G-2 and 47-J based at Buffalo Airport, N. Y. Officers include: H. Leibee Wheeler, Donald A. Heussler and Jack B. Prior.

Venezuela purchased 34 Beech Mentor trainers for its air force and seven other Mentors for the government-operated civilian flying school, the two contracts totaling more than $2 million including spares. Deliveries begin April, 1959. Venezuela is 10th government to adopt Mentor as primary trainer.

Metered helicopter taxi service for St. Louis area has been inaugurated by Remmert-Werner, Inc., available either on a trip or contract basis. Radio dispatched helicopter will provide passenger with a punched card of cost in lieu of a receipt and invoice. Remmert-Werner proposes to initially operate three helicopters on the service.

A five-place helicopter, with gross weight of 3,000 lb. and empty weight of 1,978 lb., is being built in Cuba by Juan de la Cierva Hoces, a nephew of the late autogiro designer. Model C-58 has a 39.4-ft. rotor blade, is powered by a 260-hp. engine and has a top speed of approximately 125 mph.

USAF Contracts

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

OKLAHOMA CITY AIR MATERIEL AREA, USAF, Tinker AFB, Okla.

Pneumatics Division, Thompson Products, Inc., Cleveland, Ohio, overhaul, analytical overhaul, repair and test of alternator drives, (PR OC-9-031-3-1000). $713,930.

Gladden Products Corp., Glendale, Calif., valve, 4871-311892, (RFP OCPEA-1579), $45,731.

AiResearch Manufacturing Co. Division, The Garrett Corp., Phoenix, Ariz., overhaul of valve assemblies, (RFP OC-10017), $49,385.

Aircraft Engineering & Maintenance Co., Oakland, Calif., overhaul and repair of fuel valve assemblies, (IFB 34-601-58-818), $25,435.

John J. Foster Manufacturing Co., Costa Mesa, Calif., blanket, 1AFB-1560-524-5737 (RFP 8-1957), $325,757.

The Goodyear Tire and Rubber Co., Akron, Ohio, cell assembly, 1AFH-1560-210-9052, 54 ea., cell assembly, 1AFH-1560-210-9053, 46 ea., cell assembly, 1AFH-1560-210-9045, 7 ea., (RFP 58-3), $76,851.

Hayes Aircraft Corp., Birmingham, Ala., overhaul and repair of fuel valve assembly, (IFB 34-601-58-818), $28,669.

Lockheed Aircraft Service, Inc., Ontario, Calif., radome assemblies, 1AFF-M125, (RFP OC-CIF-B50-1398), $30,968.

General Electric Co., Ontario, Calif., overhaul, modification and technical order compliance of turbosuperchargers, (RFP OC-9-03E-10015), $340,957.

Solar Aircraft Co., San Diego, Calif., screw, 0230-AFG-438000, 5,925 ea., flame arrester element, 1,848 ea., plate assembly, 0230-10187, 865 ea., (RFP OCP-NA-20-58), $321,143; cover, 0230-5930-202-0793, 2,365 ea., bracket assembly, 0230-11190, 1,290 ea., seal, 0230-10929-10, 15,816 ea., (RFP OCP-NA-15-58), $148,404.

Davis Aircraft Products, Inc., New York City, tie down cargo, nylon, 4504-AAF-202650, 905 ea., tie down cargo, nylon, 4504-AAF202655, 855 ea., tie down cargo, 4502-MIL-T-8652, 15,000 ea., $456,827.

Carruthers & Fernandez, Inc., Santa Monica, Calif., disconnect assembly, 4846-9100 (RFP-OCPEA-1436), 2,019 ea., $112,296.

Gerard Metal Craftsmen, Inc., Venice, Calif., scroll assembly engine cooling, 0230-6217 (IFB 34-601-59-1), $45,250.

Mansfield Aircraft Products Co. Division, Richland Aviation, Inc., element and cover assembly, 4569-C3864, 614 ea., container, 4569-163-180, 198 ea., container, 4569-1680-211-4719, 403 ea., (RFP OCPEA-1931), $49,550.

Hoof Products Co., Chicago, valve assembly, 4870-A22, 900 ea., valve assembly, 4870-2915-124-2214, 500 ea., (RFP OCPEA-1603), $55,154.

Allen Aircraft Products, Inc., Ravenna, Ohio, coupling, 4846-1650-304-6439, (RFP OC-8-031-1-1827), $25,471.

HEADQUARTERS, OGDEN AIR MATERIEL AREA, USAF, Hill AFB, Utah.

McDonnell Aircraft Corp., St. Louis, modification kits, 18 ea., engineering data, 24 sets, applicable to F-101B aircraft, (D. O. on contract AF42(600)-19284), $47,700.

Bendix Products Division, Bendix Aviation Corp., South Bend, Ind., spare parts applicable to B-50 series aircraft, (D. O. on contract AF42(600-19480), $98,358.

Universal Target Co. Division, Universal Lumber Co., Los Angeles, target, dart, tow, kit, type L-11, 210 ea., for training purposes, maintenance data, (P. R. 00-9-6920-2425 and 2425-1), $195,720.

The Goodyear Tire and Rubber Co., Akron, Ohio, spare parts applicable to F-89 series aircraft, (D. O. on contract AF42 (600)-19252), $36,646.

McDonnell Aircraft Corp., St. Louis, spare parts applicable to F-101 series aircraft, (D. O. on contract AF42(600)-19284), $43,891.

Bendix Products Division, Bendix Aviation Corp., South Bend, Ind., kits, modifications, 1,500 ea., applicable to B-52 series

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to cut down your landing lamp replacement costs.

Replacement charges for landing lamps are high. "Grounded" status because of burnouts is even more expensive—and aggravating.

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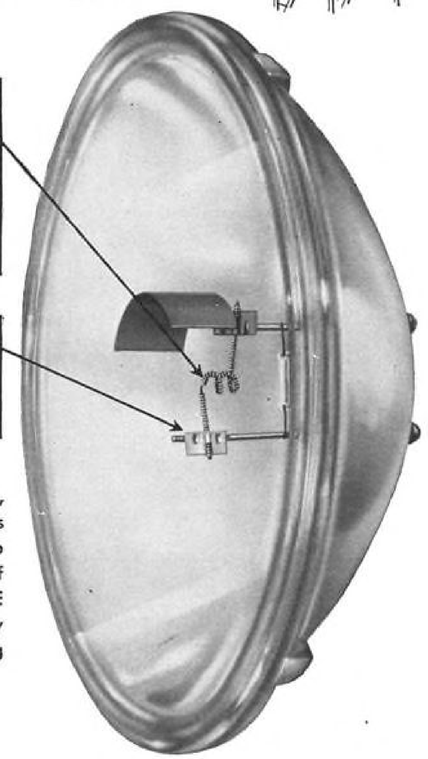

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AERO-THERMO RESEARCH: Senior Engineers with M.S. degree and experience or Ph.D. degree to conduct basic and applied research in the following areas: supersonic and hypersonic flow, heat transfer, orbital mechanics, magnetohydrodynamics, re-entry studies, nose cone design, development of design and prediction methods in these advanced areas.

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aircraft, space parts, 1,500 ea., engineering data, 25 sets, (D. O. on contract AF42 (600)-19480), $29,825.

McDonnell Aircraft Corp., St. Louis, kits, modification, 117 ea., applicable to F-101 series aircraft, (D. O. on contract AF42 (600)-18553), $1,275,531.

McDonnell Aircraft Corp., St. Louis, kits, modification, 483 ea. applicable to F-101 series aircraft, engineering data, 50 sets, technical data, (D. O. on contract AF42 (600)-18553), $946,500, kits, modification, 124 ea., applicable to F-101 series aircraft, engineering data, 25 sets, spares and technical data, (D. O. on contract AF42(600)-19284), $144,900.

Nuclear Products, ERCO Division, AFC Industries, Inc., Riverdale, Md., kits, modification, 11 ea., applicable to MB-26 flight simulator, engineering and technical data, 6 sets, (D. O. on contract AF42(600)-19275) $49,000.

WRIGHT-PATTERSON AFB, USAF, Wright-Patterson AFB, Ohio.

RCA Services Co., Camden, N. J., contract technical services, project 99-AMC-2-1, $25,400.

National Scientific Laboratories, Inc., Washington, D. C., (Intra-Governmental Procurement), contract technical services, project 99-AMC-2-2, $66,400.

Service Press, Dayton, Ohio, printing, padding and drilling holes in the following cut sheet forms: AFTO form 781A, 36 million copies, padding 720,000 pads, drilling 252,000 holes, project 99-AMC-2-3, (IFB 33-610-58-318), $78,120.

McGregor & Werner Midwest Corp., Dayton, Ohio, reproduction, packing and distribution of the following: S-03-F, category II, 1,000 copies, reproduced from manuscript, 1,399 one color pages, 4,400 additional copies, 1,400 one color pages, project 99-AM-2-4, $30,682.

Carpenter Lithographing & Printing Co., Inc., Springfield, Ohio, reproduction distribution and packaging of the following: S-00-1-1, 1,000 copies from reproduction copy, 4,165 one color pages, 9,700 additional copies, 8,166 one color pages, project 99-AMC-2-5, $135,452.

Northrop Division, Northrop Aviation, Inc., Hawthorne, Calif., contract technical services, project 99-AMC-2-8, $29,900.

International Business Machines Corp., Dayton, Ohio, tabulating cards, AMC form 600 AC, 601A and 600 AF, for use on electrical contract tabulating machines, project 99-AMC-2-9, $25,047.

HEADQUARTERS, AIR FORCE OFFICE OF SCIENTIFIC RESEARCH, ARDC, Washington 25, D. C.

Yale University, New Haven, Conn., continuation of research on "Atomic Beam Magnetic Resonance Experiments of Metastable and Excited States and Study of the Annihilation of Positrons in Liquids and Solids at Low Temperature," (AF 18(600)-1665), $37,343.

Armour Research Foundation of Illinois Institute of Technology, Chicago, continuation of research on "Radiation Effects in Organic Compounds," (AF 18(603)-121), $61,096.

Polytechnic Institute of Brooklyn, Brooklyn, N. Y., continuation of research on "Phase Transformations in Solids," (AF 18(600)-1193), $41,280.

Illinois Institute of Technology, Chicago, Ill., "Structure Studies of Imperfections in Crystals," (AF 18(638)-425), $41,025.

Vitro Laboratories Division, Vitro Corporation of America, West Orange, N. J., research on "Energy Exchange in High Frequency Arc Plasma," (AF 18(638)-477), $66,111.

Cornell University, Ithaca, N. Y., research on "Analytical Applications of Flame Spectroscopy," (AF 49(638)-484), $43,553.

The Ohio State University Research Foundation, Columbus, Ohio, research on "Certain Phases of the Intersections Between Electromagnetic Radiation and Matter," (AF 18(600)-772), $49,464.

The Ohio State University Research Foundation, Columbus, Ohio, continuation of research on "Dense Electron Beams," (AF 18(600)-980), $29,094; continuation of research on "Generation and Amplification of Current at Very Short Wave Lengths," (AF 18(600)-982), $31,501.

WHO'S WHERE

(*Continued from page 23*)

Changes

Col. James W. Anderson, Jr. (USAF, ret.), general manager, The Magnavox Co.'s Urbana, Illinois Division.

Robert W. Morris, manager-foreign operations department, The Garrett Corp., Los Angeles, Calif. Also: **Pierre DuFay,** European engineering representative, Garrett's Geneva, Switzerland office.

William F. Hoisington, director of research, Diamond Antenna and Microwave Corp., Wakefield, Mass.

Edward P. Fleischer, assistant to the president, Consolidated Electrodynamics Corp., Pasadena, Calif. **Donald J. Leman** succeeds Mr. Fleischer as manager of systems and procedures.

Guy L. Antrim, Jr., Colorado Springs, Colo. military relations representative, Borroughs Corp., Detroit, Mich.

E. Z. Gray, acting director of systems engineering, Systems Management Office, Boeing Airplane Co., Seattle, Wash. Also: **T. A. Wilson,** Minuteman program manager for the Systems Management Office.

Harold A. Keit, associate manager, Data Processing and Controls Department, Engineering Division, The Thompson-Ramo-Wooldridge Products Co., Los Angeles, Calif.

Charles E. Hunter, special assistant to the president, Thiokol Chemical Corp., Bristol, Pa.

Laurance U. Hurley, coordinator of test operations, Astro Division, Marquardt Aircraft Co., Van Nuys, Calif. Also: **John W. Cresse,** supervisor of a new project management group in Astro's nuclear operation.

Brig. Gen. Monro MacCloskey (USAF, ret.), assistant to the president, Crosley Division, Avco Manufacturing Corp., Cincinnati, Ohio. Also: **George H. Geick,** manager-market research and planning.

Ernest A. Goetz, technical assistant to the president, American Bosch Arma Corp., Hempstead, N. Y. Mr. Goetz continues as chief engineer, Arma Division.

E. S. Turner, district representative, Stromberg-Carlson's newly established office in Colorado Springs, Colo.

R. R. Muller, general manager of the new Aeronautical Division, Flexonics Corp., Maywood, Ill. Also: **D. W. Ankeney,** division sales manager; **W. C. Gage,** advanced program manager; **Charles Buck,** staff assistant to the general manager. **E. L. Helman,** of Flexonics Research and Development Division, chief engineer-aeronautical product design. **Peter H. Lauer** succeeds Mr. Muller as treasurer of Flexonics.

Carl S. Smith, executive assistant to the vice president, Wyandotte Chemicals Corp., Wyandotte, Mich.

Bert G. Maynard, resident engineering representative at Beech Aircraft Corp. and Cessna Aircraft Co., Wichita, Kan., for Republic Aviation Corp., Farmingdale, N. Y.

Frank Colonnese, superintendent, Bridgeport Thermostat Division, Robertshaw-Fulton Controls Co., Milford, Conn.

Frederick V. Dexter, Jr., representative at the newly established Dayton, Ohio office of Sundstrand Turbo, a division of Sundstrand Machine Tool Co., Pacoima, Calif.

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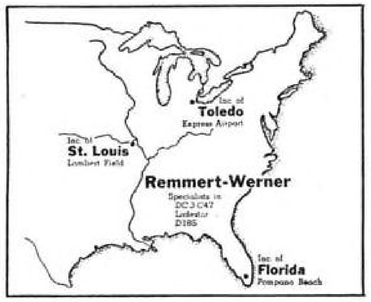

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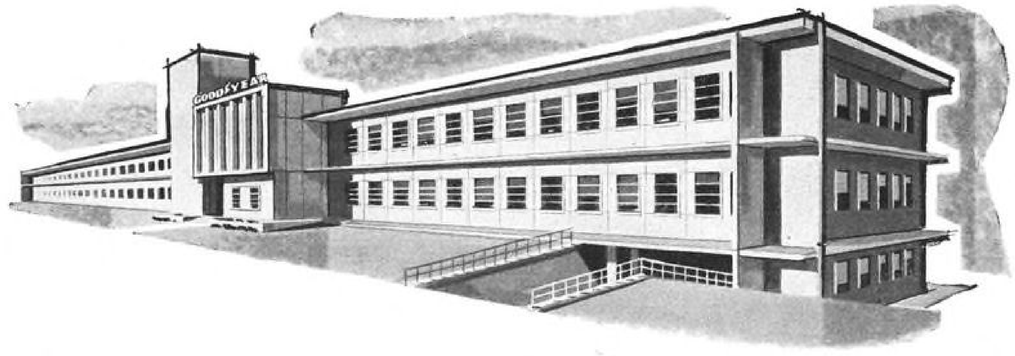
The Searchlight Section is at your service to bring business needs or "opportunities" to the attention of men in executive, management, sales and responsibible technical, engineering and operating capacities with the industry served by this publication.

FOR ENGINEERS
AND SCIENTISTS:

Address for challenges with a future



New developments at Goodyear, as well as new complexities in the international scene, have intensified our need for missile engineers—and engineers of all kinds.

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For further information on your career opportunities at Goodyear Aircraft, write: Mr. C. G. Jones, Personnel Dept., Goodyear Aircraft Corporation, Akron 15, Ohio.

GOODYEAR AIRCRAFT

Circuit Development Group Leader Ralph Wolcott (left) considers future changes in computer output unit for bombing—navigational systems.

Ground-floor opportunities in

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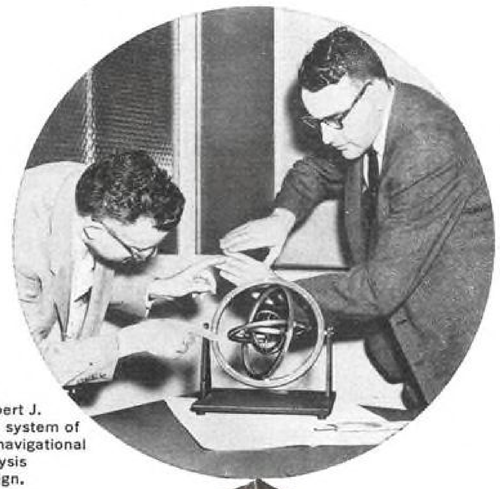
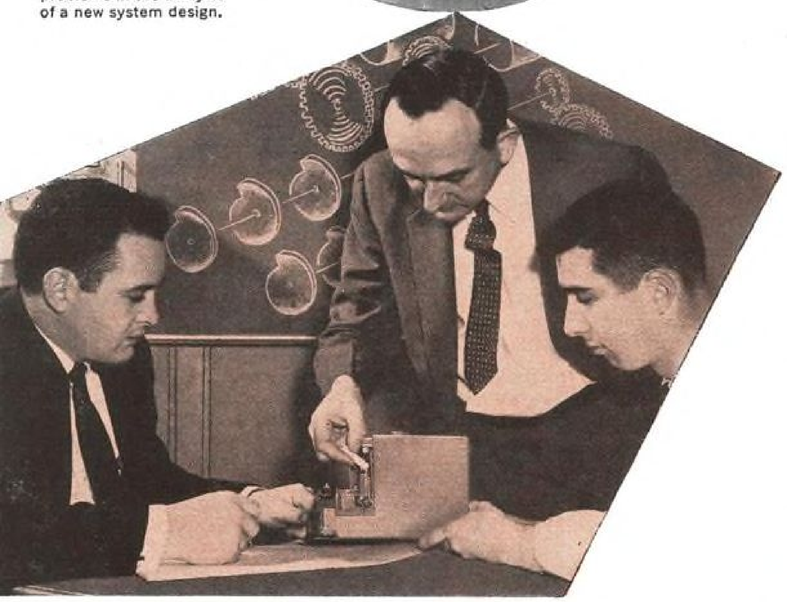


Project Engineer Robert J. Cantwell (left) uses a system of gimbals to describe navigational problems in the analysis of a new system design.



Staff Engineer William Howard (center) reviews gearing accuracy requirements of test equipment with electronic circuit designers.

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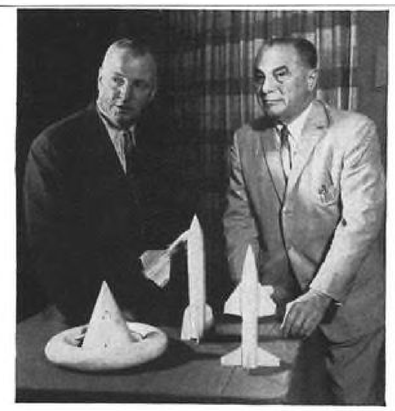

A $14,000,000 R & D Center, housing 9 new laboratories, was revealed as core of Republic's $35,000,000 Research and Development Program at recent announcement by Mundy I. Peale, President, and Alexander Kartveli, Vice-President for Research and Development.

.... To join Republic Aviation's new $35 million Research and Development Program for spacecraft, missiles and advanced aircraft

In announcing Republic's $35 million research and development program, designed to arrive at major breakthroughs in the aviation industry's transition to astronautics, Mundy I. Peale, President, set the following objectives:

"...ACCELERATION OF PROJECTS ALREADY UNDER WAY AT REPUBLIC ON LUNAR PROGRAM FOR MANNED SPACE VEHICLES, AND MISSILES TO DESTROY ORBITING WEAPONS, AND INITIATION OF INVESTIGATIONS LEADING TO NEW CONCEPTS FOR INTERPLANETARY TRAVEL."

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"...VERTICAL TAKE-OFF FIGHTER-BOMBERS, HIGH-MACH FIGHTER-BOMBERS, AND SUPERSONIC TRANSPORTS."

Alexander Kartveli, Vice-President for Research and Development, emphasized that Republic's program "will not duplicate in any way investigatory work currently in progress elsewhere, but will stress novel concepts and new approaches to basic problems of missiles and space technology."

The program includes construction of a $14 million R & D center to house 9 new laboratories, and anticipates doubling the present research staff.

Senior men interested in the new possibilities created by a simultaneous exploration of all aspects of Flight Technology are invited to study the functions of the new laboratories for more detailed information:

SPACE ENVIRONMENTAL DEVELOPMENT LABORATORY
To simulate space flight conditions and test missile, satellite and spacecraft systems and components; investigate human engineering problems.

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To study hypersonic shock dynamics, real gas effects, heat transfer phenomena and magnetohydrodynamics.

MATERIALS DEVELOPMENT LABORATORY
Study effects of high velocity, temperature, and space environment on materials for spacecraft, missiles and advanced weapons.

GUIDANCE & CONTROL SYSTEM DEVELOPMENT LABORATORY
To develop and test guidance and control systems for spacecraft, missiles and aircraft.

ELECTRONICS DEVELOPMENT LABORATORY
Study and explore all problems connected with highly specialized, complex electronic systems required for advanced forms of spacecraft, missiles and aircraft.

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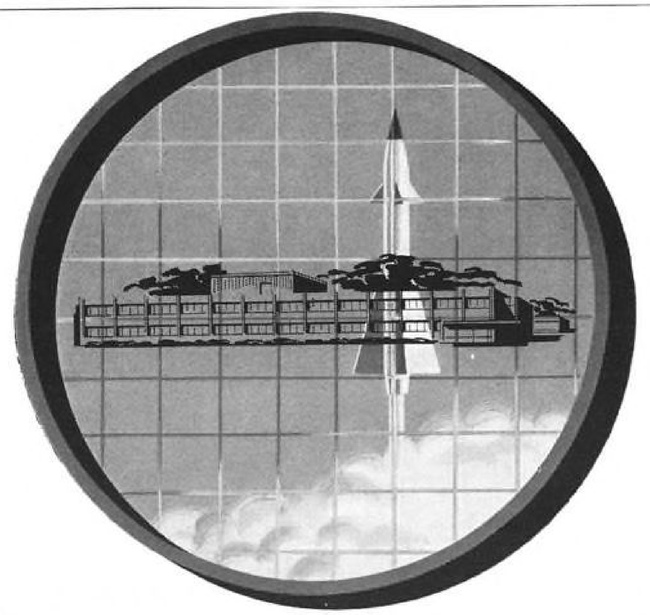

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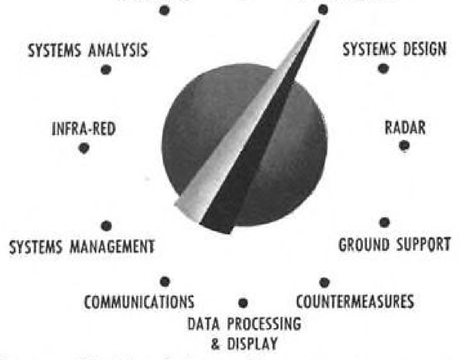

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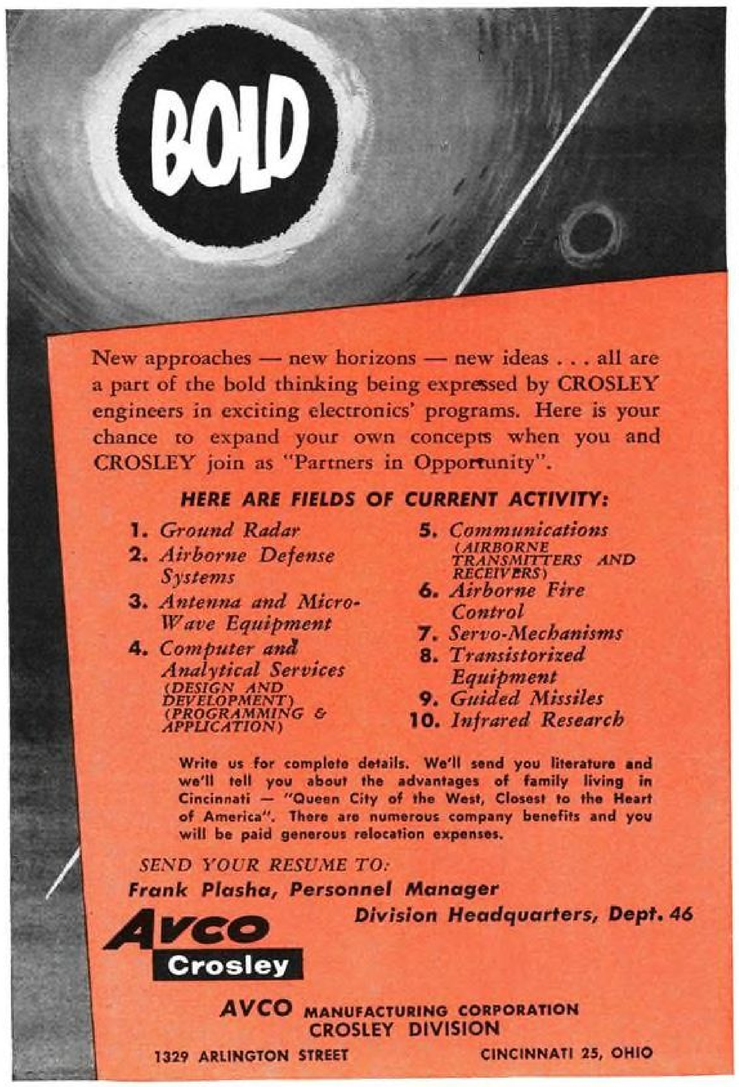

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LETTERS

707 Preflight

Your pilot report on the Boeing 707 (AW Oct. 6, p. 70) was excellent and accurate, except for one item which was immediately apparent to all the flight engineers who have been to the Boeing 707 school.

That was the reference to simple walk-around inspection. This in itself is somewhat misleading, in that a flight engineer performs a preflight inspection covering the cockpit, cabin and exterior, or walkaround.

As instructor for a large air carrier, I have just completed three months of Boeing 707 training, and I can say that the exterior inspection is not simple or done quickly. As a matter of fact, the air carrier expects the flight engineer to spend one full hour performing the preflight inspection.

Of this hour, at least 30 min. are spent inspecting the exterior 55 items, to be exact. The wheel well has more micro switches, lines, two more wheels with brake lines, pins, tires, complex gear door operation, each engine has sound suppressors, thrust reversers, there are oxygen systems in the belly plus electronic equipment, and there are more than twice the number of windows, plus four cabin doors with complex hinges. All these items must be checked for proper inflation, cuts, loose treads, proper positioning, wrinkles, connections, seals, leaks, cracks, crazing, loose hardware, missing parts and proper operation.

All the foregoing is not meant to find fault with the 707; on the contrary, it is simply to show that with larger, faster aircraft a greater degree of complexity in all phases is necessary.

I am sure that Mr. Sweeney was given this "quickie" inspection because of lack of time or because it was assumed that he was more interested in the actual flying of the plane, and that if he were writing from a purely flight engineer standpoint his entire article could have been devoted to the walkaround inspection alone.

SEBASTIAN S. ATTARDO
Long Beach, Calif.

ASW Craft

Reading the description of the Sikorsky HSS-2 (AW Sept. 1, p. 56), I was struck by the curious situation proposed whereby the aircraft had the ability to alight on the water to increase endurance, reduce pilot fatigue, and extend sonar depth.

It seems to me that we have turned full circle and have come back to the ship!

This, however, obviously ignores the fact that the helicopter is more maneuverable in the search area and can get to that area quickly from its base.

I do not claim to be an expert on the subject, but would it not be possible to combine the qualities of the helicopter with the load capacity of a ship by using a hydrofin vessel for ASW?

I visualize such a craft having a pusher engine, multi-plane hydrofoils, and a boat hull for slow speed search. To permit intricate maneuvers during search would it not be possible to use a type of propeller that

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.

was employed by the Germans during World War II? This device consisted of a horizontal disk (driven by the motor) on which were mounted about four vertical blades of aerofoil shape. These were positioned at the periphery of the disk and were varied in pitch as the disk rotated. By varying the pitch-changing sequence the boat could be propelled in all directions just like a helicopter.

This system was intended for firefighting operations, and in fact did prove its worth.

Maybe there are simpler methods of maneuvering, such as mounting the pusher engine on a turntable. This would mean that there would be no propeller noise in the water during sonar operation, although a clutch could be incorporated in the "disk-propeller" to permit short bursts of propulsion during maneuvering, the propeller being disengaged during stationary search.

Such a vessel would be capable of carrying a great load of search gear and strike missiles, would have at least helicopter speed to the search area, greater endurance and would be no more costly to produce than a helicopter of comparable size.

It may be regarded as heresy to propose such a vessel in the pages of an aviation magazine, but the aircraft industry seems to have invaded the naval field in such things as inertial navigation systems, helicopter flying boats and hydro-foils generally, that this would not be a strange undertaking for a suitable aircraft company.

TED HOOTON
Ontario, Canada

P.S. What is wrong with increasing the length of the sonobuoy cables from helicopters to increase their depth?

(Various aviation companies—Lycoming Division of Avco Manufacturing Corp. and Grumman Aircraft Engineering Corp., for example—are working on hydrofoil turbine propulsion concepts for surface ships and these developments have been reported in AVIATION WEEK*—Ed.)*

Defensive Weapons

Somewhat belatedly, may I take issue with Mr. Robert G. Hoehn, Jr. ("Grand Little Missile," AW Sept. 15, p. 134), who says that the Nike missile "can destroy any operational aicraft at any speeds up to Mach 2." Being only 19, myself, and strictly a layman where missiles are concerned, I hope I can oppose Mr. Hoehn's comments without being unduly offensive.

The Nike Ajax was obviously developed to counter the circa 1950-54 threat posed by Russia's force of B-29-type bombers. This aircraft, attacking North America at 350 mph. at 30,000 ft., dropping free-fall bombs, would have been easy prey for the Nike missile. However, I contend that even the current Nike Hercules would be 100% ineffective when pitted against the current Soviet bombers, which, while they are not even supersonic, are equipped with countermeasures gear and defensive armament, and would strike from 60,000 ft. with stand-off bombs which can be launched a full 1,000 mi. from target.

In my opinion, the Army's development of short range air defense weapons for use around American cities—and I refer to anti-aircraft guns as well as Nike type missiles—has been the greatest waste of tax money in the history of our military services. The Nike and similar weapons are of limited value in a geographical situation such as that which exists in the Formosa area, but for the defense of American cities or continental SAC bases they are useless.

It is sensible to assume that the long range jet bomber equipped with a 1,000 mi. stand-off bomb exists in Russia today. To defend our continent against such a weapon, we urgently need a long range manned interceptor with a large payload. Something in the category of the McDonnell F-101B or the Avro CF-105 would be ideal. If we are ever faced with the need to defend North America, we will have to win the battle over the North Pole, not over the outskirts of Washington, D. C.

We may also safely assume that Russia will soon have ICBMs in quantity. To defend against these, we will need long range missiles. If the Nike Zeus and/or advanced models of the Boeing Bomarc will appear suitable for this role, then by all means let's speed up their development.

As I see it, the Army has no role in strategic air defense and has not yet developed a weapon which would be of use against an air attack on the U.S. Defense of our cities, industries, and bases against air or missile attack is an Air Force mission. It should be performed with long range fighters, equally long range defensive missiles, and an increased number of early warning aircraft and bases. Militarily, we face America's darkest hour, and if we are to deter, or, at worst, win a global war, we will have to play in the long range ballpark. Mr. Hoehn's short range stadium, defended by missiles which by official admission have a range of 50 mi., is just not good enough.

ROBERT F. DORR
A/2C, USAF
U.S. Army Language School
Presidio of Monterey, Calif.

Objective Letters

Don't you think it time to call a halt to the publication of the name-calling and tub-thumping type of letter in the "Letters" page of AVIATION WEEK?

It is not seemly for a publication of AVIATION WEEK's stature, one found on the desks of the most respected authorities in the field of aviation, to condone such drivel.

Surely you must receive sufficient objective correspondence to fill the page?

C. J. SPENGLER
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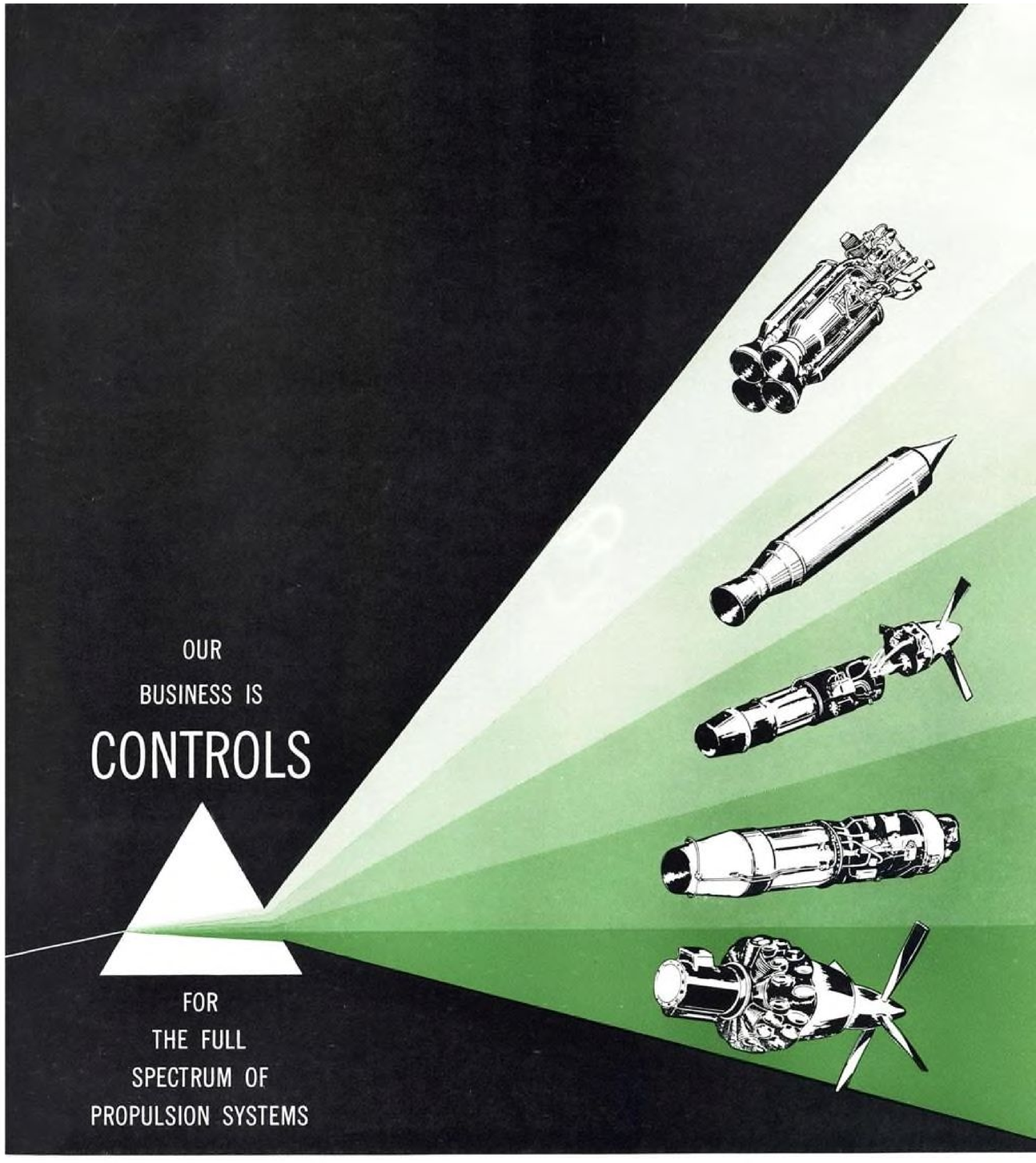

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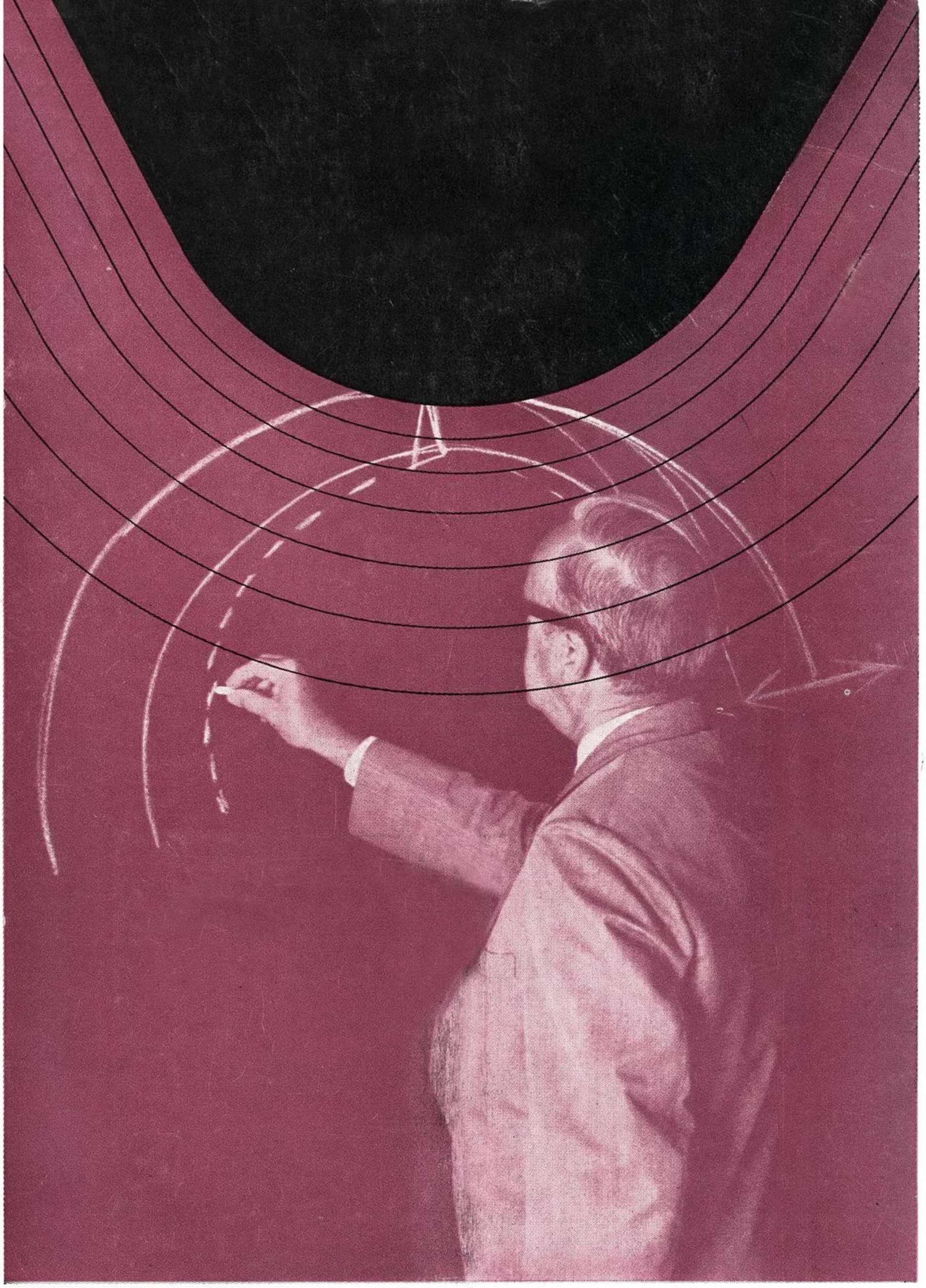

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