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AVIATION WEEK

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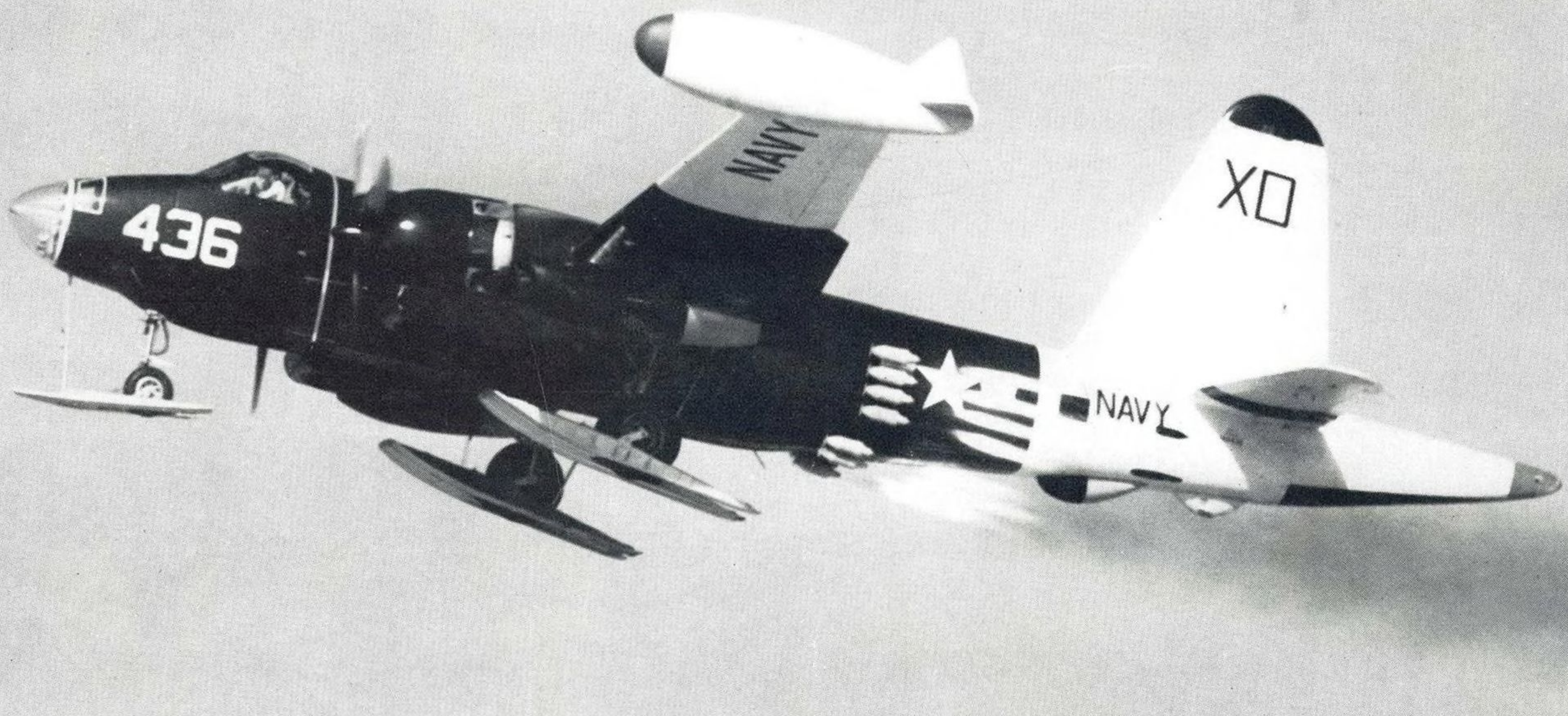
YC-134 Flow System Design Is Altered

•

Hypersonic Vehicle Reaches 5,000 mph.



Lockheed P2V-7

for lightweight

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NOW AVAILABLE

A *Complete* Line of Self-Locking Nuts made of A286 Corrosion Resistant Steel

***Physical Properties*—A286 has excellent values to 1200° F.**

***Weight* — Lightweight designs save up to 60% compared to others.**

***Magnetic Permeability* — Exceptionally low. Nuts are usable wherever non-magnetic materials are required.**

***Availability*—Obtainable in thread sizes #4-40 thru 5/16″-24 in hex nut, fixed and floating anchor nut (both regular and miniature) and gang channel configurations.**

TRADE MARK

Kaylock *extra** high temperature self-locking nuts are precision products utilizing the same locking principle and low height, full strength design inherent in the standard Kaylock high temperature 550° F. series.

*Above the 550° F. limits of standard Kaylock high temperature nuts.

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SPECIAL DELIVERY *of an Airman In Trouble*

A FEW YEARS AGO, this jet pilot would never have lived to tell the story.

Minutes ago he was flying faster than sound itself, cannon-balling 60,000 feet up—through the rarefied air of a crisp winter sky.

Suddenly trouble developed. He had to leave his ship *fast*.

Bailing out of a crippled aircraft at that altitude, speed and temperature—a conventionally equipped pilot would not stand a chance. The supersonic rush of air would rip his protective clothing to shreds exposing him to explosive decompression and sub sub-zero cold.

Thanks to a complete Escape Capsule developed and built by Goodyear Aircraft Corporation, "safe escape" is now a reality for jet-age airmen, either "off the deck" or from high altitudes.

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GOODYEAR AIRCRAFT

Plants in Akron, Ohio, and Litchfield Park, Arizona
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World's Fastest Navy Fighter

9 Proudly wears Sargent controls

Nine Sargent quality units have been selected to provide Chance Vought's F8U-1 Crusader with instantaneous, positive, feathertouch response.

These units, Sargent fabricated to Vought specifications, provide a system for control for the safe, positive, efficient operation of this great fighter.

The experience of more than 36 years of design and manufacture of precision equipment systems has given Sargent Engineering Corporation the "know-how" to aid in solving the essential and advance problems of force control. Leading airframe and missile manufacturers are using hundreds of different Sargent hydraulic, mechanical, pneumatic, electrical and electronic force control units on the nation's military planes, commercial planes and missiles.

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BUILDS QUALITY THAT BUILDS GOOD WILL

AVIATION CALENDAR

Jan. 8-9—15th Miami-Havana Air Cruise, sponsored by Florida Air Pilot's Assn.

Jan. 14-16—National Symposium on Reliability and Quality Control in Electronics, sponsored by IRE, ASQC, AIEE and RETMA, Hotel Statler, Washington, D. C.

Jan. 14-18—Annual Meeting, Society of Automotive Engineers, Sheraton-Cadillac and Statler Hotels, Detroit, Mich.

Jan. 21-22—Symposium on Solar Furnace Design and Operation, Hotel Westward Ho, Phoenix, Ariz.

Jan. 21-25—Winter General Meeting, American Institute of Electrical Engineers, Hotel Statler, New York.

Jan. 27-28—American Society for Metals, Albuquerque and Los Alamos Chapters, "Heat Tolerant Metals for Aerodynamic Applications," Albuquerque, N. M.

Jan. 28-31—8th Plant Maintenance & Engineering Conference, Public Auditorium, Cleveland, Ohio.

Jan. 28-31—25th Annual Meeting, Institute of the Aeronautical Sciences, Sheraton-Astor Hotel, New York, N. Y. Honors Night Dinner, Jan. 28.

Jan. 30—Annual Meeting, Convertible Aircraft Pioneers, Engineers Club, New York.

Jan. 31—Sixth Annual Instrument Short Course, Los Angeles Harbor Junior College, Wilmington, Calif., Additional course will be held Feb. 1.

Jan. 31-Feb. 1—Conference on Digital Computing in the Aircraft Industry, sponsored by New York University and International Business Machines Corp., NYU Bronx Campus, New York, N. Y.

Feb. 4-8—Course on X-ray diffraction, sponsored by North American Phillips Co., 750 S. Fulton Ave., Mt. Vernon, N. Y.

Feb. 7—Operations Research Symposium University Museum Lecture Hall, University of Pennsylvania, Philadelphia, Pa.

Feb. 7—Annual Mid-Winter Symposium of the New York Section, Instrument Society of America, Garden City Hotel, Long Island, N. Y.

Feb. 14-15—1957 Transistor and Solid State Circuits Conference, University of Pennsylvania, Philadelphia, Pa.

(Continued on page 6)

AVIATION WEEK • JANUARY 7, 1957
Vol. 66, No. 1

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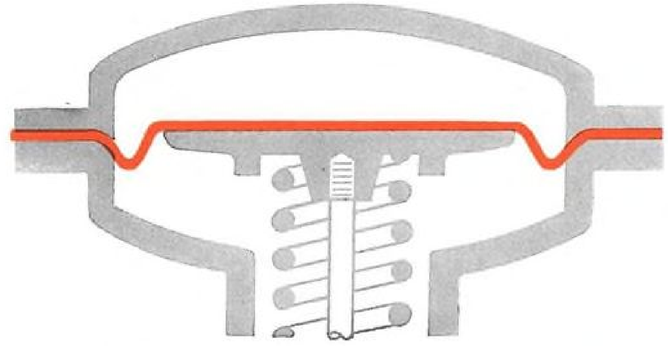

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announces new TRIMPOTS® for quick assembly

130 TRIMPOT® solder-lug type

You can solder your hook-up wire direct to this instrument, and eliminate splicing. Terminals are standard flat, slotted lugs to provide fast, secure connections.

The silver-plated solder lugs are extremely rugged. Instrument is not affected by soldering iron temperatures.

205 TRIMPOT® for printed circuits

Round pin terminals on this unit may be plugged into holes in your printed circuit boards for dip soldering. Terminals are gold-plated copper, ½" long, .028" diameter, and spaced in multiples of 0.1". Mounting is accomplished by 2-56 screws through body eyelets, or by pins only.

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AVIATION CALENDAR

(Continued from page 5)

Feb. 16-19—6th Annual Trade Show & Convention, Institute of Surplus Dealers, New York Trade Show Bldg., New York.

Feb. 26-28—Western Joint Computer Conference, sponsored by IRE, AIEE and ACM, Hotel Statler, Los Angeles, Calif.

Mar. 7-9—National Conference on Aviation Education, Hotel Mayflower, Washington, D. C.

Mar. 11-15—1957 Atomic Exposition, including Nuclear Engineering & Science Congress, 5th Atomic Energy in Industry Conference and 5th Hot Laboratories & Equipment Conference, Convention Hall, Philadelphia, Pa.

Mar. 14-15—Flight Propulsion Meeting, (Classified), sponsored by IAS, Hotel Carter, Cleveland, Ohio.

Mar. 18—Gas Turbine Power Conference, sponsored by American Society of Mechanical Engineers, Sheraton-Cadillac Hotel, Detroit, Mich.

Mar. 18-21—Pacific Coast Plastics Exposition, in conjunction with The Society for Plastics Industry National Conference, Shrine Exposition Hall, Los Angeles.

Mar. 18-21—National Convention Institute of Radio Engineers, New York Coliseum and Hotel Waldorf-Astoria, New York.

Mar. 19-21—151st National Meeting of the American Meteorological Society, University of Chicago.

Mar. 25-27—Silver Anniversary Technical Meeting and Convention, American Society of Tool Engineers, Shamrock Hilton Hotel, Houston, Tex.

Mar. 25-29—Western Metal Congress and Exposition, Ambassador Hotel and Pan-Pacific Auditorium, Los Angeles.

Mar. 27-29—Educational Colloquium on Radiation Effects on Materials, sponsored by ONR and Glenn L. Martin Co., Johns-Hopkins University, Baltimore, Md.

Apr. 15-17—First Demonstration and Symposium on Systems for Organization, Storage and Retrieval of Information, sponsored by School of Library Science (Center for Documentation and Communication Research), Western Reserve University, Cleveland, Ohio.

Apr. 17-20—Eighth Annual Conclave, Arnold Air Society, including aviation equipment display, Hotel New Yorker, New York, N. Y.

Apr. 24-25—Second National Industrial Research Conference, sponsored by Armour Research Foundation, Conrad Hilton Hotel, Chicago, Ill.

May 1-3—Spring Meeting and Exhibit, Society for Experimental Stress Analysis, Hotel Statler, Boston, Mass.

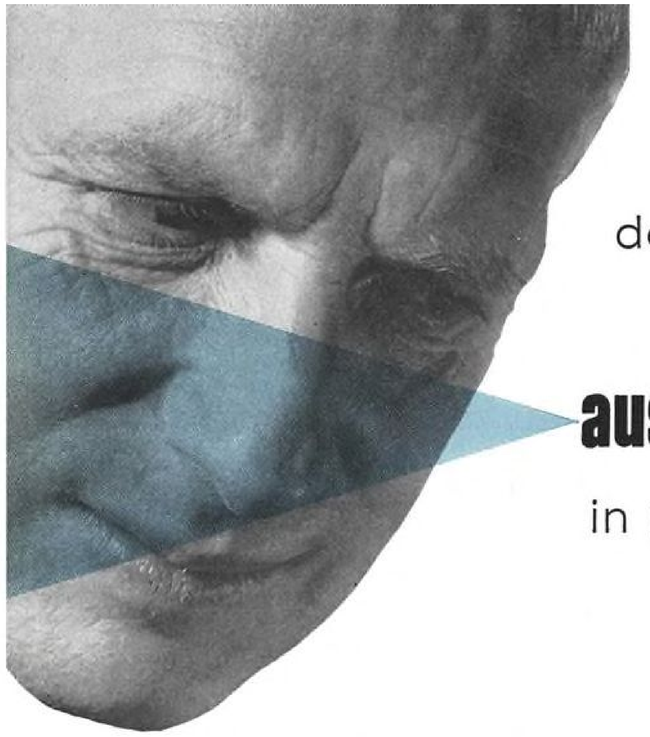
May 6-8—28th Annual Meeting, Aero Medical Assn., Shirley Savoy Hotel, Denver, Colo.

May 8-11—13th Annual National Forum, American Helicopter Society, Sheraton Park Hotel, Washington, D. C.

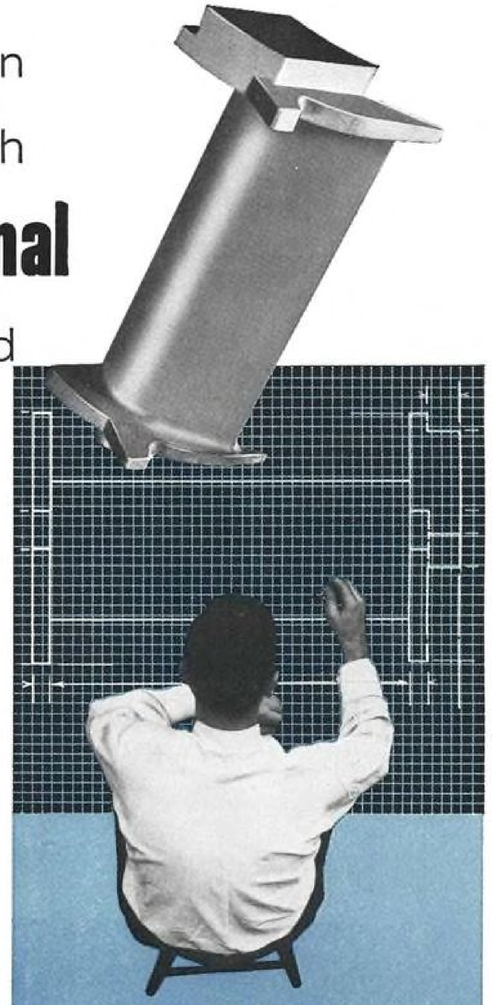
May 24-June 2—22nd Paris Air Show, Society of French Aircraft Constructors, Le Bourget Airport, Paris.

June 1-9—First Annual National Aviation Trade Show, Monmouth County (N. J.) Airport.

June 23-25—29th Annual Meeting, Aviation Distributors & Manufacturers Assn., The Broadmoor, Colorado Springs, Colo.



design with **austenal** in mind



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In order to achieve the finest finished product, design engineers consult first with Austenal engineers and profit from their experience and advice. Thus, you can *design directly for Microcast* and take advantage of the special features it makes possible.

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A rugged magnetically damped instrument with low natural frequencies for low range. High-quantity production assures good price and delivery schedules. Available in ranges from ±1 G to ±30 G.

Model DDL

Magnetically damped low-range instrument available in ranges from ±1 G to ±30 G. Ultra-sensitive models supplied as low as ±0.1 G. Certified to MIL-E-5400 and MIL-E-5272A. Especially good in severe shock and vibration applications. An acceleration-sensitive switch version of the DDL is designated as the Model DDS.

Model GAL

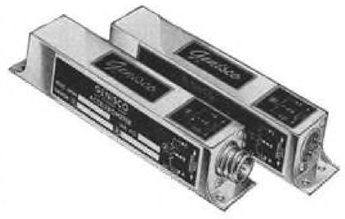
Incorporates a variable transformer a-c output with the magnetically damped sensory mechanism of the proven Models DDL and GLH. Superior reliability, life, resolution, and sensitivity. Available in ranges from ±1 G to ±30 G. Range as low as ±0.1 G also obtainable.

Model GMO

A rugged, miniature, viscous-damped instrument with ranges from ±2 G to ±30 G. Unbalanced-range instruments also available. Medium high natural frequencies.

Model GMT

Basically a Model GMO with internal thermostat-operated heater, assuring maximum environmental stability within the instrument. Damping remains constant with change in ambient temperature.



Model GDM

Miniature double-potentiometer instrument capable of sensing lateral acceleration in two mutually perpendicular planes (e.g., pitch and yaw). Ideally suited for missile and high-speed aircraft flight control systems.

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CASES GOLD PLATED INSIDE AND OUT—This new trend in instrument plating has two important advantages over tin plating or fusing. Being the least active metal, gold prevents the formation of crystalline "whiskers" inside the case which could reduce performance and even cause malfunction. Gold plating also assures positive protection against corrosion to the exterior of the case and, because of its excellent solderability, makes possible a more reliable hermetic seal. The new gold plating is available on *all* models at *no extra cost.*

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Please send request on company letterhead.

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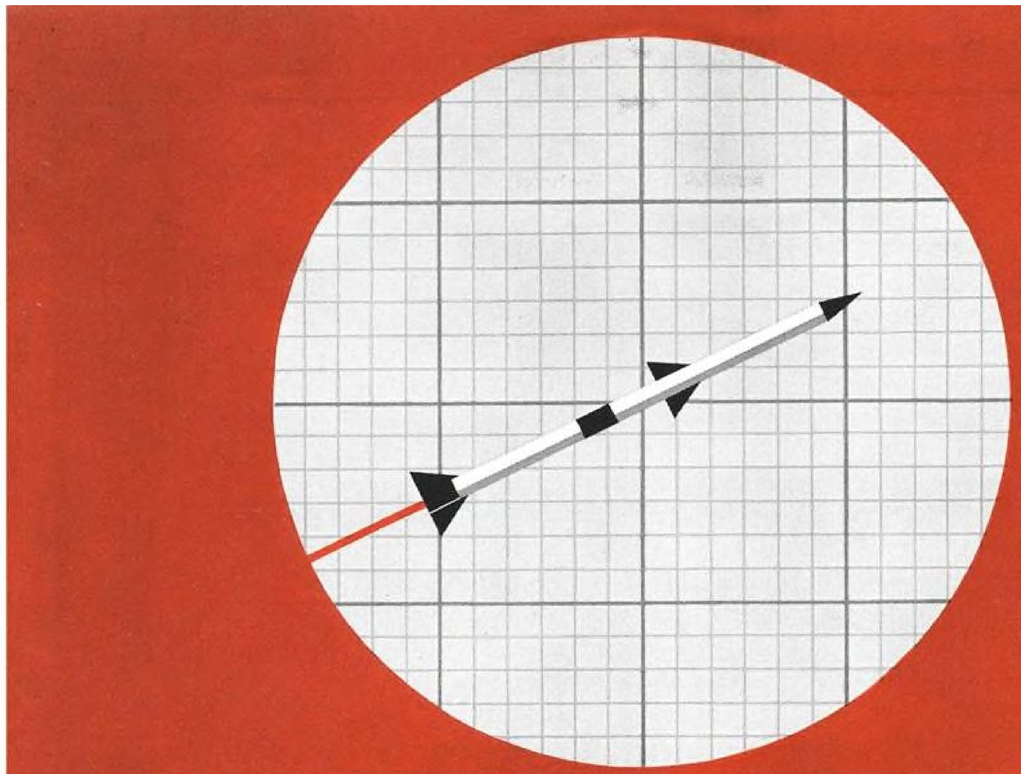

BALLISTIC MISSILES

on target a continent away through Burroughs computation

For some time, Burroughs has been participating in the U. S. Air Force Ballistic Missiles program in the field of guidance. This program consists of two intercontinental ballistic missiles: *Atlas* and *Titan,* plus an intermediate range missile, *Thor.*

Here's more proof that in its specialized areas of computation—instrumentation, control systems and data processing—Burroughs has what it takes to shoulder the overall responsibility for defense projects from beginning to end: (1) from research to development; (2) engineering and tooling; (3) production, testing, field service and training.

We welcome inquiries regarding defense contracts in all areas of our demonstrable responsibility and competence. Write, call or wire Burroughs Corporation, Detroit 32, Mich.

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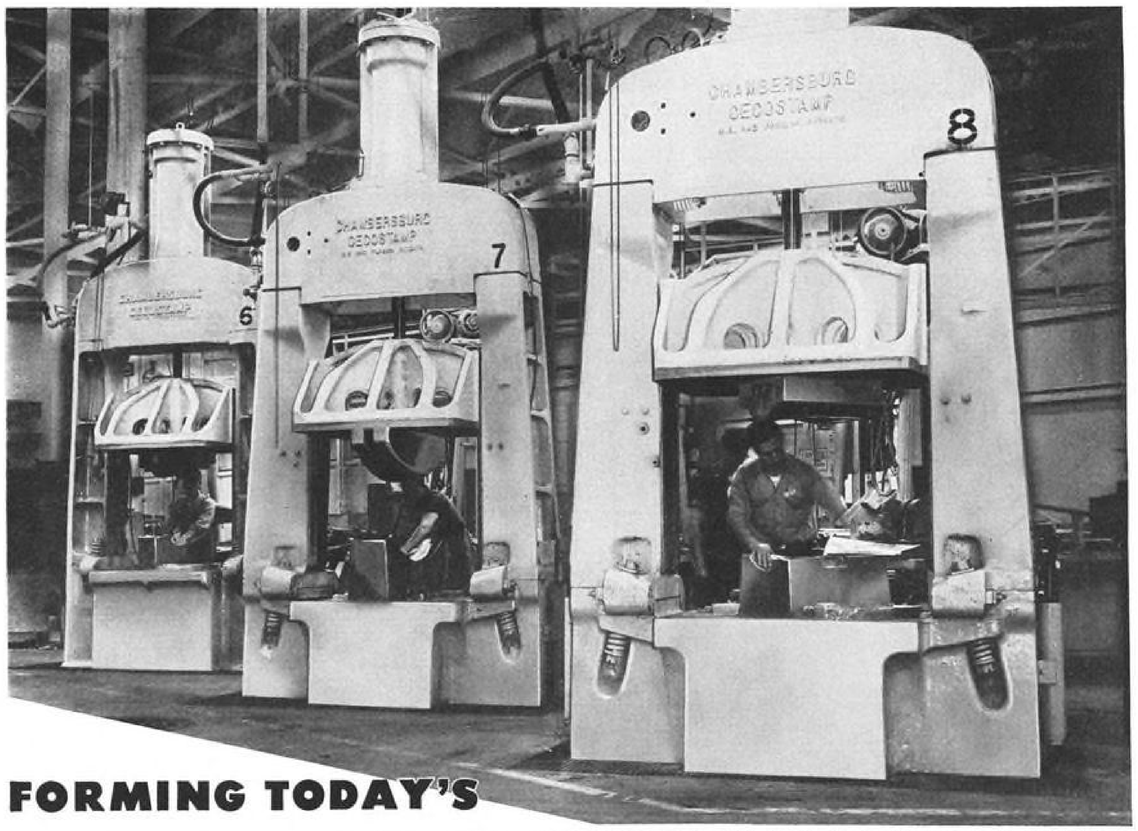

FORMING TODAY'S TOUGHER, "HARD-TO-HANDLE" METALS TAKES THE *IMPACT* OF THE CECOSTAMP

THE CECOSTAMP provides a controlled *impact* blow not obtainable on any other press. The operator has, at his fingertips, full command of the ram for sharp blows or squeezes as the job requires. This control of the blow intensity assures the correct impact and pressure required by the metal being formed. It easily forms, to a permanent set, the "hard-to-handle" metals such as heat treatable aluminum alloys, austenitic stainless steels, magnesium and titanium. There are standard Cecostamps to fit nearly every requirement with working areas from 21" x 18" to 120" x 120". Stroke of ram can be increased for deeper draws if necessary.

Send for Bulletin 30-L-5.

SOME OF THE ADVANTAGES OF CECOSTAMPS

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2. *Produces components within strict dimensional limits*
3. *Shearing can be combined with stamping of simple shapes*
4. *Skillful operators can develop and form many shapes difficult to form on any other type of press*
5. *Controlled blow is well suited to forming large integral parts*
6. *Low tooling cost and rapidity of die fabrication*

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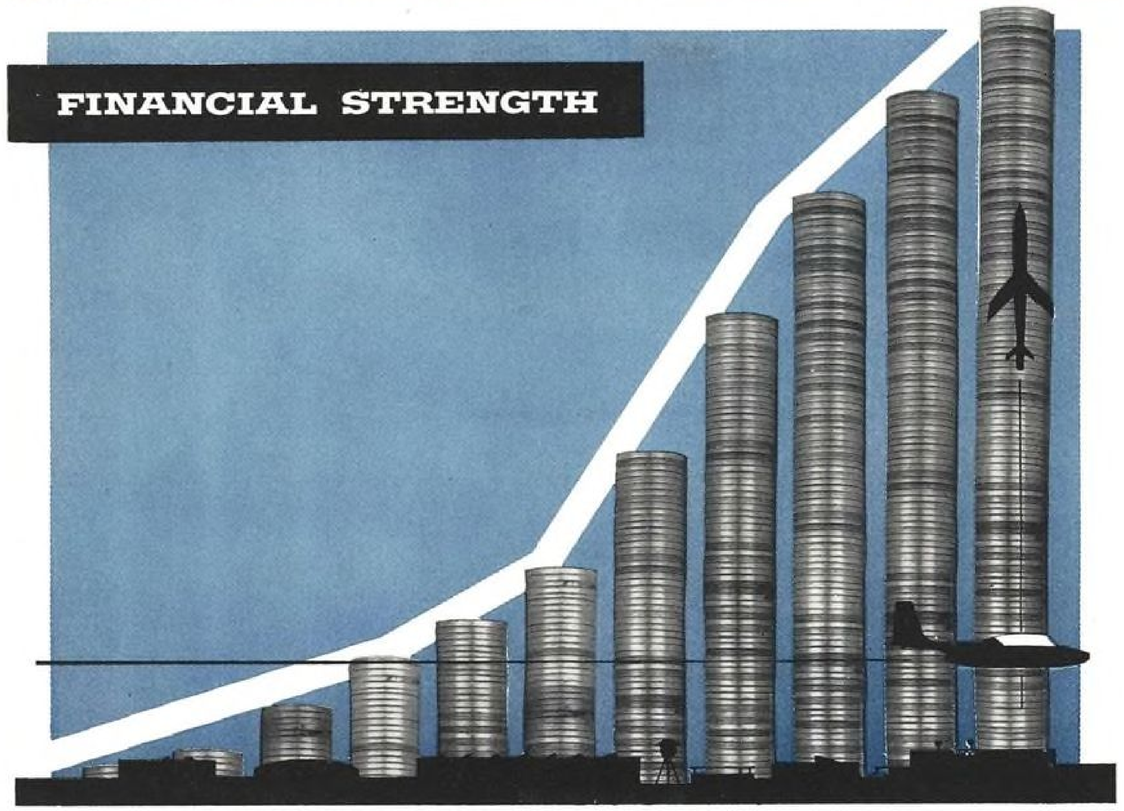

At Temco GROWTH tells the story

Growth — in financial strength, for example, tells the Temco success story.

At the end of its first full year of operation, 1946, Temco's net worth was $23,042. Within five years, this figure was multiplied one hundredfold; and in 1955 — the company's 10th anniversary — its net worth had zoomed to $10,402,937. This year, as a result of steadily expanding facilities and new prime contracts climaxing the successful development of aircraft, missiles and weapons systems of its own design, Temco's financial strength will set an impressive new record.

For the engineer who sets his sights high, Temco's increasing financial strength means the prestige of a soundly established company, plus the opportunity that only a vigorous, growing organization can offer. Here's your opportunity to match your stride to a company that's going places — fast!

Mr. Joe Russell, Engineering Personnel
Room 10-E, Temco Aircraft Corp., Dallas, Texas

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First Non-Stop Transcontinental Helicopter Flight with In-Flight Refueling
August 23 and 24, 1956

SIKORSKY H-34 ARMY HELICOPTER
World's Speed Record for 100, 500 and
1000 Kilometers, July 12, 1956

The two craft shown here use Vickers pumps, motors and valves for a variety of important operations.

• • • • • •

New and unusual applications for hydraulics are being scheduled into several of the newer helicopter designs. Among these are hydraulic motor operated fuel transfer pumps and hose reels. Vickers Hydraulic Equipment will also be used for taxiing, rotor fold, starting, rescue hoist systems and auxiliary electrical power generation.

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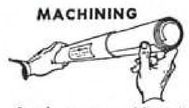
then HELP YOURSELF



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to a quarter of a million square feet equipped to solve your problem

American Welding has a quarter of a million square feet of floor space that houses the equipment necessary to manufacture production runs of welded rings (made from rectangular bars or special mill shapes) or circular weldments — from 6″ to 96″ in diameter, of ferrous or non-ferrous metal.

And that's not all — 900 specialists in ring manufacture are backed with the best in engineering and research — with heat treating, x-ray and test equipment required to meet aircraft specifications.

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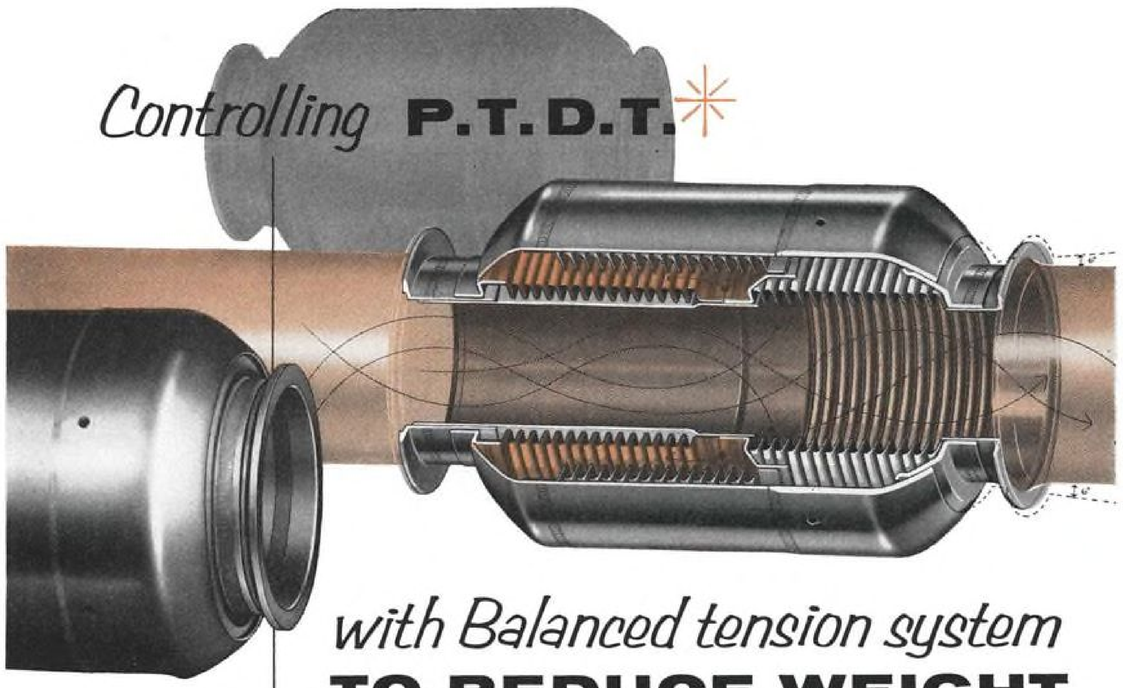
AMERICAN WELDING

Controlling P.T.D.T.*

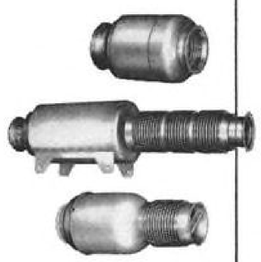


with Balanced tension system
TO REDUCE WEIGHT

Here is the first practical method of balancing the powerful end thrust or "pressure growth" of a pneumatic metal ducting system employing bellows. It is a Pressure Compensator which balances the tension, eliminates the end load and therefore the need for heavy structural bracing. Thus, it saves weight and is particularly applicable for use in bleed air systems in turbo jet and turbo prop powered aircraft.

The primary duct line bellows in this compensator provides for thermal expansion, flexure and misalignment. To offset the tendency of the bellows to straighten out or elongate under pressure, the internal duct pressure is bled off to a series of secondary bellows which create an opposing force to the primary bellows and nullify the end thrust.

Arrowhead builds three types of Pressure Compensators plus tie-rod assemblies and other stainless steel duct components including bellows, and braided assemblies. They are made in all sizes up to 8" I.D. Are capable of handling air pressures of 250 psi or over and temperatures up to 900° F. All spot and seam welding is performed to specification MIL-W-6858.



Stainless Steel Pressure Compensator Bellows

NEW SOURCE

* *Pneumatic Thermal Duct Thrust is the end force or reaction created by a rigid metal duct system employing bellows. This duct thrust is caused by the tendency of the bellows to elongate or straighten out under pneumatic pressure.*

ARROWHEAD METAL PRODUCTS DIVISION ***FORMERLY AIRITE***

ARROWHEAD, leading manufacturer of fiberglass impregnated ducts, sleeves and couplings, now offers stainless steel bellows and duct assembly components to answer all aircraft problems in handling air, gas or fluids. Arrowhead is the first and only manufacturer of ducts who can provide this complete manufacturing service. Field engineers in all localities for consultation.

ARROWHEAD PRODUCTS | *Division of Federal-Mogul-Bower Bearings, Inc.*

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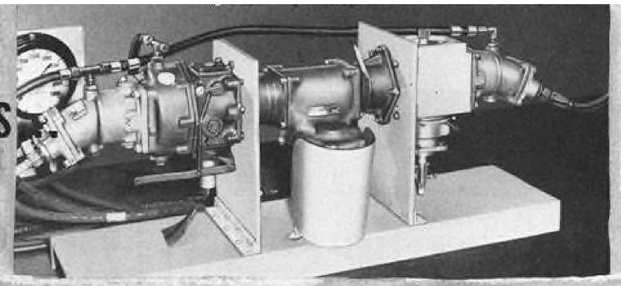
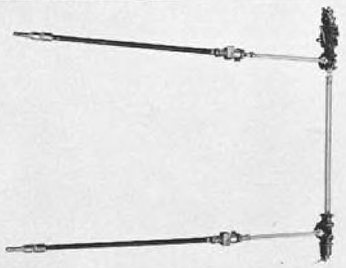
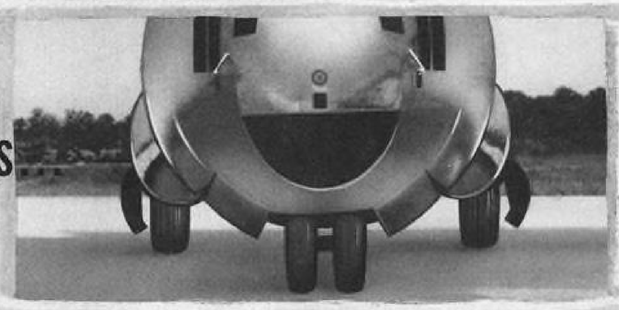


that are part of the system...

(also by Western Gear)



that lowers the wheels



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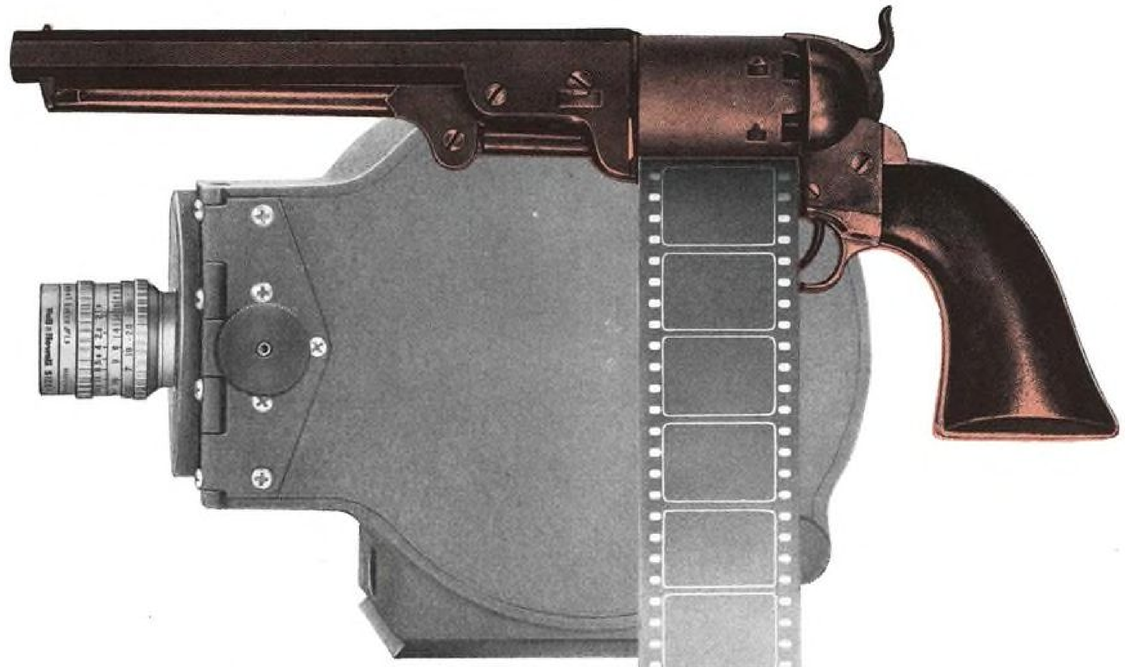

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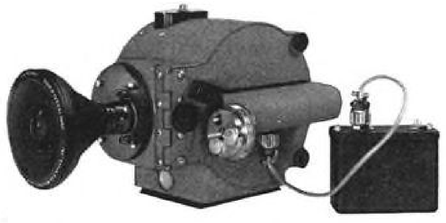

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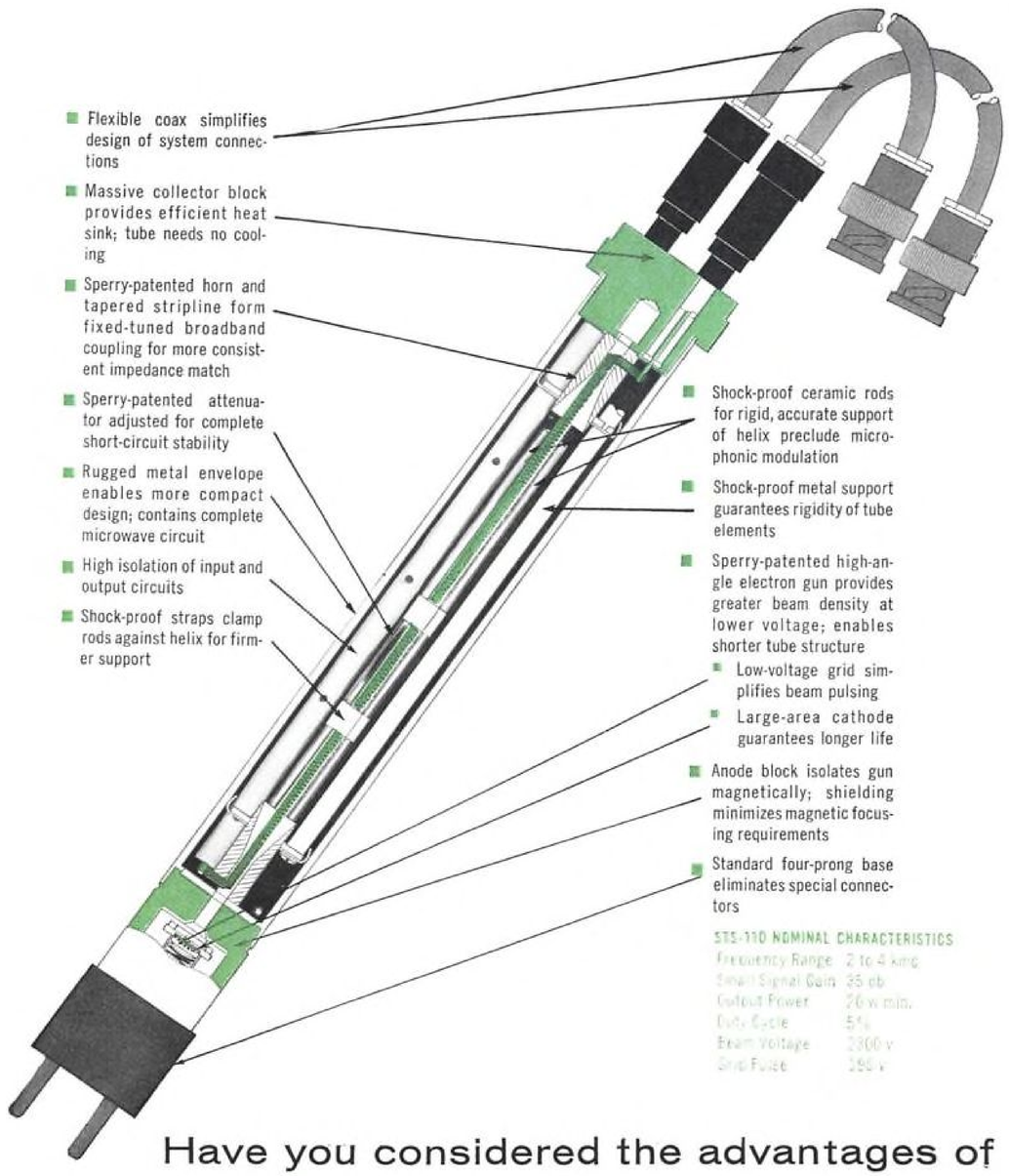

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COVER: Ski-equipped Lockheed P2V-7 Neptune takes off from Ontario, Calif., International Airport on first leg of flight to the South Pole. Four P2Vs were modified for duty in Antarctica. Included were addition of the skis, installation of equipment for pre-heating engines, attachment of 16 JATO bottles for extra thrust on high polar plateau takeoffs, and installation of interior heating fixtures for use by ground crews while the aircraft is serviced. (Other pictures on page 120.)

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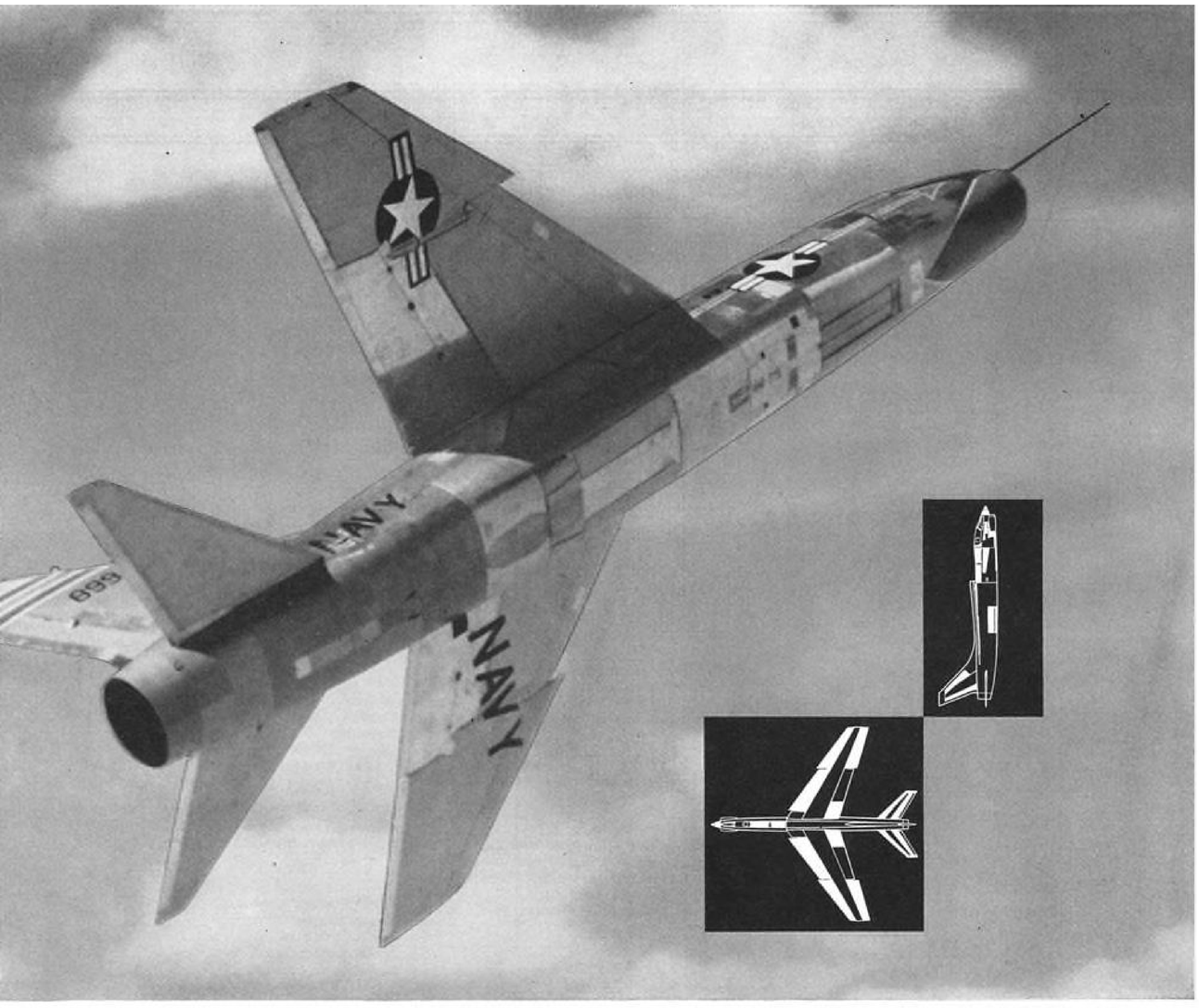

Weight-saving magnesium sheet (white areas) is used for leading edges, empennage, wheel doors and many other parts of F8U-1 Crusader.

25% of external skin on record-breaking F8U-1 made with magnesium

In Chance Vought's F8U-1 Crusader, fastest U.S. fighter by official record, many precious pounds are saved by using magnesium. Designers called for a total of 166 magnesium external skin parts—25% of the wing and fuselage surface area. 275 magnesium sand castings ranging in weight from a few ounces to thirteen lbs. were used inside the skin.

Weighing one fourth as much as steel and only two thirds as much as aluminum, magnesium gives you the best combination of strength and rigidity per pound. Its stiffness-to-weight ratio is the highest of any structural metal.

Magnesium permits clean, simplified designs—eliminates many stringers and detail parts. A selection of finishes provides remarkable protection against corrosion. Machinability is excellent, too. Fabrication, fitting and joining problems are always at a minimum.

Magnesium can help you make better designs for fuselage, wings and interior parts. Sheet, extrusions, and castings can be readily produced to meet your requirements. Call your local Dow sales office, or write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Department MA363G-3.

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EDITORIAL

Industry Faces Knotty Problems

This will be another good year for the air transport and aircraft manufacturing industries. Aircraft manufacturing sales should be close to $9 billion, while airline revenues will continue well over the billion dollar mark.

However, in the midst of this current prosperity, both the airline and aircraft manufacturing industries face knotty problems that must be solved soon if their futures are to continue to be tinged with the same rosy hue that has characterized the past five years. The effect of these problems will not be seriously felt for another two or three years.

But, by then, it will have become too late to effectively solve them.

The foundations for sound solutions to these problems must be laid now, and the legislative battles must be fought and won during the session of Congress that has just begun. Otherwise, the lead time required to set in motion the necessary action to dissolve these problems will be lost, and the problems will face both the airlines and the manufacturers in the acute form of crisis.

To tackle and solve these problems, aviation will need effective and persistent action from its two principle trade groups, the Air Transport Assn. and the Aircraft Industries Assn.; the cooperation of legislators adequately informed on aviation affairs and, most important of all, a sympathetic public understanding. This is admittedly a big order, but the stakes involved are also large. Both the airline and manufacturing industries have a continuing row to hoe with the federal government which regulates the airlines and is the major customer of the manufacturers.

The aviation industry is now faced with a clear set of alternatives for its future. It can either stand up and fight for its rights and explain its responsibilities as an integral part of the modern American profit-motivated economic system or it can quietly whimper and grouse in the background and gradually see the fundamentals of its position dissolved by the acid of increased and unreasoning government control.

Industry Problems

Among the major problems facing the aircraft manufacturers are:

• **Adequacy of military airpower.** This goes far beyond the self interest of sales. The aircraft industry has genuine responsibility to see that our military airpower is adequate, first because as the best informed taxpaying citizens of this country on the subject, its members have a more accurate yardstick to measure this adequacy, and, second, because if the inadequacy of the force on which this country now relies for protection becomes publicly apparent, it is the aircraft industry that will be hauled forth as the first scapegoat.

• **Profit limitation.** Nobody questions the necessity of some form of profit limitation legislation. But there are serious doubts as to whether any of the present legislation on the books, including the latest version of the Renegotiation Act and the Vinson Trammel Act, meet the requirements of the modern industry-military relationship. A financially sound and administratively efficient method of profit limitation legislation is vitally necessary for the aircraft industry to fulfill its technical responsibilities for the future, particularly in investing sufficiently in research and development facilities and programs.

• **Weapon system management.** This new military management philosophy portends many changes in internal organization and external customer relations for the aircraft industry. Still in a formative stage, this philosophy requires an intelligent and responsible watchdog operation from all segments of the industry to keep it from becoming a bureaucratic nightmare.

• **Technical manpower.** Demand for technical manpower in the aircraft industry will increase and become an increasingly limiting factor on the gross effort toward technical progress. Industry must assume leadership in pushing for both internal and external policies that will provide adequate technical manpower for the future.

Problems for the Airlines

Looking ahead to the airline future we see the following major problems:

• **Passenger service.** There is no better way to build public confidence in the airlines than by providing superb passenger service from the moment John Public applies for a reservation until the time he is delivered safely and reasonably on time at his destination. There is no quicker way to lose public support than by kicking the passengers around like a freight shipment. Airlines will have to devote all the effort possible within the limits of their resources to a continuing attack on this problem if they are to grow economically and enjoy the public support so vitally needed in their legislative battles.

• **Air traffic control.** This program will again bog down in the maze of inter-governmental committees unless it gets vigorous support from the air transport industry. Without a semi-automatic air traffic control system capable of handling vastly increased traffic with current or better weather minimums, the airline industry cannot hope to expand adequately.

• **New facilities.** Tremendous post-war growth of passenger volume and the technical revolution facing the airlines with the jet age impose an enormous requirement for new ground facilities ranging all the way from runways to surface transport to and from terminal areas. These facilities won't be created without strong and steady pressure and intelligent cooperation from the airlines.

These are knotty problems that cannot be solved in a single battle. They must be the subject of persistent, intelligent and vigorous industry action. Both the aircraft manufacturing industry and the airlines are too vital a part of the modern American economy to escape continuous public scrutiny and to hide their heads ostrich-like in the sand.

—Robert Hotz

Fenwal Introduces —

NEW, SMALL, LIGHT DIFFERENTIAL THERMOSTAT

Fenwal Solves Camera Compartment Problem, Comes Up With Control With Broad Applications

ASHLAND, MASS. — An aviation company in the habit of taking its temperature control problems to Fenwal asked Fenwal experts here how to control the temperature in a new plane's camera compartment.

Fenwal's experts solved the problem handily, and are making no secret of this: *Their solution, a brand-new differential thermostatic control, will find a thousand other applications — in the aviation industry and out.*

The device, weighing only 0.3 of a pound, consists of two midget Fenwal THERMOSWITCH® units and a relay — hermetically sealed in an integral stainless steel housing.

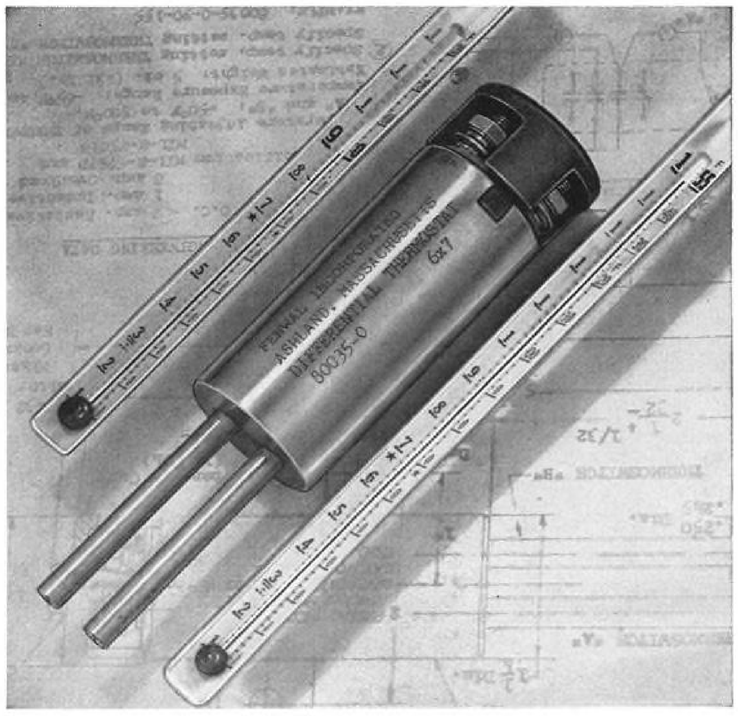
Camera Compartment Control

When it made its debut, the unit had only one purpose — to keep a camera compartment warmer than 90°F. and cooler than 155°F. It called for heat at the lower limit, and shut off heat at the upper one. It increased its own life and the life of the mechanisms it controlled by eliminating short-term cycling, by signalling for remedial action only at either limit of the acceptable temperature range.

Wide Applications

Actually, this control, which isn't much bigger than a .50 caliber machine gun cartridge, is a designer's dream, because it can be used to signal for any sort of action when an upper or lower temperature limit is reached. It can be factory set for limits anywhere from −50°F. to +500°F.

The relay rating at 28 volts D.C. is 2 amps resistive, 1 amp. inductive, and 8 amps overload. Due to high altitude performance requirements, the unit incorporates a three-terminal header and cover.



In the course of its development, the unit came by a name that doesn't begin to describe its versatility — the Fenwal Camera Compartment Over-heat Control. As happens again and again at Fenwal, experts here started with a specific problem, came up with a unit to solve it, and found that they had thereby increased the Fenwal Product line greatly, with a widely useful concept of temperature control.

Contact your local Fenwal sales engineer, or write to Fenwal direct to learn how this and other Fenwal developments may solve temperature control problems now facing you. **Fenwal Incorporated, Aviation Products Division, 121 Pleasant Street, Ashland, Massachusetts.**

Fenwal

CONTROLS TEMPERATURE ... *PRECISELY*

WHO'S WHERE

In the Front Office

D. O. Wood, vice president-operations, Lockheed Aircraft Service, Inc., Ontario, Calif.

Gen. Benjamin W. Chidlaw (USAF, ret.), chairman-planning committee, Thompson Products, Inc., Cleveland, Ohio. Gen. Chidlaw is a vice president and director of the company.

Lycoming Division, Avco Manufacturing Corp., Stratford, Conn. has announced the appointment of three presidential assistants: **Turner A. Duncan**, industrial engine operations; **Adm. Edward L. Woodyard** (USN, ret.), administration; **Paul A. Deegan**, public relations and advertising.

James D. McLean, president and general manager, Hoffman Laboratories, Inc., Los Angeles, Calif. Mr. McLean succeeds **John B. Moss**, now chairman-executive committee.

Lee S. Johnson, general manager, Sikorsky Aircraft Division, United Aircraft Corp., East Hartford, Conn. Mr. Johnson succeeds **Bernard L. Whelan** who continues as a vice president and member of the operating and policy committee.

Honors and Elections

Aubrey Keif, manager-Aviation Sales Division of the Texas Company, has been elected 1957 chairman of the Aviation Technical Service Committee, Division of Marketing, American Petroleum Institute, New York. **W. D. Parker**, aviation sales manager of Phillips Petroleum Co., succeeds Mr. Keif as chairman of ATSC's Subcommittee on Jet Fueling Systems.

Changes

John P. Poth, director of engineering, The Bullard Co., Bridgeport, Conn.

Bernard Duperier appointed a consultant to Boeing Airplane Co.'s Transport Division. Mr. Duperier's office is in Paris.

John F. Hawkins, administrative manager, Research Division, Bell Aircraft Corp., Buffalo, N. Y. Also: **Robert E. Hannel**, services manager; **William Shultz**, sales manager; **Ronald E. Shainin**, contract administration manager.

Paul Goldsborough, Staff Director for Communications, Office of the Assistant Secretary of Defense (Supply and Logistics), Washington, D. C.

Wayne K. Galloway, manager-pressure suits and Avtrim sales, Aviation Products division, B. F. Goodrich Co., Akron, Ohio.

Leon F. Edelson, chief engineer, Nader Mfg. Co., Monrovia, Calif.

William O. Boschen, assistant general manager and director of engineering, Avien, Inc., Woodside, N. Y. **Monroe A. Maller** succeeds Mr. Boschen as marketing manager, and **Frank DeNardo** succeeds Mr. Maller as manager of Avien's subsidiary, Avien Service Corporation of Calif.

Donald M. McGrath, plant manager, Solar Aircraft Co., San Diego, Calif.

Robert E. Ward, director-manufacturing, New York Air Brake Co., N. Y.

(*Continued on page 124*)

INDUSTRY OBSERVER

►Douglas Sparrow 2, an active-homing air-to-air missile developed to a different requirement than the Sperry Sparrow 1 and Raytheon Sparrow 3, differs in external configuration from the pointed-nosed, delta-winged Sparrow 1. Nose of Sparrow 2 is blunted to match the homing radar dish; fins and wings have been chopped at the tips so that they are now trapezoidal surfaces rather than triangular. Sparrow 2 has been chosen by the Royal Canadian Air Force to replace the Canadair-developed Velvet Glove as missile armament for the Avro CF-100 (AW Mar. 5, p. 23).

►Air Research and Development Command's Western Development Division is asking for proposals on a design study contract for an intercontinental ballistic missile operational base. The contract would provide an alternate to one already being conducted by Holmes & Narver, Inc., a Los Angeles engineering firm. Contract would include provision for launching sites, barracks and railroad sidings.

►Terrier guidance system for Navy's second missile cruiser, the USS Canberra, is the Sperry SPQ-5. The SPQ-5 differs in detail from the Reeves instrument system used aboard the earlier USS Boston. It has also been necessary to modify the missiles to match the Sperry system.

►Lockheed F-104B, tandem-seat version of the Starfighter, was scheduled to make its first flight last week. The XF-104, experimental version of the F-104, has completed 500 flights and logged more than 350 hr. since its initial flight in February 1954.

►Grumman Aircraft is building an early warning version of the Navy's S2F-1 Tracker with the designaton WF-2. A large oval radome, similar to the 30-ft. experimental model on Navy's WV-2 Super Constellation (AW Aug. 13, p. 27), is mounted above the Tracker fuselage.

►Leduc's latest experimental supersonic ramjet interceptor, the O.22, has begun its flight test program at the French air force test base at Istres. O.22 can make regular takeoff rather than being carried aloft in a mother ship as was its predecessor, the O.21.

►Douglas Aircraft Co. has received a $16,855,313 contract from the Air Materiel Command for IRAN and modification of C-124 transport aircraft.

►Handley Page Ltd. may offer a turboprop version of its four-engine, 44-passenger Herald transport. If plans become firm, powerplants probably will be American made.

►First flight of the Omega Aircraft Co.'s SB-12 light, multi-purpose helicopter (AW May 7, p. 50) has been made with two passengers aboard. The twin-engine, single-rotor craft hovered well during the hour and a quarter flight; vibration level was very low.

►Cessna expects to deliver 25 T-37A twin-jet primary trainers to the Air Force in the next 60 days. Flying Training Air Force Headquarters, Waco, Tex., already has received initial T-37As for evaluation and one is due to go to Eglin AFB, Fla., for Phase 7 operational suitability trails. Cessna has received a new USAF order for T-37As totaling $11,064,064. Earlier contracts include orders for 11 and 20 aircraft respectively (AW Sept. 24, p. 23).

►France's Dassault is reportedly engaged in studies aimed toward development of a long-range supersonic transport.

►Swiss parliament has vetoed proposals to purchase 40 French Mystere 4A interceptors to bridge the gap between British Venoms and the Swiss-built P. 16, which is still in the prototype test stage.

►Air Force has ordered $984,851 worth of aircraft fuel cells for F-84F, RF-84F and RF-84K aircraft from B. F. Goodrich Co.'s Aviation Products Division and another $912,081 order for the cells with Goodyear Tire & Rubber Co.

Checklist for buyers of business planes

New executive transports, new features, new performance; put them together, and they call for an entirely new set of standards before you decide.

	YES	NO
1 Is the aircraft propjet-powered—for performance, freedom from vibration?	☐	☐
2 Is the cabin pressurized and airconditioned—for comfort, for personal safety?	☐	☐
3 Is the cruising speed on a par with contemporary airliners?	☐	☐
4 Can it fly more than 2,000 miles without refueling?	☐	☐
5 Can it land and take off on small town airfields, with single runways less than 4,000 ft. in length?	☐	☐
6 Can it double as a high-priority cargo carrier, with a capacity of more than two tons?	☐	☐
7 Can it climb to 19,000 feet on *one* engine?	☐	☐
8 Does it have room for conferences and work-en-route?	☐	☐

If the airplane you are currently considering rates even one "No" on this list, you may be settling for the second-best; if you've checked off all the "Yes" boxes, you have the Fairchild F-27 in mind—there is no other plane like it.

Address inquiries to: R. James Pfeiffer, Executive Director of Customer Relations, Fairchild Engine and Airplane Corporation, Hagerstown 15, Md.

FAIRCHILD
F-27 Friendship
THE FINEST AIRCRAFT FOR AIRLINES, CORPORATION AND MILITARY SERVICES.

Washington Roundup

Small Budget for Big Stick

USAF expects the Eisenhower administration will offer it a total budget that is not much larger than last year's initial $16.5 billion, or $3.5 billion to $5 billion less than it feels necessary. To perform his mission, Gen. Nathan F. Twining, USAF chief of staff, had hoped to get funds in the neighborhood of $21 billion. He was supported by USAF Secretary Donald A. Quarles.

Their stand was not new. Before the Symington Committee last June, Gen. Twining said Fiscal 1957's funds "represented a one-time saving . . . like rolling up a rug in front of you. That roll is always there and next year we have to get over it. . . . We will have to get more money next year."

Now Fiscal 1958 is only a few months away, and there is small possibility that the administration will give Gen. Twining anything to remove the "roll."

In addition, it is attempting to increase U. S. military obligations with a threat to resist with force any new Red aggression in the Middle East. There is strong feeling in the Pentagon that the budget to go before Congress this month will impair, but not seriously damage, our power to wage total war and deter Russia from starting one. On the other hand, this same budget, if it stands, will deal a devastating blow to our ability to use airpower in localized wars. Procurement economies will be necessary, and the bite must come out of the Tactical Air Command. Planned purchases of fighters and tactical bombers will be cut back in order to support existing strategic aircraft and the missile effort. Top USAF generals are genuinely worried at this prospect at a time when the White House wants to wave a big stick in the Middle East.

USAF estimates that assumption of extensive new obligations in such areas as the Middle East could double the cost of doing the job and doing it right. Main reason is simple: USAF does not consider its deterrent to total war—primarily the Strategic Air Command—should be diverted from its prime mission to fight a localized war. In fact, it considers total war a greater possibility if a local war is raging. It follows that the Kremlin could consider acceptance of total war if it was convinced that our deterrent power was weakened by SAC's diversion to a minor one.

All in all, the expected budget is viewed by USAF as a tremendous risk, a "whack at the future."

Vacancy at CAB

For the third time in three years, the White House has let the Civil Aeronautics Board start a new year with a vacant seat. Latest vacancy occurred Dec. 31 with the expiration of Joseph P. Adams' term. Plans to take early action on the vacancy got as far as the decision not to reappoint Adams but no successor has been named. The Board worked at reduced strength for months before Ross Rizley in 1955 and G. Joseph Minetti in 1956 took office, and the White House took longer than expected to find James R. Durfee to replace Rizley as chairman last spring.

Wilson and Retirement

Defense Secretary Charles E. Wilson still parries questions about his intention to resign, if any. Pentagon betting still favors USAF Secretary Donald A. Quarles to succeed him and it is assumed that Wilson will recommend his close colleague for the post. The time is not fixed, but it appears likely that the change would come in the late spring or summer, after the defense budget has gone through Congress.

ALPA Accident Report

Air Line Pilots Assn. has produced its own accident report on the collision between Trans World Airlines and United Air Lines transports over the Grand Canyon last June.

In a document which is identical in form with Civil Aeronautics Board accident reports, ALPA has published its own findings in advance of the CAB report, which is expected this month. The pilots' union decided that the accident was due to limitations of normal human vision; restrictions to vision inherent in transport aircraft; lack of adequate traffic information to pilots, and the inability of air traffic control to provide IFR separation to all traffic on heavily traveled routes.

Amortization Reverse

Airlines are trying to get the Office of Defense Mobilization to change its mind on closing the mobilization goal for commercial aircraft, but the chances of success are very dim. When ODM cut off the expansion goal, it eliminated the prospects of any more rapid tax amortization certificates for commercial transports. The present goal, which was recently extended from 600 to 900 aircraft, has been heavily oversubscribed, and closing it leaves airlines with applications for fast write-offs for nearly 400 aircraft with no prospect of getting write-off certificates.

Air Transport Assn. President Stuart G. Tipton has written ODM head Arthur S. Fleming, asking him to reconsider the ODM decision. Tipton points out that most of the jets ordered by the airlines are among the aircraft for which the carriers have asked for amortization certificates.

He argues that the national defense function of the commercial airlines qualifies them for further rapid amortization authority.

Last time the carriers campaigned for more amortization authority, they got the goal raised by 300 aircraft. This expansion didn't begin to fill airline requirements, and they went back for more, this time trying to get an open-end goal.

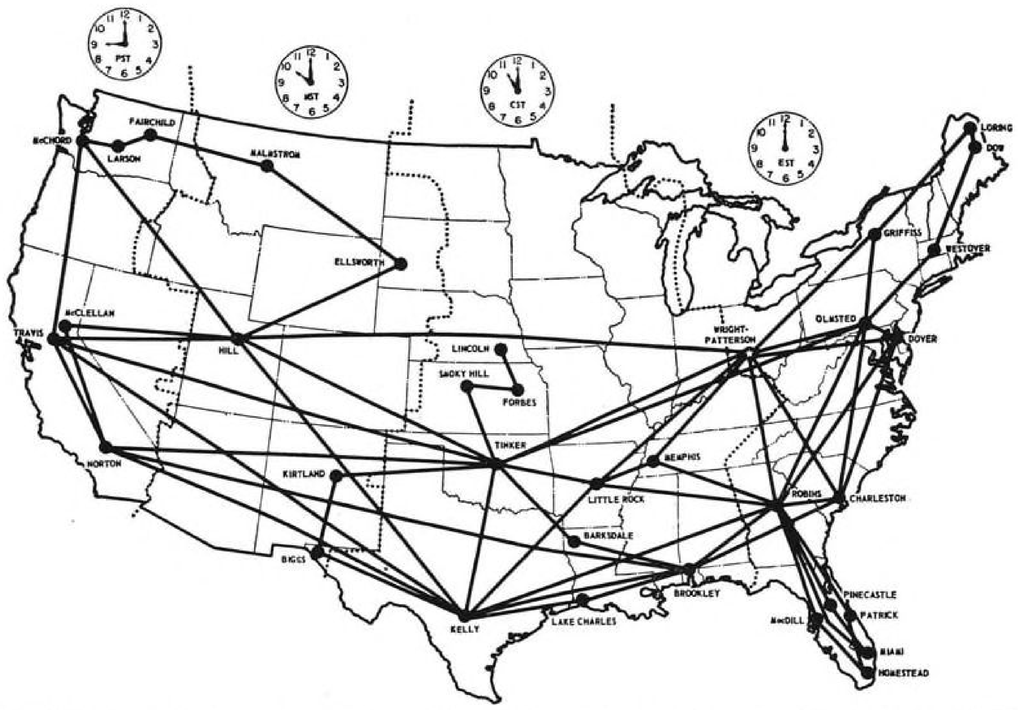
ODM has turned them down, along with the steel industry and several others, and the prospects of a reversal are not bright.

New AIA President

Gen. Orval R. Cook, former USAF deputy chief of staff for materiel, took over last week as president and general manager of the Aircraft Industries Assn. Gen. Cook, who succeeds Adm. DeWitt C. Ramsey in the post, was elected to the presidency at a meeting of the Board of Governors late last fall (AW Dec. 10, p. 28). The move was first predicted by AVIATION WEEK on Aug. 27 (p. 25).

Adm. Ramsey has been named vice chairman of the board of governors and will remain with AIA in a consulting capacity.

—Washington staff



USAF'S Logair has these routes in operation through contracts with commercial carriers for fiscal year 1957. Logair is resisting incorporation with the Defense Department's new Military Traffic Management Agency. Logair is flying its five route patterns as usual.

Logair Struggles to Keep Independence

USAF air-cargo line wants to retain identity, stay outside Defense's new single-management agency.

By Claude Witze

Washington—USAF's Logair, the nation's largest scheduled air cargo operation, is putting up a quiet struggle to keep its independence and remain outside the Defense Department's Military Traffic Management Agency (MTMA).

Logair headquarters at the Air Materiel Command, Wright-Patterson AFB, Ohio, may get a top-level decision from the Pentagon sometime this week. The issue lies in interpretation of the directive creating MTMA:

Does MTMA, the single manager agency set up last October by Defense Secretary Charles E. Wilson, have control over scheduled contract air services or is its jurisdiction confined to "one-time movements" by commercial carriers?

No Plans for Change

When MTMA headquarters opened for business, it was made clear the agency expected to assume responsibility for the award of all Fiscal 1958 air carrier contracts for all branches of the armed forces (AW Oct. 15, p. 32). It was evident then that Logair and the Navy's Quick Trans charter services probably would resist being swallowed.

USAF's attitude last week was that Logair is operating as usual and has no plans to make any changes. Furthermore, Logair wants no changes.

MTMA, on the other hand, feels it has been charged with the responsibility for negotiating contracts with commercial carriers and deciding what they will haul.

Aviation Week has learned that there has been correspondence on the subject between James H. Douglas, Undersecretary of the Air Force, and Robert C. Lanphier, Jr., Deputy Assistant Secretary of Defense.

Magnitude of the problem is best illustrated by the fact that in the current fiscal year Logair will fly 200 million freight ton-miles, more than all the commercial cargo flown by domestic air lines. It will pay about $21 million to its contract operators. Average cost, Logair claims, is 12 cents per ton-mile.

The largest Logair contractor is Resort Airlines, Inc., of Washington D. C., which inaugurated DC-4 service in November, 1954 from a base in Oakland, Calif. The company says it is moving Air Force cargo at the rate of more than 50 million ton-miles a year. Outgrowing its fleet of Douglas DC-4 Skymasters, Resort has ordered two new Lockheed Super-H Constellations and has anticipated that its Logair job will grow to 75 million ton-miles a year by mid-1959.

Other carriers serving Logair are American Air Export & Import Co., Miami; Capital Airways, Inc., Nashville, Tenn., and Riddle Airlines, Inc., Miami.

AMC Option

When they received their approximately-equal contracts for Fiscal 1957, the four carriers were requested to submit alternate proposals for furnishing air transport cargo service for fiscal years 1957, 1958 and 1959. It was made clear at the time that AMC retained the option to extend the services through these years, subject to availability of funds, existence of a requirement and acceptable performance by the contractor.

Maj. Gen. David H. Baker, AMC director of procurement and production, said last June that, by having the bids made for a one-year period with a two-year option, the Air Materiel Command could realize estimated savings of $165,000 a year.

Turning the negotiation of the contracts over to MTMA presumably would introduce a new program in addition to removing from AMC's Airlift Division the power to fix routes and determine fully what will be carried on wings.

Logair Patterns

In the past, AMC's request for proposals from the contractors has been made on an overall cost basis for one or more of five patterns, or zones, to be served. For each of the patterns, there are established routes and timetables:

- **Pattern One: Resort Airlines.** McChord AFB, Wash., to Dover AFB, Del., with stops at Travis AFB, Calif.; Hill AFB, Utah; Wright-Patterson AFB, Ohio, and others. Minimum monthly mileage: 409,398.
- **Pattern Two: Capitol Airways.** Travis AFB, Calif. to Dover AFB, Del., with intermediate stops. C-46 aircraft. Monthly mileage: 546,790.
- **Pattern Three: Riddle Airlines.** Olmstead AFB, Pa., to Loring AFB, Me., serving more intermediate points than other patterns. Monthly mileage: 400,786.
- **Pattern Four: American Air Export & Import.** Covers Texas, Oklahoma, New Mexico, California and Utah. Monthly mileage: 418,414.
- **Pattern Five: American Air Export & Import.** From Hill AFB, Utah, to Ellsworth AFB, S. D.; Malmstrom AFB, Mont.; Fairchild, Larson and McChord AFB in Washington and back to Hill AFB. Monthly mileage: 74,673.

Lt. Col. E. L. Sawhill, deputy chief of AMC's Airlift Division, emphasizes that Logair is not used exclusively by AMC. It serves all of USAF's commands and from time to time hauls cargo for the Army and Navy.

RIDDLE AIRLINES, a Logair contract carrier, loads a C-46 at Wright-Patterson AFB, Ohio, for a fast flight to the West Coast for further shipment to an overseas base.

But AMC probably is the one command that can profit the most from its operation. It was almost five years ago that test operations were set up to prove that economies could be realized from use of scheduled air lift. In one of them, engines and electronic parts were supplied to a bomber wing, initially in the U. S. and later overseas. In the second phase of this operation, one million tons were airlifted overseas. The routing supply cycle of 50 days was cut to approximately 11.

Time Saving

A second domestic test involved moving engines to Strategic Air Command bases from overhaul and production plants. The normal 135-day cycle to get an engine from SAC to overhaul and back again was cut to 75. Surface shipment would have required an additional 28 engines in transit. Their cost: $1,680,000.

At least partially on the basis of this experience, Logair was launched a little more than two and a half years ago.

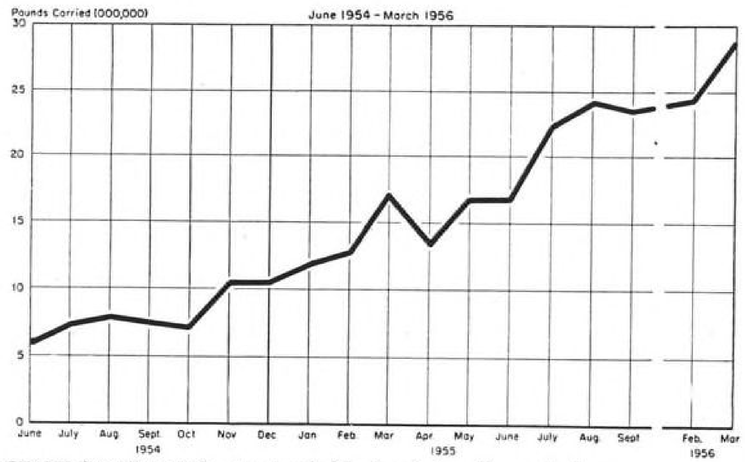


CHART shows increase in cargo handled by Logair since the service began.

The objectives were defined:

- **To provide** AMC with a guaranteed and dependable in-being airlift, practicing for D-Day.
- **To expedite the delivery** of critical and high-value items, resulting in shorter pipelines, reduced stockpiles and procurement cut-backs.
- **To determine** for AMC what items should be airlifted to USAF units.

In April 1954, Mercury Service—the initial Logair schedule with C-46 aircraft—was launched. There were contracts for the Eastern and Western zones. On the first circuit, there was five-day-a-week service out of Kelly AFB, Tex., northeast to Westover, Mass., and back again. On the second, flights went from Kelly northwest to McChord AFB in Washington.

Cost, Route-Miles Grow

AMC figures show that 368,637 route-miles were flown in the first month. Load factor was 92%; total cost of the operation $262,669. When Resort introduced DC-4 service in November of that year, tonnage jumped from about 4.5 million lb. to 6.3 million lb. Cost rose to $407,000; route-miles to 546,646.

All curves have gone up in the past two years. Last August, for example, Logair moved 16,850 tons. Ton-mile cost was 13.8 cents and contractors were paid $1,395,480. The load factor ran 71.3%. Service was provided to 35 stations—12 of them AMC bases, the rest offloading points for that command's "customers."

If MTMA takes over contract negotiation for Logair and determines what it shall carry, the single manager agency claims it will make better utilization of the available space. This means the end of AMC's priority system and the substitution of another one that USAF looks upon with some skepticism.

It is equally certain that MTMA would merge Logair with the Navy's Quick Trans, a coast-to-coast run oper-

ated by California Eastern Aviation, Inc.

The final major possibility: MTMA might reduce the magnitude of the two services, substitute greater reliance on existing scheduled commercial air cargo facilities.

This would be an obvious anathema to Air Materiel Command and the Navy, who say these facilities offer no major contribution to their mobilization potential.

Argentina to Build T-34 Under License

Beech Aircraft Corp. will build 15 T-34 trainers at its Wichita, Kan., plant and ship the balance of an order for approximately 90 to Argentina disassembled under a $4 million contract with the Argentine government.

Beech will provide technical assistance for the assembly operation at Cordoba, Argentina. Contract is the first licensing and technical agreement between a U. S. manufacturer and Argentina since World War 2. Argentina, which will have the trainers equipped for armament systems training, is the seventh foreign nation to buy the T-34 and the third to sign a licensing agreement.

First Flights Made By F-106A, FJ-4B

Two new versions of military airplanes —Convair's F-106A and North American's FJ-4B—have made first flight.

The F-106A is the redesignated F-102B, and differs from the F-102A mainly in the change from the Pratt & Whitney J57 to the more powerful J75 engine.

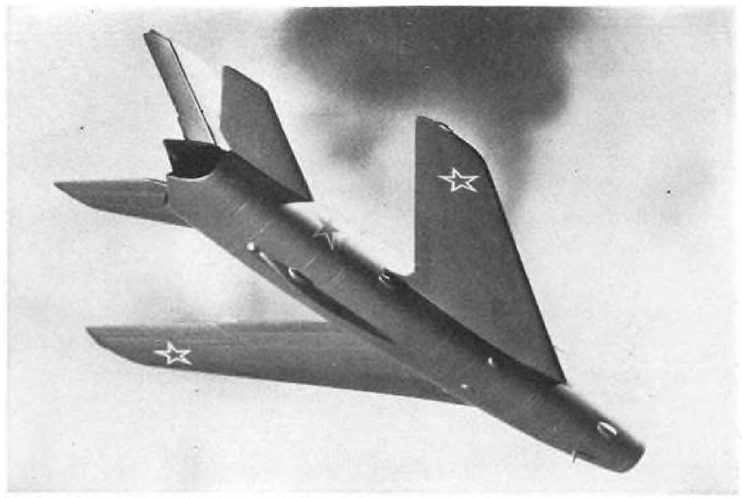
R. L. Johnson, chief engineering test pilot at Edwards AFB, Calif., for Convair and head of the F-106A test program, was the pilot on the 20 min. flight.

Convair has $83 million contract for the F-106A.

The FJ-4B, flown from North American's Columbus Division at Port Columbus, Ohio, is an FJ-4 Fury modified for low altitude attack operations. Longitudinal, lateral and directional control system improvements have been made for very low altitude high speed operation, and a low altitude bombing system is utilized.

Wright J65 engine developing 7,800 lb. thrust powers the FJ-4B.

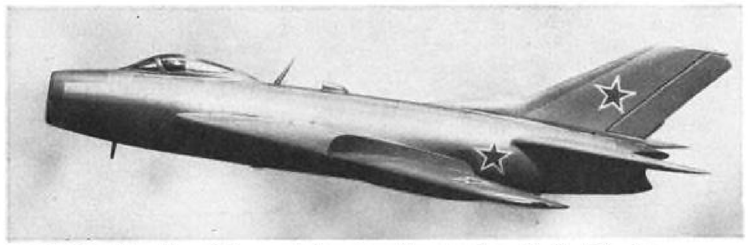
Convair also proposes a newer development of the F-102 series, tentatively designated F-106C. It would have a top speed of well over Mach 2, incorporate an advanced development of the J75 and feature a clipped vertical fin and canard design (AW Dec. 3, p. 23).



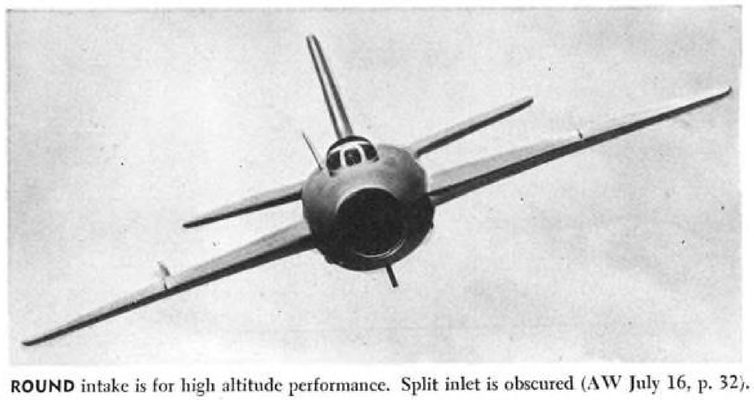
VENTRAL fairing, nozzles for twin jet engines are accented in this belly view.

Soviet Twin-Jet Supersonic Farmer Details Are Shown

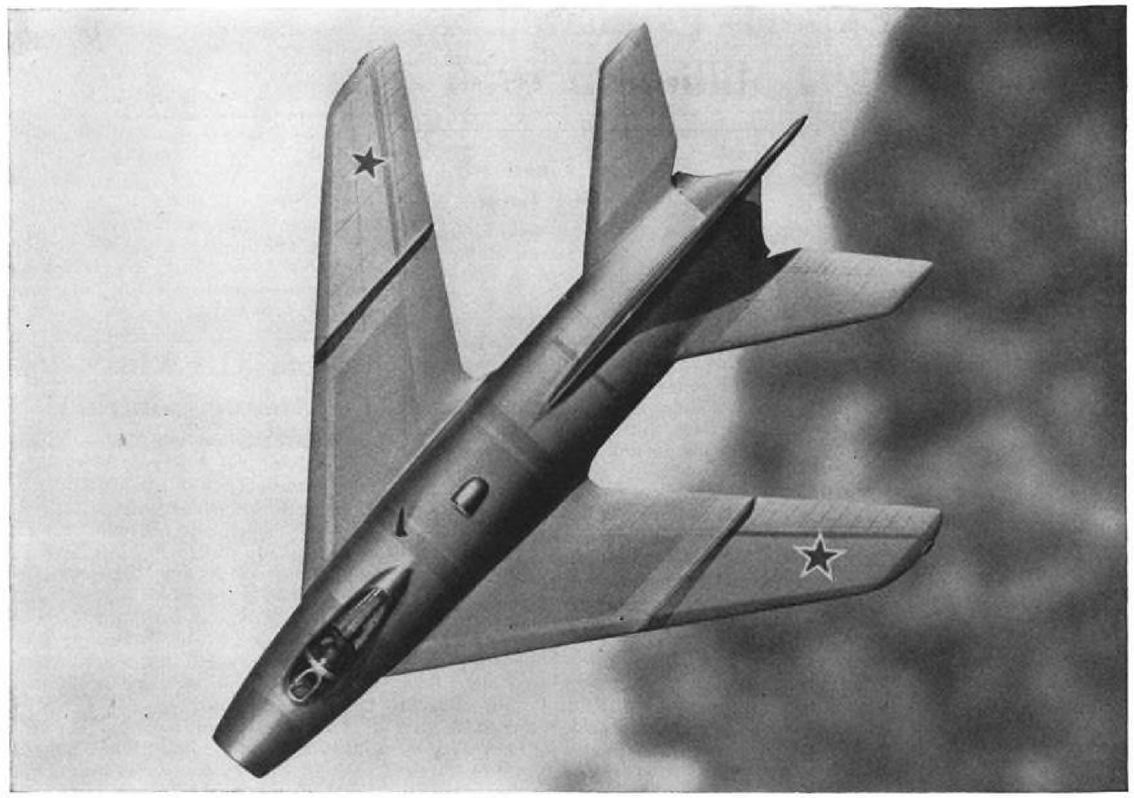
Russian fighter, code named Farmer by NATO, can reach 40,000 ft. in about 2 min. 7 sec. after takeoff. Navy model shows mid-mounted wing and low set tail are tapered to blunt tips. Nose intake is round, but fuselage flattens and broadens after cockpit to house two engines, believed to be axial flow turbojets of bypass design (AW July 2, p. 28). Sharp nose probe located at bottom of intake does not appear on model, but shows on photographs (AW July 9, p. 30). Farmer is in 900 mph. class, can attain Mach 1 in level flight. Long flat fuselage contrasts with barrel shape MiG-15 and MiG-17.



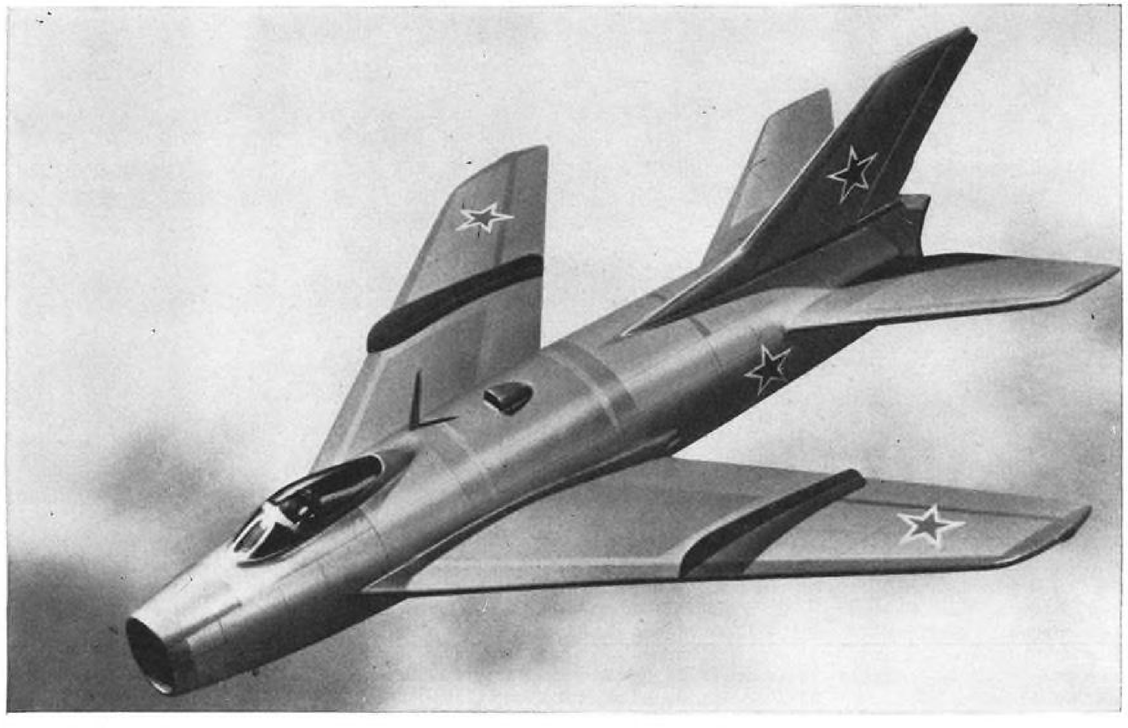
VERTICAL tail section of Farmer is large, angular, extends well aft of fuselage.



ROUND intake is for high altitude performance. Split inlet is obscured (AW July 16, p. 32).



SWEEPBACK of wings and horizontal stabilizer is 52 deg. Definite bite appears in trailing edge of stabilizer at nozzles.



British Air Exports Estimated At Record $294 Million in 1956

London—British aircraft industry's record exports are expected to total $293.4 million for 1956.

Preliminary figures given by the Society of British Aircraft Constructors show the following export breakdown:

- **Airframes** $201 million.
- **Engines** $78.4 million.
- **Components** $14 million.

This is an increase in exports of more than 90% over the past two years and establishes Britain as the nearest competitor to the U.S. industry. Final British figures are due in three weeks.

(By comparison, latest Department of Commerce figures for U.S. exports of complete civil aircraft and parts alone January-September, 1956, totaled $393 million.)

SBAC says the record trade vindicates British industry policy and technical excellence in recent years. Recent contracts give rise for quiet optimism in the future, the SBAC adds.

In answer to those who have criticized the annual SBAC flying display at Farnborough. The society says there is a direct relationship between the flying display and the rapid expansion in export trade. The 1957 display will be Sept. 2-8.

SBAC notes that Viscount orders during the year numbered more than two a week. Twenty-three Bristol Britannias were sold during 1956: five of them to Northeast Airlines. Capital Airlines purchased 14 Comet 4s in another large dollar sale.

In addition, there were orders from Holland for Sea Hawks, from India and Finland for Gnats and from Denmark for Herons. Western Germany ordered more than 200 aircraft of varying types, the society reported.

A large part of the industry's profits are being plowed back for development and research, the SBAC said. It noted that the Cyprus airlift during the Suez crisis spotlighted the RAF's shortage of modern transport aircraft.

This, and the need to build up a sizable home market for large airliners, was again emphasized during the year, a spokesman said.

Finland Licensed To Build Gnat

London—Finland has signed a license agreement for manufacture of Folland Gnat lightweight fighters in that country.

The agreement follows an order for 12 Gnats placed last year (AW Nov. 12, p. 34). The British-designed aircraft will be built by Valmet Oy at Tampere in Finland. Folland will train Finnish engineers at its Southampton plant.

Finland is expected to buy components as well as jigs and tools from British manufacturers. Arrangements for manufacture of the Gnat under license in India already are underway, in addition to an Indian order for the Gnat.

The Hindustan Aircraft Co. will build the Gnat at Bangalore, India.

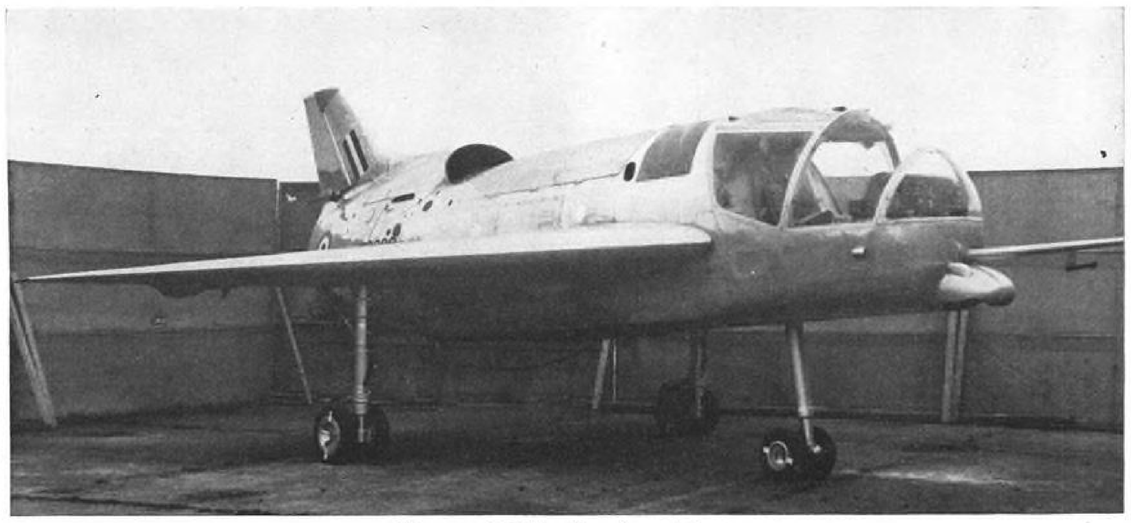
Cessna 310 Wins Lightplane Contract

Wright-Patterson AFB, Ohio—Cessna Aircraft Co. will receive a $5 million USAF contract for 80 Model 310 light twin-engine aircraft the Air Materiel Command announced last week.

The award is the first under AMC's new policy of buying "off-the-shelf" planes when USAF needs a model also available on the commercial market.

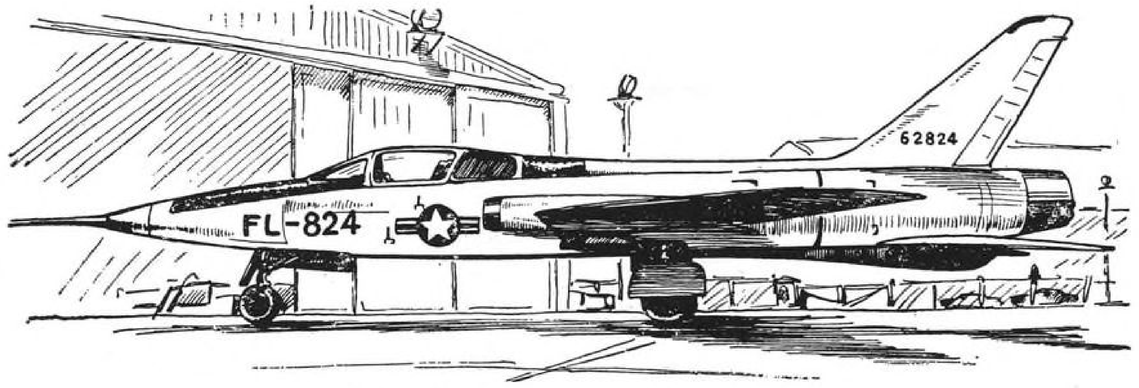
The 310 is a five-place metal aircraft with a cruising speed of more than 200 mph. USAF will use it for liaison and light cargo missions.

Three other manufacturers submitted proposals in the competition. Cessna won the contract after a joint evaluation by AMC and the Air Research and Development Command.



Short SC.1 Begins Test

Short SC.1. is British vertical lift research aircraft built around five Rolls-Royce R.B. 108 turbojets similar to the Soar. Layout is a delta wing of thick section mounted on a short body; fixed landing gear is used. Current speculation places four of the engines in a central group discharging downward for vertical lift, and the fifth at the tail in the conventional position for forward propulsion. Four control jets—at wingtips, fuselage nose and tail—provide stability and control during hovering and transition to forward flight. Control and stabilization systems were developed by Short in collaboration with Royal Aeronautical Establishment, Farnborough. Presumably this system was tried out on the Flying Bedstead test rig built by Rolls-Royce for RAE as a control test vehicle. Taxiing trials have begun with the SC.1. Development is being done at the Castlereagh plant of Short Brothers and Harland, Ltd., Belfast, Ireland.



Artist's F-105—Partly Right, Partly Wrong

This drawing by a Japanese artist of Republic F-105 Thunderchief has several radical errors—one almost ludicrous—but also is close enough to the actual airplane to indicate the artist had more than a verbal description, company says. Background is authentic—the flight line at Edwards AFB, Calif. As described by Republic, F-105 has short, very thin sweptback wings, long cylindrical fuselage, one-piece flying tail set low on aft fuselage, and ventral fin. Intakes on drawing do not appear to conform with company description, which has them set in wing roots (AW Aug. 6, p. 459). The artist is known to have visited Edwards.

Congress Girds for New Aviation Battles

By Katherine Johnsen

Washington—Congress began its new session last week with early fights over military and commercial aviation already in the offing.

On the military side, the Eisenhower Administration has cut between $3.5 billion and $5 billion from USAF's Fiscal 1958 budget requests. The cut probably will be a springboard for the Democratic majority's attack on the administration's overall defense policy. The battle will be touched off by these developments:

- **Release of the Senate Air Power** Investigating Subcommittee's report. The subcommittee, headed by Sen. Stuart Symington (D.-Mo.), will issue a report highly critical of the administration's defense policies based upon hearings held last spring, during which the commanders of USAF's various commands testified to the need for more funds to meet the increasing Russian threat. Sen. Symington says he "hopes" the report will be unanimous.

There is little likelihood, however, that it will be.

One of the Republican members of the subcommittee—Sen. James Duff (Pa.)—was defeated in the November elections. The three Democrats on the subcommittee—Symington, Sen. Henry Jackson (Wash.), Sen. Sam Ervin (N. C.)—are expected to sign a report criticizing the administration's defense policies down-the-line, with a counteracting minority report by Sen. Leverett Saltonstall (R.-Mass.).

- **Briefings before Senate** Armed Services Committee—of which Symington is a member—and the House Armed Services Committee. These briefings probably will furnish the basis for further challenges of the administration's defense policies by Congressional Democrats.

Civil Aviation Controversy

In civil aviation, the main controversy will be over the role of the nonscheduled lines.

The Independent Military Air Transport Assn. and Air Coach Transport Assn., will push for legislation authorizing the Civil Aeronautics Board to grant certificates to "supplemental carriers" for limited schedules without drawn out proceedings. The move will be opposed by the Air Transport Assn. ATA will argue that the CAB already has authority to give non-skeds' certificates defining area, charter-service, commodities to be carried, etc.

ATA fears that any CAB authority to limit the schedules themselves might also be used against the scheduled lines.

Agreement on MATS

On one proposition, however, there is basic agreement among the scheduled and nonscheduled groups—that the Military Air Transport Service, newly organized as a self-sustaining entity (AW Dec. 17, p. 34), should rely primarily upon contracts with commercial operators for its service. Congress also leans toward this view. The House Appropriations Committee last July noted it "recognized the strategic importance and necessity of a strong MATS type operation (but) at the same time it is apparent that commercial air facilities, including scheduled and non-scheduled airlines, are an essential part of the overall mobilization transport strength of the U.S." The commercial carriers, the report said, "will provide a major part of the ability of the nation to meet the huge demands for transport in the event of a sudden war emergency."

More Investigations

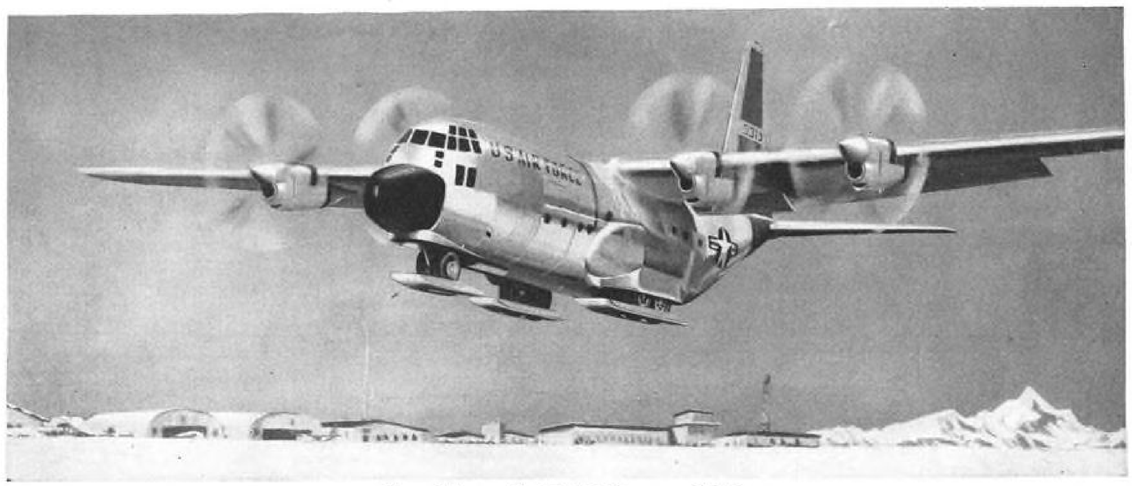
More investigations also are in the offing.

They include:

- **Senate Permanent Investigating** Subcommittee will open hearings within the next few weeks on the heavy trading of Northeast Airlines shares after the CAB granted the carrier a New York-Miami route in executive sessions. Wall Street trading jumped from 400 shares on Aug. 2—the day before the CAB's action—to over 20,000 shares on the following morning. The CAB decision was made public on Aug. 10.
- **House Appropriations** Armed Services Subcommittee headed by Rep. George Mahon (D.-Tex.) has been carefully following government practices on the procurement of aircraft and related equipment and profits allowed. Other subcommittees are expected to cover the same territory on various aviation earnings.

Members of the appropriations committee of the two houses also will play a prominent part in the aviation debate.

After hearings last July, the Senate Appropriations Committee declared that it had "had forcibly brought to its attention frequent examples of duplica-



Lockheed C-130 on Skis

Retractable skis which can be used alternately with tandem landing wheels on Lockheed C-130 Hercules will be tested this winter at Bemidji, Minn. Artist's conception shows how 19½ ft. x 5½ ft. main skis and 9½ x 5½ ft. nose ski will fit on the airplane. Weight added is approximately 4,400 lb. Installation is designed for operation from improvised arctic airstrips or from conventional paved runways.

tion of facilities and functions throughout the Department of Defense. In some cases, it added, "This duplication borders on unconscionable waste of the country's resources, not only in material, but in land resources, manpower, and money." The committee has directed the Defense Department to file a report by Jan. 30 outlining the steps that have been taken to correct duplicative activities.

Air Traffic Control

Debate and verbal argument and pressure is the main influence the new Democratic Congress can have over the course of the airpower program.

The show-down votes, as always, will be on budgetary proposals. But the fact stands that an administration, unconvinced of the need, does not use money—even if it has been appropriated by the Congress.

The debate over funding for air traffic control facilities probably will not be raised until the spring voting on appropriations. Railroad representatives can be counted upon to try and hold the funds to a minimum, arguing that the cost should be borne by the airlines.

To counter this, congressional appropriations committees are expecting a report recommending methods of assessing the users of airways. Under Secretary of Commerce for Transportation Louis Rothschild promised it in testimony last summer.

The particular legislation wanted by the scheduled lines is a measure authorizing carriers to "set-aside" subsidy income for use in financing equipment purchases. IMATA will not oppose the move, but individual nonscheduled lines probably will.

Navy Quits Joint IRBM Project, Confirms Plans for Own Missile

Washington — Navy confirmed last week that it is pulling out of the joint Army-Navy intermediate-range ballistic missile program to develop its own IRBM as first reported by AVIATION WEEK last Feb. 20 (p. 26). The Navy IRBM has been designated the Polaris.

The basic reason behind the split, as detailed by AVIATION WEEK on Feb. 27, (p. 34), is Navy's requirement for a solid-fuel rocket with a relatively squatty configuration to meet shipboard storage, handling and launching problems. The Jupiter, compromise missile under the joint program, is a further development of the Army's long, thin and liquid-fueled Redstone.

Major contractors for the Polaris are Lockheed Aircraft Corp., General Electric Co. and Aerojet General Corp.

Abandonment of the joint program by the Navy is the second major blow to Army's missile efforts.

A month ago, Defense Secretary Charles E. Wilson took responsibility for "operational employment" of land-based IRBMs away from the Army and gave it to Air Force, leaving the Army free only to make feasibility studies on IRBMs (AW Dec. 3, p. 30). Some Pentagon observers believe that Army's nucleus of designers and engineers will break up without Navy support and with little prospect of future work on anything but short-range missiles.

The Polaris is the fourth intermediate-range ballistic missile program being conducted in the West. Besides Jupiter, others are Air Force's Thor and a British program (AW Feb. 27, p. 34).

Polaris will be capable of underwater firing from submerged submarines as well as from ships. Rear Adm. John E. Clark, director of the Guided Missiles Division in the Chief of Naval Operations' office, said in Senate testimony last May that the Navy would be "reasonably sure of the form that the ballistic missile will take . . . within the next year," and that "we could build a submarine and have it ready shortly after the missile (is) ready."

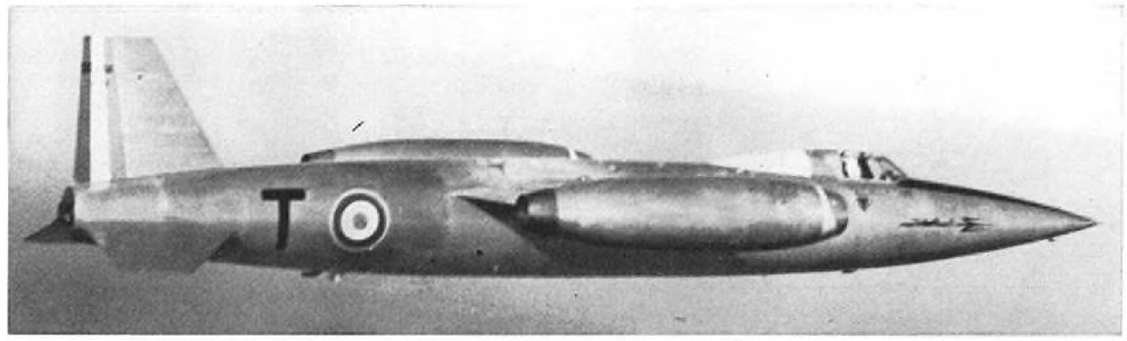
The Navy also has talked of using battleships or large cruisers as mobile launching platforms for the missile.

News Digest

Lee S. Johnson has been elected general manager of Sikorsky Aircraft Division of United Aircraft Corp., succeeding Bernard L. Whelan. Whelan will continue as a vice president and as a member of the operating and policy committee of United. Johnson is former senior assistant general manager.

Two new Assistant Secretaries of Defense have been appointed by President Eisenhower:

• **Mansfield D. Sprague,** who will be in charge of manpower, personnel and reserve affairs, replacing Carter L. Burgess, who resigned to become president of



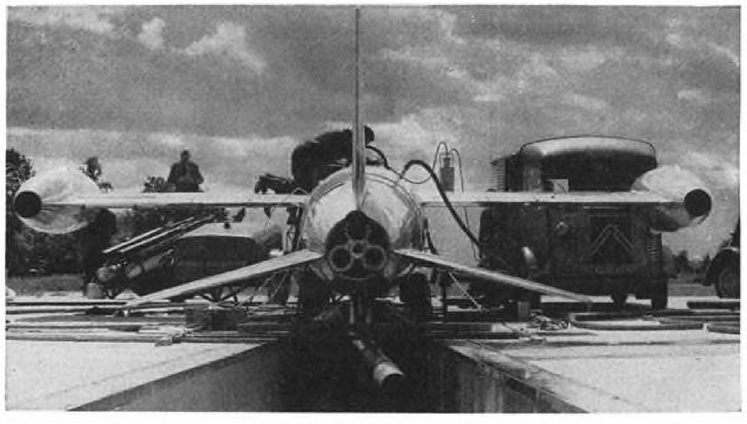
Trident 2 In Flight, Ground Tests

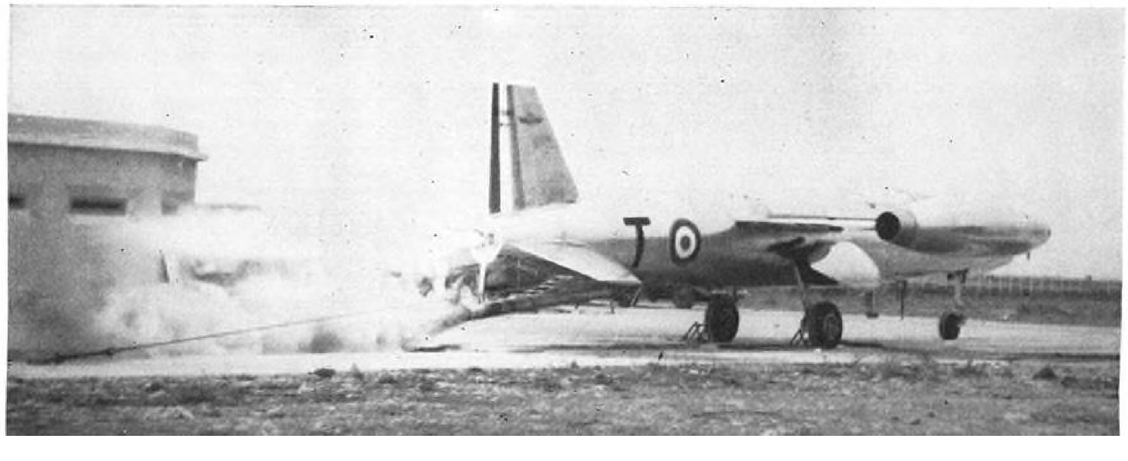
French Trident 2, in first flight (above), is powered by a combination of SEPR liquid-propellant rockets in tail and turbojet engines mounted on wingtips. Powerplants of first 10 planes will be Dassault-built Armstrong-Siddeley Vipers of 1,650 lb. thrust each. Next 10 will have turbomeca Gabizo engines rated at 2,400 lb.

How Trident 2 (top right) compares with Trident 1 (bottom right) is shown in fueling views. Trident 2 has two rocket engines, not three, and landing gear has been lengthened and redesigned. Span of Trident 2 is about 23 ft., compared with 25 ft. of Trident 1. Small downward pointing fins on horizontal stabilizer tips of Trident 1 have been eliminated.

Single rocket engine is test fired below. Turbopump exhaust is carried off in pipe from belly.

Ouest Aviation, which builds Trident, says it has amazing stability in high supersonic speed maneuvers (AW Nov. 5, p. 34). Ceiling is limited by pilot vulnerability at high altitudes.





B-58 on Takeoff

Indication of how the long bogie landing gear of Convair's B-58 Hustler supersonic bomber retracts is given in these takeoff photographs. Struts are jointed to permit wheels to rise directly upward to fit in wing recesses covered by doors in process of closing in the two photos. Increase of conical camber of wing toward tip is evident. Note central spike in variable geometry inlets to force inclined shock wave at supersonic speeds (AW Dec. 17, p. 26; Dec. 31, p. 30). Aviation Week first revealed the conical camber technique in the Nov. 26 issue (p. 26), and followed with exclusive B-58 pictures in the Dec. 17 issue.

Trans World Airlines (AW Dec. 10, p. 39).

• **Edward P. McGuire,** who will be in charge of supply and logistics, replacing Thomas P. Pike, now a special adviser to Defense Secretary Charles E. Wilson.

Aero Digest Magazine suspended publication with its December issue. The monthly was founded by Charles J. Glidden in New York in 1922.

Eastern Aircraft Corp. Hackensack, N. J., will be exclusive North American agent of the Louis Breguet Co. of France. Breguet is manufacturing 15 BR 765 four-engine passenger/cargo transports.

Strategic Air Command flew 1¼ million hr. in simulated combat missions in 1956, completed more than 150,000 refueling hookups. Accident rate in heavy flight schedule was 11 per 100,000 flying hours, including minor as well as major incidents.

Canadair, Ltd., with flight tests imminent for CL-28, has added Paul Falconer to its test pilot staff. Falconer, who was second pilot of the Bristol Britannia on its North American tour, has logged 500 hr. in the Britannia. CL-28 is a piston engine maritime reconnaissance version of Britannia. Transport version, the CL-44, is being considered by the Royal Canadian Air Force, which has ordered the CL-28.

North American Aviation rolled out the last of more than 6,000 Sabre jets, bringing production in the U.S. to a close. Production under license continues in Canada, Italy, Japan and Australia. F-86F line at North American's Los Angeles plant has been converted to production of F-100F, two place version of the F-100 Super Sabre.

Rohr Aircraft Corp. will offer $7.5 million of convertible subordinated debentures due in 1977. Offering, which will be underwritten by the First Boston Corp. and Lester, Rhons & Co., will be used for some plant modernization and expansion, and to reduce outstanding short-term bank loans.

Aircraft industry backlog, estimated by Commerce Department at $19 billion at the start of 1957, is a one-third increase over backlog at beginning of 1956 and the highest level since World War 2, the department reports.

Fruehauf Trailer Co. will build combination transporter and launcher for USAF's Martin TM61B Matador missile. Subcontract from Goodyear Aircraft Corp. is for more than $1 million. Trailers will be built at Fruehauf's Ft. Wayne, Ind., plant.

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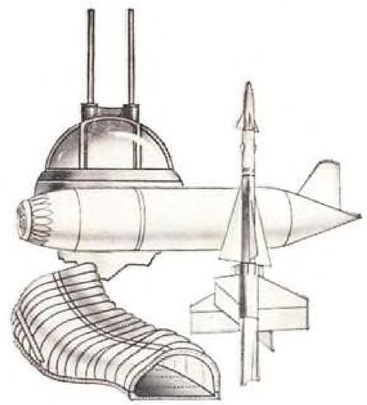

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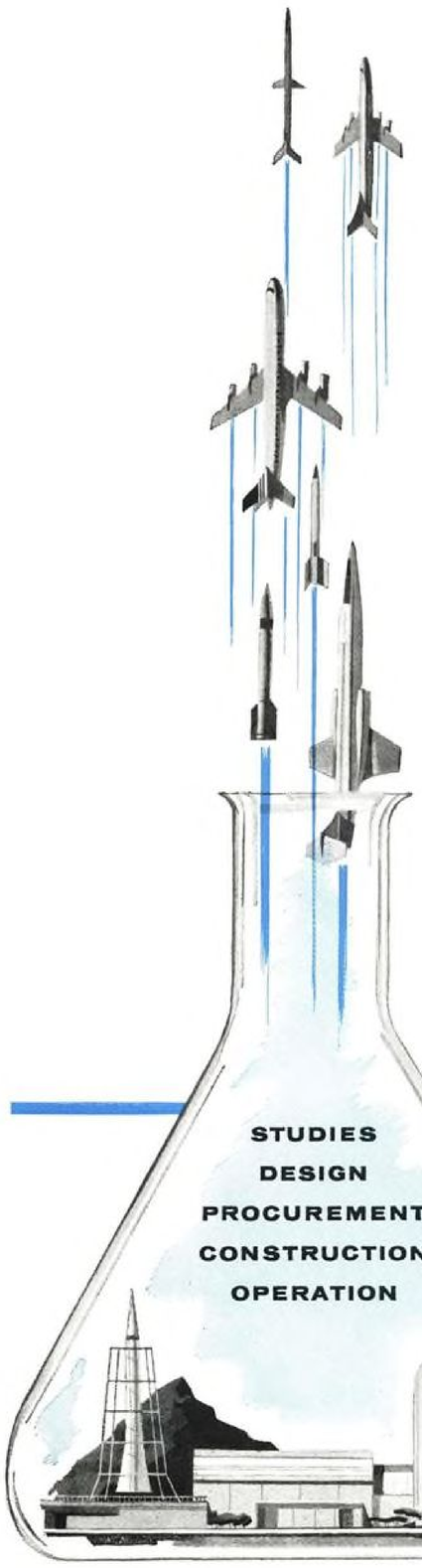

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New Global Service Authorized by CAB

CAB provides second service to compete under U. S. flag with Pan American; TWA extended to Manila.

By Craig Lewis

Washington—Civil Aeronautics Board has provided a second U. S. flag round-the-world air service by extending Trans World Airlines' system to Manila where it will link with Northwest Airlines' Pacific route.

The new service, approved by President Eisenhower, will provide competition for the round-the-world service Pan American has operated since 1947.

In order to link TWA and Northwest routes at Manila, the CAB extended TWA's Far East route from its old terminal at Colombo, Ceylon, to Manila via Bangkok, Thailand. The new route gives the airline a much stronger Far East anchor.

The new world service links TWA and Northwest 10 years after the CAB first authorized such a service. In 1946, a link was approved at Shanghai, but was never started because of the political situation in China.

TWA tried again in the Transpacific Case with an application for a route to Tokyo to meet Northwest. In 1955, the CAB denied the request, mostly because it would mean point-to-point duplication of Pan American's route, and would overlap a new route given to Northwest.

The CAB said its decision to give TWA the new route is an integral part of its policy of balanced competition by American-flag carriers. The Board noted that it has established this policy, with White House approval, in a number of decisions over a period of years.

The need to strengthen TWA's system was another major factor in the Board's decision. The CAB pointed out that Colombo is one of the weakest foreign terminals; that Manila generates over 12 times as many passengers.

Unsettled conditions in the Middle East were cited as another factor, since a strong route beyond India will help TWA maintain full operations to the Far East if the carrier should have to discontinue service in the Middle-East.

The new, longer route also will help TWA overcome restrictions on both TWA and Pan American imposed by the Indian Government in the U.S.-India bilateral signed a year ago, since it eases TWA's dependence upon Indian traffic in its Far East operations.

Praising the CAB decision, E. O. Cocke, TWA vice president for sales, said that round-the-world traffic now totals nearly 15,000 passengers a year; estimated it will double by 1960.

Rejecting Pan American's estimates of the traffic diversion the new route will cause, the Board said that expected traffic growth, plus the new promotional efforts of TWA and Northwest, lead to the conclusion that most of TWA's traffic will be newly generated. CAB says diversion from PanAm won't total more than $300,000 a year.

Opposing the new route extension, Pan American argued that it would postpone the time when PAA will be able to justify resumption of its service to New Delhi. Under the U. S.-India bilateral, the American carriers have to justify increasing their flights by proving that they are carrying more traffic to and beyond India.

Answering this argument, the CAB said the round-the-world service is clearly more important than service to New Delhi. The Board added that its action probably will not have the effect Pan American claims it will have on the New Delhi situation.

The CAB also rejected Pan American's contention that TWA does not have enough aircraft to operate the new service. CAB said it is confident that TWA will acquire whatever aircraft are needed, but it also said that the availability of equipment "is not a necessary factor in determining whether we should grant an extension.

"TWA's new authority to serve Manila and Bangkok terminates July 4, 1959. The carrier's entire authorization for the Middle East and Asian points also expires on that date, and the Board will review them all at the same time."

CAB Member Chan Gurney filed a strong dissent against the decision. He called it "economically unsound and internationally unwise."

Gurney feels that no need for another round-the-world service has been shown. He said there is no evidence that present service is inadequate or will be inadequate in the future.

The dissent maintains that the new service will be of little value to passengers traveling around the world because they generally make several stops and side trips, using several airlines in the process. Gurney also points out that travelers will still have to change carriers in Manila.

The minority member said that the record in the case indicates there will be little additional round-the-world traffic generated by TWA and that most of its traffic will be diverted from Pan American. Comparing CAB diversion estimates of $300,000 with Pan American's claim that it will need $3 million more in subsidy, Gurney said that whichever figure is nearer right, the increased subsidy cost won't be offset by increased service and convenience.

"I firmly believe that it is definitely not in the public interest to authorize a competitive service on such a thin route and when the new service would impair the existing service. This award appears to be in the nature of competition for competition alone without regard to the services required or the impact on the existing carrier which provides the service," Gurney said.

The dissenting CAB member also pointed out that the route award may have a bad effect on U. S. international aviation relations.

Off-Route Restrictions Removed

Washington—Restrictions against off-route operational stops were removed last week by the Civil Aeronautics Board from the certificates of American Airlines, Trans World Airlines and United Air Lines.

The lifting of the restrictions reverses a 10-year CAB policy against allowing the three transcontinental carriers to make operational stops at points not on their routes except for emergencies. The ban was imposed to avoid pressure from the off-route points for regular service from the airline making operational stops.

Now CAB has decided that American, United and TWA can make stops at cities not on their routes so long as they do not enplane or deplane any traffic.

The investigation, which stemmed from the Denver Service Case, was decided by a three-man Board. Vice Chairman Joseph P. Adams and Member Harmar D. Denny voted to lift the restrictions, and Member G. Joseph Minetti voted to retain them. Minetti said conditions which led to the restrictions have not changed to warrant lifting them.

$67 MILLION Vanguard order by Trans-Canada Airlines totals 20 aircraft, with initial deliveries in 1960. TCA has optioned four more.

Trans Canada Buys Stretched Vanguard

New York—Trans-Canada Air Lines will buy 20 Vickers Vanguard 952 airliners at a cost of $67.1 million, and four more of the British turboprops, at an additional $11.7 million price tag, are on option.

TCA, currently operating 18 Vickers Viscounts with 20 more on order, expects delivery of the first Vanguards in fall of 1960 and plans to use them on its transborder routes to New York and Chicago.

Vickers also is negotiating with other North American carriers for Vanguard orders. Trans World Airlines, Northwest Orient Airlines and United Air Lines are said to be interested in the aircraft.

The TCA Vanguards, about double the Viscounts in size and 100 mph. faster, will carry 82 first-class or 102 tourist passengers.

Their capacity in mixed configuration is 60% tourist.

The aircraft, which will be delivered in a North American, fully winterized version, will be powered by Rolls-Royce Tyne RB. 104 Stage 2 engines (AW June 18, p. 43). The Tynes, each developing 5,315 equivalent shaft horsepower, will give the Vanguards a 420 mph.-plus cruising speed at 20,000 ft. TCA says.

Gross weight of TCA's Vanguards will be 141,000 lb. with a 114,000-lb. maximum landing weight and a 24,000-lb. payload.

Effective stage range in Canadian winter operations will be 1,750 mi. Still-air range with 21,000-lb. payload is 3,000 mi.

The Vanguard's "double-bubble" fuselage will include a lower section with two pressurized cargo compartments with a total two-ton capacity in mixed flights or 10 tons in all-cargo service. TCA will use an interior that includes four washrooms, two galleys.

Stretched Version

The airline plans to retire its DC-3s, North Stars and Super Constellations before mid-1961. It then will have an all-turbine fleet including DC-8 as well as the two Vickers types.

The specifications of TCA's Vanguards show differences from those first announced for the aircraft. Fuselage has been stretched from 118 ft. to 122 ft., 4 in. Maximum takeoff weight was increased by 6,000 lb., and 3,000 lb. of payload was added.

Rolls-Royce appears to be ahead of schedule in its development of the Tyne. Previously announced plans called for three stages in the development program, the first to be available for 1959 delivery and to be rated at 4,470 eshp. for takeoff.

Second stage, expected to be ready in early 1961, was to be rated at 5,075 eshp. and to feature a turbine disk cooling system and higher-temperature resistant blades. The third stage, planned for first-half 1963 availability, was to be rated at 5,500 eshp.

With 5,315 eshp., the engines for TCA's Vanguards fall between Stages 2 and 3 and are set for earlier delivery than had been planned for Stage 2 Tynes.

Cargo Flexibility

Freight space in the Vanguard is entirely separate from passenger accommodations, and its 1,410 cu. ft. can accommodate almost a full payload without interference with the seats. This arrangement is expected to give the aircraft flexibility between mixed and all-cargo operations.

TCA expects to operate its Vanguards at "remarkably low" aircraft-mile and seat-mile costs, according to G. R. McGregor, the airline's president. An earlier comparison of a 93-passenger version of the Vanguard with a 44-passenger Capital Airlines Viscount over a 400-mile stage showed a cost of 1.32 cents for the Vanguard against 1.6 cents for the smaller plane.

Ease of Maintenance

Vickers designed the Vanguard for ease of maintenance comparable to the Viscount's, and also kept in mind the integration of Vanguards into a Viscount operator's fleet. TCA was the first North American turboprop operator with its Viscounts, which were developed for operation on this continent with TCA-Vickers cooperation.

As with the Viscounts, equipment and electrical systems of the Vanguard will conform with North American requirements.

Vickers has estimated its Vanguard market at between 100 and 500 aircraft.

British European Airways has ordered 20, and expects delivery beginning in the spring of 1960. First trial flights of the aircraft are scheduled for fall, 1958.

TCA Vanguard Specifications

Number of Passengers	82 all-first class; or 102 all-tourist. Combination: 60% tourist 40% first-class
Cargo Volume	1,410 cu. ft.
Cruising Speed (Standard Atmosphere)	424 mph. (110,000 lb. at 20,000 ft.)
Ultimate range	3,000 statute miles with fuel tanks and with 21,000 lb. payload.
Stage Range	2,600 mi. (21,500 lb. payload and reserves: fuel for 230 mi. diversion and 60 min. holding on four engines at 5,000 ft.)
Maximum Payload	24,000 lb.
Powerplant	Rolls-Royce Tyne II producing 5,315 eshp.
Fuel	JP-4
Fuel Capacity	39,000 lb. or 5,100 imp. gal.
Runway Takeoff Length	6,300 ft.
Runway Landing Length	5,500 ft.
Gross Takeoff Weight	141,000 lb.
Landing Weight	114,000 lb.
Span	118 ft.
Overall Length	122 ft. 4 in.
Height	35 ft.
Interior Width, Cabin	10 ft. 9 in.
Normal Cruising Altitude	20,000 ft.
Pressurization	6.55 psi. or 8,000 ft. in the cabin at 30,000 ft. altitude.

CAB Upholds Full Fare for Minors

Washington—Airline authority to charge full fares for unaccompanied children was upheld last week by the Civil Aeronautics Board in its decision in a complicated child fare case.

The Board found that, under the law, the airlines have the right to charge full adult fares for unaccompanied children between the ages of five and 12 years, and it refused to require carriers to fly children at a lower rate.

In its decision, the CAB rejected arguments that airlines should have to follow the custom of common carriers in offering lower fares for children. The Board said that, while lower fares may be desirable, the law does not require them.

Observing that the Civil Aeronautics Act allows the airlines substantial areas of discretion in setting fares, the Board said it is "not prepared to intrude on that discretion merely because our concepts of social policy might favor one fare practice rather than another."

The Board found that the record in the case shows the cost of carrying children is at least as high as that for carrying adults. It also found that it costs more to carry an unaccompanied child than it does to carry a child traveling with an adult, and that carriers are not being unjustly discriminatory in charging more for unaccompanied children.

A second issue in the investigation involved the practice of charging half fare for a child on the domestic leg of an international flight and full fare for a child on a purely domestic flight. The Board found this practice is unjustly discriminatory and ordered the carriers to correct it.

In removing this international-domestic discrimination, the carriers have a choice of charging reduced fare for children on both flights or full fare for both. They can choose one or the other, but they cannot charge both types of fare.

The third issue involved a Northeast Airlines plan to charge full fare for a child accompanied by a non-family adult, while charging only half fare for a child traveling with a parent or other close family adult.

The Board found this Northeast fare system unjustly discriminatory and ordered it changed.

Northeast can either drop its fare concessions to accompanied children or apply the half fare to all children traveling with adults.

CAB Vice Chairman Joseph P. Adams and Member G. Joseph Minetti disagreed with the majority on the main issue of the investigation—the lawfulness of charging full fares for unaccompanied children.

Adams argues that the issue should be judged in relation to fare concessions for accompanied children. He objects to discrimination between accompanied and unaccompanied children, and he finds no basis in the record for allowing the airlines to charge more to carry unaccompanied children.

Minetti said that, since the record shows no cost difference or other valid justification for discrimination against unaccompanied children, the practice should be found unlawful.

He believes that fares for unaccompanied children should be reduced to their former levels.

BEA Will Inaugurate Viscount 800 Service

London—Plans for introduction of the Vickers Viscount 800 into service with British European Airways were outlined in a year-end statement by Lord Douglas of Kirtleside, BEA chairman.

BEA will introduce the new 58-passenger Viscount on the London-Paris route in February. Later the 800 series will replace the present 47-passenger Viscounts on services to Amsterdam, Geneva, Zurich and Frankfurt. It will replace Elizabethans on routes to Brussels, Dussledorf, Nice, Hamburg and Berlin.

Lord Douglas said BEA carried 2,450,000 passengers during 1956, an increase of 13.6% over the previous year.

The airline flew 29,800,000 revenue-miles for a 15% increase. Air freight went up 28.1% to 22,000 tons.

The BEA chairman said this expansion was achieved at an increase of only 11.3% in the number of hours flown.

ADIZ Regulations Softened by CAB

Washington—Civil Aeronautics Administration has eased security control rules for aircraft flying over Air Defense Identification Zones.

Under the new regulations which became effective last week, flights originating in an ADIZ and flying away from either the Eastern or Western Defense Area and flights leaving the U.S. are no longer subject to security rules.

When the old rules were in effect, all flights flying into and through an ADIZ had to file an Instrument Flight Plan and report periodically or file a Defense Visual Flight Rules plan and make periodic position reports.

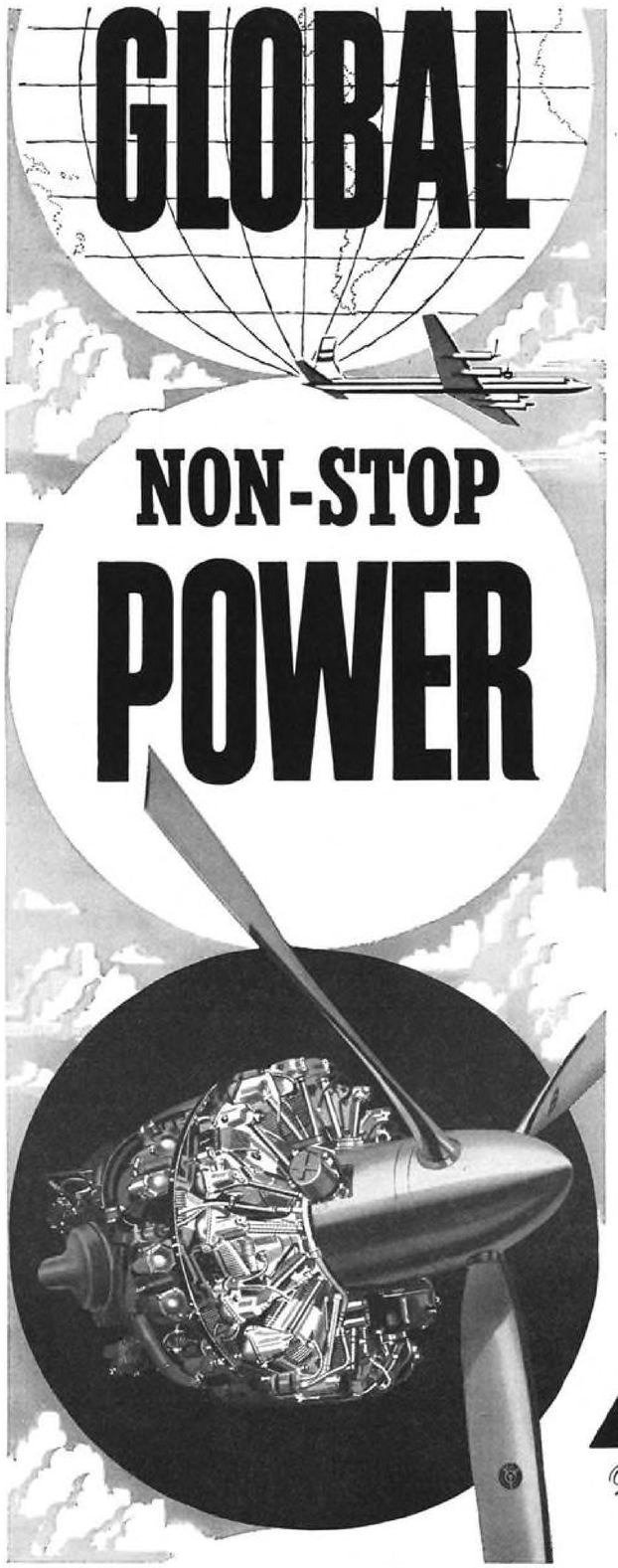
Last month, the Albuquerque ADIZ was eliminated. The Northern ADIZ in the western half of the State of Washington was deleted on Jan. 1. These two moves, along with the easing of flight rules, will simplify operations for civil aviation in the affected areas.

TAI, French Independent, Buys Four DC-8 Jets

Santa Monica, Calif.—TAI, independent French airline, ordered four Douglas DC-8s to raise to 122 the number of the jet transports now on order.

Nat Paschall, vice president for commercial sales for Douglas, said the company's backlog of DC-8s now stands at more than half a billion dollars in orders from 13 airlines throughout the world.

Deliveries to TAI are to begin during first half of 1960.



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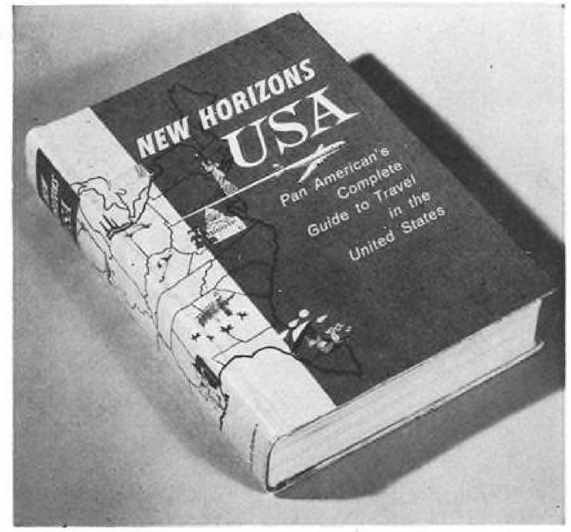

AIRLINE book programs include travel tip booklets featured in TWA advertising (left), commercially-published Pan American guidebook.

Airlines Find Promotion Bonus In Travel Books They Prepare

By Glenn Garrison

New York—Promotion people of the two biggest U. S.-flag airlines are enjoying considerable success in the book publishing field, where their dividends are only indirectly in cash.

Services of Pan American World Airways and Trans World Airlines are advertised through 16 book titles covering tips and facts about international travel, cookery, wining and dining and sports. Book programs of both airlines have been growing during the last few years and further expansion is planned.

Approach to Publishing

Best-seller of both carriers is their compilation about life in various countries of the world. More than half a million copies of Pan American's "New Horizons" world-wide travel guide have been sold, the airline says. TWA has distributed over 750,000 copies of its eight "Travel Tips" booklets covering individual foreign countries.

The carriers' approach to their publishing ventures has differed. Pan American generally works through established publishing firms, which produce the airline's books and distribute them through bookstore outlets in addition to the airline and travel agent office sales and mail orders filled by Pan American. The carrier breaks even financially on the books, according to Harold J. Laird, sales promotion manager, and the promotional value is all gravy.

TWA on the other hand has preferred to produce and distribute entirely on its own, absorbing some immediate financial loss. B. W. Van Del, the airline's manager of export advertising, estimates the deficit at about $10-$15,000 a year, but finds this cost greatly outweighed by the promotional returns. TWA is in fact prepared to go as high as $50,000 a year if necessary to maintain and expand the program.

Both airlines set the ticket-selling potential of the programs high. TWA calls the operation "fantastically successful." Laird estimates the additions to Pan American's "very best" mailing list at 100,000.

Pan American's experience in publishing began in 1951 with the first edition of "New Horizons," published by Simon and Schuster at $1. New editions appear about twice a year, Laird says, to keep the information up to date.

Another best-seller is "The-Round-the-World-Cookbook" of recipes gathered by Pan American and published in 1954 in hard covers by Doubleday. About 40,000 of these have been sold, according to Laird, and a Bantam abridged paperback out this year is selling even better.

Five Languages

Pan American's five-foot shelf now includes a United States version of "New Horizons," selling for a dollar abroad and $1.95 in this country. The book, out last November, will be printed in five languages and is designed primarily for overseas consumption.

Other Pan American-connected titles include a menu translator by Myra Waldo, author of the cookbook; a travel guide for the skier; and a guide to fishing in Latin America. Only the fishing guide is published by Pan American itself and it is the only title not available through bookstores.

The airline plans to add new titles within the next couple of years, one of them a "luxury" volume of travel poster reproductions and one still unspecified. Goal of the program will continue to be financial break-even only, according to Laird, with promotion providing the dividends.

TWA originated its "Travel Tips" booklet in 1949 from an idea and material supplied by its sales manager in Spain. Advertising department took over in 1951, following the original format, and added to the list of countries.

Advertising Help

The airline gives away the booklets to ticketed passengers—tourist and first-class—who are bound for overseas points. Otherwise (except within Europe) they sell for a quarter, and TWA pegs national advertisements to the booklets, with coupons for mail orders. The coupons provide leads for ticket sales.

Like Pan American, TWA gets its travel information from offices throughout its overseas system. TWA revises its booklets from time to time, has added maps, and may go to pictures.

The carrier added "Travel Tips—USA" to its publications over a year ago in response, Van Del says, to requests from sales people in Europe. Initial run of 75,000 has been exhausted.

One book involving the airline is "TWA Vacation Guide and World Atlas," a Doubleday hard cover, but

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TWA provided only material and has nothing to do with distribution or profits. Naturally the book (which was on the bonus list and has reached 200,000 distribution, Van Del says) doesn't make TWA's advertising people unhappy.

Arranging with publishers to put out the books, as Pan American does, restricts the degree of plugging that can go into some of them. The cookbook, for instance, mentions Pan American's name sparingly and sketches of Stratocruisers in the hardback editions show indiscernible initials on the aircraft.

Laird feels the promotion is enough, however, and believes the airline could be oversold with much heavier plugging. In any case, he points out, the promotional ride is free.

More far-reaching aspect of the guide books of both airlines is their value to air travelers and the general stimulating effect on travel.

American Extends Luxury DC-7 Service

American Airlines is extending its de luxe "Mercury" service to nine cities in addition to New York, Washington and Los Angeles.

The DC-7 flights are scheduled for inauguration Jan. 15 at Chicago, San Francisco, Detroit, Boston, and Cincinnati. Dallas, Fort Worth, Tucson and Phoenix will be added on Feb. 3. "Mercury" flights feature reserved seats, meals, and "red carpet" terminal service.

PanAm Borrows for Jet Aircraft Program

Pan American World Airways has arranged for $30 million in additional financing for its equipment program, particularly jet aircraft acquisition, the airline recently announced. Program involves sale of promissory notes carrying 4¾% interest with final retirement scheduled for 1980. There is provision for extension to 1995.

Financing was negotiated with a group of institutional investors by Lehman Brothers and Hornblower and Weeks, the airline reports.

Japanese Airline Gains Brazil Entry

Rio de Janeiro—Brazil and Japan signed an accord to permit regular Japan Air Lines flights to Brazil. Air transport from Japan to Brazil has been irregular and so far no Brazilian airline has made the trip to Japan. However, Real-Aerovias is expected to make a test run to Tokyo in the near future.

Pan American Gets U. S. Rights For New York-Nassau Service

Washington—Pan American World Airways has won U. S. rights to compete with British Overseas Airways Corp. for traffic between New York and Nassau.

The Civil Aeronautics Board, with White House approval, chose Pan American as the U. S. carrier for the route provided for when the U. S.-United Kingdom bilateral was amended in August 1955.

Pan American was given the nod on a split 3-2 CAB decision. Vice Chairman Joseph P. Adams and Member G. Joseph Minetti favored Eastern Air Lines for the route.

In an attempt to keep Pan American out of the New York-Miami market, the CAB majority put a restriction on the five-year certificate that prohibits the carrier from operating single plane service between the two points via Nassau. The airline is also prohibited from advertising a New York-Miami service.

Subsidy was the prime factor in the majority decision to give the route to Pan American. CAB believes revenues from the New York-Nassau operation will reduce PanAm's subsidy needs.

In its decision, the Board takes an optimistic view of traffic growth on the route. Forecasting that Pan American will capture 60% of the market, the Board estimates that the U. S. flag carrier will fly 37,400 passengers and operate 41,035,000 passenger-miles over the route this year.

Basing its judgment upon this traffic estimate, the CAB believes Pan American's revenues from the route will total $2,313,000. The Board estimates expenses for the first year of operation at $1,814,000, leaving a $500,000 profit to help reduce the carrier's subsidies.

In view of these optimistic forecasts, the Board rejected the examiner's recommendation that Pan American be restricted from requesting subsidy for the New York-Nassau operation. The Board said: "We are satisfied that Pan American will promote and develop the market involved successfully, that the characteristics of the New York-Nassau route and the nature of the nonstop operations by Pan American will make any subsidy problems academic."

The CAB agrees with Pan American's estimate that the introduction of competitive American flag direct service on the route will promote a 50% increase in traffic. The Board said the proposed service will provide new, improved, faster, lower cost service than that presently available.

Since BOAC offers only two coach flights a week between New York and Nassau, the CAB feels the coach potential is relatively undeveloped and that Pan American's proposed daily coach service will stimulate the market.

A further stimulus to traffic growth described by the CAB lies in the fact that Pan American plans to offer substantially lower fares than those currently offered by BOAC. Pan American's proposed tourist fare is $100.80 round trip, $56 one way; first-class fare is $145.80 round trip, $81 one way. BOAC charges $168 round trip, $93.30 one way tourist, with an off-season round-trip excursion fare of $130. BOAC's first-class is $185 and $102.80.

Explaining its Miami restriction on the new service, the CAB said the conditions imposed "will make it clear that Pan American is not authorized to offer or advertise to the public a New York-Miami service, whether by single-plane or by connecting service via Nassau, nor will it be permitted to sell through tickets between New York and Miami."

Without this restriction, Pan American would be able to offer a through service by linking the new route with its Nassau and Miami route.

The CAB agreed with the examiner, who also chose Pan American, that the new service integrates well with the seasonal fluctuations of the airline's heavy summer traffic across the Atlantic. The Board also pointed out that operating economies will result from the fact PanAm is established at both New York and Nassau.

The CAB found that the other two major applicants—Eastern and National Airlines—were capable of handling the route but said the advantages of certificating Pan American dictate that choice.

Mackey Airlines, the fourth applicant, was turned down because the CAB said the Florida airline lacks facilities in New York and would have to operate with the competitive handicap of unpressurized DC-4 equipment.

Adams and Minetti disagree with the majority on the subsidy issue. They maintain that Pan American's case is the weakest of the four applicants because of the possibility the carrier will require subsidy for the new route.

The minority members favored Eastern for the route because, they said, it will suffer greatest because of the diversion of Nassau traffic now traveling through Miami.

Adams and Minetti dispute the cost estimates used in the majority's forecasts. Pan American, they said, will lose about $1,743,000 on the new route in its first year of operation with the schedules proposed by the airline.

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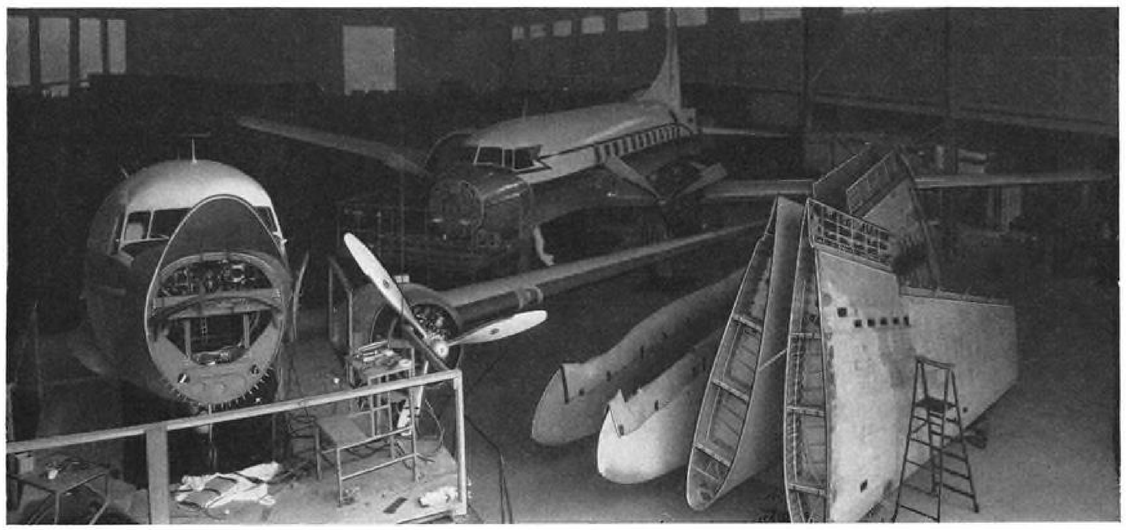

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SHORTLINES

► **Aerovias Ecuatorianas** is the first South American airline to buy the Fairchild F-27. The Ecuadorian carrier, which now operates a fleet of DC-3s, has ordered one F-27 and taken an option on another.

► **Airline Stewards and Stewardesses Assn.** is looking for a "Miss Spirit of St. Louis" to help commemorate the 30th anniversary of Charles Lindbergh's flight across the Atlantic. A stewardess from each U.S. airline will be chosen before the final selection, which will be made in time for the premiere of the motion picture "The Spirit of St. Louis" in May.

► **Allegheny Airlines** has purchased its sixth Martin 2-0-2 and taken options on two more. The carrier will take delivery on the first Martin this month; the second in early spring, and the third at a yet undetermined date.

► **Braniff Airways'** shareholders have approved the board of directors' plan to issue up to $40 million worth of equipment mortgage sinking fund bonds. The long-term bonds will be sold as funds are needed up to April 29, 1961, to an insurance company group including Mutual Life Insurance Co. of New York, the Equitable Life Assurance Society of the United States, The Prudential Insurance Co. of America, New England Mutual Life Insurance Co., The Northwestern Mutual Life Insurance Co., Connecticut General Life Insurance Co. and The Connecticut Mutual Life Insurance Co.

► **Capital Airlines** now has an all-Viscount operation at New York, with 40 turboprop flights a day scheduled out of Idlewild, LaGuardia and Newark Airports.

► **International Air Transport Assn.** Clearing House handled interline transactions worth $354,456,000 during the first nine months of 1956, a 32% increase over the volume for the same period of 1955.

► **Japan Air Lines** carried more than 29,000 passengers and 630 tons of freight last year, increases of 40% and 87% respectively over traffic in 1955. System passenger load factor for 1956 was 64.9%

► **Northwest Airlines** reports operating revenues of $76,988,000 and a net profit of $3,222,000 for the past year as compared with revenues of $71,248,000 and net profit of $2,116,000 for the previous year.

AIRLINE OBSERVER

► Northeast Airlines has leased an 88-passenger DC-6A from Flying Tiger Line and will begin day and night coach service on Jan. 9 over its newly acquired New England-Florida run. A single day coach round-trip flight will be operated every day except Wednesday between New York (LaGuardia) and Miami with this airplane. The DC-6A also will be used on one night coach flight from Miami to New York on Tuesdays only and on a night coach flight on Thursdays only from LaGuardia Airport to the Florida point.

► **British Airlines are facing a severe pilot and navigator shortage and are conducting an extensive recruiting campaign to combat the problem. High cost of flight training is given as the primary reason behind the dwindling ranks of flight crew prospects.**

► Market study presented by B. E. Foster of Frontier Airlines at a recent Air Transport Assn. Purchasing Committee meeting forecast a stable market of raw materials until the second quarter of 1957 when labor-management negotiations in heavy industry will be reopened. Aluminum supply is considered adequate but imports of brass, copper and lead are unstable because of the unsettled international situation. Steel prices are edging up and price advances 5 to 10% on stainless steel and nickel were forecast in the study by Foster.

► **Riddle Airlines handled more than 40 million lb. of cargo in 1956, an increase of 50% over the previous year. The carrier expects to carry more than 60 million lb. this year.**

► Caravelle jet transport may undergo cockpit modifications directed primarily toward positioning controls to conform with Society of Automotive Engineers standards. The modification is being studied by Sud-Est with an eye toward U.S. sales and will not affect 12 Caravelles on order by Air France.

► **Regulation allowing the exchange of air transportation for advertising goods and services by local service airlines has been extended an additional year to Dec. 31, 1957, by the Civil Aeronautics Board. The Board also approved a request by the carriers that the ceiling on values of the trade agreements be increased from $50,000 to $100,000 annually for each local service airline. CAB refused to grant a request that the program be extended for two years on the grounds that the trade agreements are still in an experimental stage.**

► Canadian Pacific Airlines has applied to the Canadian government for an extension of its Mexico City-Toronto routes to Lisbon via Montreal. Part of the carrier's argument in the case is the growing need for greater Canadian participation in the transatlantic market. CPA does not now serve Montreal, and no carrier offers Montreal-Lisbon service direct.

► **United Air Lines set a new company record for mail ton-miles carried in a single day on Dec. 19 when 194,645 mail ton-miles were handled, a 9% increase over the previous record established Dec. 20, 1955.**

► Eastern Air Lines has been authorized by the Civil Aeronautics Board to lease seven DC-3s from Remmert-Werner, Inc., of St. Louis, at $3,500 per aircraft per month. Three of the aircraft will be leased until May 15, 1957, and four until June 15, 1957, with an option to lease a maximum of five until June 1, 1958.

► **A Peruvian airline has been formed in Lima with plans to operate a scheduled service between Miami and Lima. The airline owns two Curtis C-46s, holds an option on a third.**

► Lockheed Air Terminal, Inc., will make a financial study for the proposed $12 million Honolulu International Airport Terminal. Study will include recommendations to the Hawaii Aeronautics Commission for regulation of jet traffic, establishment of rate structures and charges, development of non-aviation revenue-producing activities in the terminal.

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SPECIFICATIONS

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Type No.	Rating KVA	Rated Cooling Air Pressure in "H_2O"	Rated Cooling Air lb./min.	Diam. in.	Speed RPM	Approx. Weight lbs.	Flange and Drive Spline
*28E16-1	20	4	11	8.25	5700-6300	60	AND 10266 XVI-A
*28B23-1	20	4	11	8.25	4800-7200	65	AND 10262 XII-A
*28E17-1	30	8	14	8.25	5700-6300	69	AND 10266 XVI-A
*28E14-1	40	5	14.5	9.25	5700-6300	83	AND 10266 XVI-A
*28E15-1	60	6	16	9.25	5700-6300	103	AND 10266 XVI-A
28E19-1	10	4	7	6.5	7600-8400	30	AND 10262 XII-A
28E19-3	10	4	7	6.5	7600-8400	31	New 9" Flange
28E20-1	20	6	8.5	6.5	7600-8400	45	AND 10262 XII-A
28E20-3	20	6	8.5	6.5	7600-8400	46	New 9" Flange
28E21-1	30	10	12.4	6.5	7600-8400	60	AND 10262 XII-A
28E21-3	30	10	12.4	6.5	7600-8400	61	New 9" Flange
**28E10-1	9	6	8.6	6.5	7600-8400	39	AND 10262 XII-A

*These generators include integral fan permitting full load continuously up to 80°C at sea level with no additional cooling.

**This generator incorporates a DC output of 30 volts, 50 amps capacity in addition to the AC output.

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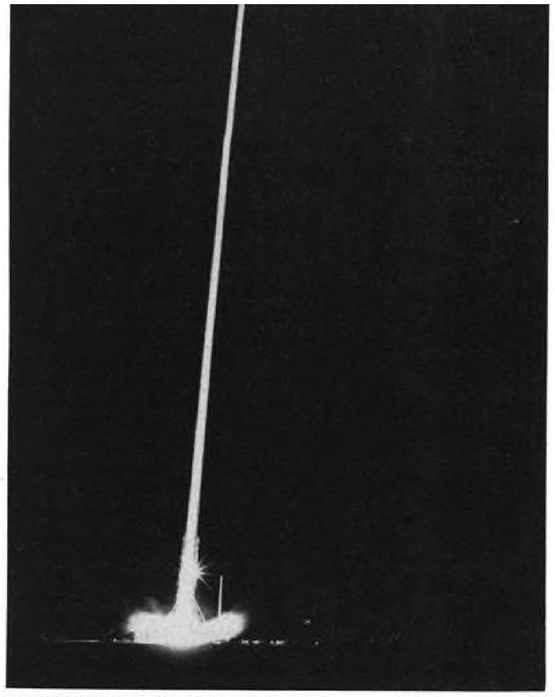
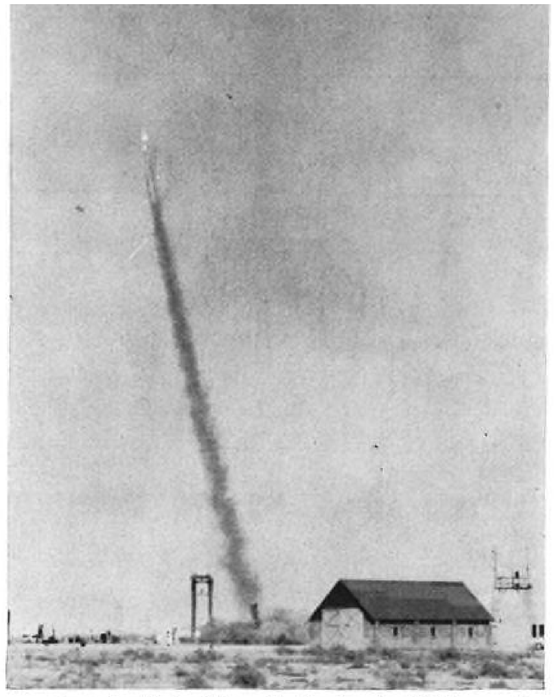
Airline Income & Expenses — October 1956

	Passenger Revenue	Mail Revenue	Express Revenue	Freight Revenue	Subsidy	Total Operating Income	Total Operating Expenses	Net Operating Income (before taxes)
DOMESTIC TRUNK								
American	$23,508,801	$600,837	$336,283	$1,606,387	.....	$26,481,512	$22,999,727	$3,481,785
Braniff	3,742,872	106,425	52,511	107,261	.....	4,139,234	3,674,723	464,510
Capital	6,466,116	125,037	88,673	120,775	.....	6,899,661	6,226,120	673,541
Continental	1,536,267	38,650	11,117	43,032	.....	1,673,333	1,514,561	158,771
Delta	5,293,026	124,122	117,466	180,909	.....	5,851,188	5,403,603	447,585
Eastern	15,168,647	276,345	206,089	291,628	.....	16,308,471	15,813,290	495,181
National	3,084,877	76,953	20,506	111,520	.....	3,566,612	3,212,823	353,789
Northeast*	.....	.....	.....	.....	.....	.....	.....	.....
Northwest	3,954,814	132,228	95,290	207,730	.....	4,474,134	4,149,776	324,357
Trans World	14,596,614	356,015	346,218	530,342	.....	16,163,660	15,544,017	619,643
United	19,889,085	752,134	399,641	1,144,312	.....	22,347,092	19,794,935	2,552,157
Western	2,977,977	92,551	30,023	55,667	.....	3,215,245	2,744,636	470,608
INTERNATIONAL								
American	409,569	10,615	223	71,372	.....	510,230	491,819	18,411
Braniff	418,187	117,592	.....	28,910	.....	601,156	541,941	59,214
Caribbean Atlantic	89,928	1,701	.....	4,412	.....	101,927	104,113	−2,186
Delta	380,686	5,650	.....	14,845	.....	418,194	373,749	44,445
Eastern	1,163,333	23,936	.....	22,243	.....	1,234,773	1,027,292	207,481
National	209,730	3,176	1,878	8,717	.....	229,667	300,300	−70,633
Northwest	1,338,832	506,042	54,695	286,436	.....	2,335,969	2,101,650	234,318
Pan American								
Alaska	336,000	18,000	.....	69,000	.....	451,000	693,000	−242,000
Atlantic	8,392,000	729,000	.....	836,000	.....	10,838,000	9,628,000	1,210,000
Pacific	4,544,000	583,000	.....	589,000	.....	6,420,000	5,533,000	887,000
Latin American	4,644,000	262,000	.....	977,000	.....	6,992,000	7,347,000	−355,000
Panagra	1,207,946	91,183	.....	138,351	.....	1,686,847	1,582,702	104,144
Trans World	4,308,715	550,550	.....	389,115	.....	5,764,467	5,923,720	−159,253
United	951,293	26,543	.....	13,772	.....	1,007,844	929,947	77,897
LOCAL SERVICE								
Allegheny	430,329	7,129	13,316	6,173	426,586	894,227	604,493	289,734
Bonanza	150,562	3,541	1,738	1,304	96,250	268,365	256,879	11,486
Central	122,006	3,698	1,084	3,240	165,425	300,856	287,709	13,147
Frontier	267,836	220,942	2,583	20,871	.....	537,939	521,901	16,037
Lake Central	136,092	3,191	8,152	.....	99,278	259,384	257,106	2,278
Mohawk	484,447	5,328	5,586	9,044	52,084	595,638	574,196	21,442
North Central	603,841	17,990	13,071	.....	78,383	739,494	726,156	13,338
Ozark	335,601	283,923	5,603	9,170	.....	646,402	543,882	102,520
Piedmont	420,705	8,641	7,944	6,592	157,146	638,539	68,775	−42,236
Southern	178,863	7,710	4,961	.....	154,368	367,938	361,975	5,962
Southwest*	.....	.....	.....	.....	.....	.....	.....	.....
Trans Texas	290,400	10,306	4,727	12,869	182,100	514,556	536,213	−21,656
West Coast	193,991	3,466	1,242	2,983	144,764	346,610	328,595	18,015
HAWAIIAN								
Hawaiian	307,813	3,210	.....	60,594	.....	379,638	408,574	−28,936
Trans Pacific	149,970	892	.....	8,091	4,194	167,182	188,088	−20,905
CARGO LINES								
Aerovias Sud Americana*	.....	.....	.....	.....	.....	.....	.....	.....
Flying Tiger	277,137	.....	.....	855,394	.....	998,094	1,223,550	−225,456
Slick*	.....	.....	.....	.....	.....	.....	.....	.....
Riddle*	.....	.....	.....	.....	.....	.....	.....	.....
Seaboard & Western*	.....	.....	.....	.....	.....	.....	.....	.....
HELICOPTER								
New York Airways	37,746	3,421	2,355	3,340	108,736	159,970	216,631	−56,661
Los Angeles Airways	13,423	8,575	8,069	.....	60,378	90,736	95,744	−5,007
Chicago Helicopter Airways*	.....	.....	.....	.....	.....	.....	.....	.....
ALASKAN								
Alaska Airlines	152,355	45,136	1,152	63,728	95,536	493,306	531,815	−38,509
Alaska Coast	33,500	9,610	5,575	.....	27,850	83,070	87,109	−4,039
Cordova	14,101	24,685	.....	8,298	.....	122,926	119,544	3,382
Ellis Air Lines	38,029	5,207	.....	5,034	21,457	80,722	71,734	8,988
Northern Consolidated	81,171	26,055	320	47,316	375,575	323,146	331,487	−8,340
Pacific Northern	382,855	214,320	.....	72,182	.....	690,341	720,126	−29,785
Reeve Aleutian	33,979	18,199	.....	9,149	.....	85,581	78,034	7,546
Wien Alaska	85,345	41,140	.....	29,813	35,723	438,019	439,848	−1,828

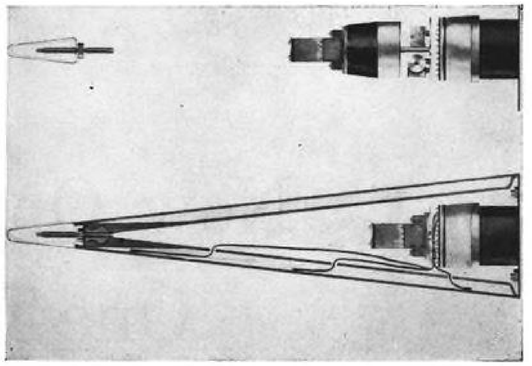
*Not available.
Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board.





HYPERSONIC TEST VEHICLE trajectory, marked by smoke (right), curves toward vertical milliseconds after launch at Holloman Air Force Base, N. M. Time exposure of night firing (left) shows no such deviation. Vehicle has reached 5,000 mph. at 50,000 ft. altitude.

FINAL PREPARATIONS are made for HTV launching at Holloman. Rifled and straight rail launchers are used. Canted fins supplement rifling.



NOSE CONE section shows installation of miniature tape recorder. Unit is secured to forward bulkhead and weighs 2 lb. Shock resistant steel case weighs 3 lb.

Hypersonic Test Vehicle Moves Toward 6,800 mph. Design Goal

By Irving Stone

Los Angeles—Originally projected for speeds of about 10,000 fps. (6,800 mph.), the hypersonic test vehicle (HTV) developed by Aerophysics Development Corp., already has reached the 5,000-mph. mark at altitudes in the region of 50,000 ft.

Aerophysics, a subsidiary of Curtiss-Wright Corp., developed the HTV in conjunction with Air Research and Development Command's Wright Air Development Center (AW Sept. 17, p. 34).

Cost and Description

Twenty-eight of these hypersonic research rockets have been fired at Holloman Air Development Center, N. M., since the first firing in November, 1954. Cost of the HTV ranges between $10,000 and $15,000.

Basically a two-stage assembly of solid-propellant rocket motors and a nose payload section, the unit weighs approximately 231 lb., is 12 ft. 10 in. long. Booster stage has seven rocket motors and three fins, the second stage four rockets and four fins.

By grouping different numbers of rocket motors in clusters and by arranging these clusters in stages, a highly flexible family of flight-test vehicles can be achieved. Special-purpose vehicles can be constructed very close to an assembly line basis, Aerophysics reports.

New information on the HTV reveals the unit's applications, makeup, and recovery techniques. Some of these details were outlined recently by David Shonerd, Aerophysics' project engineer, before the Southern California Section of the American Rocket Society.

HTV Applications

Initial application of the HTV has been as a research tool. Areas in the field of hypersonic research which can be probed with the HTV include:

- **Effect of Reynolds** number on heat transfer coefficient, with particular emphasis on determination of transition from laminar to turbulent flow. Special instrumentation such as audio pick-ups appear possible for this application, Aerophysics says.
- **Relation of surface** roughness, pressure gradient (nose shape), dissociation, and skin-freestream temperature ratio to heat transfer coefficient.
- **Studies of hypersonic** boundary layers, including investigation of shock and boundary layer intersections and their effect on transition from laminar to turbulent flow.
- **Upper atmosphere** studies. Instrumented payloads may be ejected at high altitudes and parachuted to ground. Example of this type of research, Aerophysics reports, is the investigation of the visibility of artificial meteorites produced by firing shaped charges in the nose of the HTV.
- **High temperature** materials investigation. Heating rates which can be attained are higher than those experienced in rocket nozzles, Aerophysics says, and dynamic pressures exceeding 50,000 lb./sq. ft. may be achieved in flight. Many types of materials can be studied in a single flight of the vehicle.

Developmental Uses

As a developmental test device, the HTV could be used to test:

- **Special high velocity** parachutes or other drag devices.
- **Transmission properties** of various antennas under hypersonic conditions.
- **Tracking aids** such as flares, smoke generators, or spotting charges.

In addition, the HTV could serve as a radar target in the tracking of high speed objects. Corner reflectors or chaff could be ejected at extremely high altitudes for testing radar detection equipment.

Nose cone of the HTV is made of a Fibreglas inner shell and pure nickel outer shell, with a ¼-in. layer of Refrasil batting between the two for insulation. Maximum diameter of the nose is limited to approximately 7 in. To allow for various skin temperatures, the outer shell can be varied in thickness from its .020 dimension. It is attached at its forward end to the inner shell and is free to expand axially and radially at its aft end. Thermocouple wires are spotwelded to the inside of the metal outer shell and conducted through the Fibreglas inner shell to the recording equipment located in the base of the nose cone.

Aerophysics is conducting design studies on various nose cone configurations including those fabricated from thick-wall glass cloth laminates and matting and from high conductivity materials. Under construction are lightweight nose cones incorporating flotation features to facilitate water recovery.

Time Intervals

Inflight data are obtained on a small magnetic tape recorder carried in the HTV's nose. Secured to the forward bulkhead, the unit records from eight channels. It weighs only 2 lb., and is contained in a shock-resistant steel case weighing 3 lb. A radioactive beacon is secured to the base of the steel case and will accompany the recorder if it breaks away from the main body of the vehicle. The radioactive source is detected after the flight by scintillometer carried in search aircraft, jeeps or boats.

A time base oscillator is normally an integral part of the recording system and makes exclusive use of one of the eight channels. Time intervals as small as one millisecond are easily resolved, and accumulated time may be read with an accuracy of 0.1%.

If more channels are required, any or all of the remaining seven channels may be shared by means of a commutating switch which can be driven by the same motor or the tape transport. In this way, Aerophysics reports, it is technically feasible to serve as many as 35 information sources with a sampling rate of ten times each per record. It is also possible to obtain a larger recording unit consisting simply of two standard eight-channel units placed mechanically in series. In this way 14 channels of continuous flight data and two time base channels may be accommodated.

Mechanical drive for the tape transport system is a small permanent magnet type d.c. motor. This is coupled to the tape transport system by a three-stage rubber belt and pulley reduction system. Functional reliability of the tape transport and the mechanism of the whole has been determined under axial accelerations of 600Gs and at angular velocities of 200 rad./sec.

Sufficient recorder power for an eight-minute flight is supplied by a six-ounce silver-zinc type battery pack consisting of eight standard units. Tests indicate that these cells are practically noise-free under environmental flight loads.

Aluminum connector plates are used to attach the instrumented nose cone to the HTV's second stage and to join the second stage to the first stage.

Motor Bonding

Rocket motors are bonded together with high strength epoxy resins, and fins are bonded to the motor cases.

First stage fins are constructed of phenolic resin-impregnated .045-in. glass cloth laminate stabilized with a plastic foam core material.

Area of each of the second stage fins is about half that of the area of each first stage fin. Triangular load-carrying framework of each second stage fin consists of a molded glass cloth laminate leading edge, aluminum spar trailing edge, and cylindrical aluminum base bonded to the rocket motor shell. Bonded to this framework are flat skins of glass cloth laminates molded under high pressure. Space within the fin is filled with perforated balsa wood. The thick-wedge shape used for the second stage fins can be used to house components, as small cameras, flares, beacons, and antennas.

After the data-gathering portion of the flight, second stage fins are blown off to destabilize the vehicle, which then falls relatively slowly because of its high drag-to-weight effect. Impact speed is thus kept to approximately 70 mph. enabling the tape to be recovered

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1 TORQ-SET by American now enables you to do every fastening job with just *one* recess design. TORQ-SET's exclusive recess will adapt itself to all head configurations in an unlimited range of sizes.

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3 TORQ-SET permits simple one-piece tooling, that adjusts easily to any type wrenching unit, allows "close-to-head" operation on every fastening job.

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5 TORQ-SET can be power-driven tighter than any other fastener in every fastening job. This is made possible by the unique wrenching recess with driving walls that form a direct axis for driving. And TORQ-SET is supplied in high-strength alloy steels (including the newer heat-resistant types) and is designed to permit extremely high wrenchability without burring or distortion.

Find out how TORQ-SET can help solve your production problems. Write, wire or phone, American Screw Co., Willimantic, Conn.

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and the magnetic recorder to be salvaged in reusable condition most of the time.

The launcher is designed to facilitate transportation, and is easily adaptable for permanent installation or for shipboard use. The vehicle is slid onto the launching rails while the launcher is in a horizontal position. The launcher is then elevated to the angle desired for firing.

Both rifled and straight-rail launchers have been used successfully in HTV flight tests. For very high altitude tests in which low dispersions are required, the rifled launcher is desirable. The rifling provides an initial spin rate of a few revolutions per second to reduce dispersion caused by thrust or fin misalignment. The fins are canted to maintain spin throughout the vehicle's boost period. For specific applications where missile spin is not desirable or in which short trajectories are expected, straight launching rails can be used.

Lockheed Acquires Missile Test Site

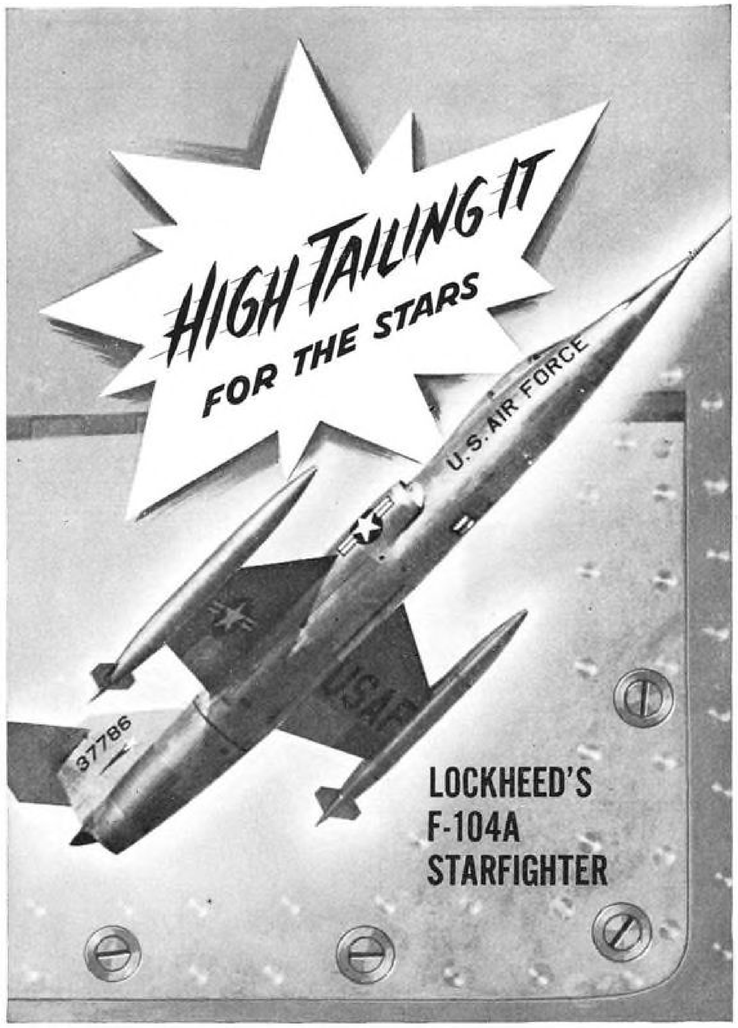
Sunnyvale, Calif.—Development testing and research on new and advanced missile systems and components will be carried out by Lockheed Missile Systems division at a new 4000-acre Santa Cruz mountain site.

The facility will be used to evaluate fuel and engine operation of advanced missiles and for the development and static testing of control and sub-system elements to be used with new liquid and solid propelled rocket engines. Also to be evaluated are electronic and chemical experiments and instrumentation.

The site, now being acquired, is in a remote Redwood-forested section on the coastal side of the mountain about 15 mi. from Santa Cruz, Calif. It was carefully chosen so that hazardous and noisy activities would not annoy population centers, according to L. Eugene Root, Lockheed vice president and Missile Division general manager.

The division already has invested $19 million in facilities in northern California and anticipates an investment of about $30 million by the end of 1957. Facilities already built and underway at the division's Palo Alto and Sunnyvale sites have a total of more than 500,000 sq. ft. of floor space. This includes 168,000 sq. ft. of research laboratory space in Stanford university's industrial park, and 346,000 sq. ft. of administrative, engineering and manufacturing space at a Sunnyvale, Calif., site adjacent to Moffett Field.

The missile Division now has 1,000 scientists, engineers, technicians, and service and administrative employes at work in the Bay area and almost 4,000 at the Van Nuys, Calif., plant.



Unusual aerodynamic design of the F-104A Starfighter gives this slim, razor-winged streak of fighter power the greatest combination of speed and flying performance ever built into a combat airplane. The high tail is a significant contribution to precision control . . . just as Camloc's 4002 Series quarter-turn fasteners on the F-104A's access panels are a significant contribution to security in flight and speed of maintenance . . . Camloc quarter-turn fasteners open fast, close fast, hold fast!

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PUMP PRIMERS

High mechanical and volumetric efficiencies from GEROTOR aircraft pumps

The design of Gerotor pumps combines a number of valuable advantages to aircraft engineers, among which are exceptional mechanical and volumetric efficiencies.

The Gerotor is basically a form of internal gear pump. It has only two moving parts – an *inner* toothed element which meshes with an *outer* toothed element. The inner has one less tooth than the outer and this "missing tooth" provides a chamber to move fluid from the intake to discharge port. (See Figure 1).

Both Gerotor elements turn in the same direction –, and either one may be driven. The difference in number of teeth results in a slow relative rotation between the Gerotors as they turn, gradually opening the chamber as it passes the intake port, allowing fluid to enter, slowly closing as it passes the discharge port, forcing the liquid out. The fluid-tight engagement of the two elements, the resultant *continuous contact* of each inner Gerotor tooth with the outer, provide high suction, high pressure, and high volumetric efficiency.

The rate of change of the tooth chambers is at a maximum halfway across the ports; at a minimum at the instant of change-over from one port to the other and tapers smoothly in between. *Hence porting is not critical and there are no violent pressure changes.* This is particularly valuable at high altitudes where rapid pressure changes and excessive turbulence engenders foaming and lowered efficiency in other types of pumps.

With only two moving parts, with slow relative rotation between them, a single shaft and closely maintained clearances, mechanical efficiency remains high over a long service life.

***Technical data** – is available and your inquiry is invited. Write:*

FIG. 1

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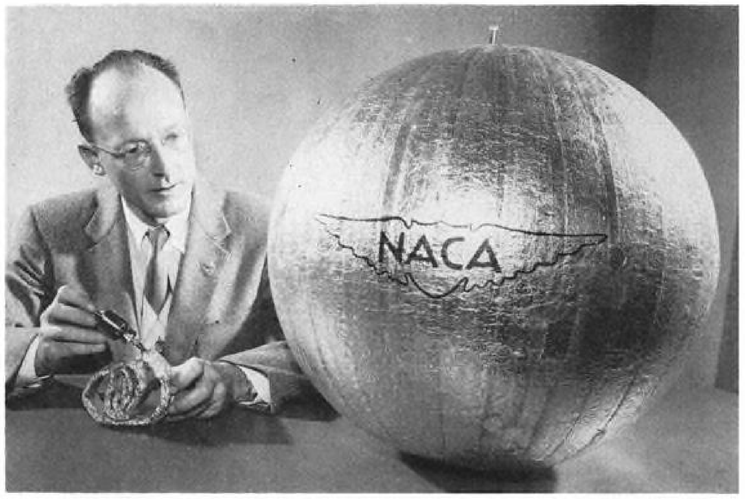

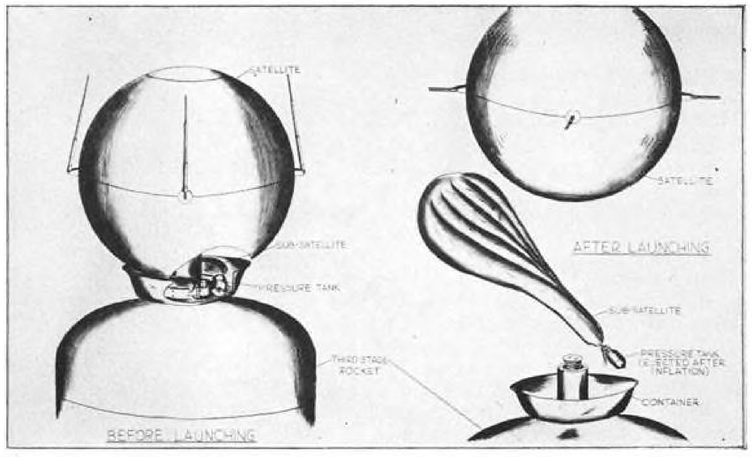

Proposed Plastic Sub-Satellites

Inflatable plastic sub-satellites have been proposed as a method of relieving the main satellites of part of their information gathering tasks during the International Geophysical Year (AW Dec. 24, p. 33). William J. O'Sullivan, Jr., aeronautical research scientist at the National Advisory Committee for Aeronautics Langley Aeronautical Laboratory (top), proposed the plan to the committee. He holds one of the collapsed aluminum-coated sub-satellites, and one is inflated to its 20-in. diameter at his left. How sub-satellites, which weigh less than a quarter pound, would be carried with main satellite and how they would be inflated automatically is shown below.

Cornell Plans Building Program

Cornell Aeronautical Laboratory will spend about $3,000,000 next year on expansion of its research facilities.

Ira G. Ross, Laboratory director, said that the major portion of the 1957 building program will be expansion of the laboratory's hypersonic and full-scale research facilities for aircraft and its vehicle-dynamics research for non-aircraft programs.

Looking toward the future, Ross said that Cornell is working on contracts involving the development of new and advanced weapons systems. He indicated that the new work is a logical result of the laboratory's successful completion in 1956 of the development of the Lacrosse guided missile.

Present yearly value of the laboratory's research work totals $13-$15 million, Ross said. Most of this work is performed for the armed forces, but Ross said that non-defense, industrial research work in 1956 exceeded $1 million for the first time.

Besides crash injury investigations, Cornell is using its flight test dynamics techniques in studying automobile han-

Mark of a New and Deadly Guided Missile

"Sidewinder" is the Navy's newest air-to-air guided missile. Flight tests have proved the missile to be as vicious as the desert rattlesnake for which it was named.

In brilliant performances against airborne targets at China Lake, "Sidewinder", Navy's new air-to-air guided missile, has captured the attention of the entire missile industry.

Simple in operation, small and light enough to be carried in quantity by single-seat Interceptors, "Sidewinder" can be fired singly or in salvos. It requires no complex launching system or special pilot training, and it maneuvers deftly at supersonic speeds. The missile displays extremely high single-shot accuracy —and even more important, *it can be launched well beyond reach of the target aircraft's defense.*

"Sidewinder" was developed by the Naval Ordnance Test Station of the Navy Bureau of Ordnance at China Lake, California. Philco assisted NOTS in the research and development program, and performed the subsequent engineering required for manufacture of the missile. "Sidewinder" is *now in full production at the Philco Government and Industrial Division.*

Philco is proud to have made this important contribution to the development of more effective electronic systems for our national defense.

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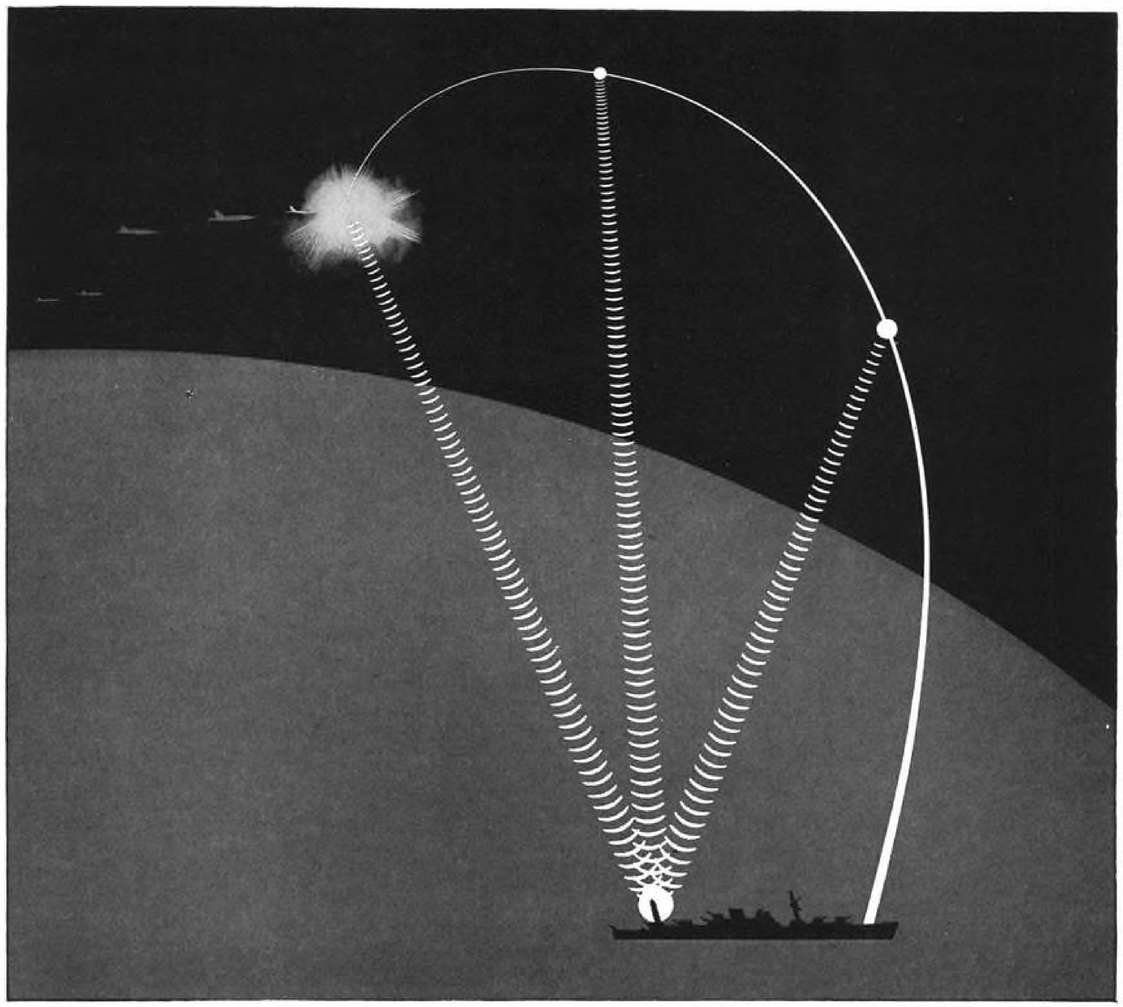

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• A supersonic missile, even though out of sight, is never "out of mind". The commander directing the attack must know how effectively the missile performed its mission of destruction. And intricate AMF feed-back equipment tells him—sending an automatic report-card from launching to final target "kill". • Keeping tabs on the flight of a missile is but one of the hundreds of complex tasks AMF performs every day. The highly specialized yet widely diversified activities of some 35 engineering and production facilities provide AMF with a wealth of experience that covers nearly every field of industry. And it is immediately available to you. • Call upon AMF with your problem. See for yourself why this all-around experience in answering the needs of government and industry alike has made AMF a "can do" company.

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dling characteristics for General Motors and using wind tunnels for studies of the Electra turboprop transport's propeller and nacelles for Lockheed Aircraft Corp.

Half the $7 million, three year facilities expansion program is being financed by Cornell's own funds from profits on research contracts. The balance is being supplied by the Air Force. The $3 million for next year will complete the program.

In 1956, $2 million was spent on major modifications of the Laboratory's large transonic wind tunnel. In 1955 a similar amount was spent in building construction.

The Laboratory now has 1,200 employes, expects an increase of 10% in the coming year. It is planned eventually to level off personnel somewhere between 1,500 and 2,000, Ross said.

Certificates of Necessity

Office of Defense Mobilization has awarded the Ladish Co. three certificates of necessity for accelerated tax amortization totaling $11,770,008 covering facilities for special forgings for military end items. Of the total amount, one certificate for $10,270,603 was allowed 70% of the rapid rate, and the other two were allowed 65% of the amount certified. Other certificates awarded:

Kearfott Co. Inc., Little Falls, N. J., military aircraft instruments, $3,200,000 certified with 40% allowed.

Varian Associates, Palo Alto, Calif., electronic equipment for the military services, $4,700,000 certified with 50% allowed.

The Glenn L. Martin Co., Baltimore, Md., military aircraft, $400,667 certified with 65% allowed.

Collins Radio Co., Dallas, Texas, military aircraft equipment, $40,341 certified with 65% allowed.

The Ryan Aeronautical Co., San Diego, Calif., research and development, $500,000 certified with 60% allowed; military aircraft parts, $200,000 certified with 60% allowed.

Kenyon Instrument Co. Inc., Huntington Station, N. Y., military aircraft parts, $10,197 certified with 70% allowed.

The Cornelius Co., Minneapolis, Minn., military aircraft parts, $26,876 certified with 70% allowed.

Kearfott Co., Inc., Little Falls, N. J., military aircraft instruments, $8,403 certified with 65% allowed.

Bendix Aviation Corp., Utica Div., Utica, N. Y., military aircraft parts test facility, $235,528 certified with 60% allowed.

Bendix Aviation Corp., Bendix Products Division, South Bend, Ind., military aircraft parts, $325,823 certified with 65% allowed.

Ex-Cell-O Corp., Elwood, Ind., military aircraft engine parts, $101,728 certified with 65% allowed.

Westinghouse Electric Corp., Pittsburgh, Pa., research and development, $4,130,000 certified with 40% allowed.

Simmonds Aerocessories, Inc., Vergennes, Vt., military aircraft parts, $100,000 certified with 45% allowed.

Goodyear Aircraft Corp., Litchfield Park, Ariz., military aircraft parts, $218,304 certified with 65% allowed.

Hughes Aircraft Co., Culver City, Calif., military electronic equipment, $708,075 certified with 65% allowed.

AMC Contracts

Wright-Patterson AFB, Ohio—Following is a list of unclassified contracts for $25,000 and over as released by the Air Materiel Command.

Radio Corp. of America, Los Angeles, Calif., $1,101,110 for components of AN/APN30A.

Western Electric Co., New York, N. Y., $1,050,260 for technical services.

Curtiss-Wright Corp., Electronics Division, Carlstadt, N. J., $1,007,753 for C-121 simulators.

Curtiss-Wright Corp., Wright Aeronautical Division, Woodridge, N. J., $1,910,000 for engineering for J65 engines.

Bendix Aviation Corp., Bendix Products Division, South Bend, Ind., $3,370,054 for wheel assemblies and brake.

Curtiss-Wright Corp., Electronics Division, Carlstadt, N. J., $1,032,526 for technical services.

Solar Aircraft Co., San Diego, Calif., $1,777,500 for gas turbine generator sets.

Douglas Aircraft Co., Tulsa, Okla., $5,800,000 for fabrication of modification sets.

Lockheed Aircraft Corp., Marietta, Ga., $6-million for fabrication of modification kits.

Four Wheel Drive Auto Co., Clintonville, Wis., $6,195,475 for multi-purpose truck.

General Motors Corp., Allison Division, Indianapolis, Ind., $20,202,750 for J71 turbojet engines.

Republic Aviation Corp., Farmingdale, Long Island, N. Y., $8,075,748 for instrumentation and flight testing.

Sperry Gyroscope Co., Division of Sperry Rand Corp., Great Neck, Long Island, N. Y., $6,471,402 for transmitter antenna indicator.

General Electric Co., West Lynn, Mass., $2,723,274 for aircraft engine combustion starters.

Cole Electric Co.

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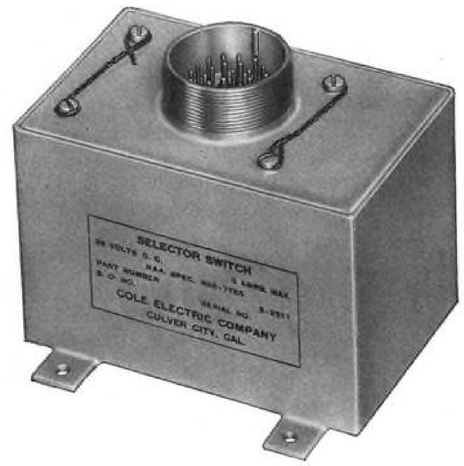

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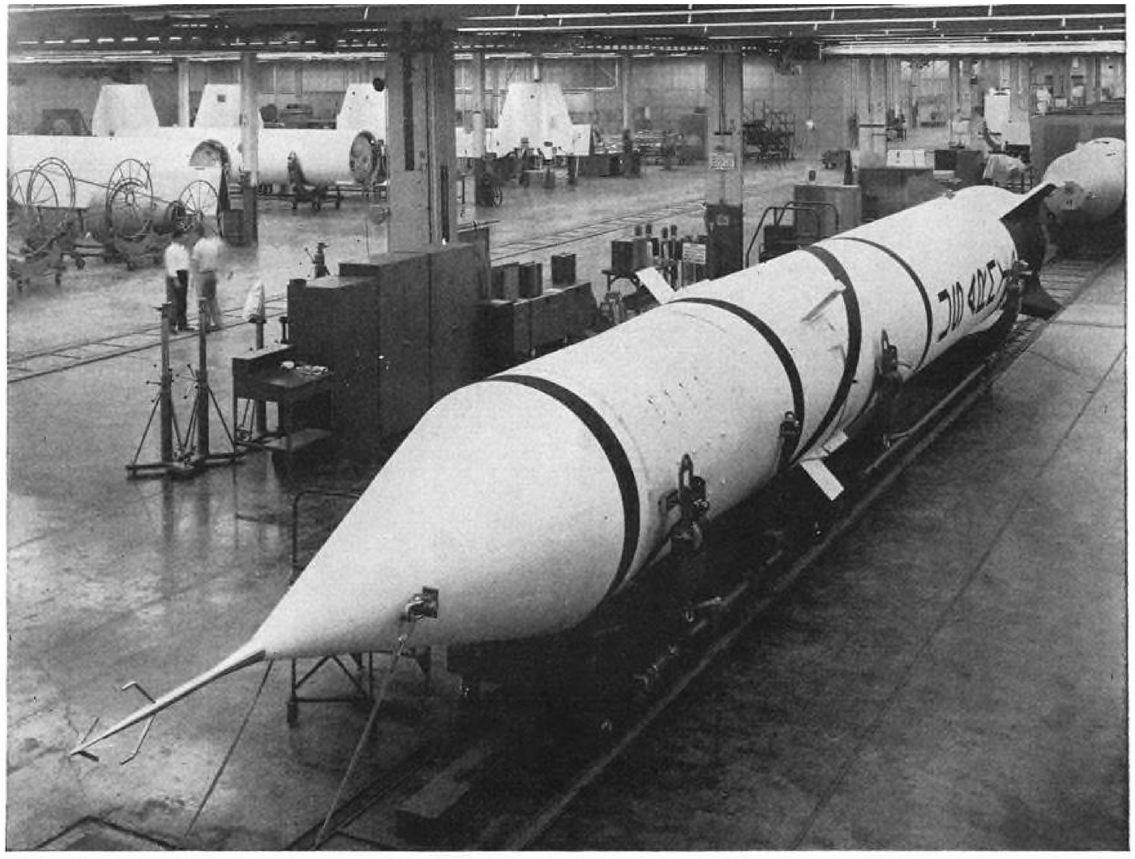
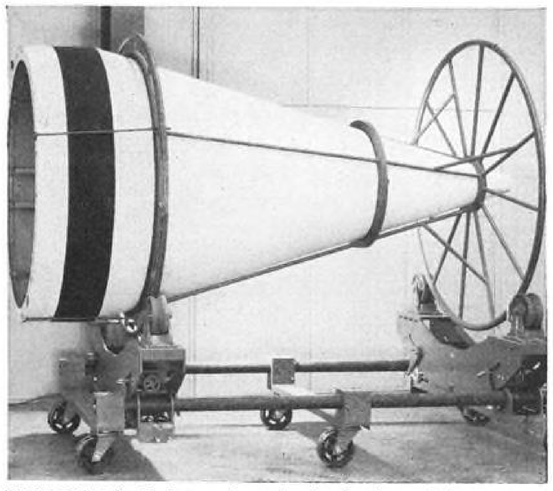
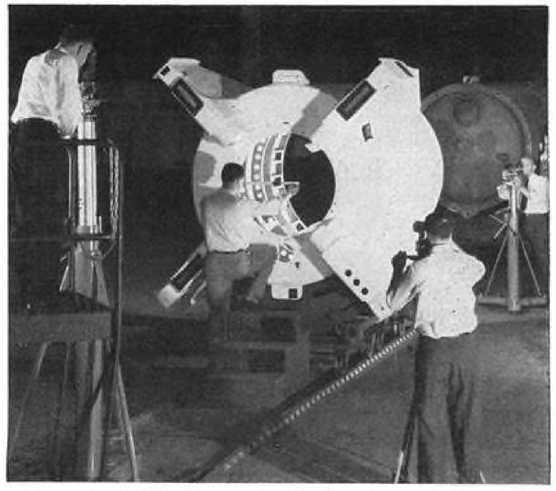


COMPLETED REDSTONE moves down Chrysler Corp.'s Detroit production line on portable rail tracks. Missile is 6 ft. in diameter, 69 ft. long. Four main sections are warhead; guidance and control; alcohol, liquid oxygen, hydrogen peroxide steam source tank; rocket motor.

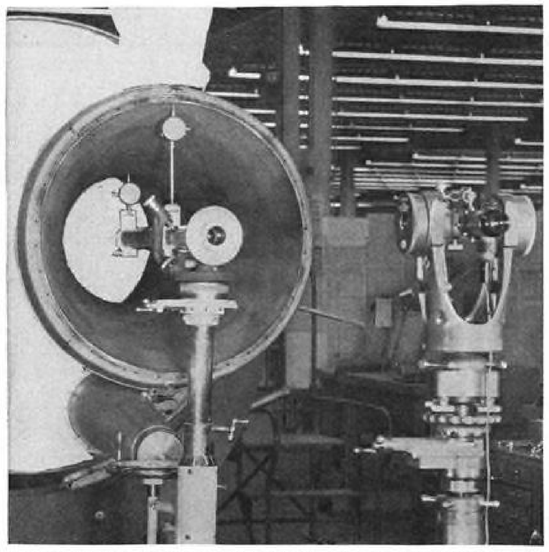
Redstone Assembly Melds Four Sections

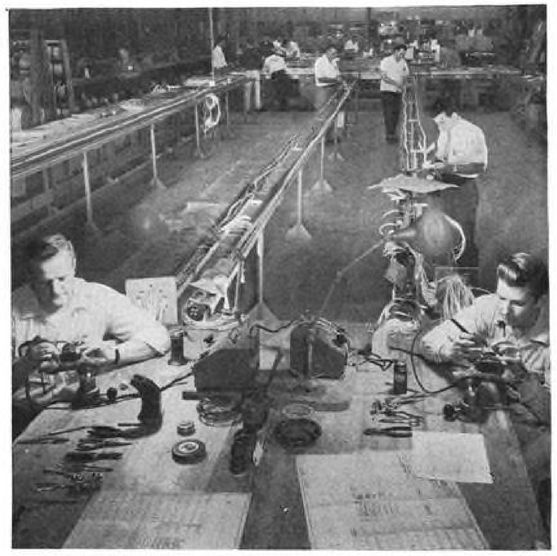


NOSE CONE for Redstone, in production for Army Ordnance, rests on special dolly. Chrysler has found it important to keep a parts pedigree check on all units as they go down assembly line in order to achieve final reliability for the one-shot ballistic missile.

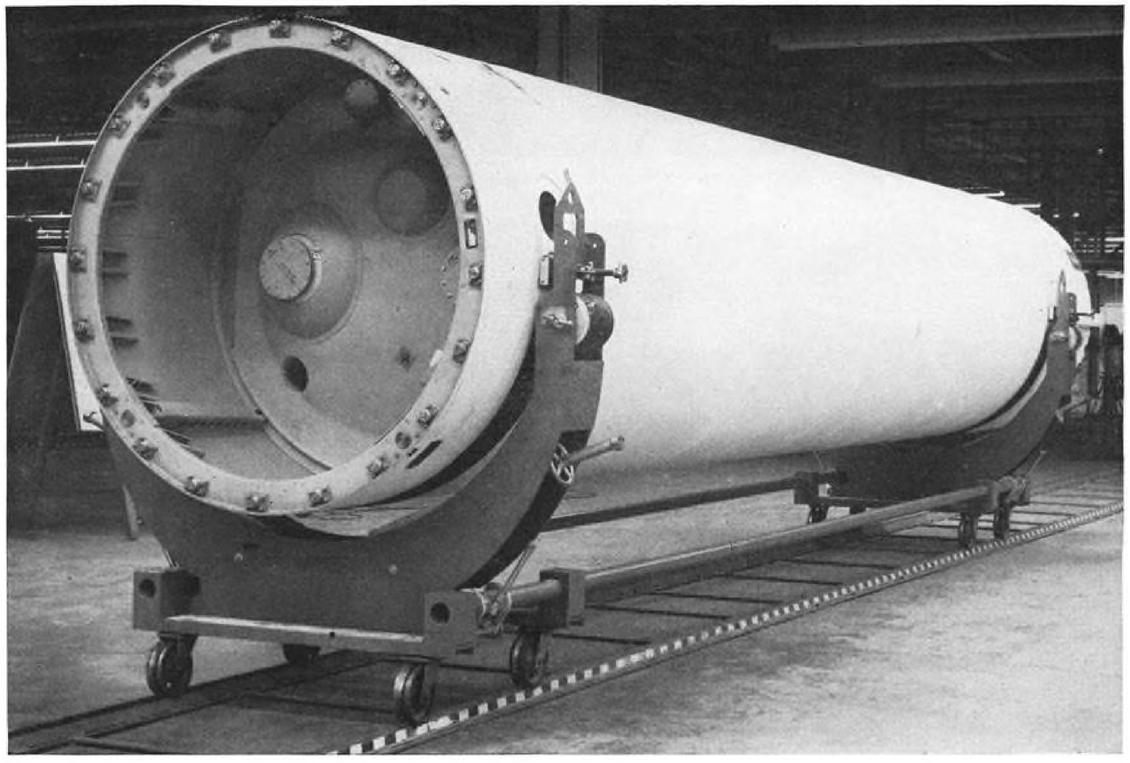


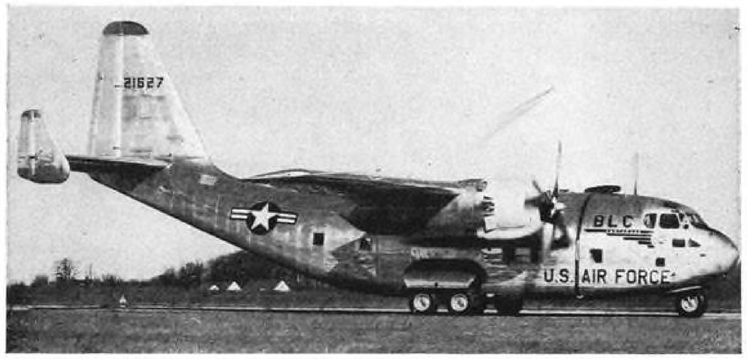
ROCKET ENGINE housing is optically aligned prior to being joined to tank section. The four radial protrusions around the exhaust nozzle aperture house the actuators for the graphite plates which help control the missile by deflecting the rocket exhaust.



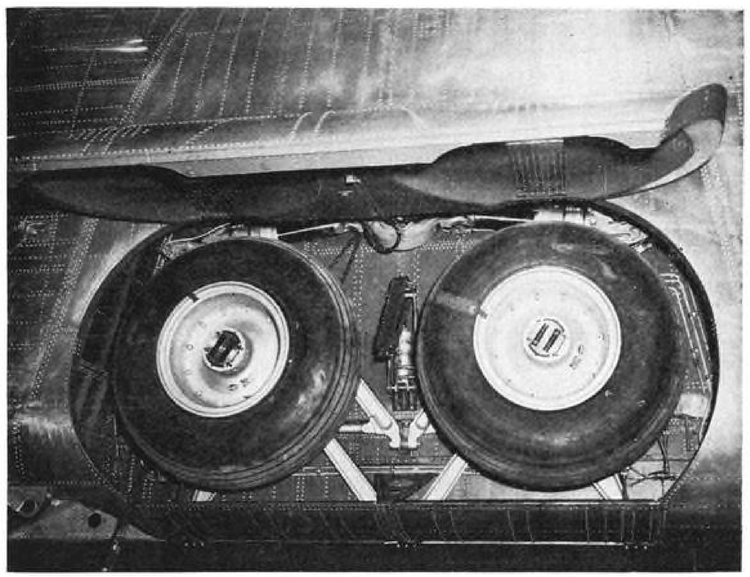


ROCKET NOZZLE (upper left) is aligned in a fixture before it is placed in housing. (Rocketdyne Division, North American Aviation, builds the rocket motor.) For the critical juncture of engine and fuselage, Chrysler first aligns the fixture containing the fuselage mounting locations so that the line of sight is perpendicular to, and intersects with, the center of the mounting face. After the engine is mounted in the fixture, a collimator is placed in the exhaust nozzle and adjusted so that it is on the line of sight. Dial indicators at the throat and exit locations are rotated to measure the run-out of the nozzle with respect to the line of sight. The mounting face ring on the fisture is then detached and used to drill the mounting holes in the fuselage. By making the pads on both the engine and the housing join at a plane which is perpendicular to the missile's center, complete interchangability is achieved. Length of cable assemblies is indicated in photograph at upper right. Tank section (below) is slung on two endless conveyor type belts mounted on dolly. Belts can be manually cranked to rotate the section for mating bolt holes.

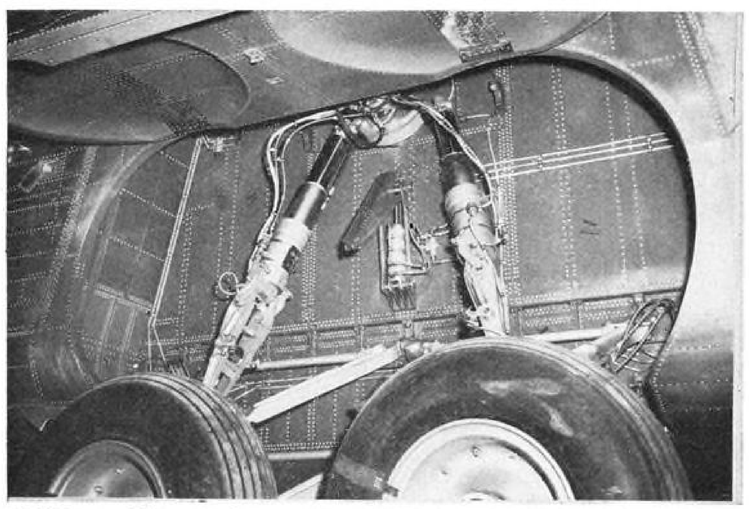




EXTRA vertical fins on YC-134 are needed for engine-out stability with bigger engines.



MAIN gear is retracted by actuating cylinders coaxial with shock cylinders in legs.



ROCKER arm joint to fuselage equalizes wheel loads by driving unloaded wheel down.

Question on

By Russell Hawkes

Trenton, N. J.—Control problems expected from the failure of one boundary layer control engine in the dual system for the YC-134 assault transport have caused Stroukoff Aircraft to turn to a single system for the YC-134A, scheduled to fly next spring.

Stroukoff engineers believe that asymmetrical lift and drag with BLC on only one wing demands too much reaction speed from the pilot in shutting down the good system. They also believe that control forces are too heavy in the period before the good system is completely stopped.

However, early fears that the airplane would be immediately uncontrollable have failed to materialize in tests at Wright Air Development Center using a BLC equipped C-123. Airplane inertia and the excellent control offered by the drooped ailerons give the pilot a brief interim in which to turn off the operating BLC air pump.

Dual System

The dual system on the YC-134 is powered by two 400 eshp. Continental-built Aspin 2 turbofans buried in transversal positions in the wings. Boundary layer is actuated over the full span of the trailing edge. Flow over the inboard flaps is actuated by suction and flow over the outboard flaps and ailerons is actuated by chordwise pressure jets.

Air for the systems is drawn through the flap gaps on the inboard flap sections. Inlets are louvers in the wing trailing edge and require a specially designed rear spar. Air and exhaust gases from the turbofans are carried outboard by large ducts and blasted over the outboard flap sections and the ailerons, which can be drooped 40 deg. to serve as flaperons.

Stroukoff studies indicate that ailerons cannot be drooped more than this and still provide good lateral control. Maximum deflection of the flap sections is 60 deg.

Flow rate at maximum power is about 600 cu. ft./sec. This figure is modulated to some extent by changes in inlet and outlet area when the deflection angle of the trailing edge surfaces is changed.

Turbofans have variable area inlets to provide an independent control of flow rate.

Heating downstream of the turbofan has not been much of a problem

Control Influences YC-134 Flow Change

because of the low proportion of exhaust products to bypassed air and because of the low compression ratio in the pressure ducts.

Surface and structure temperatures do not rise more than 150F above ambient.

To allow for this, a small part of the outboard trailing edge structure is made of stainless steel. Expansion joints are used in the skin of ailerons and outboard flap sections to keep stress levels down.

Single System

The single BLC system of the A model uses suction actuation of the boundary layer from tip to tip. In full-scale mock-up tests this has proved to be more efficient from the standpoint of the volume of air which must be moved to provide an equal increase in lift.

Both systems cut landing and takeoff runs by about 40% and approximately double the coefficient of lift, but the single system only handles about 150 cu. ft./sec. This has made it possible to take the ducts out of the wing and run them through the ailerons and flaps sections.

The surfaces are mounted on large diameter slip joints which let air pass from section to section. Upper leading edges of the movable surfaces have perforated or porous segments through which the system sucks air to pull flow down over the wing.

One of the advantages of ducting indrawn air through the movable surfaces is that internal fuel storage space is more than doubled. With ducts and engines in the wing the only internal space available for fuel is in the nacelle.

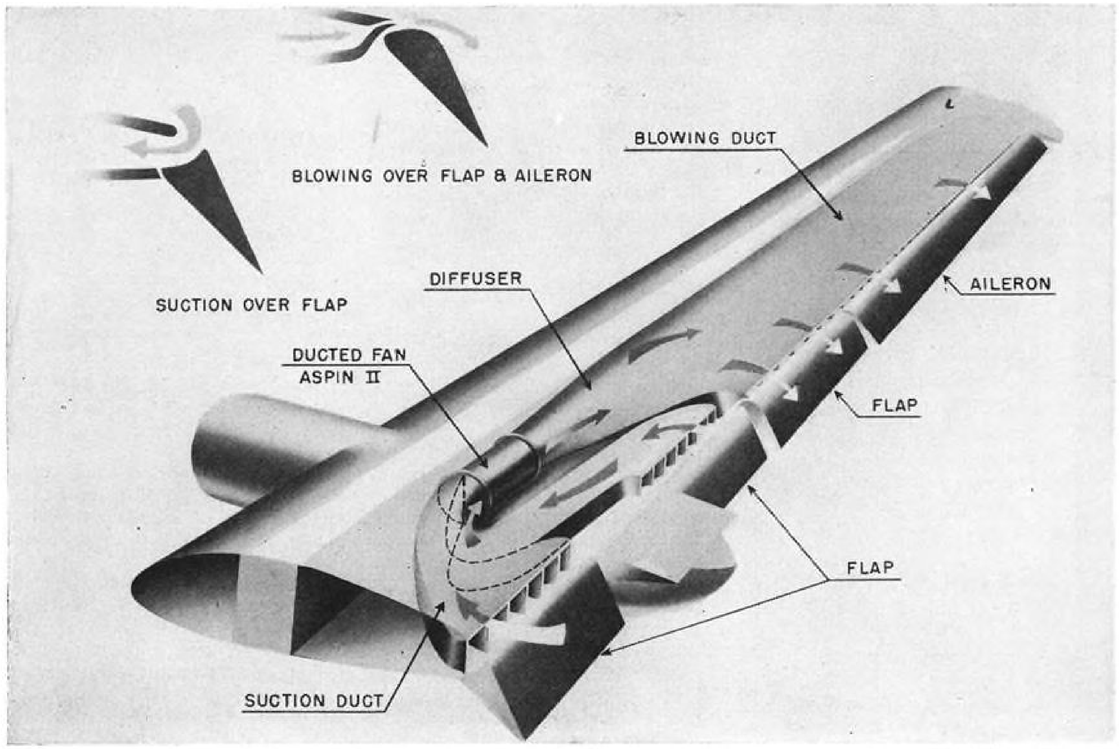
Power for the single system is a Westinghouse J30 turbojet mounted aft of the cabin and exhausting over the main cargo door. This arrangement is more expensive in terms of weight than the dual system but Stroukoff believes that the advantages of the single system more than offset this. Both dual and single systems draw fuel from the thrust engine tanks.

When the equipment is available Stroukoff hopes to replace the J30 with either one or two turbofans. These would cut the weight penalty exacted in designing the aft fuselage section to withstand the heat of turbojet exhaust. Two engines drawing air from both wings would increase reliability of the boundary layer control.

Stretched Version

Both the YC-134 and the YC-134A are stretched, Pantobase variations of the Stroukoff-designed, Fairchild-built C-123. Though its hull is engineered for water-based operations, the YC-134 version is intended for use only on land and snow. Its hull is not sealed and it has no tip floats. There is not enough propeller clearance either for sea operations. The thrust line of the A model is about 30 in. higher than that of the basic airplane.

Both models use Wright R3350



BOUNDARY layer of YC-134 is actuated by suction through gap of inboard flap sections and ejection of air and turbofan combustion products over outboard flap and drooped aileron. Heat of combustion and compression is slight, internal fuel space limited.

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turbo-compound engines. The main vertical fin, which is identical to that of the lower powered C-123, cannot cope with the greater asymmetry of thrust created by the failure of one of the bigger engines. This was corrected by adding small fins and rudders at the stabilizer tips.

The Pantobase assault transport concept demanded something new in the way of landing gear and both the skis and the wheels of the new Stroukoff airplanes incorporate innovations.

Landing Loads

The Pantobase skis intended to bear landing and take-off loads on snow and water use novel two stage shock absorbers. Ratio of pressure increment to stroke increment increases sharply in mid stroke. At that point a shoulder on the piston barrel picks up the cylinder packing gland and carries it along as an extra few square inches of piston face. Its effect is to stiffen the shock absorber in the last part of the stroke.

This is especially valuable with the narrow tread Pantobase landing gear, which does not provide much stability in a cross-wind. If one wing drops, the shock absorber on that side will be flexed more than the other and when the second stage is picked up it will tend to roll the airplane level.

The wheeled main landing gear for use on dry land has two tandem mounted wheels retracting into the fuselage on each side. Each wheel has a separate leg and shock absorber.

The problem of equalizing the load on fore and aft wheels in a tandem configuration is solved by joining the legs to the fuselage through a single rocker arm. As the load is increased on one wheel and leg, the rocker arm drives the other wheel down to pick up half the load. This prevents all the weight from shifting onto the front wheels when brakes are applied and keeps the braking effect on the rear wheels at a high level. It also loads wheels equally in high angle of attack assault landings.

Flexible Structure

Sidewise scrubbing of the tandem wheels in taxi turns does not seem to be a problem. The attaching structure intended to prevent lateral movement is flexible enough to allow the wheels to toe in and out and conform to the turning circle.

The YC-134 has been taxied through a 180 deg. turn well within the width of a runway. The nosewheel was swiveled 60 deg. The shock absorber cylinders and the retraction cylinders of the main landing gear are coaxial within the leg.

The nosewheel has the same diameter as the main wheels to increase its ability to ride over bumps. The compression load bearing leg of the nose wheel is hinged at the top to allow it to swing aft under longitudinal loads.

A solid tension member is hinged to the fuselage well forward of the axle. This hinge is the center of rotation for fore and aft and vertical movement of the wheel. Because of this design the nosewheel can ride over bumps higher than the axle.

YC-134 Specifications

WING:

Total wing area ..... 1,235 sq. ft.
Wing span ..... 112 ft.
Height ..... 34 ft. 8.5 in.
Length ..... 82 ft. 5 in.

POWER PLANT:

Two Wright...R3350 turbo-compound
Power—normal rated . . . 2,600 hp. at sea level
Power—take off....3,500 hp. at sea level
Propeller—two four-bladed Aeroproducts.

WEIGHT:

Gross ..... 66,600 lb.
Payload ..... 25,000 lb.
Weight empty ..... 41,600 lb.

MISCELLANEOUS:

Wheel tread ..... 190.10 in.
Wheelbase ..... 320.00 in.

Low Level Supersonic Gust Effects Tested

First phase of Project Sniff, a study of gust effects on low flying supersonic aircraft, has been completed by Northrop Aircraft Corp. under a USAF contract for a two-phase flight test program.

Objectives of the project are to:

- **Estimate gust load** factors for design of supersonic close support aircraft.
- **Determine intensity** and frequency of gusts in various terrain and weather conditions.
- **Record psychological** and physiological effects of gusts on test crews.
- **Obtain data** to be used in design of a terrain clearance indicator for jet aircraft.

Hundreds of hours of data reduction remain to be done before first phase results will be understandable. The data were observed in over 50 low level flights near Edwards AFB. Average flight duration was 14 min. In each flight more than 18,000 data readings were taken. The 230 hr. of test flights remaining in Phase 2 will be planned on the basis of Phase 1 results. Study ap-

صفة بيضة تخرج وتحرق

er-Rammah's self-moving egg

Join two flat pans; fill with an incendiary mixture; add a tail; propel by two large rockets. In A.D. 1280, Arabia's Hassan er-Rammah, gazing centuries ahead, proposed this ovoid in his "The Book of Fighting on Horseback and with War Engines."

Today, rocket-powered ordnance is foremost in American defense...and Aerojet-General Corporation is foremost in rocket power. Aerojet's solid-propellant rockets are used on the Sparrow and Regulus and on the newest, most advanced American missiles.

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We invite you—the engineer, the scientist—to participate at Aerojet in the creation of tomorrow's realities from yesterday's dreams.

Here is the ideal protection for wiring assemblies requiring a high degree of environmental resistance without the use of metal conduit.

Scinseal, originated and developed by the Scintilla Division of Bendix*, is a multi-purpose thermo-plastic material designed to protect and seal vital wiring assemblies from every operational hazard.

By the combination of plasticizers, stabilizers, pigments and fillers, Scinseal has been formulated to meet the requirements of many adverse conditions.

For example, one usage may require low-temperature flexibility, while another is concerned primarily with a high temperature condition, and still other applications may present fuel and acid problems—or perhaps a combination of all of these characteristics is the desired result.

That is why Scinseal is virtually a miracle material, for it can be "tailored" to meet a wide range of requirements, and at the same time, minimize the weight of the finished product.

Scinseal can be provided in a variety of solid colors, and can be hot stamped to provide positive identification. Many electrical connector adapter molds are available, as well as the T's, Y's and variable molds necessary to provide reliable assemblies of any configuration.

Detailed information and data on Scinseal available on request.

*TRADEMARK

Can be tailored to meet individual needs and purposes

Scinseal is used in such specialized fields as underwater devices, ground radar equipment, missile control wiring.

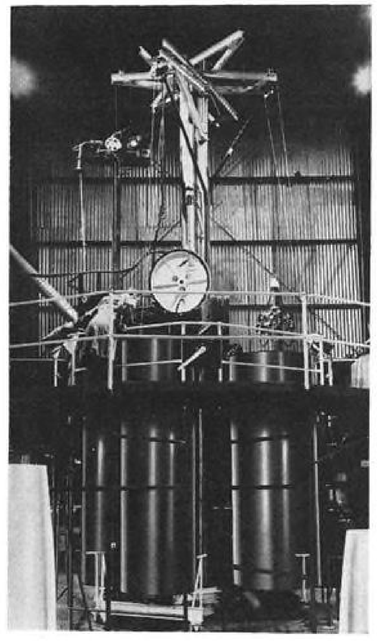
SCINTILLA DIVISION OF BENDIX AVIATION CORPORATION
SIDNEY, NEW YORK

Bendix
SCINTILLA DIVISION

Bendix
AVIATION CORPORATION

proach to gust load prediction is statistical rather than functional.

Standard all-weather electronic equipment, nose fuel tank and radar observer cockpit were removed to make space for instrumentation. Manometer ports and flow direction vanes (see photo) are mounted in a nose boom to pick up flow changes for correlation with accelerations and stresses measured elsewhere in the airplane. High speed movie cameras record the beating taken by the pilot in gusts.



Plastic Cylinders Made at Low Cost

Los Angeles—Machine designed by Pastushin Aviation Corp. for GFR (glass fibre resin) process is turning out plastic cylindrical shapes at low cost.

The new machine (see above) with six tubular molds rotating at high velocities produces plastic shapes with exceptional strength, uniformity and tolerances by centrifugal action. (AW Feb. 29, 1955, p. 38.)

It distributes controlled amounts of resin and chopped fibres simultaneously, turning out parts as large as 10 ft. long and 44 in. dia. It accurately forms parts "out of round" as much as 20% between major and minor axes and molds integral stiffeners into them.

Typical applications for the GFR machine's capabilities are missile and jet engine containers, mine sweeping floats, aircraft fuel tanks, missile body components, chemical containers and various commercial items. Experimental production on components is underway.

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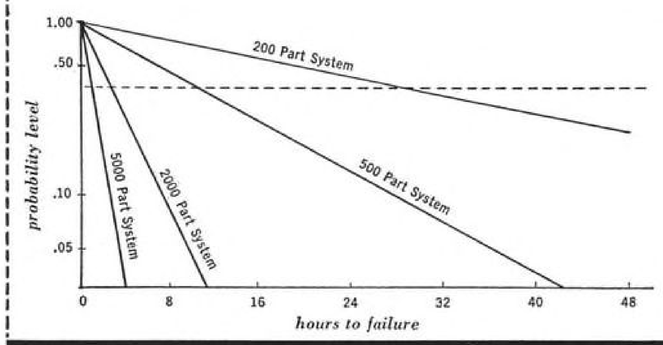
SIMPLIFIED DESIGN



Avion's "High Reliability" program is fundamentally a philosophy of plus performance . . . derived in large measure from a bold concept of design simplicity.

It's just that simple!

The fewer the number of components required for any electronic system—the longer the life expectancy of effective performance.

High Reliability has been achieved for missile guidance, fire control, infrared seeker, and other systems . . . largely through the application of this design concept. The relationship between simplicity of design and plus performance is firmly established at Avion.

And this relationship is sound, whether the electronic system is designed for the military, or for industrial use.

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For main rotor shafts of jet engines, all such bearings are designed and constructed to meet individual specifications. The bearing illustrated is a "custom tailored" super-precision ball bearing which features close dimensional tolerances, high finishes, and special construction for maximum performance and to insure absolute reliability.

DSRP SERIES AIRFRAME CONTROL BEARINGS

These bearings offer "the most capacity for weight and size" . . . a series that is clean in design and balanced in capacity. Their features include a full complement of precision rollers, large roller-to-race contact areas on both inner and outer rings plus exceptional protection against possible damage to seals in case of severe misalignment.

Y-PWI SERIES CYCLIC PITCH CONTROL BEARINGS

Especially designed for swash plate applications in helicopters, the Y-PWI series consists of a matched pair of thin section, angular contact-type bearings equipped with Fafnir patented Plya-Seals. All exposed surfaces as mounted are cadmium plated. Bearings are prepacked with lubricant conforming to the latest military specifications.

EXTRA SMALL SERIES BEARINGS

Designed for use on actuators, automatic pilots and other precision aircraft instruments, the extra small series bearings are available in metric bore sizes down to 4 mm and in inch sizes to ⅛". They are also available with standard, special or super-precision tolerances in various constructions, and they can be fitted with various combinations of seals and shields.

BALANCED-DESIGN SERIES ROD ENDS

This is the only series of rod end control bearings with three-way-balance design providing strength and capacity without excess weight. In the series, there are three sizes of high capacity roller-type rod ends for power-operated control systems and two sizes of ball bearing rod ends with high-strength shanks for manually operated control systems.

TORQUE-TUBE TYPE BEARINGS

The KP-BS Series was developed specifically for hinge applications and push-pull controls where saving in weight is essential without any reduction in bearing capacity. The self-aligning feature plus Plya-Seals permit simplification of application. The Plya-Seals are retained by stainless steel snap washers. All exposed surfaces as mounted are cadmium plated.

B500DD SERIES BEARINGS

Positive protection against contaminants and retention of lubricant are the outstanding features of this extra thin section, torque tube type series. These advantages make possible the use of simply designed, space and weight saving housings. Shields are non-metallic, close-clearance type. All exposed surfaces as mounted are cadmium plated. This series is dimensionally interchangeable with the B500 series.

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AIRCRAFT BEARINGS

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Pressure Suit at 198,770 Ft.

Air Research and Development Command's new emergency partial pressure suit comes in two versions—MC-3 for bomber crewmen and MC-4 with built-in anti-gravity suit for fighter pilots. Biggest improvement is that pilots wearing the suit do not have to learn to reverse breathe as they did with the T-1 suit. Maj. Arnold I. Beck is shown wearing the MC-4 suit as he sets altitude record of 198,770 ft. in an altitude test chamber at Wright Air Development Center, Ohio, (AW Dec. 24, p. 26).

Peacetime use of atomic energy has become a reality, thanks to the development of the first nuclear reactor designed for private industrial research by Atomics International, a division of North American Aviation.

Research Welding congratulates Atomics International on this tremendous achievement and is proud to be a subcontractor to such a forward looking concern.

Research Welding's unparalleled skills in metal fabrication of tanks, spheres and components are available for experimental and development work in the construction of missiles, atomic structures and sub-assemblies.

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Lockheed Plans Test Bed, Electra Assembly

Lockheed Aircraft Corp., beginning assembly operations this month for its medium range Electra turboprop, will modify a Super Constellation to serve as a four-engine test bed for the Allison 501D13 engines that will power the airliner.

The four engines, which will be equipped with Aeroproducts 606 four bladed propellers, are commercial versions of the Allison T56 that powers the C-130 Hercules. The engine develops 3750 eshp.

Lockheed's goal is to pile up over 1,000 flight hours on the engine-propelled combinations under hot and cold weather extremes at altitudes up to 30,000 ft.

Flights of the Constellation test bed will begin in July, six months before the Electra is scheduled to take to the air. This "head start" plan is part of the Lockheed-Allison program to log 800,000 engine hours before the first Electra delivery.

Lockheed reports "excellent results" on the first phase of the program during which a single T56 engine was modified to resemble the commercial version and flown in a Constellation test bed. This airplane now is being

Helicopters Supply Mid-Canada Line

Sikorsky S-55 helicopters of Royal Canadian Navy Antisubmarine Squadron HS-50 take off from a marshaling base at Knob Lake in Northern Quebec on a supply mission for sites on the mid-Canada warning line in Labrador. Six Navy helicopters were among 40 supplied by the RCAF, USAF and private operators to help complete the stations by the first of this year. Helicopters filled in for fixed wing aircraft which had been unable to land on thinly iced lakes. The Navy helicopters have averaged 8 hr. daily in the air. On one recent 10-day mission, an S-55 carried steel riggers and radar technicians to the line, carried 400 ft. of 3-in. plumbing pipe, a ton of lumber and diesel fuel and other cargo in short trips from a lakehead loading area to the stations. Total air time was 52 hr. and ton mileage was 1,390.

Break-Through Maintenance Cost Barriers with CEE-BEE Specialized Aviation Chemicals

Two major barriers in aircraft maintenance are the man hours required to perform a job and the "out of service" time of the equipment. Cee-Bee aviation chemicals *minimize* these two important cost factors. Field results prove CEE-BEE products and methods require less time and give superior and long lasting results. Our engineers and on the job service representatives will help you solve your maintenance problems. write for free brochure.

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CTS—completely transistorized system—for longer life, elimination of tube unreliability, and significant reduction in weight, space, and power required.

DOS—direct output synchros—right on the outer frame of gyro to eliminate backlash and signal inaccuracy due to servo gear trains.

OTP—only two package system—for ease of installation and maintenance, greater compactness, and reduction of weight because of minimum inter-connecting cabling.

ILC—internal latitude compensation—for accurate performance at any point on the earth's surface.

PCS—printed circuit system—for greater dependability and reduction in weight and cost.

ASG—all steel gyro—exclusive design reduces variation in drift due to temperature change; provides free drift of less than 4 degrees an hour.

DMO—dual mode operation—providing a "slaved" mode for areas of normal magnetic flux, and a "free" mode for areas of magnetic disturbance.

LIC—lowest in cost—considerably less than any other compass of its type. Yet the Lear LC exceeds every performance specification laid down by the Bureau of Aeronautics, U.S. Navy, for the MA-1 type of compass.

LEAR LC COMPASS

Gyro-stabilized compass system providing accurate directional heading and autopilot control for aircraft under all conditions anywhere on the globe.

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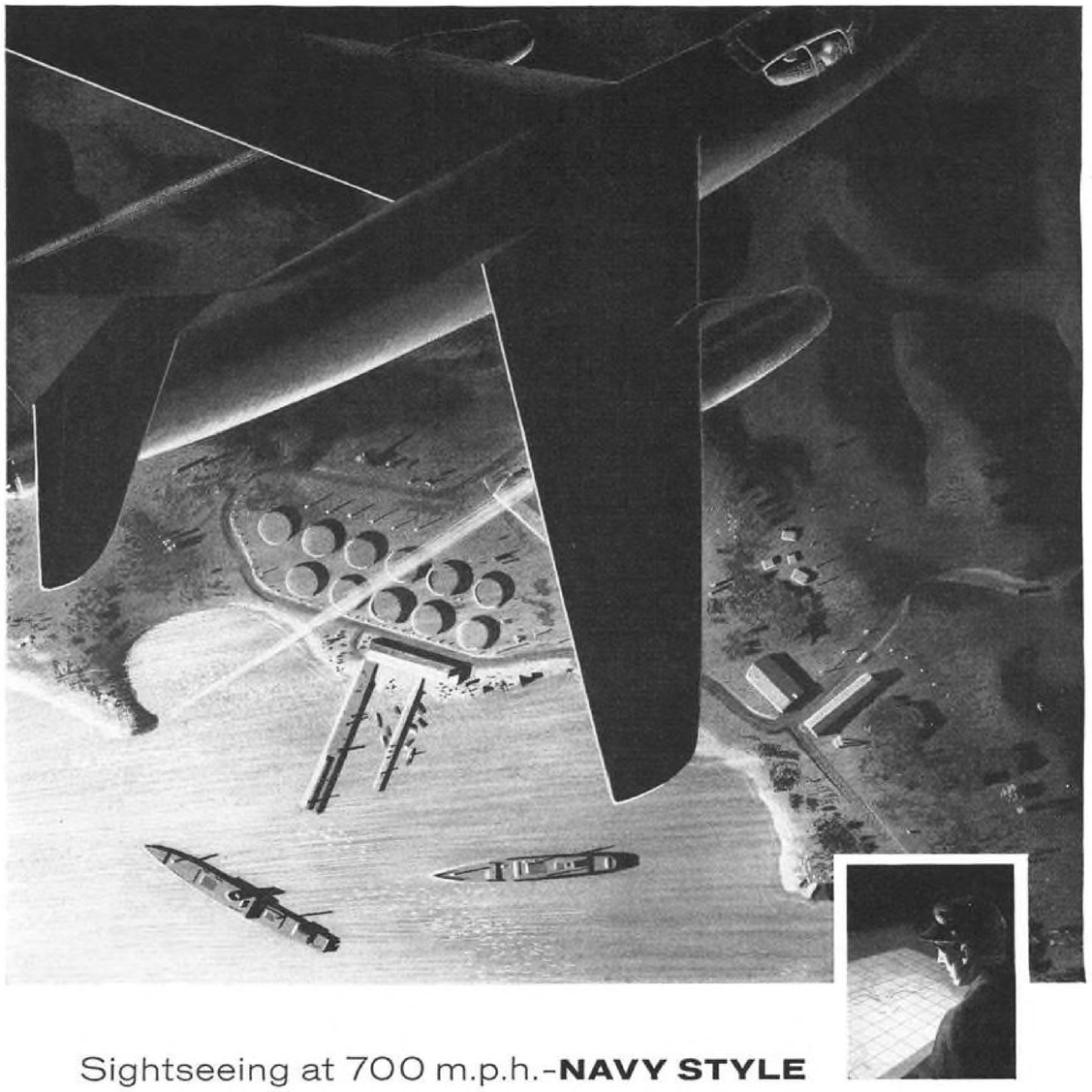

Sightseeing at 700 m.p.h.-**NAVY STYLE**

A jet-propelled "camera strike" pays off—as a Navy "eye" streaks in low under enemy radar—zooms to proper height—drops its flares and snaps intelligence pictures. Clear pictures are assured, despite the extreme speed, because Librascope photo-reconnaissance equipment is part of the mission. But getting the picture is only part of the job. The data must be correctly interpreted back at home base. Here Librascope photogrammetric equipment assures final success of the mission.

Librascope is noted for important developments in military science, including pilot and navigator viewfinders, periscopes, fire control systems and airborne computers. This reputation has been built on advanced engineering skills in optical, electronic, mechanical and analog/digital computer technology. If you are concerned with military or commercial projects—specialized engineering personnel and exceptional facilities are available to you at Librascope for research development and production.

ENGINEERS...*learn about Librascope's new creative "Project Development Teams"... write Don Webster, Chief Engineer*

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fitted with a single 501D13, and its first flight is scheduled for next month.

To prepare for assembly Lockheed has negotiated over 2,700 purchase commitments totaling more than $100 million.

Material worth more than $2.5 million has already been delivered.

Initial assembly operations involve wing skins, wing beams and trailing edge assemblies. Main wing box beam pieces and fuselage structures will follow in February.

Production away from the main plant includes: Lockheed, Bakersfield, tail assemblies; Maywood, small subassemblies; Rohr Aircraft, San Diego, power package; Temco Aircraft, Dallas, wingtips and wing trailing and leading edges; Menasco, Burbank, main landing gear assemblies. Final assembly is scheduled for August.

The first Electra will go to engineering flight test in December and will fly January, 1958.

Other Electra developments:

• **Design Consultant** Henry Dreyfuss will show Electra customers how cabins will look by means of a dollhouse-size model of half sections, complete with carpet, seats, windows, drapes, and interior linings in various colors and texture arrangements.

• **Passengers walking** down the aisle will be kept free of sparks by a network of wires in the carpet underwebbing to ground static electricity.

• **New nose gear** that can be disengaged for ground handling so that it turns freely in its socket will be used. When towing tension is removed, the wheel returns to normal.

Coating Provides Fog-Free Surface

Burbank, Calif.—Sierracote, an electrically conductive coating developed by Sierracin Corp. for heating surfaces of aircraft transparent enclosures, is now being applied to prototype versions of canopy plastic side panels for the Convair F-106A and the Air Force's new MA-1A pressure helmet visor. Purpose of the transparent coating is to provide a fog-free surface with a minimum of optical distortion.

If the Sierracote panels for the F-106A successfully pass qualification tests, now underway at Convair, San Diego, they are projected for the tandem-seat F-106B trainer and the side-by-side seat TF-102 trainer.

Sierracote visors for the MA-1A pressure helmet have been supplied to Wright Air Development Center's Aero Medical Section under a research and development contract and are now under test there. The helmet was designed by Bill Jack Scientific Instru-

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AIR-TURBINE DRIVES . . .

The Answer to Jet Age Accessory Power Problems

The need for hydraulic, electric, and mechanical power multiplies with every major advance in aircraft performance. The high air speeds of today's jets demand more hydraulic power for aerodynamic surface and braking control. Widespread use of electronic equipment has greatly increased electrical requirements. The blistering surface heat of high-performance planes only compounds the problem. Not only must today's designer plan an accessory system that can meet increased power requirements, in much less space, but he must be sure it can operate in hot environments.

Some accessory equipment now in use is grossly affected by heat. Direct drives attached to the engine, hydraulic motor drives, and gas turbine power units (GTPU's)—are extremely vulnerable to high ambient temperatures. In addition, they generate so much heat in operation that a method of removing the heat must be employed. Other limitations, such as inadequate lubricants, heat pumps, or the absence of extremely high-temperature metals may preclude the use of these methods if thermodynamic requirements continue to grow.

Heat Problem Changes The Design Picture

The heat problem has become so complex that top engineers now realize the importance of integrating the accessory system as part of the basic powerplant and airframe design effort. In the absence of adequate alloys to withstand high skin temperatures, designers now see the advantage of installing thermal-conditioning equipment and airducts as part of the airframe design in order to cool surface areas as well as internal components.

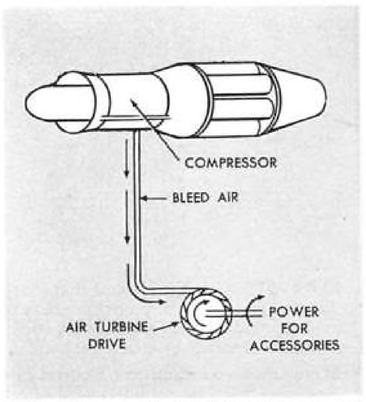
As a reliable, convenient source of compressed air, the jet engine provides the way to solve many of these problems. Air, extracted from its compressor, can be ducted to nearly any part of the aircraft surface for purposes of cooling, boundary-layer control, and deicing. Since the weight of this equipment is chargeable to the aircraft mission, it becomes practical to use the common energy source—compressed air—for operation of the plane's entire accessory system.

Air-turbine Drives Permit Integrated System

This trend casts new importance on the role and selection of accessory systems. With a compressed air supply already integral with the airframe, the use of air-turbine drives permits more effective integration of the airframe and the accessory system. In many installations, the same air used in the existing airduct system can be used to spin small turbine wheels mounted on shafts. These, in turn, drive generators, hydraulic pumps, fuel pumps, thermal-conditioning equipment, mechanical actuators, and other accessories.

The operating history of units now in use, such as those on Boeing's B-52, shows that the simple, comparatively friction-free construction of air-turbine drives can greatly minimize wear and result in longer, more dependable service. In addition, they permit more effective paralleling of generators if required, and with a ground source of air, can be tested without running the main engines.

Install Where Power Is Needed



Turbines Run on Air Ducted from Compressor

Air-turbines Permit Functional Location

Operating on this simple principle, air-turbine drives can effectively perform nearly every accessory function aboard jet or turboprop aircraft.

Simpler Construction—Greater Reliability

Air-turbine drives are inherently more reliable because they require fewer moving parts than any other method of generating power. Only one efficient, rotating turbine wheel and shaft is required to drive the plane's electrical and hydraulic units. Completely automatic operation is obtained by an integral control system. Whenever a load demand occurs, a system of signaling and actuating devices changes the unit's output to meet the power requirements.

Reliability of an air-turbine drive system is achieved by cross-manifolding the plane's air supply ducts. Through this method, all units on the aircraft can operate from one or any combination of engines. In multi-engine aircraft, failure of one or more engines would not mean loss of accessory power as long as one engine remained to supply bleed air.

Air-turbine drives and the accessories they operate may be located anywhere in the plane where power is needed. In the B-52, for example, ten hydraulic turbopumps are distributed in both wings and the fuselage—close to the point where power is needed. Such versatile, functional location is possible because air is relatively easy to transport and because it requires no return system.

Located away from the engine, these drives can contribute to a sleeker airframe design by cutting engine nacelle size and reducing frontal areas. Also, by installing them close to the "service area," short hydraulic and electric transmission lines can be used. This results in a lighter and less complex system.

These advantages permit a significant increase in aircraft speed and range, or payload.

Forecast for the Future

Ramjet and Nuclear Powerplants—It is expected that air-turbine drives will play an increasingly important role in the future. In aircraft utilizing a turbo ramjet, the turbojet portion of the engine may be shut down during the supersonic portion of flight. This would mean that no mechanical power would be available from the main powerplants for accessory operation. A pneumatic system, however, could provide accessory power under such conditions.

Another indication that more accessory power will be needed in the future exists in the anticipated requirements for nuclear-powered aircraft. Large amounts of power may be needed for specialized functions associated with the reactor. Remotely located air-turbine drives, linked with an auxiliary power unit, could supply a huge block of power without a prohibitive increase in unit weight or size.

G.E. Pioneered Air-turbine Drives

General Electric's Aircraft Accessory Turbine Department in Lynn, Mass. is one of the nation's prime suppliers of air-turbine drives for aircraft accessory power.

Drawing on G.E.'s vast experience in producing industrial and aircraft gas turbines, this department has consistently advanced the state of turbomotive equipment design.

Just as General Electric pioneered the "radical" aircraft turbosupercharger in 1918, through the Aircraft Accessory Turbine Department, it is now building air-turbine drive equipment to answer the accessory power problems of the jet age.

G-E Turbopumps and Turbodrives help supply all hydraulic and electric power on the Boeing B-52 Stratofortress, first aircraft in history to use pneumatic-driven power equipment for operating its entire accessory system.

Driven by air ducted from the jet engines, G-E turbopumps and alternator drives supply 8 gpm at 2650 psi and 60 kva at 400 cps, respectively. They give the big bomber power for operating steering, control surfaces, landing gear, bomb-bays, spoilers, radar, lighting, and armament.

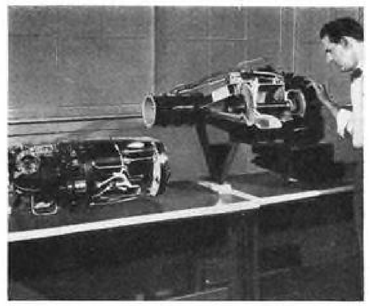
G-E Fuel Turbopump

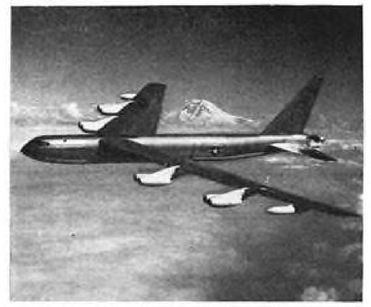
This tank-mounted, air-driven unit provides 86 gallons of vapor-free fuel per minute, giving North America's F-86D interceptor the extra fuel needed for afterburner operation. Characteristic of G-E air-turbine drives, the Afterburner Fuel Pump is lightweight and compact and can be functionally located in the aircraft.

G-E Turbostarters

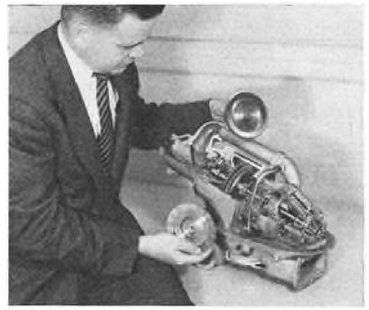
Another application of the versatile turbine is in the self-contained turbostarter (used on the Martin B-57) which starts a jet engine in less than 10 seconds.

It is powered by hot gases resulting from the combustion of an easily replaceable solid-propellant cartridge. Turbostarters eliminate the need for ground power starting units, minimize logistics problems, and increase jet aircraft availability.





G-E Turbopumps and Turbodrives Help Power B-52's Accessory System



G-E Afterburner Turbopump Gives North American F-86D Instant Power Reserve

G-E Turbostarter Gives Martin B-57 Quick Starts. G.E. Also Makes Fuel/Air Starters

Advanced Air-turbine Drives Are "In the Works"

General Electric's Aircraft Accessory Turbine Department, with facilities valued at more than $15 million, is carrying out an extensive development program on advanced air-turbine equipment. Units with extremely high power-to-weight ratios are already in advanced stages of testing. These programs promise powerful answers to accessory power requirements that lie ahead.

To find out how G-E air-turbine equipment can help you now in the planning stages, contact your General Electric Aviation & Defense Industries Sales Office or write for the descriptive brochures on the drives you are interested in.

General Electric Co., Section D231-8, Schenectady 5, N. Y.

Please send me the following brochures on G-E Air-turbine Drives

- ☐ GEA-5870A Air-turbine Drives For Jet Aircraft
- ☐ GEA-6333 Hydraulic Turbopumps For Modern Aircraft
- ☐ GER-1088 Gas Turbine Starters For Jet Aircraft
- ☐ GEA-5871A Aircraft Afterburner Fuel Pumps

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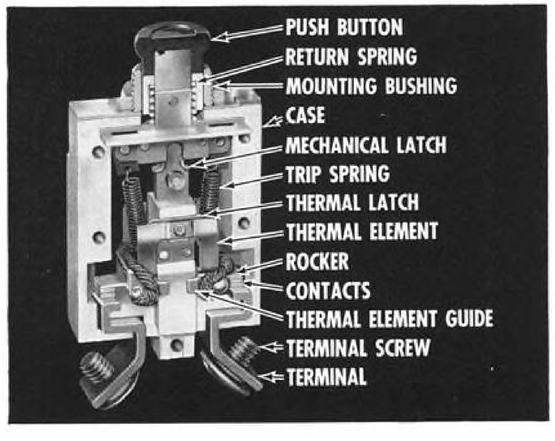
weighs only 1.5 oz., measures only 1-13/16 inches in length

SAVES WEIGHT! SAVES SPACE!

Meets Military Performance Requirements

Send them higher and farther . . . with better protected electrical systems. MP-700 Series—the important new development in breakers—is so small you can use many more and still end up with less weight. Give circuits individual protection instead of grouping. Performs in accordance with MIL C-5809 B (ASG). Self-cleaning contacts. Industry developed equipment (IDE) approval issued August 31, 1956.



Write for detailed Spec Sheet No.AW-1

MECHANICAL PRODUCTS, INC. • JACKSON, MICHIGAN

ment Co., Solana Beach, Calif.

A Sierracote panel also is being tested at Douglas' El Segundo Division for an anti-fogging application on the F4D Skyray. This is an insert panel used in conjunction with the present canopy panel to avoid extensive retrofit.

Sierracote applications are also being considered for the plastic side panels of pilot's enclosure on the Douglas C-133A, and for the overhead transparent portion of Pacific Airmotive Corp.'s Learstar executive transport.

In the C-133A installation, the coating would be utilized to replace the present hot air defogging system. In the Learstar the coating would be used solely as an infrared reflector to reduce solar heating and provide a cooler cockpit. In such an application it is possible to get up to 85% infrared reflection, Sierracin claims, if light transmission is not of primary importance. WADC's Materials Laboratory is evaluating a similar use for a protective heat-reflecting fire-fighting helmet visor.

Sierracote is applied to polyester plastics and is incorporated in a vinyl laminated construction to protect the coating from abrasion. Sierracote supplies a flat plastic laminate complete with leads for connecting to the aircraft power supply. A sensing element (installed on the surface or imbedded in the vinyl) automatically controls heat input to the panel. Any forming or machining of the panel is performed by the plastic fabricator to provide a finished part.

The coating may also be applied to glass surfaces, Sierracin says, and methods of coating protection for such application are being developed.

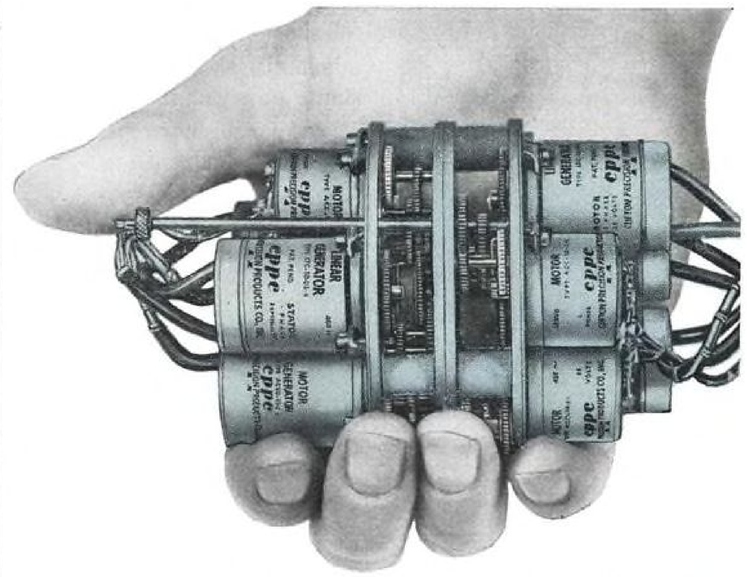
Approximately 70% light transmission is obtained with Sierracote. It may be applied in resistivities of 5 to 20 ohms per square area. It may also be applied with a gradient resistivity to compensate for non-rectangular heated areas.

For anti-fogging applications, Sierracote normally requires a heat output of one to two watts per square inch, although laboratory tests have indicated that the coating has power-handling capacity considerably in excess of this, Sierracin says. This indicates that anti-icing applications may be possible, although this phase of research has not yet been thoroughly investigated by Sierracin.

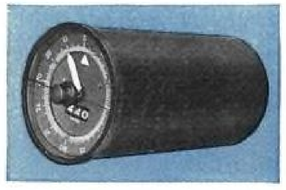
Ultrasonic Measuring Devices Developed

Los Angeles—Development of two new ultrasonic liquid measuring devices, a level indicator and flowmeter, for missiles and aircraft, were revealed by Dr. W. Welkowitz, Gulton Industries,

4 Intercoupled servo loops



weight less than 2 lbs.*



This indicator, part of an Automatic Navigational System, contains 6 synchros, 2 motors and 2 motor generators—all Clifton Size 10 units.

These units (and 2 mechanical differentials) are built into 4 independent, intercoupled servo loops. Weight of these 4 loops plus gears and gear plates is less than 2 lbs.

The main reason for the lightness of Clifton synchros, and hence the lightness of systems built around Clifton components, is that no unnecessarily heavy materials are used in their manufacture.

When it is a question of highest accuracy with the least bulk and weight, look to CPPC rotary components.

* *If this system had been built with our latest Size 8 synchros, weight would have been brought to about 1⅓ lbs.*

Look to CPPC for Synchro Progress

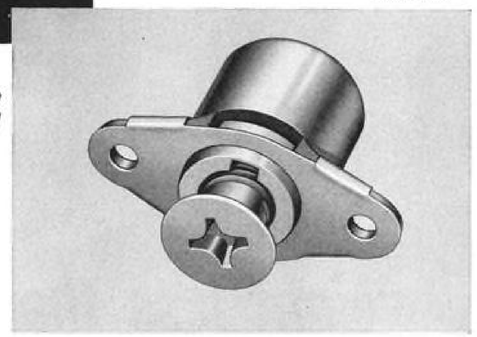
CLIFTON PRECISION PRODUCTS CO., INC. cppc **Clifton Heights, Pa.**

The *New* Pastushin Full-Shear Stress Panel Fastener does what a panel fastener should do!

- absolute positive lock . . . full shear strength
- automatic spring ejection of stud . . . no prying to free panel
- curved panel is no problem
- only two assemblies (self-retained) . . . stud and retainer
- no special installation tools . . . Phillips head recess

PATENT PENDING

Available now in quantity!



Fastens and unfastens a panel faster and easier than any other fastener on the market!

Check these important features:

Full Shear Strength . . . stud design transmits full shear strength equal to NAS-547 specification, and/or NAS 334-335 close tolerance bolt.

Positive Mechanical Lock . . . when stud is seated, it's locked! Visual inspection assures safe lock.

Automatic Stud Ejection . . . when stud is released, it is automatically spring-ejected from the retainer, allowing panel removal without forcing or prying.

Curved Panels offer no problem . . . small radius of entry of stud into retainer assembly allows installation and operation on surfaces of less than one inch radius.

Double Lead Stud Thread . . . assures top performance and trouble-free long service life.

Materials and Finishes . . . critical bearing surfaces are of CM steel, heat treated to rigid specifications. Steel parts are cadmium plated, aluminum alloy parts anodized.

This is the actual size of the ¼" fastener assembly . . . tiny, lightweight and strong. The 5/16" unit is proportionately larger.

Write for complete information on Pastushin's Full-Shear Stress Panel Fasteners, designed for high-strength and simplified securing of access panels and equipment on modern aircraft.

PASTUSHIN INDUSTRIES, INC.

5651 WEST CENTURY BOULEVARD, LOS ANGELES, CALIFORNIA

Affiliate Companies

PASTUSHIN AVIATION CORP. Los Angeles, California | **HAWAIIAN AIRMOTIVE, LTD.** Honolulu, Hawaii

DEVELOPERS AND MANUFACTURERS OF AIRCRAFT FASTENERS

Inc., Metuchen, N. J., at Perlmuth Electronics Associates' second annual instrumentation symposium.

Gulton's liquid level indicator has been obtained by Douglas Aircraft Co. for evaluation in ground test of the Thor intermediate range ballistic missile. In this application the indicator will measure liquid oxygen and JP-4 fuel levels.

The instrument functions independently of temperature by making a continuous measurement of acoustic impedence of the liquid, giving a continuous correction for density. Calibration is performed only initially because it is independent of the liquid being measured.

Measurement is performed through the tank wall and liquid with an ultrasonic pulsing system. Rate of pulsing is a measure of the liquid height. Pulse goes through the liquid, is reflected from the liquid surface, returns to transducer, and retriggers the transmitter.

An independent system pulsing across the tank (fixed distance) corrects for sound velocity, so that by relating both measurements (pulsing in the liquid and across the tank cross-section) the absolute height of the liquid is obtained independent of the liquid's acoustic properties.

Gulton's flowmeter is an ultrasonic beam deflection system which has a built-in correction for acoustic impedence so that the output reading is a measure of mass flow and is independent of the acoustic velocity in the liquid.

The entire system is located outside the pipe. Ultrasonic beam is projected at an angle across the pipe and is picked up by a differential crystal transducer. Flow of fluid causes a change in the angle of the beam and this change is proportional to the flow velocity. This produces an unbalanced output on the pickup transducer. An auxiliary sensing system measures acoustic impedence directly across the pipe. By relating the beam deflection output and the impedence measurement the true mass flow is obtained for any liquid being used.

Kidde Gets Contract For F-27 Pneumatics

Pneumatic system responsibility for the Fairchild F-27 Friendship turboprop transport is being handled by Walter Kidde & Co., Belleville, N. J.

Specifications call for two Kidde 2-D compressors, each developing 3,300 psi., 2 scfm. at sea level. The compressors are powered from gear boxes driven by the 1,600 shp. Rolls-Royce Dart engines.

The pneumatic systems are expected to result in weight saving of 100 lb. over comparable installations.

Skyways WITHOUT Runways

A small clearing in the jungle . . . an ice floe in the arctic . . . a mountain plateau—a cruiser deck, a rooftop—these are some of the airbases of Vertol aircraft.

Free from the restricting dimensions of distant airfields and costly runways, Vertol helicopters have led the way in developing a new kind of mobility. Their tandem rotor performance has withstood the test of Army field service, Naval duty and of global Air Force missions ranging from arctic tundra to equatorial forests.

Revolutionary aircraft now taking shape at Vertol will combine helicopter ability to hover, to rise and land vertically, with the performance of current jets. Now, at Vertol, the Skyways-without-Runways concept is being taken to its ultimate phase: high speed aircraft capable of vertical takeoff and landing.

Engineers, join Vertol's advanced engineering team!

VERTOL Aircraft Corporation

MORTON, PENNSYLVANIA

FORMERLY PIASECKI HELICOPTER CORPORATION

How to make your automatic heat-treating and hardening even more automatic

...at no extra cost

FAST, continuous operation is the key to profitable automatic forging production lines. Especially in high speed heat-treating and hardening operations. They're extremely sensitive to changes in chemical composition and structure of steel used. Interruptions to make tests or adjustments slow production, increase costs, reduce the advantages of automatic operation. This makes the uniformity of the steel you use an even more vital factor. The more uniform the steel, the steadier the production and the greater the potential you can realize from your automatic equipment.

You can get the utmost in uniformity, and automatic operation—at no extra cost—by using Timken® fine alloy steel. Uniformity is constant from bar to bar, heat to heat, order to order.

We take many extra quality-control steps to assure this uniformity. For example, the Timken Company uses a magnetic stirrer for molten steel to assure equal distribution of alloys, uniform temperature and improved working of the slag. It's the first installation of its type in the United States.

To further assure uniformity, your order of Timken fine alloy steel is handled individually. We target our conditioning procedures to meet your end use requirements. Each bar is stamped to identify the heat it came from. This limits variations within an order as well as from order to order. And every heat is examined spectrometrically to insure uniform grain size.

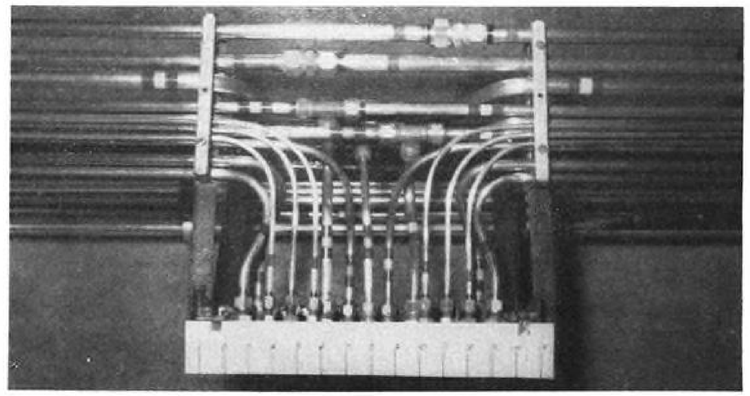
To make your automatic heat-treating and hardening operations even *more* automatic—at no extra cost—always specify Timken fine alloy steel. You'll get money-saving performance and uniform results every time. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

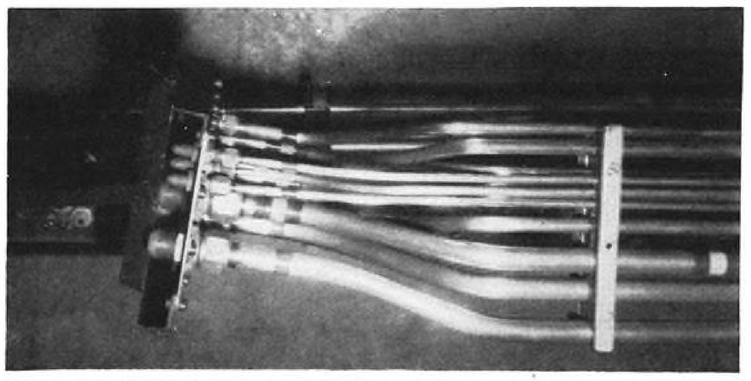
TIMKEN *Fine Alloy* **STEEL**

TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

New Jig Is Designed For DC-3 Galleries





Melbourne, Australia—An economical new jig has been designed and manufactured by engineers of MacRobertson Miller Airlines Ltd., a Western Australian airline operator of Perth, Western Australia. The new jig is designed for building and aligning the plumbing gallery of DC-3 aircraft.

Its introduction means a big saving in the time taken to install the plumbing gallery. At the same time it allows a much higher degree of accuracy in the installation work. Cost of construction of such a jig is extremely low and the use of the jig is expected to result in a standardization of all the DC-3 plumbing galleries at major overhauls.

The chief engineer of MacRobertson Miller Airlines Ltd. said the necessity for developing a fuselage and center wing plumbing jig for DC-3 galleries was brought about by the numerous discrepancies encountered when using an unserviceable line as a template for the replacement line. The gallery contains all the fuel, hydraulic and instrument pipe lines. Top photo (right) shows center wing lines at leading edge connector plate; bottom view details arrangement at nacelle end of wing center section.

The plumbing gallery jig provides an

A little pull in the right place . . .

the ROBINSON wire twister

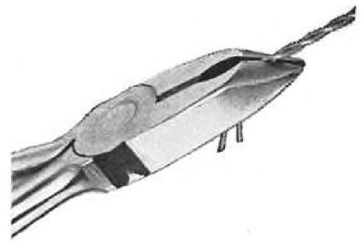
Aircrafts' Who's Who Reports

A cross section of the Who's Who in the aircraft industry—including Douglas, Allison, Fairchild, Grumman, Martin, Republic, Canadair Ltd., Pratt and Whitney among a host of others — is reported to have reduced engine wiring time as much as 66%. This saving is effected by the use of the new Robinson Wire Twister, an improved model of the ones that have seen service with the army, navy and airforce since 1943. Improvements include the exclusive diagonal jaw design that permits easier access to hard-to-reach areas, and clamps a vice like grip on the wire by pulling it into a 30° bend thus delivering added leverage for twisting.

In addition to the greatly increased engine wiring speed, users attest to improved shop safety — fewer skinned knuckles and bruised fingers.

Besides their production line assignments, Robinson Wire Twisters readily adapt in the shop to bench work, on radio and radar equipment, on magnetos, carburetors, instruments and sub-assembly work of all kinds.

List price is $19.50. Write for fully descriptive literature to Ralph C. Robinson Company, Dept. W, Box 3494, 2516 Crosby Way, North Sacramento 15, California.



. . . saves ⅔ the usual wiring costs

the ROBINSON wire twister

#1 Safety Factor for Jet Engines . . .

the ONLY Tester for EXACT HEAT & R.P.M. MEASUREMENT!

JETCAL®

analyzer

Tests EGT System Accuracy to
±4°C at Test Temperature
(functionally, without running the engine)

Tests RPM Accuracy to
10 RPM in 10,000 RPM (±0.1%)

This NEW "J" Model JETCAL contains NEW . . .
1) Takcal, 21 "Ta'Pot" Potentiometer.
3) Ruggedized Light-Beam Galvos,
4) Test Circuits.

Two of the most important factors that affect jet engine life, efficiency, and safe operation are *Exhaust Gas Temperature (EGT)* and *Engine Speed (RPM)*. Excess heat will reduce "bucket" life as much as 50% and low EGT materially reduces efficiency and thrust. Any of such conditions will make operation of the aircraft both costly and dangerous. The *JETCAL Analyzer* predetermines accuracy of the EGT and (interrelatedly) Tachometer systems and isolates errors if they exist.

The *JETCAL* is in worldwide use. Used by U. S. Navy and Air Force as well as by major aircraft and engine manufacturers. Write, wire or phone for complete information.

B & H INSTRUMENT also makes TAKCAL TEMPCAL

ANALYZES JET ENGINES 10 WAYS

1) The JETCAL Analyzer *functionally* tests EGT thermocouple circuit of a jet aircraft or pilotless aircraft missile for error *without running the engine or disconnecting any wiring.* GUARANTEED ACCURACY is ±4°C. at engine test temperature.
2) Checks individual thermocouples "on the bench" before placement in parallel harness.
3) Checks thermocouples within the harness for continuity.
4) Checks thermocouples *and* paralleling harness for accuracy.
5) Checks resistance of the EGT circuit *without the EGT indicator.*
6) Checks insulation of the EGT circuit for shorts to ground and for shorts between leads.
7) Checks EGT Indicators (in or out of the aircraft).
8) Checks EGT system with engine removed from aircraft (in production line or overhaul shop).
9) Checks aircraft TACHOMETER system accuracy from 0 to 110% RPM with guaranteed accuracy to within ±0.1% in the operating range.
10) JETCAL Analyzer enables engine adjustment to proper relationship between engine temperature and engine RPM for maximum thrust and efficiency during engine run (Tabbing or Micing).

ALSO *functionally* checks aircraft Over-Heat Detectors and Wing Anti-Ice Systems (thermal switch and continuous wire) by using TEMPCAL Probes. Rapid heat rise . . . 3 minutes to 800°F! Fast cycling time of thermal switches . . . 4 to 5 complete cycles per minute for bench checking in production.

B & H INSTRUMENT CO., INC.
3479 West Vickery Blvd. • Fort Worth 7, Texas

Dayton office: 209 COMMERCIAL BLDG., DAYTON, OHIO
West Coast office: 427 EAST GRAND AVE., EL SEGUNDO, CALIF.

JETCAL

accurate means for rapid plumbing replacement and allows a standard to be set from which interchangeable spare galleries may be manufactured and fitted as replacement components. Such a factor is, of course, highly desirable in the progressive overhaul of aircraft.

The Australian jig consists of a center RSJ base to which eight legs are welded. They enable it to be used for either gallery or plumbing. A series of angle iron tees are mounted on the upper and lower sides of the base in such a manner as they represent the contour of the fuselage mountings for the galleries.

Each base is drilled and taped to take the Adel clamp attaching bolts in their correct multi-plane positions. Outriggers are fitted to each end and at the center to accommodate the end connector plates. Dummy connectors are fitted for the correct positioning of take off points.

By inverting the jig, either gallery may be brought uppermost allowing absolute ease of access.

When the gallery is dismantled and the connector plates and lower portions of the Adel clamps are in position, the replacement lines may be formed and fitted to the jig. By sliding a line in the Adel clamps to meet its particular bulkhead union at the connector plate, alignment can be obtained to very fine limits and the center connections made with accuracy.

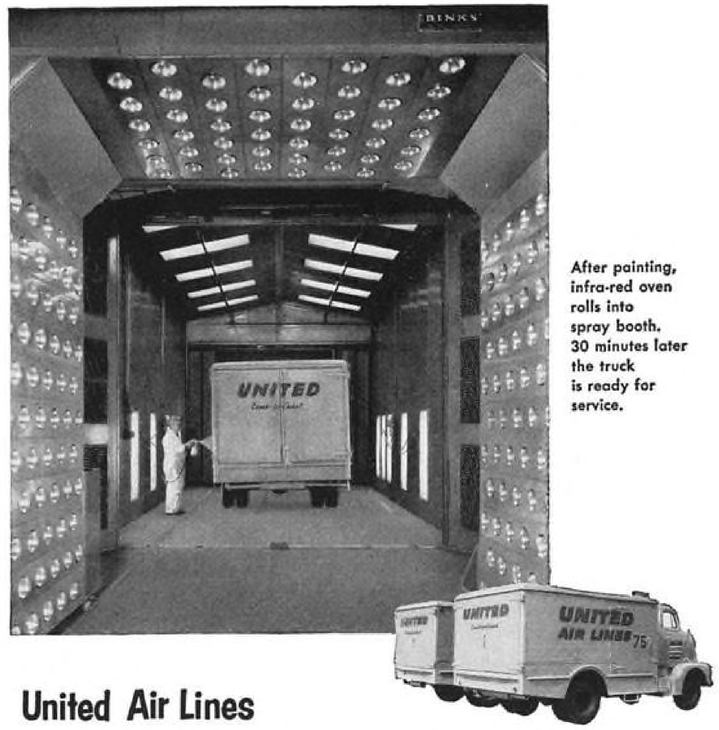
As each layer of plumbing is completed, the next portion of the Adel clamps is fitted until the gallery is completed. As the end connector plates are held in their correct angular position, the coupling nuts may be finally tightened before the gallery is installed in the aircraft. This avoids tool damage due to the restricted access to the coupling nuts.

THRUST & DRAG

The real value of any scientific or professional society meeting lies in the opportunity for discussing your problems with somebody else. The technical papers are secondary.

Some day, perhaps, one of our many societies will recognize that fact by scheduling a week-long session during which time there will be absolutely no papers presented, no speeches—especially after dinner—no pre-planned panels, no sponsored symposia.

Instead the society will provide a number of rooms with soft chairs and good lights, a blackboard and chalk, pads and pencils. These rooms will be mobbed by engineers with common problems and the talk will be loud and energetic. And more will be accomplished than ever could be by sitting in a darkened room, while tor-



After painting, infra-red oven rolls into spray booth. 30 minutes later the truck is ready for service.

United Air Lines

Saves on painting time & space

"From a customer relations standpoint, our ground equipment must look as good as our spotless aircraft," reports Mr. George Lantz, United's Chief of Plant Maintenance at Midway Airport in Chicago. "We were jobbing out part of this work because we had limited space in our paint shop, but our gear was away from the airport for long stretches at a time. A Binks engineer helped us solve both our time and space problems."

How time was saved...based upon previous experience, Mr. Lantz recommended the installation of Binks equipment and called in Binks engineers for consultation. A Binks "drive-thru" spray booth and drying oven were installed to produce factory quality, dust-free finishes . . . quickly dried to a mirror-like hardness. This set-up accommodates the largest trucks or several units of small equipment. A climate-controlling filtered air supply system was also installed in the shop to replace the air exhausted through the booth and to prevent dust infiltration.

How space was saved...the drying oven was placed on tracks so it could be rolled into the booth for finish drying or storage when not in use. Electrical interlocks prevent accidental simultaneous operation.

Engineering assistance—yours without obligation...over 60 years of unmatched experience in the manufacture and application of spray painting equipment is ready to serve you. Call your nearest Binks office or write to the address below:

Ask about our spray painting school
Open to all...NO TUITION...covers all phases

GUNS

COMPRESSORS

EXTRACTORS

671

Binks
EVERYTHING FOR SPRAY PAINTING

Binks Manufacturing Company
3116-30 Carroll Ave., West, Chicago 12, Ill.

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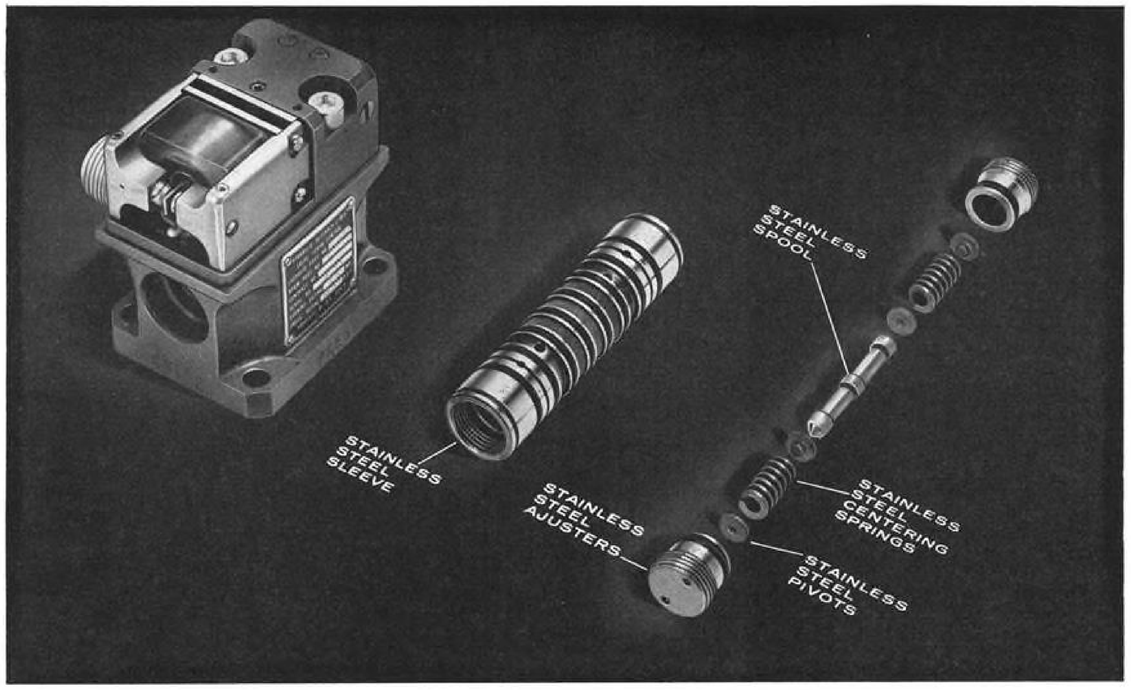


GREATER NULL STABILITY IN SERVO VALVE THROUGH UNITIZED POWER STAGE

The Hydraulic Research Dry Coil Servo Valve maintains excellent null stability under all conditions.

Stainless steel control spool, centering springs, pivots, null adjustments and power sleeve are an integral unit with no brazed joints. Adjusting mechanism is never subject to different coefficients of expansion regardless of the range of operating temperatures.

Threshold characteristics are enhanced by this integral construction of sleeve and adjustments, as it assures precise alignment of centering springs along the spool axis.

Micro finishes in sleeve-spool assembly keep friction to absolute minimum reducing valve hysteresis, and providing substantial increase in valve life.

Maximum reliability of the valve is further assured, by triple filtration with sharp particle size cut-off; and by dry torque motor construction using an encapsulated coil.

CHALLENGING ENGINEERING POSITIONS OPEN

HYDRAULIC RESEARCH
AND MANUFACTURING COMPANY
Subsidiary of Bell Aircraft Corp.
2835 N. Naomi Street • Burbank, Calif. • Victoria 9-2227

MANUAL SHUT OFF

PRIORITY

PRESSURE SWITCH

PRESSURE REDUCER

PRECISION HYDRAULIC VALVES AND COMPONENTS FOR FLIGHT CONTROL SINCE 1943

tured by the remains of last night's hospitality and trying to concentrate on a droning speaker reading a prepared text on a dull subject.

There is a real problem with these professional meetings. It has been calculated that an engineer—perhaps a project engineering type, with a broad general interest—could spend almost his entire professional career attending meetings, eating the same roast chicken and ice cream pie, listening to the same general or admiral or high civilian official recast the past year's progress in stale prose.

Yet these meetings furnish one of the rare meeting places for people with common interests who would like nothing better than the opportunity to communicate with each other.

Maybe some of the societies might take a look at the traditional scheduling of meetings and see if there isn't a better way. Maybe there should be some informal discussions tried out, paralleling the formal presentations in the auditorium.

Maybe more societies should follow the pattern of insisting on a 20-min. maximum oral presentation with a guaranteed question period afterward, in the SAE pattern. Maybe there should be more attempts to cut down on the number of meetings.

The meetings are essential, but many of their appurtenances aren't.

Canadair Rolls Out CL-28 Maritime Search Aircraft

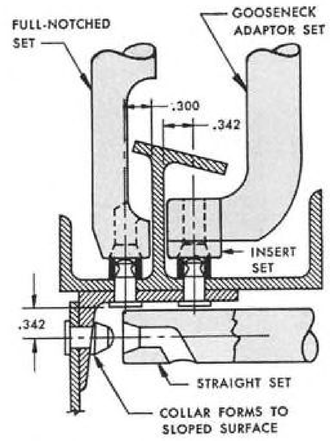
Canadair CL-28, piston-engine version of the Bristol Britannia designed for long-range overwater patrol, was rolled out at Montreal plant of Canadair, subsidiary of General Dynamics Corp. Plane, largest ever built in Canada, is on order by Royal Canadian Air Force.

F-100Ds Shipped to Japan

Sprayed with a plastic cocoon, North American F-100D Super Sabre is hoisted from a loading dock on the Sacramento River to a barge for ferrying to the Alameda Naval Air Station dock and transshipment to a Military Sea Transport Service aircraft carrier for shipment to Japan. The supersonic fighters are being assigned to the 8th Fighter-Bomber Group, 5th Air Force, Itazuke AFB, on the southermost island of Kyushu. Planes were flown from North American's Los Angeles plant to Sacramento Air Materiel Area's McClellan AFB, where they were sealed and cocoons applied. Then planes were towed 15 mi. on highways to the loading dock. On board carrier, USAF representative checked 24 planes on deck three times daily for cracks in plastic coating, which protects them against salt spray, wind, sun or rain. Repairs could be made with portable kit. Although F-100 could be flown to Japan using aerial refueling, surface transportation is less expensive.

HERE'S A TOUGH PROBLEM OF ACCESSIBILITY

for some fasteners but easily licked with HI-SHEARS!



Above minimum layout dimensions are for 1/4" diameter HI-Shear rivet.

Because of its minimum protrusion, weight and tool clearance, the HI-SHEAR rivet is installed into critical space areas not accessible to other high strength fasteners.

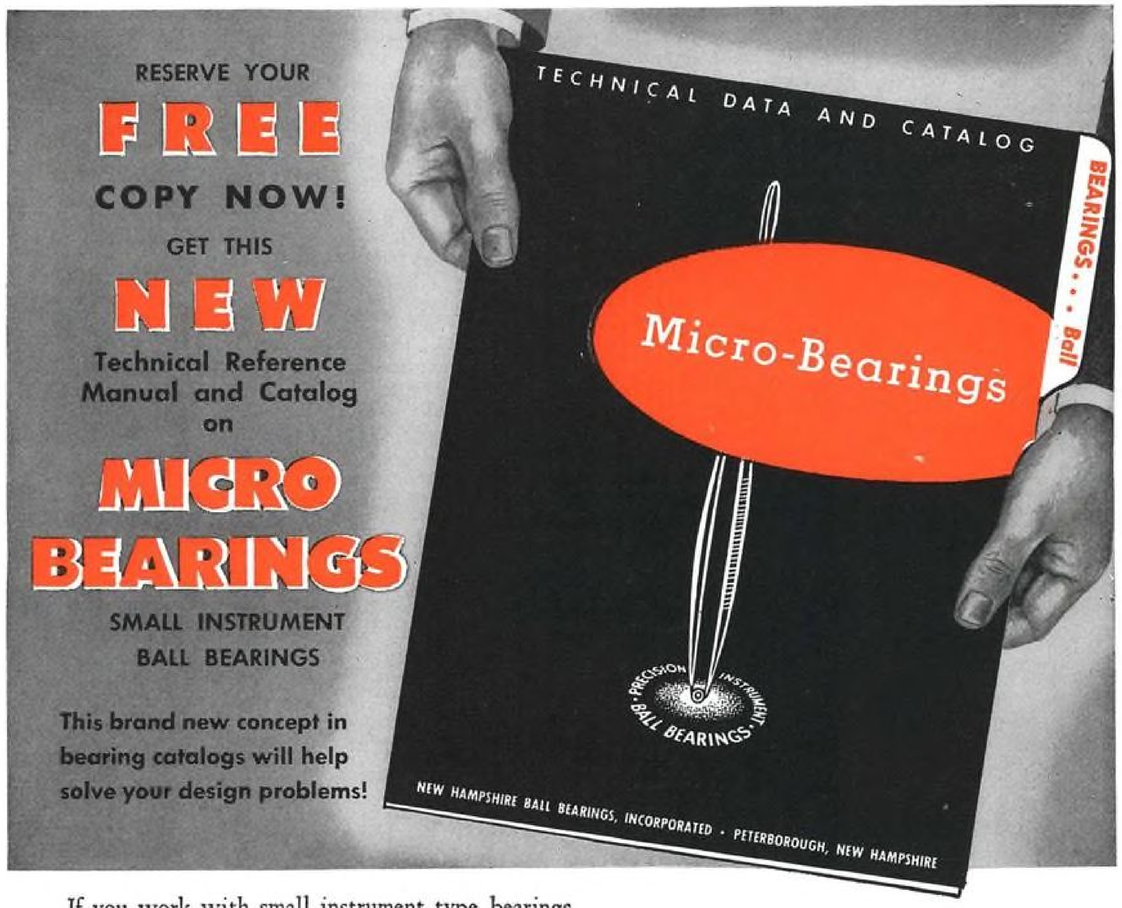
Inexpensive HI-SHEAR Sets are available in a variety of shapes and sizes.

HI-SHEAR tools are used in standard rivet guns and squeezers — eliminating special single purpose driving equipment.

Write for the Tool Catalog for tool dimensions.

U.S. and foreign patents—Trademark registered.

hi-shear RIVET TOOL COMPANY
2600 W. 247TH ST. TORRANCE, CALIF.



If you work with small instrument type bearings you'll find this new, authoritative publication an extremely valuable and handy source of engineering data arranged in convenient form for practical reference.

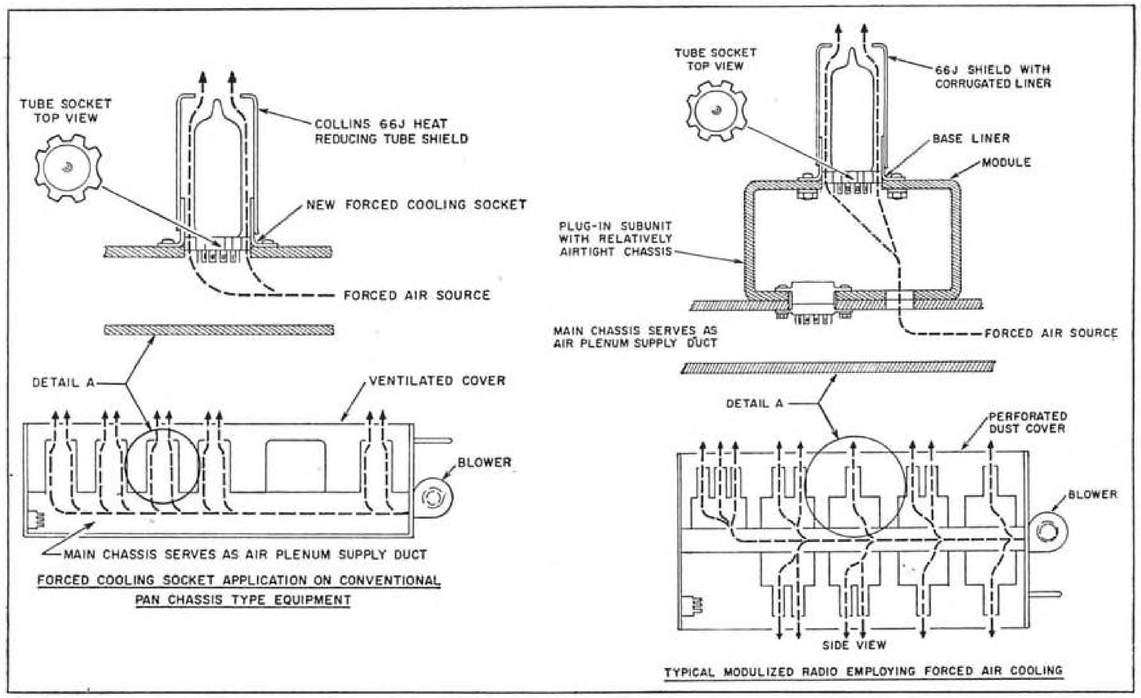
LOOK AT THESE FEATURES . . .

- A helpful survey article: "FACTORS TO CONSIDER IN SELECTING SMALL INSTRUMENT BALL BEARINGS."
- A complete, practical presentation of bearing facts:

Types of bearings
Materials
Components
Engineering standards
Tolerances
Dynamic and static loads
Lubrication
Radial and Axial play
Torque
Mounting practice etc.

- Large, clear illustrations.
- Big, easy to follow charts.
- Convenient nomographs and conversion charts.
- Simple bearing designations make ordering easy.

NEW HAMPSHIRE BALL BEARINGS, INC., *Peterborough, New Hampshire*



SLOTTED tube socket, developed by Collins, gives efficient forced-air tube cooling with chassis or modular type construction.

Socket Slots Pay Tube Cooling Dividend

By Philip J. Klass

Cedar Rapids, Ia.—Reduction in tube failures, biggest single cause of avionic equipment unreliability, may result from use of a new type socket for miniature tubes.

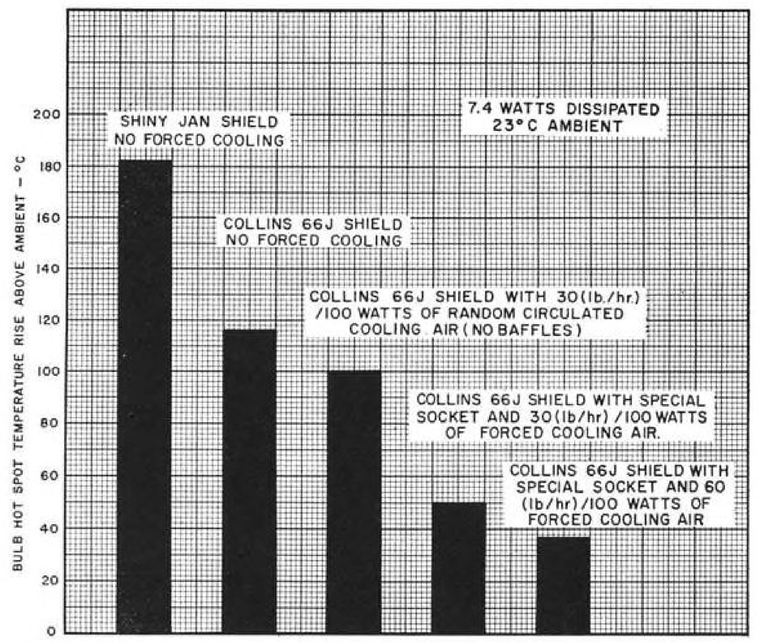
Slots in the tube socket permit forced air to pass between tube and its shield, multiplying cooling air effectiveness several hundred per cent.

Collins Radio Co. developed the socket, together with a simple graphical technique for predicting forced air flow rates for individual tubes in new avionic equipment. It has not been decided whether Collins or Sylvania, which is tooling to manufacture the socket for Collins, will market the device to other avionic equipment makers.

Heat Is Deadly

Significance of the Collins socket is emphasized by recent General Electric tests, under military sponsorship, which provided quantitative evidence on the deadly effect of temperature on tube life.

For example, type 5670 (twin-triode) tubes operated at a bulb temperature



COLLINS tests show sharp reduction in tube temperature rise with new slotted socket.

NEW

Trans-Sonics*

"TAPE-ON" SURFACE TEMPERATURE RESISTORS

for Temperature Telemetering

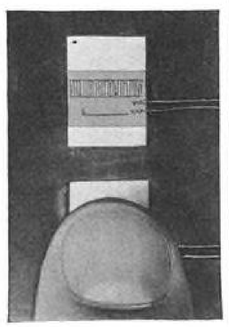
- NO HOLES TO DRILL — QUICK AND EASY "TAPE-ON" INSTALLATION
- OUTPUT UP TO 5 VOLTS WITHOUT AMPLIFICATION
- AVAILABLE IN VARIOUS RANGES FROM −300° to +400°F.
- RESISTANCE CHANGE OF 100 OHMS OVER SPECIFIED RANGE

Trans-Sonics Type 1371 "Tape-on" Surface Temperature Resistors are precision resistance thermometers with a platinum resistance winding as the sensing element. They may be applied to *any surface* whose temperatures are to be measured. In a commutation circuit, they modulate standard telemetering transmitters without amplification. The new Type 1371 "Tape-on" Surface Temperature Resistors may be added to an installation using other Trans-Sonics temperature transducers without any further circuitry modification. Each resistor is furnished with two 6" long fibreglas-covered constantan leads. Write for Bulletin 1370 to Trans-Sonics, Inc., Dept. 7.

*Reg. Trademark

SPECIFICATIONS

SIZE: 1/4" x 5/16"
Accuracy: ±2% of full scale range
Precision: ±0.5% of full scale range
Maximum Continuous Current: 20 ma rms (averaged over 1 second)
Environmental Operation Conditions
Vibration: 1" double amplitude, 0 to 22 cps ± 25g, 22 to 2000 cps
Shock: 100g in any direction, per paragraph 4.15.1 of MIL-E-5272A (10 milliseconds shock)



As easy to apply as a thumb print.

For Transducers, See Trans-Sonics

Trans-Sonics, Inc.

P. O. BOX 328 LEXINGTON 73, MASSACHUSETTS

of 115C suffered only 4% failures after 300 hr. operation whereas the same tube operated at a temperature of 260C suffered 26% failures over the same period.

After 3,000 hr. operation, there was only 8% failure of tubes operated at 115C bulb temperature compared to 66% for those at 260C. After 5,000 hours, the 115C tube failures reached only 26%, compared to 76% for the 260C tubes.

Controlled Cooling

Instead of random cooling of the entire avionic chassis, by blowing or sucking air through it, Collins pipes the air through a plenum duct in the chassis. Cooling air is forced up through slots in the tube socket, passing between the tube and its shield, out through the top of the shield and exiting finally from louvres in the equipment case.

To determine the effectiveness of the cooling technique, Collins ran tests on a number of different configurations using a 12AU7 (twin-triode) dissipating 7.4 watts.

When the tube was operated with an old-style JAN shield and no forced air cooling, tube bulb temperature rise was 182C above ambient temperature (23C), for a total temperature of 205C. At the higher ambient temperatures encountered in military aircraft, total tube temperature would be pushing 250-300C.

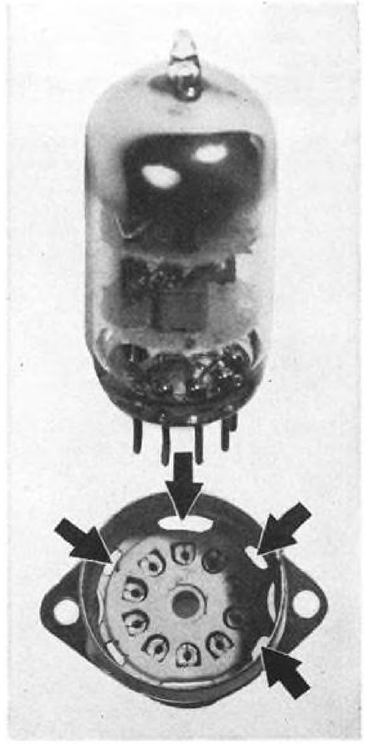
On the basis of its extensive tests, GE concluded that miniature receiving tubes of this type should never operate at total temperatures above 165C, and if long-life is desired, maximum total temperature should not exceed roughly 100C.

When Collins operated the tube using its 66J shield with corrugated liner that conducts heat from tube envelope to shield, temperature rise was reduced from 182C to 116C, a significant but insufficient improvement.

When forced air at a rate of 30 lb./hour/watts power dissipation was circulated around the tube shield, similar to the cooling technique now employed in many avionic equipments, tube temperature rise was lowered only 16C (from 116C to 100C).

But when the same air flow was piped through the new Collins tube socket, tube temperature rise was dropped from 116C to a mere 50C, a four-fold improvement over the temperature reduction achieved by conventional cooling techniques. When the rate of air flow was doubled (60 lb./hr./100 watts), tube temperature rise was reduced to 37C, Collins tests indicate.

The new slotted tube sockets and associated forced air cooling technique appear so promising that Collins already is using them in a number of new equipments now under design. One is an



TUBE socket slots (arrows) permit direct forced air cooling of tube envelope.

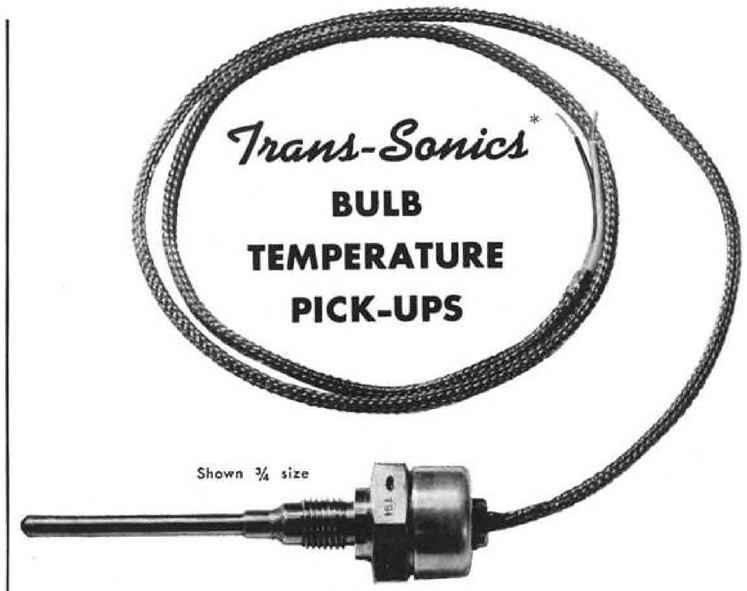
integrated communications-navigation-identification (CNI) package being developed for McDonnell Aircraft Co.

Tailored Air Flow

Different amounts of air are required to cool different tubes within an equipment and so air flow rates must be tailored to an individual tube's needs. To avoid the necessity of using a number of different tube sockets, each with different size slots, Collins controls the flow by means of the size and/or shape of chassis cut-out into which the socket is mounted. Seven standard cut-out patterns, three for 7-pin tube sockets and four for 9-pin sockets, provide varying degrees of closure for the air flow slots in the socket.

Collins Radio's Harry M. Passman points out that no attempt is made to seal the socket to the chassis to prevent air leakage. However, the main chassis which serves as a plenum supply duct does need to be moderately well sealed. Collins uses liquid neoprene for this purpose. The more tubes there are on the chassis, the less critical the leakage problem becomes since it represents a smaller percentage of the total exhaust areas, Passman points out.

Collins has developed a few simple charts which enable an avionic equipment designer to establish quickly the



Trans-Sonics* BULB TEMPERATURE PICK-UPS

Shown 3/4 size

- OUTPUT UP TO 5 VOLTS WITHOUT AMPLIFICATION
- ACCURATE UNDER 25G TO 2,000 CPS VIBRATION
- AVAILABLE IN VARIOUS RANGES FROM −300°F. TO 1500°F.
- RESISTANCE CHANGE OF 100 OHMS OVER SPECIFIED RANGE

Trans-Sonics Type 1300 Bulb Temperature Pick-ups are precision high-speed resistance thermometers with a platinum resistance winding as the sensing element. Each Type 1300 Bulb Temperaure Pick-up is individually calibrated and supplied with its own calibration sheet. The temperature interval over which the 100 ohm resistance change will occur may be as low as 100°F. These pick-ups are designed to withstand pressures up to 3,000 psia. When specified they can be furnished for installations in *corrosive* liquids or gases. Their leads can be exposed to temperatures up to 600°F. and may be detached from the instrument proper for shortening or easy replacement. Write for Bulletin 1300 to Trans-Sonics, Inc., Dept. 7.

* Reg. Trademark

SPECIFICATIONS

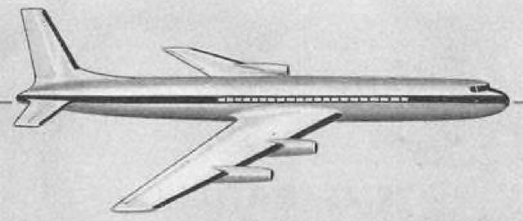
CASE CONSTRUCTION: Stainless Steel
ACCURACY: ±1% of full scale range
PRECISION: ±0.2% of full scale range
MAXIMUM CONTINUOUS CURRENT: 20 ma rms (averaged over 1 second)
TIME CONSTANT: Less than 2.5 seconds in agitated water
ENVIRONMENTAL OPERATION CONDITIONS
PRESSURE: 3000 psia (at room temperature)
VIBRATION: 1" double amplitude, 0 to 22 cps ±25g, 22 to 2000 cps
SHOCK: 60 g in any direction, per para. 4.15.1 of MIL-E-5272A (10 milliseconds shock)

For Transducers, See Trans-Sonics

Trans-Sonics, Inc.

P. O. BOX 328 LEXINGTON 73, MASSACHUSETTS

PIONEERING is our business



BENDIX

—a leader for over 25 years in aircraft oxygen breathing equipment—

ANNOUNCES NEW HIGH-ALTITUDE STANDBY OXYGEN SYSTEM FOR JET AIRLINERS

Safety considerations for new jet airliners demand a standby oxygen system for passengers and crew in the remote event that cabin pressurization is lost.

On the new commercial turbo-jets, which fly at 40,000 feet, this system must be able to supply pure oxygen to passengers and crew via individual demand regulators. On the turbo-prop airliners, flying at altitudes up to 30,000 feet, this system may use continuous flow regulators.

Pioneer-Central announces a new Bendix High-Altitude Oxygen System to satisfy requirements of the forthcoming high-altitude jet transports. Advantages include:

- Maximum protection for flight from 40,000 feet at any rate of descent.
- Provision for automatic visual and/or audio warning.
- Instant availability to each passenger and crew member when needed.
- One-piece, self-adjusting face masks for passenger use.
- Complete flexibility of arrangement and location of passenger masks and regulators to best suit individual types of airliners.
- Full walk-around mobility.
- Ready availability at all times for therapeutic requirements.

For full particulars on this advanced system and why it meets jet airliner needs most efficiently, contact PIONEER-CENTRAL DIVISION, BENDIX AVIATION CORPORATION, DAVENPORT, IOWA. Ask for publication No. 56-185.

West Coast Office: 117 E. Providencia Ave., Burbank, California.
Export Sales & Service: Bendix International Division, 205 E. 42nd St., New York 17, N.Y.
Canadian Affiliate: Aviation Electric Ltd., 200 Laurentien Blvd., Montreal, Quebec.

Pioneer-Central Division

Bendix AVIATION CORPORATION

forced air source requirements, estimate pressure drop and determine what size chassis socket cut-outs should be used to match individual tube air flow to its cooling needs.

The air flow required to cool each tube below a predetermined temperature, say 100C, depends upon a number of factors. Some, like power dissipation, can be determined in advance of building the prototype. Others, like heat radiated from nearby components, can not.

Collins says it can obtain a good approximation by basing air flow on a tube's power dissipation, its diameter (7-pin or 9-pin) and length.

The techniques and charts which Collins has developed are described in the company's report No. CTR-170. A limited number of copies are available.

Requests should be directed to Collins Radio Co., Technical Publications Dept., Cedar Rapids, Ia.

FILTER CENTER

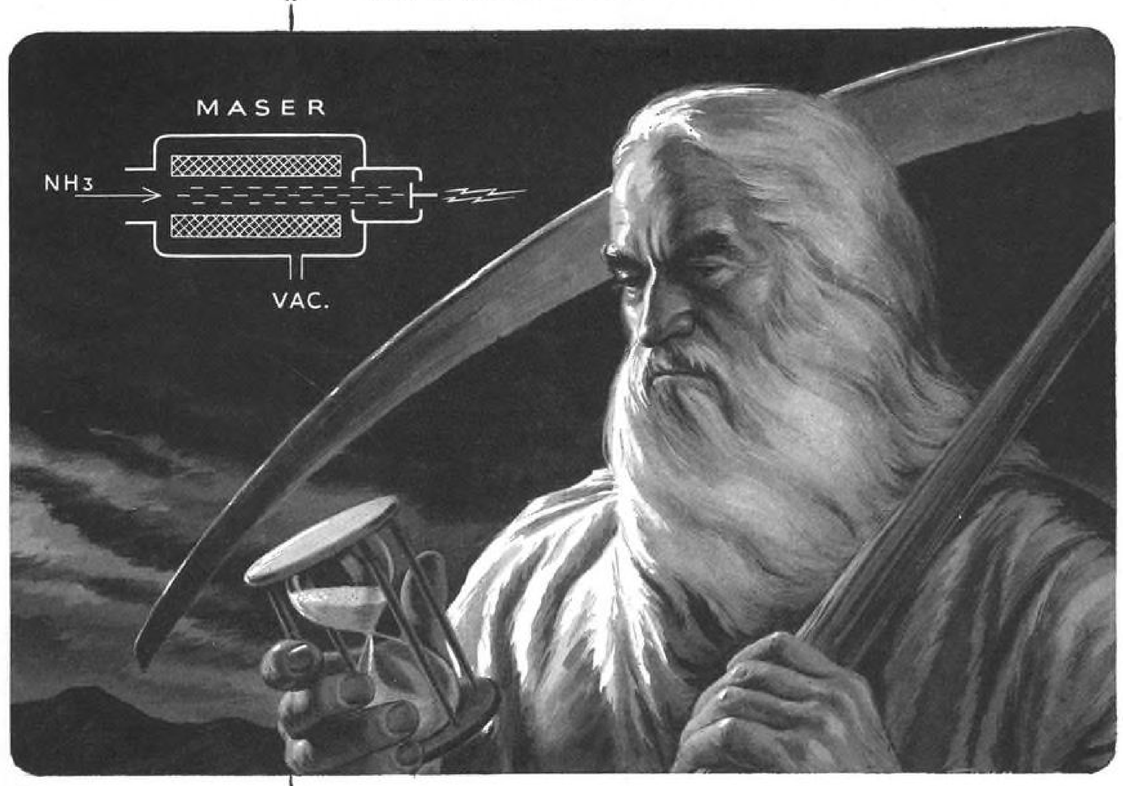
► **Any Counter-claims?**—Texas Instruments Inc. believes that it is the world's largest manufacturer of transistors, measured in numbers or in dollar volume, according to its president, J. E. Jonsson. Company predicts that the industry will have produced 12.5 million transistors in 1956, valued at $34 million. By 1961 production is expected to reach 175 million units worth $150 million and by 1965 the figures should jump to 400 million units and $225 million, according to TII. These figures do not include diodes and rectifiers.

► **Inertial Guidance** – White-Rodgers Electric Co. has completed development of an inertial guidance system for short-range missiles. Bench testing currently is under way.

► **Telemetry Checker**—Semi-automatic programmed tester which can check out a 177-channel FM/FM missile telemetering system in less than one hour, automatically printing out its measurements in digital form, has been developed by Pacific Division, Bendix Aviation Corp. The tester, which has provisions for self-calibration, can check carrier frequency and power output and frequency and amplitude of each subcarrier channel with respect to predetermined input signals. Voltage and frequency measurements are converted into digital form, then printed on tape.

► **Valuable Addition**—Remarkably complete and comprehensive treatment of the physics, technology and circuit applications of transistors, diodes and photocells is available in the newly pub-

IMPORTANT DEVELOPMENTS AT JPL



Pioneers in Electronic Research

The Jet Propulsion Laboratory is a stable research and development center located north of Pasadena in the foothills of the San Gabriel mountains. Covering an 80 acre area and employing 1600 people, it is close to attractive residential areas.

The Laboratory is staffed by the California Institute of Technology and develops its many projects in basic research under contract with the U.S. Government.

Opportunities open to qualified engineers of U.S. citizenship. Inquiries now invited.

Electronic research at the Jet Propulsion Laboratory covers many areas of interest to engineers working on problems of missile guidance and control. One of these is frequency and time standards—a prime requisite in Missile System Engineering.

The familiar crystal oscillator and similar timing sources have been exploited to the limits of their applicability. Looking to the future, our Electronics Research group is keeping abreast of developments in atomic and molecular resonance devices.

One such device under advanced development at the Laboratory is known as MASER (Micro Wave Amplification by Stimulated Emission of Radiation) invented by Prof. C. H. Townes of Columbia University. In MASER a beam of ammonia molecules is separated into energetic and non-energetic parts by an electrostatic field. The energetic molecules then enter a microwave cavity and sustain an oscillation by giving up their energy to the microwave field. The frequency of oscillation is determined principally by those properties of the molecules which are independent of environment.

MASER is one of the most stable sources of oscillations and is therefore a prime source reference for frequency and timing information. This device will have many applications in future missile design and is one of many challenging research projects in electronics in which the Laboratory is engaged.

If you are interested in an exceptional research opportunity and are qualified to do truly creative work in this field, write us today.

JOB OPPORTUNITIES IN THESE FIELDS NOW

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TELEMETERING • RADIO AND INERTIAL GUIDANCE • GUIDANCE ANALYSIS
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JET PROPULSION LABORATORY
A DIVISION OF CALIFORNIA INSTITUTE OF TECHNOLOGY
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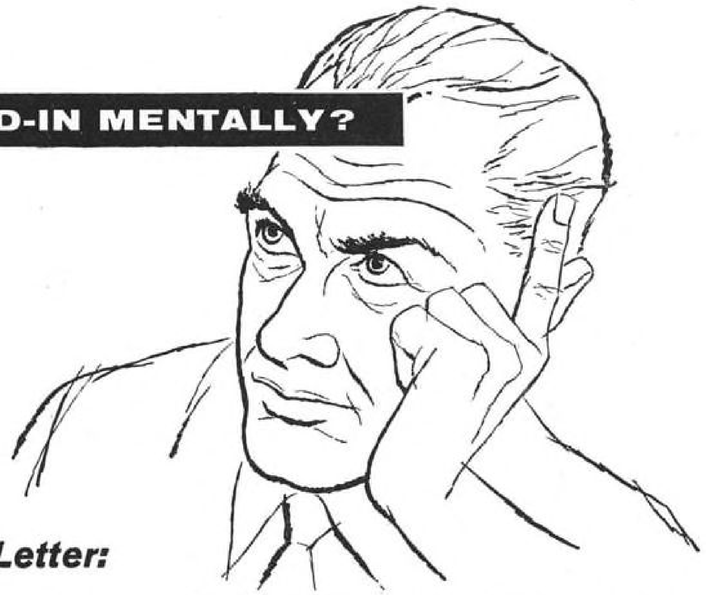


BOXED-IN MENTALLY?

An Open Letter:

TO ENGINEERS, SCIENTISTS AND MATHEMATICIANS

Who Are Thinking of the Future

Whatever Your Past Experience...
There's a Place for You in Atomic Energy at B&W

Take stock of yourself . . . your job . . . your living conditions. If you're boxed-in mentally; if your future looks dim; if you're living somewhere west of nowhere, or in a crowded city—or an outlying suburb—now is your chance to get out and better yourself. Get in atomic energy. Enjoy an interesting job and live in Lynchburg—the heart of Virginia's Blue Ridge country.

There's plenty of elbow room right now in atomic energy at B&W. There's plenty of room to grow, as so many of our men have discovered. This is the place and the field to consider, if—like most men with your education and background—you're thinking about your future.

HERE IS A NEW FRONTIER—for you at B&W. And you don't need specific nuclear experience to take advantage of the opportunities. If you have training or experience in any of the following fields, there's a job waiting for you at B&W in which you can fruitfully apply your talents.

Mechanical Engineering • Physics • Chemistry • Mathematics
Civil Engineering • Chemical Engineering • Electrical Engineering • Engineering Physics • Fuel Technology • Metallurgy • Metallurgical Engineering • Nuclear Engineering

THERE'S AN EXTRA PLUS, TOO. Fine living conditions in a clean city with excellent schools—and the friendliest sort of people for neighbors.

B&W's engineering research and development background spans nearly 100 years. We've been active in atomic energy from the beginning — at Oak Ridge, Los Alamos and Hanford. We're working today on a variety of projects—designing and building the first privately owned nuclear power plant, pioneering in research reactors at home and abroad, developing a pressurized-water reactor for the first nuclear-propelled cargo vessel.

Atomic energy is in its infancy. The opportunities for personal and professional recognition are great. You can become part of the group of engineers, scientists, and mathematicians who truly are writing the rules, paving the way for those who come after you in this great field. It's like being at Kitty Hawk with the Wright Brothers. You're on the ground floor with B&W and you can grow with the field.

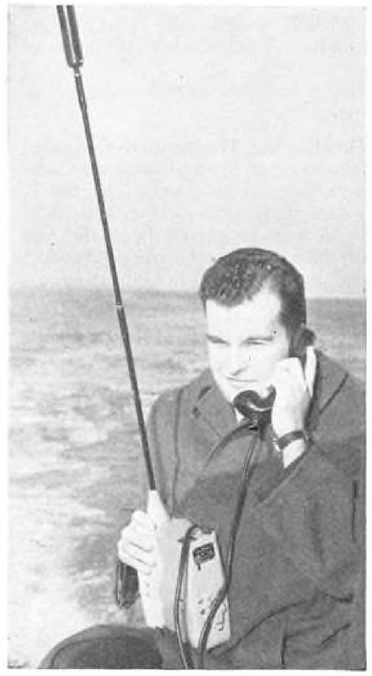
TODAY is the day to take that step toward building your future. If you like new and different problems, we have the job for you. The Babcock & Wilcox Company, Atomic Energy Division, 161 East 42nd Street, New York 17, N. Y.

PE-19-AE

Write for literature describing some of B&W's atomic energy activities or send resume to: Personnel Department, Sect. AW-12, The Babcock & Wilcox Company, 161 East 42nd Street, New York 17, N. Y.

BABCOCK & WILCOX

ATOMIC ENERGY DIVISION



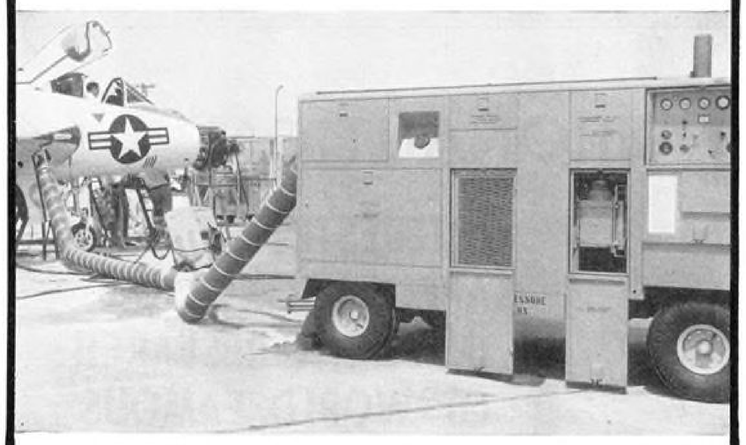
Light Walkie-Talkie

Lightweight mobile HF walkie-talkie operates in the 2-4 or 4-6 mc. band, weighs 8 lb. including antenna and batteries, puts out three watts am power. Set can operate for 10 hr. continuously on a duty cycle of five minutes transmitting, 15 minutes receiving from rechargable battery. Transistorized receiver will operate for 250 hr. on one battery charge. New set, called Avcom Mark I, was developed by Avco Manufacturing Corp.

lished "Handbook of Semiconductor Electronics." The handbook is the work of 12 contributors, from a number of different companies, edited by Lloyd P. Hunter of International Business Machines Corp. Circuit design sections cover low frequency, high-frequency and video amplifiers. Sections on graphical analysis of non-linear circuits and matrix methods of circuit analysis are included. Extensive list of outside references follows each of handbook's 20 sections. (McGraw-Hill Book Co., Inc.; $12.00.)

► **Automatic Flight Control Report**—Radio Technical Commission for Aeronautics Special Committee 18 has released report on its studies of the use of automatic flight control techniques for take-off, cruise, approach, landing and taxiing. Report includes analysis of the final approach problem, with criteria for adjustment of ILS localizer facilities. Standards for localizer receiver output and autopilot coupler output characteristics also are recommended. Copy of the report, identified

there's a heat barrier on the ground, too!



With so much talk about the various in-flight "barriers," it should be mentioned, there is a "heat barrier" problem for jet aircraft on the ground, too. Ground checking of instrumentation and other parameters requires efficient and dependable cooling. That's why manufacturers like Douglas Aircraft Co. use American Electronics' MA-3 ground support air conditioners on the F4D-1 SKYRAY and other aircraft.

The unit shown here has a "design load" output rating of 100 lbs/min of 45F air against 0 to 3 psig static pressure with controllable output temperatures ranging between 35F and 65F. The unit is designed to perform under all world wide operational conditions including ambient temperatures ranging from —65F to 137F. American's MA-3 is gasoline engine powered, but is also available with electric motor driyes and is but one of a series of designs and capacities available. Construction and instrumentation are such that satisfactory operation and maintenance may be obtained with relatively untrained personnel.

If you have aircraft ground support cooling or heating problems, why not consult with American Electronics Engineers? They can provide an economical solution.

AMERICAN ELECTRONICS, INC.
Marketing Division
655 W. Washington Boulevard
Los Angeles 15, California

Other products manufactured by the Electric Machinery & Equipment Division of American Electronics include: Motor Alternators, Static Power Supplies, and Magnetic Amplifiers.

as Paper 151-56/DO-74, can be obtained for $1.50 by writing RTCA Secretariat, Bldg. T-5, Room 2036, Washington 25, D. C.

► **Predictions For 1957**—Avionics industry business for 1957 should be up 8-10% over 1956, according to predictions by officials of two major suppliers:

• **Minneapolis-Honeywell's** Stephen F. Keating, vice president, predicts that automatic controls and instrument sales for aircraft and missiles will reach $1.5 billion in 1957, approximately $100 million above 1956 and twice the figure of five years ago.

• **General Electric's** Dr. George L. Haller, general manager of the Defense Electronics Division, estimates that military electronics will hit $3 billion, approximately 10% over the figure for 1956. Haller predicts that this figure will double in the next ten years even with a relatively stable defense budget.

(Some observers place the current military electronics expenditures in the $4-billion bracket. Exact figures are difficult to obtain because the cost of much avionics equipment is now included in airframe-missile procurement figures.)

► **Airlines To Test SSB**—Collins Radio is building approximately 50 single sideband AN/ARC-58 transceivers, some of which will be tested by domestic and international airlines late this year or early in 1958.

Set is being developed under USAF sponsorship.

► **Hustling For The Hustler**—Some idea of the scope of Sperry Gyroscope Company's program to develop the bombing-navigation system for the B-58 Hustler can be gained from the fact that four of Sperry's major vendors alone have more than 200 engineers working on the program.

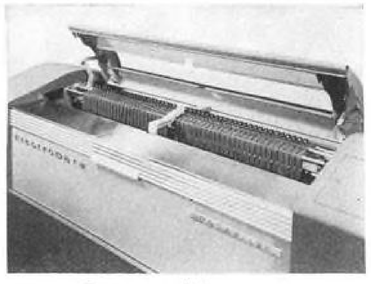
► **New Business**—Recent announcements of new contracts by avionics companies include:

• **Minneapolis-Honeywell** received $9.4 million contract from Air Force for automatic flight control systems for North American F-100F, two-place trainer version of the F-100 Super Sabre.

• **W. L. Maxson Corp.** reports $2 million Navy Bureau of Aeronautics order for airborne electronic countermeasures equipment.

• **Burns and Roe, Inc.**, New York consulting engineering firm, has received "sizable contract" to design and supervise construction of facilities to house electronic equipment for SAGE air defense system.

• **Electronic Equipment Engineering Co.** of Dallas has received $70,000 contract from Bendix Radio Co. to produce 250 automatic direction finder control heads.



Super Memory

Twenty million bits of information can be stored in new Burroughs ElectroData Datafile, 10 times the capacity of any other equipment now available, according to manufacturer. Ten such Datafiles can be integrated into one computer system to provide 200 million bit storage capacity. Datafile employs 50 250-foot magnetic tapes each of which move under computer command at speed of 5 ft./second. Twin read-write heads are propelled underneath tapes into correct position to insert or extract desired data. Company reports orders for 50 units and says it will be turning them out at rate of 15 per month in 1957.

AERONAUTICAL

INTERESTING APPLICATIONS IN FLIGHT RESEARCH OF WORLD FAMOUS SPERRY EQUIPMENT

ENGINEERING TEST PILOT

with recent jet fighter or 4 engine experience. Engineering degree, and 2500 hours minimum flying time required.

UTILITY PILOT

Commercial and instrument ratings required. Minimum of 2500 hours first pilot time. Seaplane rating desirable.

FULL EMPLOYEE BENEFITS
RELOCATION ALLOWANCES

APPLY TO MR. R. STEWART

SPERRY GYROSCOPE CO.

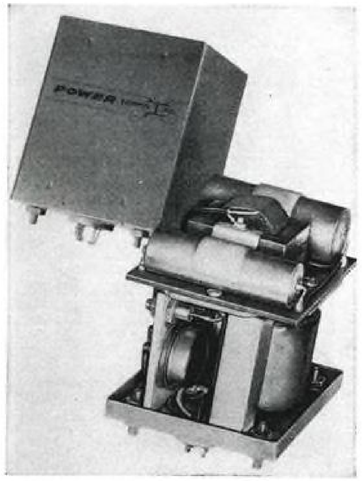
Division of Sperry Rand Corp.

MacArthur Field
Ronkonkoma, L. I., N. Y.

NEW AVIONIC PRODUCTS

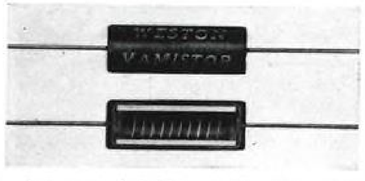
Components & Devices

• **DC to DC Trans-Converter,** using semiconductors, is available in four models for inputs of 14 or 28 v.d.c. and outputs of 325 v.d.c. at 100 or 200 ma. Units come in hermetically sealed cans measuring approximately 3¼ x 3¼ x 2½ in., can be operated in ambient temperatures of —55 to 75C



with efficiencies up to 90%. Regulation is quoted at 20% on standard units, but is available to 0.5% if required. Special units also are available with different input, output voltages and ratings up to 500 watts. Power Sources, Inc., 6 Schouler Court, Arlington, Mass.

• **Metal-film resistors,** fused and hermetically sealed in ceramic tube, with accuracies of ½ or 1%, rated ½ watt at 85C or 125C are now available in



resistances of 1,000 to 100,000 ohms with temperature coefficients of 25 or 50 ppm. Weston Electrical Instrument Corp., Newark 12, N. J.

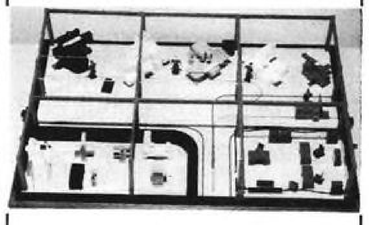
• **Transistorized servo amplifier,** Model 1800-0700, for 60 cps. use, is designed to drive a 6 watt servo motor (Kearfott Type R 160-5 or equivalent). Amplifier draws 350 ma. at 28 v.d.c. for maximum output signal, 20 ma. for zero signal. Voltage gain is 550 at 2 watts output; input impedance is 10,000

ohms. Unit comes in hermetically sealed, plug-in case, measures approximately 1¼ x 1¾ x 3¾ in., weighs 6 oz. M. Ten Bosch, Inc., Pleasantville, N. Y.

• **High temperature chopper,** Type 310, for operation at temperatures of —65 to 125C, is designed for 400 cps. use, with contacts rated for 2 ma. at 100 v. Phase angle lies between 50 and 80 deg. lagging between —20C and 100C, and between 45 and 80 deg. from 100C to 125C. Drive coil is rated for 6.3 volts. Units are hermetically sealed. The Airpax Products Co., Middle River, Baltimore, Md.

• **Subminiature Trimpot** for printed circuit applications, Model 205, has

MODEL COSTS CUT IN HALF!



Models now cost *less* than most home made templates. Now you can get a new type of layout model containing only essential detail (no "gingerbread") and costing half as much as heavily detailed models. New cost is 2¢-4¢/sq. ft. of plant depending on congestion and size. These simplified models are available in various scales: ⅛, 3/16, ¼, ½" to the foot.

A team of engineers & craftsman

Industrial Models, Inc. 2800 SCONSET RD., WILMINGTON 3, DEL. CLEVELAND - NEW YORK - PITTSBURGH LOS ANGELES - NEW ORLEANS - HOUSTON THE HAGUE, HOLLAND - MANCHESTER, ENGLAND

TRY THIS TEST ON YOUR PRODUCT'S LABEL

Coin test equals years of normal wear

Scrape a coin briskly over your product's name plate or decal. Chances are it will scratch the name plate or tear the decal right off. Not so with Metal-Cal.

Even under extreme conditions of temperature and abrasion, Metal-Cals remain bright and easy to read for years. Metal-Cal, the original aluminum foil applique, is made of .003 inch aluminum, backed with an amazing adhesive requiring no screws, pins, rivets or heat for normal application.

And the eye appeal of Metal-Cal's shiny or matte aluminum finish plus a choice of deep, rich colors... anodized, dyed and etched right into the metal, is a real sales tool in itself.

Try the coin test today. See if your present label measures up to the permanent, long wearing beauty of a low cost Metal-Cal.

Metal-Cal®

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WITH cold drawing experience like ours at your service, you can submit the most exacting tubing specifications for any combination of flawless through-and-through quality, perfect finishes inside and out, unique shaping, absolute straightness . . . and be *sure* of the results. Modern testing methods prove it every day.

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Specify TMI

Specialists in small diameter tubing .050" to .625" O.D. with tolerances as close as .001" when required. Problems? It will be a privilege to solve them for you.

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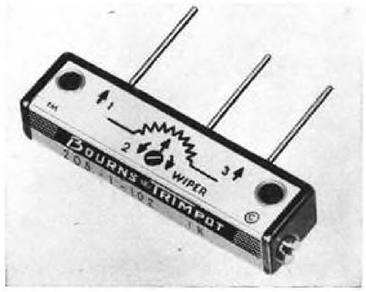
TUBE METHODS INC.

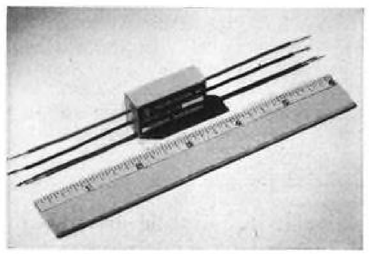
METALLURGISTS • ENGINEERS • MANUFACTURERS

BRIDGEPORT (Montgomery County), PA.



0.028 in. dia. pin terminals for mounting and connection. Provision also is made for body mounting screws. Unit is rated ¼ watt at 50C, can operate up to 105C. Pot provides 25-turn screwdriver adjustment. Bourns Laboratories, Inc., 6135 Magnolia Ave., Riverside, Calif.

• **Miniature crystal filter,** with 20 mc. center frequency and 50 kc. bandwidth at 6 db. attenuation, occupies only ½ cu. in. in volume and weighs 1 oz. Shape factor (ratio of bandwidth at 60



db. to 6 db.) is 4:1, insertion loss is 3 db. maximum. Technical bulletins describing this and other filters in the 10 kc. to 30 mc. range are available. Hycon Eastern, Inc., 75 Cambridge Parkway, Cambridge 42, Mass.

• **Subminiature relays,** in DPDT contact arrangement, are available in two types. S-310, with 25 mw. per pole sensitivity, measures ¾ in. dia. x 1 3/8 in. Type SM-310 has sensitivity of 60 mw., measures ¾ in. dia. x ⅞ in. long. Units can withstand 50G shock, operate over temperature range of −65 to 125C. Non-gaseous silicone materials are used throughout. U. S. Relay Corp., 1744 Albion St., Los Angeles, Calif.

Laboratory Equipment

• **Transistorized pulse generator,** Model 502, operates from self-contained 22½ v. battery which provides useful life of 450 hr. Device provides pulse length from ½ to 3 microseconds in three steps with a 20 volt peak into an 800 ohm load. Positive or negative pulses are continuously variable in amplitude from zero. Rise and decay time is 0.1 micro-

second or less, with less than 2% tilt and overshoot. Repetition rate from internal synchronizer is 50 to 5,000 pps., or 0 to 5,000 from external synchronizer. Device weighs 4½ lb., is priced at $325 including battery. Cubic Corp., 5575 Kearny Villa Road, San Diego 11, Calif.

Computers & Datamation

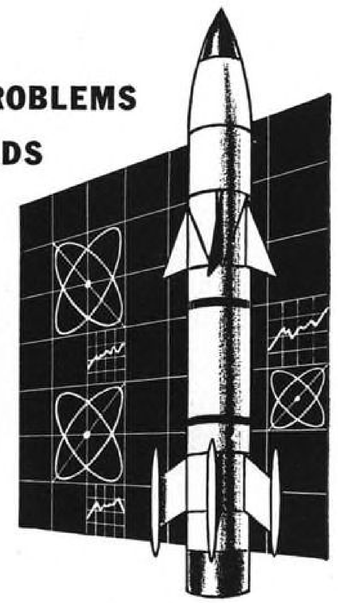
• **Electric typewriter** for use as input/output device with computers, operates at speeds of 120 words/minute. Unit, approximately same size as standard office electric typewriter, is available with carriage lengths up to 30 in., and is priced from $740. International Business Machines Corp., Electric Typewriter Div., 590 Madison Ave., New York 22, N. Y.

• **Pulse-to-analog converter,** Model 8915 "Rotostepper," is an electro-mechanical shaft positioning device which provides controlled incremental shaft rotation of one two-degree step per d.c. pulse. Rotation is unlimited in either a CW or CCW direction and stepping speed is as high as 60 steps per second, with torque output up to 14 oz. in. Between pulses,

shaft position is accurately locked. Input is 1 amp at 28 v.d.c. with pulse duration as short as 10 milliseconds. Optional control feature provides homing to a fixed reference position, automatic continuous stepping with steady d.c. input voltage, and/or potentiometer output proportional to shaft position. G. M. Giannini & Co., Inc., 918 East Green St., Pasadena 1, Calif.

WHICH OF THESE PROBLEMS FIT YOUR FIELDS OF INTEREST IN

INERTIAL GUIDANCE ?



BELL has recently scored an important break through of one of the major technological barriers in the field of inertial instrumentation . . . a break through of such importance that its impact on inertial techniques of the future can hardly be overestimated. This has resulted in one of the most far reaching and most promising inertial navigation programs that exist today. Here are some of the pertinent problems in the field of precision inertial instrumentation on which Bell engineers are now working.

1. Develop an AC amplifier with a gain stability of 1 part in 20,000 over a temperature range from 30° F to 140° F, a frequency response from 300 to 500 cps, a weight of less than 2 pounds, and capable to withstand up to 10 g's vibration.

2. Measure the position of the center of gravity of a pendulum to less than .01 milliradians and its variation with temperature.

3. Build a continuously emitting light source of a .005" in diameter covering 230° solid angle with a "surface luminosity" greater than that of the sun!

4. Develop a resolver system for DC or AC with an accuracy of 1 part in 20,000 that uses standard electronic and mechanical components and weighs less than 2 pounds.

If your qualifications place you in a position to help solve these challenging problems...or if you are now limited in the scope of your opportunity and would like to participate in any of Bell's widely diversified activities in other fields, write today: Manager, Engineering Personnel, Department E-1, BELL AIRCRAFT CORPORATION, P. O. Box One, Buffalo 5, N. Y.

BELL Aircraft CORP.

BUFFALO N.Y.

SKYWATCH for returning planes is kept from operations tent (foreground) as a war-surplus Naval Aircraft Factory N3N loads up for another trip over forest fire.

BORATE POWDER is emptied from 50-lb. bags and is mixed with water to heavy consistency.

LOADED STEARMAN (below, right) waits for N3N to clear the loading area.

Fire Fighting Planes Tested

Aircraft may play an important role in fighting future forest fires as a result of successful experiments conducted by the U. S. Forestry Service in California. These trials have also furnished valuable information on improving aircraft equipment and tactics for these missions.

California's Forestry Service personnel estimate that the use of several aircraft would provide savings of more than $600,000 in one year, their indicated effectiveness saving that much in timber, cost of replanting, extra fire crews and special equipment. It is calculated that the planes would be used a minimum of 400 hr. annually with operational expenses being approximately $90/hr.

An evaluation program is now under study by the Forest Service Special Equipment Center at Arcadia, Calif., which is practicing operational techniques at various fires and areas.

Shasta Fire

Both state and federal departments of the Forestry Service used aircraft to a limited extent in 1955. The technique marked time until a fire broke out in the Shasta National Forest near Castella at the 3,500-ft. level. Since surface fire crews would require several hours to get to the scene, it was decided to try aircraft.

By the time the five Stearmans were loaded and on their way, the fire had expanded to an area of approximately 150 acres, yet the airplanes extinguished it with some 60 drops before the fire crews could get to the scene.

This experience was a key factor in the decision to let contracts to aircraft operators for fire control work in 1956. Actually, the response was low, because many agricultural plane operators felt that the modifications necessary would restrict the maximum utility of their planes.

Willows Flying Service, Willow, Calif., a seed and dust firm, took the opportunity because the contract period was during its slack season. In operations during fires in the San Bernardino Mountains, where rugged slopes of 50% or more were met, aerial application turned out to be the only way of reaching the blazes.

The crop dusting planes and pilots used proved to be readily adaptable to their mission.

In most cases to date, water only has been dumped from the aircraft; where fires threaten large areas, a chemical solution of borate and water has been dropped.

Four pounds of borate, a sodium-calcium powder made by Pacific Borax Co., is mixed with sufficient water to make a gallon of solution, weighing some 12 pounds.

Although more effective than water because its evaporation rate is much less, the borate solution sterilizes soil and plants, making replanting impossible for several years, paving the way to soil breakdowns in hilly areas.

The water or chemical is dropped in four to six seconds. Spray booms cannot be used. In the case of water, the discharge would be too fine permitting rapid evaporation; the chemical solution is too thick to be pumped through booms or nozzles.

Maximum Load

The Stearmans initially used standard six-inch dump valves. These were changed to a full throat hopper dump valve, with most planes having a six-inch x 20-inch rectagular throat lid hinging forward.

Loading throats were enlarged to five or six-inch diameters.

The 450-hp. Stearmans can take a maximum load with safety factor of 115-125 gal. of chemical and make their drops from approximately 30 ft. altitude. The chemical generally dispersed to a width of approximately 125 ft.

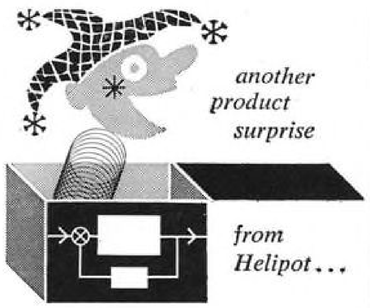
Drops are made on the fringes of a fire by one or more aircraft flying singly or grouped in a staggered formation, guided by a director plane.

As a result of initial experience with aircraft, these improvements for future operations are indicated:

- **Radio equipment** is a must; none of the Stearmans were so fitted and the use of a director plane proved to be inefficient, leading to confusion. Radio would allow the chemical or water dispensing pilot to stay in contact with fire ground crews for greater efficiency and also with the airstrip.
- **Loading and dumping** of material must be simplified to speed up operations; the dump valve should be controllable to allow several passes. The current forward hinging opening cannot be closed after it is opened in flight until after landing.
- **Aircraft** should be fitted with racks for dropping fire equipment to ground crews; it is believed lives of some ground crews who perished in forest fires could

CHEMICAL SWATH is dumped by low-flying surplus N3N trainer. Fringe or spot blazes are hit by individual planes; formation drops are made on major areas or along a fire front.

STEARMAN PULLS AWAY after quick dump of its load. Swath may widen to 125 ft.



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Servomotor-

Rate Generator

Snug as two bugs in their unitized stainless steel housing, motor and generator work hand-in-hand on the same shaft . . . to improve response characteristics of suffering servo systems.

Where the trouble is in the dynamics of your system components, watch this purposeful pair roll up their sleeves and go to work. The high torque-to-inertia motor, for instance, responds quickly and accurately to error signals . . . with acceleration at stall up to 100,000 radians/sec.². Signal-to-noise ratio of the linear generator is 25:1 or better. Aiding and abetting each other in their dedicated mission, they'll operate continuously at stall and at total unit temperature from −55°C to 200°C.

Right now, our corrosion-resistant, completely encapsulated Servomotor-Rate Generators are available in sizes 11, 15 and 18. (We'll soon add size 8; eventually, other sizes.) We've got descriptive literature available too. It's data file 13B.

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have been saved if they were in contact with aircraft.

• **Colored smoke** or dye markers would be useful in pinpointing objectives.

• **Evaluation** of fire-fighting chemicals should be made to find those that may be used without harming plant life.

First-hand evaluation of the use of aircraft in fire-fighting has been made by personnel of Transland Co., Torrance, Calif., for the purpose of adapting the company's Ag-2 spray/dust airplane to this operation.

The Ag-2 has four 62.5-gal. tanks in the wings, each with a separate dump valve, allowing individual jettisoning, they point out. Also, there is a 300-gal. capacity hopper in the fuselage ahead of the pilot, with a 12-in. x 42-in. fully controllable dump opening.

Controllable dumping is an important factor the Transland people who witnessed the operation say. Some areas require dropping of only a partial load to bring them under control.

Banker Gives Tips On Plane Financing

Loans to finance purchase of aircraft are desirable because they represent relatively large units with not very much more paper work involved than handling of auto loans, according to owner-pilot Kent Ravenscroft, president of the First National Bank of Clayton, St. Louis, Mo.

Speaking at the National Aviation Trades Assn.'s recent annual convention, Ravenscroft offered these guidance points for bankers:

• **Require sufficient** buyer equity in the plane; 30% down on new planes, 40% down on used models.

• **Be realistic** about the term of the loan; 24 months on used aircraft, 36 months on new planes being preferred.

• **Insurance** should contain "breach of warranty" clause so plane is fully covered even when flown by unqualified pilot.

U. S. BUSINESS & UTILITY AIRCRAFT SHIPMENTS

(January—October 1956)

Make and Model	Aircraft		Builders's Net Billing Price	
	Oct.	Jan.-Sept. Total	Oct.	Jan.-Sept. Total
Aero Design 560-A	2	46	$1,546,000	$7,978,000
680	18	68		
Beech 35 Bonanza	34	571		
E18S Super 18	9	82		
D18S	0	6	1,814,068	23,134,269
50 Twin-Bonanza	50	105		
45 Trainer	0	60		
Callair A-4	0	16	0	91,418
Camair 480	2	14	55,690	369,140
Cessna 170	1	71		
172	97	1,293		
180	20	445	2,745,226.91	30,045,936.27
182	83	727		
310	17	182		
Champion 7EC	21	155	90,300	608,103.46
Colonial C-1 Skimmer	2	4	34,000	68,000
Helio H-391B Courier	2	21	46,000	484,000
Lear Learstar Mk. 1	1	6		
Learstar Mk. 2	0	1	495,000	2,353,000
Mooney M18	0	9		
M20	5	55	52,000	588,006.65
Piper Super Cub PA-18	17	218		
Super Cub PA-18A	28	370	1,548,524	19,040,070.04
Tri-Pacer PA-22	71	900		
Apache PA-23	31	331		
Royal Gull P.136-L1	1	10	74,500	819,000
Taylorcraft Model 20	2	31	20,961.43	273,953.80
Totals	514	5,797	$8,522,270.34	$85,852,897.22

Source: Compiled by AVIATION WEEK.

Narmco Materials Development...

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Teamwork

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Action!

Progress is the result of advanced design and advanced materials keeping abreast of each other . . . meeting, *as a team*, the enormous responsibilities imposed by the aircraft industry.

Write for brochures detailing application and performance characteristics of METLBOND 302 and CONOLON 506 laminating materials.

A STRIKING EXAMPLE OF NARMCO'S LEADERSHIP IN DYNAMIC MATERIALS DEVELOPMENT:

This sandwich-type, static test article was designed and fabricated by Narmco, Inc. for the Air Force and proved its structural efficiency by achieving a weight saving in excess of 50% over its metal counterpart. Carried externally to the aircraft, the component was developed to accommodate the same basic load as a similar aluminum structure. It employed Conolon laminating materials, Metlbond 302, and aluminum honeycomb core. It successfully met all elevated temperature static tests, thus substantiating predicted results.

NARMCO

Narmco technical field representatives throughout the United States and Canada can assist in solving your structural design problems quickly, efficiently, and economically. For immediate assistance write, wire, or phone.

Narmco Resins & Coatings Company, Dept. 862, 600 Victoria Street, Costa Mesa, Calif.

Hartzell.

COVERS THE FIELD

CESSNA 180

why Hartzell constant speed and feathering propellers are specified as standard equipment on nearly all aircraft in the 150 to 400 HP category

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- Lowest maintenance cost—easy to overhaul
- Lowest blade replacement cost—only ½ the cost of others
- World-wide sales and service organization backed by the progressive 40-year-old Hartzell Propeller Co.

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Beech
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Aero Design
Mooney
Taylorcraft
Helio
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Dornier
and others

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More **narco** radios are installed as standard equipment in new production business aircraft than any other type because **narco** builds reliable, high-performance, thoroughly proven equipment for every requirement.

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Ideal for the manufacture, test, maintenance, modification, repair or storage of: aircraft, aircraft components, armament, guided missiles, drones, jet engines, rockets.

Five thousand acres isolated from populous regions. Four long runways, which can be readily expanded. Large parking aprons. Operational buildings & hangars.

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Flight Tests Begin For Austrian O.K. 15

Vienna, Austria—Initial flight tests have started on the first Austrian designed airplane since 1938. Prototype O.K. 15, a low-wing two-seat side-by-side lightplane is designed for utility and training.

Powered by an aircooled four-cylinder Walter Minor III engine, of 105 hp., the O.K. 15 has a top speed of 136 mph. and cruises at 124 mph.

Range of the new aircraft is approximately 400 mi.

Mixed construction, comprising metal, wood and fabric is used. Designer is Otto Kauba and the airplane was built by Austrian Aircraft Works, Ltd., Wiener Neustadt.

Following tests by the government, the O.K. 15 is scheduled to be put into production.

New Training Course for Agricultural Pilots

Course to train commercial pilots in aerial application of agricultural materials has been drafted by several California aviation and educational organizations.

Aim of the schooling is to relieve what these organizations call a critical shortage of trained spray/dust specialists in the state.

Patterned after Texas A & M College System's course (AW Apr. 16, 1956, p. 93), the training is being offered by University of California, Davis.

Flight instruction of approximately 30 hr. will be provided in Stearman and Piper PA-18A aircraft. Experienced applicator pilots may take an abbreviated 15-hr. flight course if they desire check-outs.

Classroom instruction in the handling of aerial application chemicals is included in the curriculum.

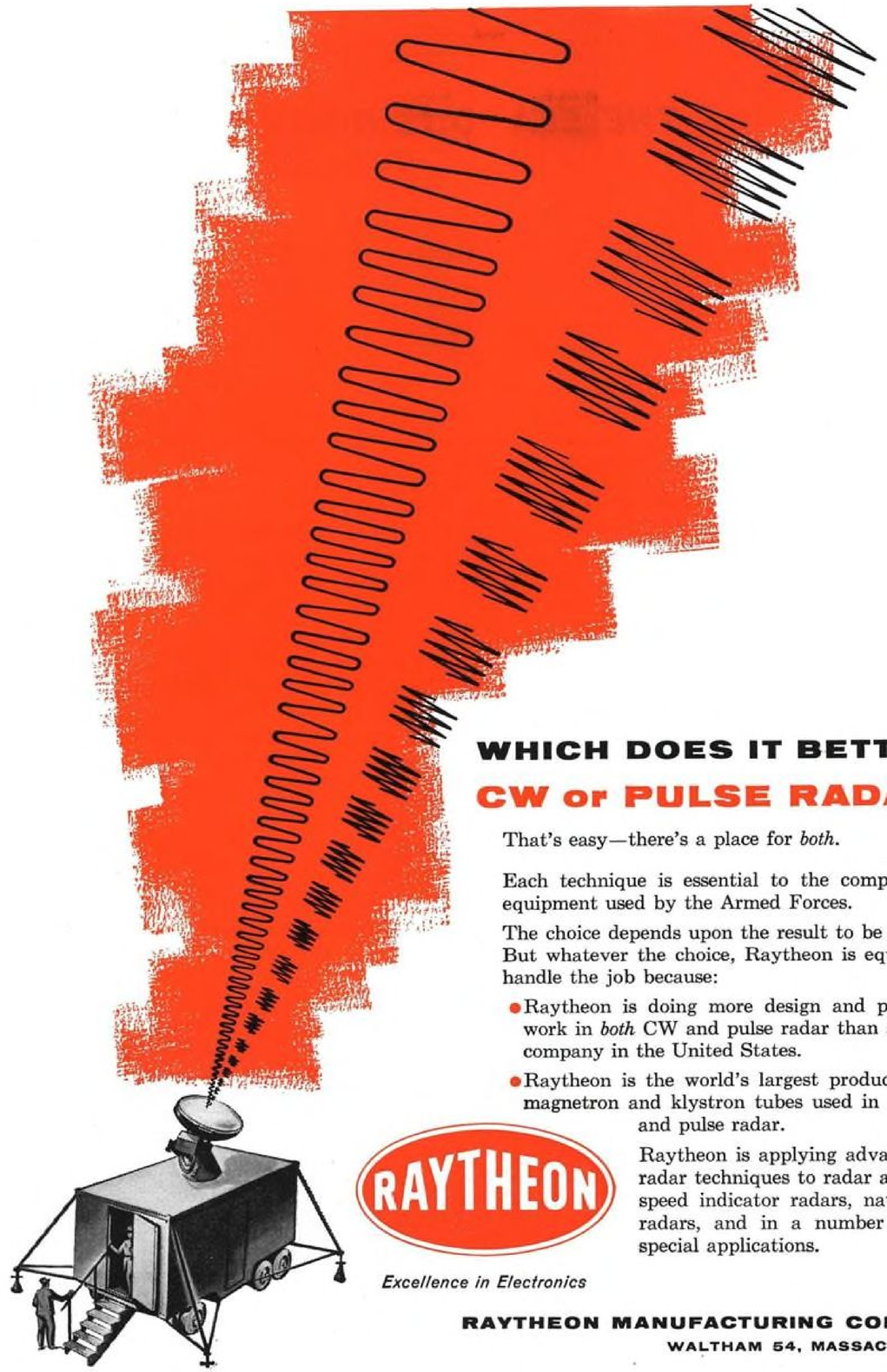
Oakland Airport Plans New Hangar Construction

Building of 24 business and personal plane hangars costing more than $200,000 at Oakland Metropolitan Airport has been approved by the Board of Port Commissioners.

Construction bids will be opened Jan 21.

Type of hangar will depend upon cost, both T-model and clover-leaf layouts are approved. Plans call for building 20 units to house single-engine aircraft, the remainder for twin-engine types.

The airport area has sufficient room for construction of 300 small hangars, the Port of Oakland states.



WHICH DOES IT BETTER—
CW or PULSE RADAR?

That's easy—there's a place for *both*.

Each technique is essential to the complex radar equipment used by the Armed Forces.

The choice depends upon the result to be achieved. But whatever the choice, Raytheon is equipped to handle the job because:

- Raytheon is doing more design and production work in *both* CW and pulse radar than any other company in the United States.
- Raytheon is the world's largest producer of the magnetron and klystron tubes used in both CW and pulse radar.

Raytheon is applying advanced CW radar techniques to radar altimeters, speed indicator radars, navigational radars, and in a number of other special applications.

RAYTHEON

Excellence in Electronics

RAYTHEON MANUFACTURING COMPANY
WALTHAM 54, MASSACHUSETTS

THE ERA OF THE ELAND IS BEGINNING...

The case for ELAND conversion

To forward-looking operators of medium-haul airlines the case for ELAND conversion becomes clearer and more convincing month by month. Increasingly they see that ELANDS point the way to the achievement of better performance, greater earning capacity, and greater dependability in service from well-proven airframes.

No beat, whine or whistle

ELANDS possess to the full that inherent asset of the turbo-prop—a greatly reduced noise level. And over and above this they have an inherent asset of their own—a complete absence of beat, whine or whistle. The passenger appeal implicit in this needs no emphasis.

Flexibility of power

ELAND design provides a wide range of power in a one-sized package. The 3,000-4,200 e.h.p. range of ELAND engines differ nothing in size and only little in overall weight. This flexibility will enable operators to standardize on one basic engine and nacelle design where two or three different types of piston engines are now required.

Conversion of the Convair 340

The Napier Eland Convair—a Convair 340 which we bought from the makers and converted to ELANDS—has proved the simplicity of ELAND installation, the low cost of conversion and the increased profits that accrue from ELAND operation.

From studies made of the published direct operating costs (including depreciation) of a number of typical airlines, it is proved that in the light of our guarantees a converted aircraft will be cheaper to operate—whether the costs are calculated on the basis of aircraft miles, ton miles or passenger miles. The ELAND-engined Convair 340 can carry its maximum payload 930 miles further than piston-engined Convairs, and its cruising speed is 50 m.p.h. higher.

In short, we offer to operators of the Convair—and other medium-haul 'planes—an airliner with a new lease of life at a cost which will be written off over a relatively short period. That is the essence of the case for ELAND conversion.

Eland conversion means increased profits to the progressive airline

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Representatives: J. C. K. SHIPP & A. GUALTIERI, Suite 909, Dupont Circle Building, 1346 Connecticut Avenue, N.W., Washington, 6 D.C. Tel: Dupont 7-2123

P. J. WAITE, Marconi Aviation Dept., 970, McEachran Avenue, Montreal 8, Quebec. Tel: Victoria 3627

Three examples of successful Napier Eland conversions: the Convair 340, the Elizabethan, the Varsity.

BIGGEST MOVE in Pacific Airmotive's expansion and strengthening program was purchase of former Lear Aircraft Engineering Division. Pacific Airmotive gained this facility where Learstar conversion is underway, and 32 experienced engineers.

Pacific Airmotive Aims at Expansion

By Bernie Lang

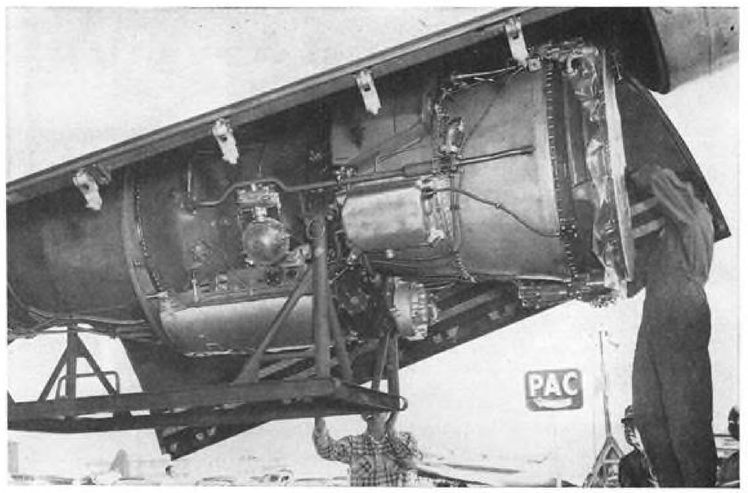
Burbank, Calif.—Major buildup in engineering talent keynotes Pacific Airmotive Corp.'s program to enlarge and strengthen its West Coast aircraft modification and service facilities.

PAC made its biggest move when it recently picked up Lear Aircraft Engineering Division, Santa Monica. Renamed PacAero Engineering Corp., the new subsidiary added 32 engineers to Pacific Airmotive's roster, with experience ranging from the latest four-engine airline transports through multi-engine business planes, jets and helicopters, missiles and test vehicles, including airframes, control systems and advanced types of propulsion.

Wrong Competition

The former owner, equipment manufacturer, Lear, Inc., felt that the division had grown to where it was competing with Lear's customer's. The Santa Monica facility is housed in a $320,000 facility capable of handling Super Constellations and DC-7s.

"It is a facility which has demonstrated its engineering capacity in the Learstar," Pacific Airmotive president John Myers told AVIATION WEEK. Much of PacAero's development work and proving out of complex equipment installations has potential application to military aircraft.



AIR FORCE C-97 delivers a Pratt & Whitney J57 engine to Pacific Airmotive for modification and overhaul. Pacific Airmotive had handled more than 200 J57s.

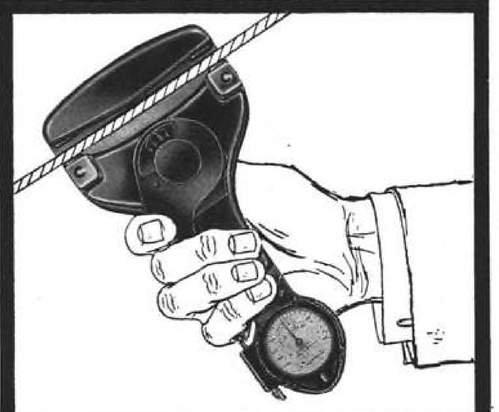
PacAero will continue to exploit the Learstar executive transport market, in addition to studying similar modernization programs for other types, such as the DC-3 and Beech 18. Also in the works is adaptation of the Convair 340 to Napier Eland turboprops—PacAero says that this modification will increase the transport's cruising speed by 55 mph. It says that it is talking to one airline about such a conversion.

The parent company estimates that it will gross over $20 million in the current fiscal year. It expects that the

NOW... it's self-contained!

Pacific T-60 TENSIOMETER

...this simple, one-hand operation takes the guesswork out of control cable rigging!



Control cable tension is accurately checked—in seconds—with the new model T-60 Pacific Tensiometer. Completely self-contained, this versatile instrument quickly clamps onto cables to give an exact reading—*directly in pounds of tension!* Where the diameter of the cable is not already known, the T-60 will determine the size, and then measure its tension. One model covers all normal rig tensions and cable sizes...also available for high rig tensions.
Lightweight and portable, the T-60 is easy to use...easy to read. It can be inserted through closely grouped, taut cables, and where the dial cannot be seen, a lock will hold the exact reading after the cable is released. Send for new Bulletin No. MT-1 giving full information—write today!

NOW... it's self-adjusting!

Pacific SEAT POSITION LOCK.

...automatically compensates for wear, never needs adjusting or service!

This maintenance-free position lock for reclining seats is entirely mechanical . . . has no fluid to soil passengers' clothing . . . needs no lubrication or service during its life.
The lightweight Pacific Seat Lock is now automatically self-adjusted for any wear during its entire life. Provides smooth, easy operation, and needs no further attention after installation.

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new PacAero Division will bring in $4 million next year in sales of the Learstar alone.

Pacific Airmotive's trump card is diversification; it breaks its operations down into these five classifications:

- **Airframe overhaul** of commercial, executive and private aircraft, which accounted for $1.7 million of its 1956 business.
- **Engine,** propeller and accessories overhaul, $4.2 million.
- **Military airframe overhaul,** accounting for $5.3 million this year.
- **Products sales,** including distribution of aircraft and engine parts, which totaled $6.7 million in 1956.
- **Manufacturer** of test and ground support equipment, $3 million.

Pacific Airmotive is planning expansion of its business aircraft overhaul plant and is negotiating with Lockheed for additional room; also available are 62 acres on Ontario (Calif.) Municipal Airport.

Workload Rise

Its Burbank engine and products division was increased its workload 50% over 1955 through signing long-term contracts with 11 airlines. It is looking for fast expansion of its executive aircraft engine and equipment business segments.

A major feature of the engine overhaul operation is its experience with jet engines and accessories. It has considerable experience in jet engine modification, including the P&W T34 turboprop, Westinghouse J40 and P&W J57 turbojets. It has worked on over 200 of the latter.

Myers told AVIATION WEEK that the company has started discussing overhaul and modification contracts with several airlines and is particularly interested in those carriers who will be operating from four to 10 jet transports. He expects that PAC will be in a position to offer airlines considerable savings in overhaul by using its facilities instead of building their own.

Shop Ready

The fact that PAC already has a shop working on J57s should place the company in a favorable position when discussing overhauls with airlines, it feels. At Tinker AFB, airline personnel were told by the Air Force that an airline would have to spend $4,270,000 to build and equip an engine shop (AW Oct. 29, p. 32). PAC points out that the J57 fuel control test stand alone costs between $60,000-$70,000. In 1957 the company plans to put in a jet engine test cell and additional facilities, plus equipment to test J57 fuel control systems.

Myers says that it is difficult to give a flat-price figure on overhauling the J57 at this time, because the engines

ENGINEERS
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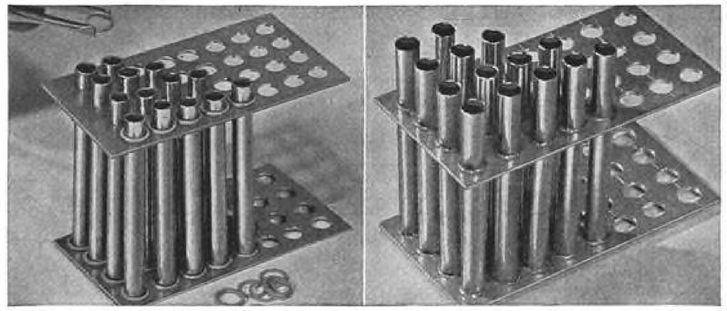

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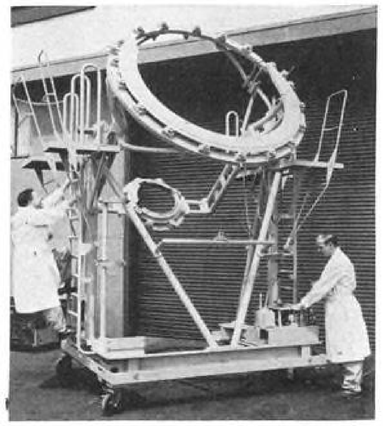

ROCKET engine handling dolly for Douglas missile is displayed at Pacific Airmotive.

processed thus far by the company have varied in the type of work required and that no one engine has had a typical "routine" overhaul. He did say, however, that PAC expects that it will be able to overhaul J57s at considerably less cost than figures quoted by the Air Force.

Manpower training is another important consideration. Myers says that it takes 200 hr. to train personnel to operate a jet engine fuel control test stand properly and 750 hr. for a test bench operator to learn to calibrate a jet main fuel control. The company has been calibrating these systems for approximately a year and a half.

Last summer Pacific Airmotive revised its loan agreements with Union Oil Company of California. Sale of 150,000 shares of Union Oil's PAC stock to key PAC officers and management personnel gave the group the largest block of stock interest, with Union Oil still retaining a substantial portion.

Revised loan agreement provides for a 10-yr. 4% mortgage loan of $3,100,000 with principal payable in quarterly installments starting Dec. 1, 1956. The arrangement amounts to a $340,000 reduction in PAC's long-term debt.

Aero Design Building New Commander Plant

Construction is underway on a new $1.5 million 126,000-sq.-ft. plant for expanded Aero Commander business plane production. Aero Design & Engineering Corp. expects the 44-acre site to be operating Aug. 1, 1957.

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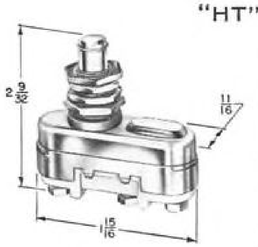

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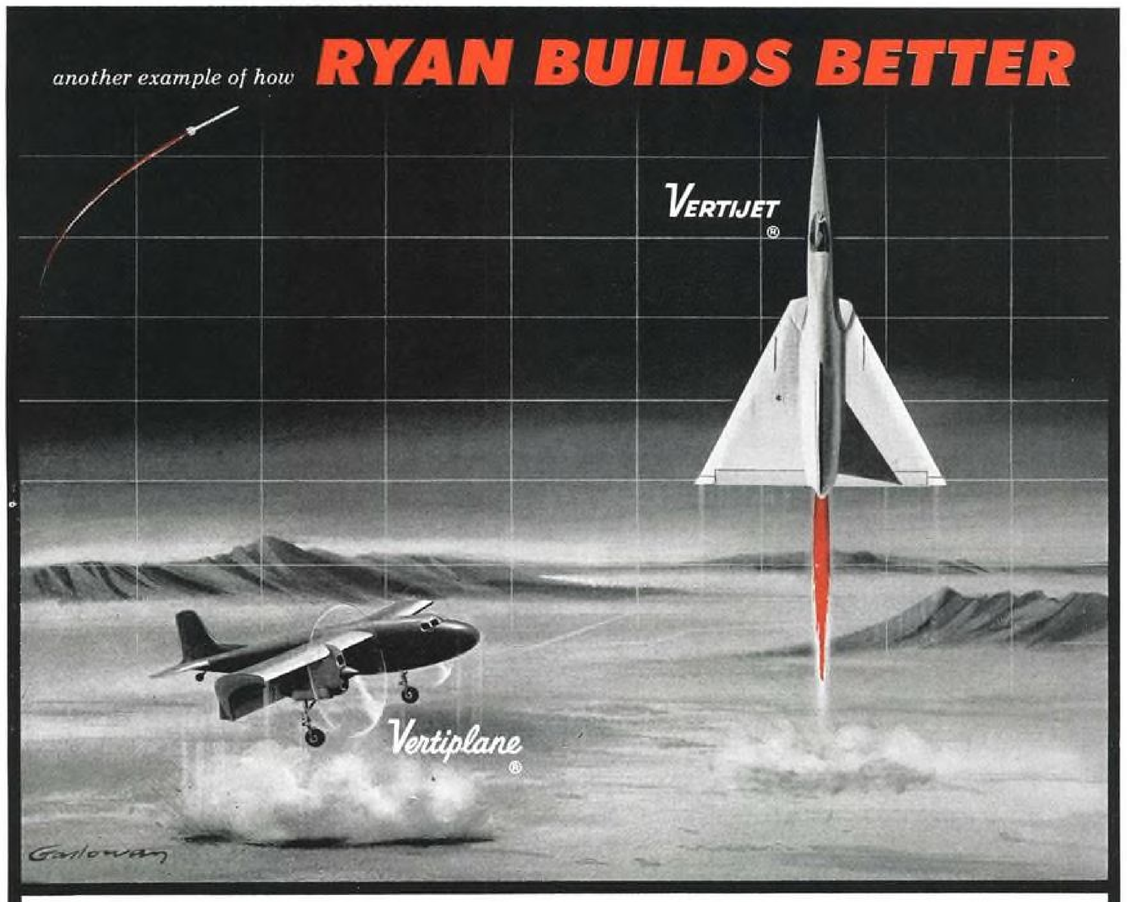

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Airlines Invest $50 Million in Idlewild

By George L. Christian

New York—Three major U. S. airlines, Pan American World Airways, Trans World Airlines and American Airlines, are investing over $40-million in hangar and office construction at New York International Airport.

Two other large carriers, United Air Lines and Eastern Air Lines, have occupied new hangars which cost together over $9-million, bringing the investment of just completed, under construction, or planned airline hangar facilities at Idlewild close to the $50-million mark.

PAA's and TWA's hangars are under construction. American's will probably start early this year.

PanAm's Plan

Pan American and TWA plan large facilities in which they will consolidate Atlantic Coast activities under one roof.

TWA will group its Atlantic Region offices at Idlewild, but will retain its LaGuardia maintenance hangar for planes using that airport. American, United and Eastern will use their Idlewild facilities as additions to their existing New York area hangars and offices.

Pan American plans to centralize its entire Atlantic Division in the $14-million hangar/office buildings going up at Idlewild. Included will be all departments making up the organization, such as operations, traffic and sales, stores and purchasing, properties, medical, and personnel.

These offices are now scattered at three different Idlewild locations and at LaGuardia.

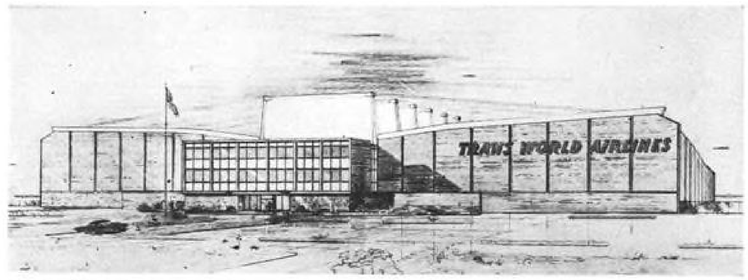
Cable Cantilever

Also included will be Dehmel trainers to check flight crews out on Pan American's latest aircraft, overhaul and maintenance facilities capable of handling any type of service from turn-around to heavy service (complete airframe overhaul), and the overhaul of some engine and airframe accessories.

Engine overhaul, now performed at Miami, is not contemplated for the Idlewild base.

PanAm's and TWA's hangars are of identical design (although different in size) done by Ammann & Whitney, structural engineers.

Concept, called cable suspended cantilever construction, uses 2½ in. diameter steel strands to support heavy con-



TWA will group its Atlantic Region offices in this $15 million facility at Idlewild.

PAN AMERICAN will centralize its Atlantic Division in a $14 million facility.

UNITED moved into this hangar 18 months ago, leases half of it to American.

EASTERN also leases half its year-old facility, in this case to Seaboard & Western.

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crete folded plate or "corrugated" roofs.

The design eliminates the need of posts or pillars to support the roof, giving a completely clear, unobstructed hangar floor.

The buildings consist of a long, main center section on each side of which the hangar roofs extend, supported by a system of steel cables whose opposite ends are secured to anchorage walls spaced at 30 ft. intervals along the top of the hangar center section.

First Use

Ammann & Whitney developed this new type of hangar construction in conjunction with TWA. The first hangar built to this design is now about 85% complete at TWA's new Kansas City overhaul base.

The outer edge of the wide roof (130 ft. on each side in PAA's case) will have an up-and-down deflection of 12-14 in. due to heat and cold caused expansion and contraction, snow loads, and other factors. To accommodate this considerable movement, the hangar doors have a 10 ft. upper section whose lower edge is hinged to the top of the door and whose upper edge rides on tracks underneath the hangar roof.

Ceiling height ranges from 48 ft. at the door to 36 ft. at the inner side. Pan Am's hangar, which is 640 ft. long, will accommodate five DC-7C or four 707 or DC-8 jets per side. Provisions have been made to expand this hangar capacity by about 75% if required.

Within the 100-ft.-wide, three-story center section will be a training school, complete commissary and in-flight food service kitchens, warehouses and stores, and maintenance and overhaul shops and offices.

Two Wings

In addition, there will be two wings. The west wing, measuring 338x109 ft. and the East wing 290x91 ft. will house additional offices.

The hangar will be radiant heated, the offices completely air conditioned. The windows, which will be sealed to cut down noise and dirt, are so built that a second sash may be easily added to combat jet engine noise should this prove to be a problem once the gas turbine-powered aircraft go into operation.

Additional facilities include land on which component overhaul shops can be built, a ramp area capable of accommodating 22 four-engine aircraft and a parking lot with an initial capacity of 850 cars.

Both PAA's and TWA's hangars have the heating and air conditioning plants in enclosed structures on the roof of the center section rather than on the ground floor where floor space is too valuable. Fuel oil is pumped up to the furances.

Idlewild is an ideal location for a Trans World Airlines' overhaul base, being the Eastern terminus of its major domestic flights and the Western terminus of its international network.

TWA's New Base

The $15-million facility will be used primarily for line maintenance of TWA's International fleet and much of its four-engine domestic fleet. Engine overhaul and heavy maintenance will be centered in the airline's new overhaul and maintenance base in Kansas City, Mo.

The TWA hangar is somewhat larger than Pan Am's, being 814 ft. long and 400 ft. wide, with an 80 ft. wide center section. The cable suspended cantilever roofs on each side are 150 ft. wide to which is added 10 ft. per side for the hinged doors. Height at the doors is 44 ft.

The hangar can accommodate 12 planes the size of 1049 Constellations (six to a side), or 10 1649 Constellations—or jets—five to a side.

The center section will house such facilities as stores, maintenance shops, and associated offices.

While TWA plans to move all its LaGuardia regional offices to the new

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Idlewild facility, it will retain its hangar at LaGuardia and whatever offices are required for that operation. The facility will perform line maintenance on TWA's planes using the field, such as Martins, 049s and 749s, but will not handle the larger and newer piston engine and jet equipment flying into Idlewild.

Included in the new Idlewild facility will be a ground equipment garage (trucks, tugs, etc.) a food unit commissary, and a ramp area big enough to park 22 four-engine planes.

The airline expects to have about 1,000 persons working at the hangar by 1959-60.

The new building is now beginning to take shape on TWA's 50-acre lot adjoining Van Wyck expressway just east of PAA's lot of approximately the same size. The airline hopes to move in by the end of 1957.

United Airlines

United's hangar is similar to Eastern's dimensionally except that United has more extensive office space which includes a Link Trainer room. The airline moved in about 18 months ago and is currently leasing half of its new facilities to American.

The hangar proper has six bays, three per side, which can accommodate a DC-7C size plane each. The 33-foot roof is too low to accept DC-8s. UAL plans to build "dog houses" into the roofs which will give sufficient clearance to the jet fins and rudders.

United is now doing checks ranging from a turn-around to a 125 hr. heavy service check, mostly on DC-7s and DC-6A freight aircraft. Most other United aircraft are serviced at either LaGuardia or Newark.

A United spokesman said that he did not anticipate much change of maintenance activity at the Idlewild base until jets go into operation. The facility now employs about 500 persons.

Eastern Air Lines

Eastern moved into its hangar in December 1955. Half is leased to Seaboard & Western.

The hangar has six four-engine aircraft bays. Since the roof is too low for EAL's DC-8s, dog houses also will be built for adequate tail clearance.

At the moment, the base handles only turn-arounds, 25 hr. checks and any emergency situations which might arise.

An Eastern spokesman said that he expects the facility to become a major repair base in time as new equipment is assimilated into the fleet and the frequency of flights into Idlewild increases above its current level.

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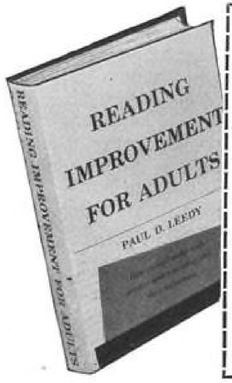

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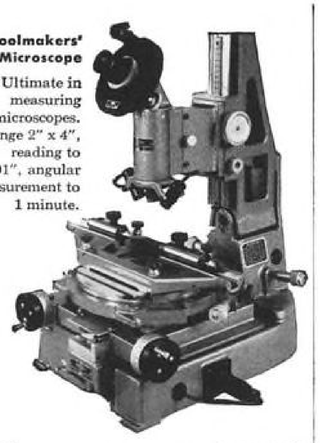

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Preloading, unitizing and palletizing are the three keys to streamlining air cargo operations to obtain minimum aircraft ground time, cut unnecessary cargo handling, lower costs, achieve highest plane utilization and increase revenue.

These opinions were expressed in a paper given by C. W. Meldram at a meeting of the American Society of Mechanical Engineers held recently at New York. His talk was concerned primarily with all-cargo operations, which now account for about 40% of total tonnage of the combination passenger/cargo airlines.

Meldram, who heads his own air cargo consulting company, made these points:

- **Preloading cargo** allows it to be assembled on pallets or other types of containers and loaded as soon as the aircraft is ready to receive its freight.
- **Unitizing a load** allows a shipper to handle his cargo in the most efficient manner. By using a device called a stackable dolly box, cargo need be handled only twice during the loading operation—once from truck to conveyor, and again from conveyor to box. This will also help to keep breakage at a minimum.
- **Palletizing,** while now a practical time-saver for cargo aircraft loading and unloading, should be replaced by stackable boxes, Meldrum advocates.

An American Airlines representative cited this dramatic saving which palletizing accomplished under certain operating conditions:

Straits Air Freight Express, Ltd., used three Bristol Freighters to shuttle cargo across the 50-mi. wide Cook Straits between New Zealand's North and South Islands. By going to a palletized system called Cargon, the company penalized their 12,000 lb. payload 2,000 lb., but Cargon resulted in one aircraft being able to do the work of three, bringing about large equipment and maintenance savings. The Cargon system allows a 10,000 lb. cargo to be inloaded in about 12 minutes.

An objection was voiced against this type of palletizing as being too inflexible for military use where cargo aircraft rarely fly over the same route twice. However, it was conceded that the method was probably fine for the two-terminal operation of SAFE.

Meldram suggested the use of a new type of driverless, automated tractor for towing dollies to predetermined locations. The tractors would follow wires buried under the floor or suspended overhead.

Such an installation which the U. S. Air Force has called Guidomatic, is going into operation at Kelly AFB, San Antonio, Tex. The tractor follows a line painted on the floor with a special kind of paint. As a guide to what weight of cargo is sent by air, Meldram cited these figures:

An average shipment weighs 213 lb. and the average piece weighs 36¼ lb.

About 91% of all cargo air cargo shipments weigh less than 500 lb. and 66% of all shipments weigh under 1,000 lb. Some 37% of tonnage shipped weighs between 100-500 lb., and 70% of the tonnage weighs between 100-1,999 lb. only 5% of total tonnage exceeds 5,000 lb.

Meldram concluded his paper by suggesting that pack planes, such as the Fairchild XC-120, might be successfully used as air freighters. Completely preloaded fuselages could be taken to the carrier plane by straddle carriers and attached in minutes.

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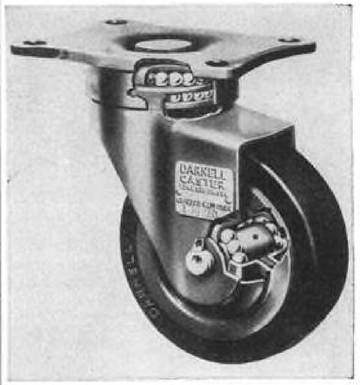
CASTERS AND WHEELS

PROVIDE *Outstanding* PERFORMANCE AND ECONOMY



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1 **RUBBER TREADS . . . a wide choice of treads suited to all types of floors, including Darnelloprene oil, water and chemical-resistant treads, make Darnell Casters and Wheels highly adapted to rough usage.**

2 **RUST-PROOFED . . . by zinc plating, Darnell Casters give longer, care-free life wherever water, steam and corroding chemicals are freely used.**

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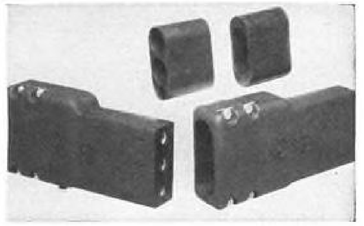

Plug, designed for use with external electrical starting power supplies, is detachable and may be removed from a damaged cable and quickly attached to a new cable. Only a soldering or crimping tool and screwdriver are required to make the new connection. Specially-designed slotted, floating contacts make the plug easy to insert. Marketer: Albert & J. M. Anderson Mfg. Co., 301 A St., Boston, Mass.

New service tray, which can fold into the back of a seat, is independent of the back rest when in use. It provides a steady surface from which the passenger may eat or which he may use to read or write. The tray is available in kit form for installation on existing Hardman seats and is incorporated in passenger seats in new Convair 340 and 440 aircraft. Manufacturer: Hardman Tool & Engineering Co., 1845 South Bundy Drive, Los Angeles 25, Calif.

AMONG IMPORTANT ACTIVITIES AT HUGHES IS A PROGRAM INVOLVING COMPREHENSIVE TESTING AND EVALUATION IN CONNECTION WITH HUGHES-DEVELOPED RADAR FIRE CONTROL AND NAVIGATION SYSTEMS FOR LATEST TYPE MILITARY ALL-WEATHER INTERCEPTORS.

Convair F-102
all-weather interceptor.

System Test Engineers and Instrumentation Engineers

There is need on our Staff for qualified engineers who thoroughly understand this field of operation, and who have sufficient analytical and theoretical ability to define needed tests; outline test specifications; assess data derived from such tests, and present an evaluation of performance in report form.

Engineers who qualify in this area should have **1** *a basic interest in the system concept and over-all operation of test procedures;* **2** *experience in operation, maintenance, "debugging," development, and evaluation testing of electronic systems, and knowledge of laboratory and flight test procedures and equipment;* **3** *understanding of basic circuit applications at all frequencies;* **4** *initiative to secure supporting information from obscure sources.*

Scientific Staff Relations

HUGHES

Research and Development Laboratories
HUGHES AIRCRAFT COMPANY
Culver City, Los Angeles County, California

Henry Rempt (second from left), head of the Electronics and Armament Systems Division, discusses problems inherent in the application of large electronic sensing devices to aircraft with David Morrissey, A.E.W. Systems Specialist, Harold Held, Data Links Specialist in the Advanced Techniques Group, and Nelson Harnois, head of the Electronics and Armament Systems Engineering Department.

Lockheed expands electronics division

■ To keep pace with its ever-increasing emphasis on electronics, Lockheed has expanded and centralized research and development activities under the Electronics and Armament Systems Division. The Division is under the direction of Henry Rempt.

Responsibilities of the Division include originating and developing complex electronics and armament systems for all new Lockheed aircraft.

A number of technical management positions for Electronics Systems Engineers has been created. The positions will appeal particularly to those who seek an extremely wide range of assignments.

Technical management positions are open in fields of:

Fire control, countermeasures, inertial systems, weapons, communications, infra-red, optics, sonics, magnetics, antennas and micro-waves.

Under Lockheed's philosophy of operation, Electronics Systems Engineers supervise and participate in conceiving advanced systems and then performing research, development and evaluation up to production stages on all Lockheed aircraft – radar search planes, high-speed fighters, cargo and passenger transports, bombers, jet trainers.

Electronics Engineers possessing experience or keen interest in systems activities are invited to write E. W. Des Lauriers. Dept. ED-3-1-1

California Division

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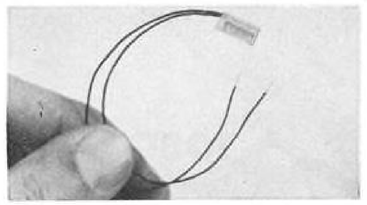
NEW AVIATION PRODUCTS

Radiation-Powered Lamp

High brightness signal and marker lamps are powered by radiation from isotope. Designed for installations where power and maintenance are limited, isolamps require no fuel, batteries or external power source. Phosphor crystals are excited to luminescence by radiation from Krypton[85] source in hermetically sealed, transparent capsule which is weather and tamper-proof. Life time is greater than 10 years. Range visible is over 500 yards. Radiation levels are well below established tolerances.

U. S. Radium Corporation, Morristown, N. J.



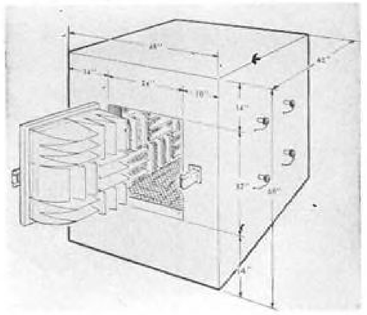
Telemeter Temperature Sensor

Resistance type tape-on surface temperature sensing element for telemetering can be applied quickly to any surface by pressing small piece of mylar tape over it. Element has output up to 5 volts without amplification which can be used directly in commutation circuit to modulate standard telemetering transmitters. Because resistance change over the specified temperature range is 100 ohms the element may be added to an installation with other temperature transducers without any circuit modification. Resistors are available in various ranges from −300F to +400F and each is furnished with two 6 in. constantan leads. Accuracy is +2% full scale range. Maximum continuous current is 2 ma. rms. (averaged over 1 sec.).

Tran-Sonics, Inc., Box 328, Lexington 73, Mass.

Portable Anechoic Chamber

Portable anechoic chamber is designed to test small microphones, signal devices and miniaturized electronic and mechanical equipment. Low frequency cut-off point (at which energy absorption drops below 99% and pressure reflection exceeds 10%) is 250 cps. Chambers with other cut-off points can be made to specifications. Sound is absorbed by wedge-shaped, wire enclosed fibrous glass units on the walls, ceiling and floor. Uses include location of mechanical noise sources, acoustical behavior study of radio, audio equipment, determination of loudspeaker response and acoustic characteristics, precise free-field calibration of microphones and psycho-acoustic and audio research.



Mounting floors in the free area of the chamber can be spring-tension cable or grating.

Eckel Corp., 155 Fawcett St., Cambridge, Mass.

Zipper Cable Cover

Cost of lacing and sewing electrical harness assemblies is cut by use of zippered plastic tubing. Air Force approved tubing is used to enclose, identi-

New Tools for Your Needs

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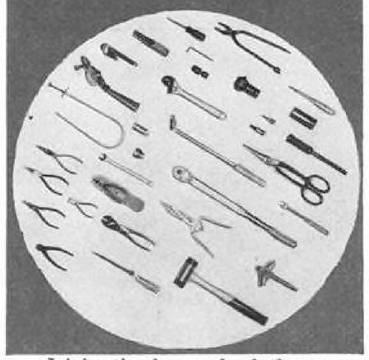

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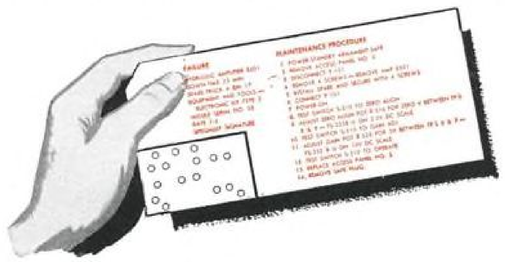
PROTO means PROfessional TOols

Forging Ahead Through Leadership Quality, Service and Understanding

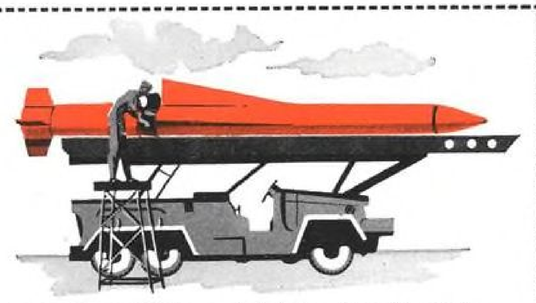
1002 Before launching this missile hundreds of tests must be made — a process usually requiring several hours and highly-trained technicians.

1003 Sperry Check-Out Equipment built into truck is readily moved to launching area to handle all tests.

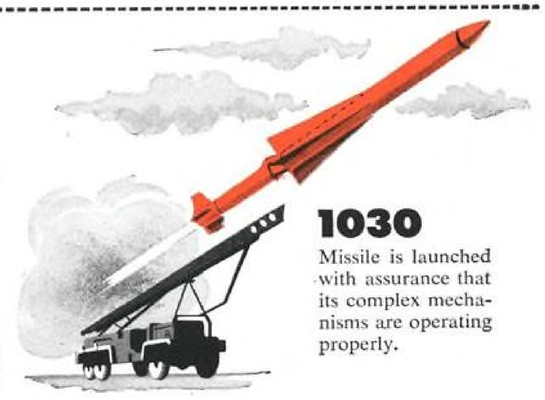
1008 Inside truck the operator sits at console and by merely pressing button sees micro-filmed information for operational decisions on each malfunction.



1009 Pressing another button operator receives card showing adjustment or repair required and detailed instructions.



1025 With complete instructions for repairs, the check-out is rapidly and accurately completed.



1030 Missile is launched with assurance that its complex mechanisms are operating properly.

SPERRY AUTOMATIC CHECK-OUT EQUIPMENT

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Saves time, cost . . . requires no highly trained personnel

• Keeping a weapon system operable at all times requires complex testing and evaluating. With Sperry Automatic Check-Out Equipment, this procedure can be simplified . . . time reduced to a minimum.

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fy and protect multi-conductor wiring. It can replace wiring ducts and can be used as replaceable jacket to protect expensive custom cables from abrasive wear. Tubing may be re-used or permanently sealed. Zipper pull-tab is detachable. When sealed Zipper tubing will withstand strength test of 30 lb./in.

W. A. Plummer Mfg. Co., 752 San Pedro St., Los Angeles, Calif.

Binocular Magnifier

New 3-D binocular magnifier leaves hands free for such work as fine scale assembly and assures accurate reading of micrometers, height gages etc. Matched and balanced prismatic lenses are made of high quality crown optical glass. Normal vision may be resumed by raising head. Headpiece excludes extraneous light. Magnifier may be worn with eyeglasses. It is available in three magnification factors; 1¾, 2¼, and 2¾.

Edroy Products Co., 480 Lexington Ave., New York, N. Y.

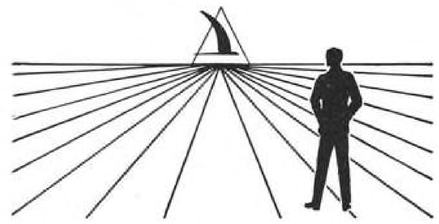
Side Operated Drain Valve

Side operated aircraft tank drain valve available with magnetic-connecting drain fitting is free of disadvantages of center operated drain valves. Valve is operated by small lever on one side with one finger or any small tool. Operator's hand is out of line of flow. Magnetic drain fitting is fluid-tight and requires no threaded or bayonet lock. Flexible hose of fitting will carry tank contents to a container without spillage. Removal of magnetic fitting automatically closes valve.

Technical Development Co., Glenolden, Pa.

Small Accelerometer

Tiny accelerometer weighs 3 oz., has high output potentiometer pickoff and pressure sealed case. It is intended for



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At Northrop Aircraft in Hawthorne, Southern California, many fine engineering positions are available in electrical design, dynamics, electronics, computing, weapon systems, mechanical design, and structures.

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At Northrop Aircraft, the progress of personnel is as important as the progress of projects. Your initiative and ambition will be respected. Constantly fresh assignments will be yours. You'll be among friendly people of your own caliber, and you'll be living in sunny Southern California where you and your family can enjoy life at its best, the year 'round.

At Northrop you will find the success you are seeking. For complete information about the many career positions now available, we invite you to contact the Manager of Engineering Industrial Relations, Northrop Aircraft, Inc., ORegon 8-9111, Extension 1893, or write to: 1015 East Broadway, Department 4600-0, Hawthorne, California.

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Producers of Scorpion F-89 Interceptors and Snark SM-62 Intercontinental Missiles

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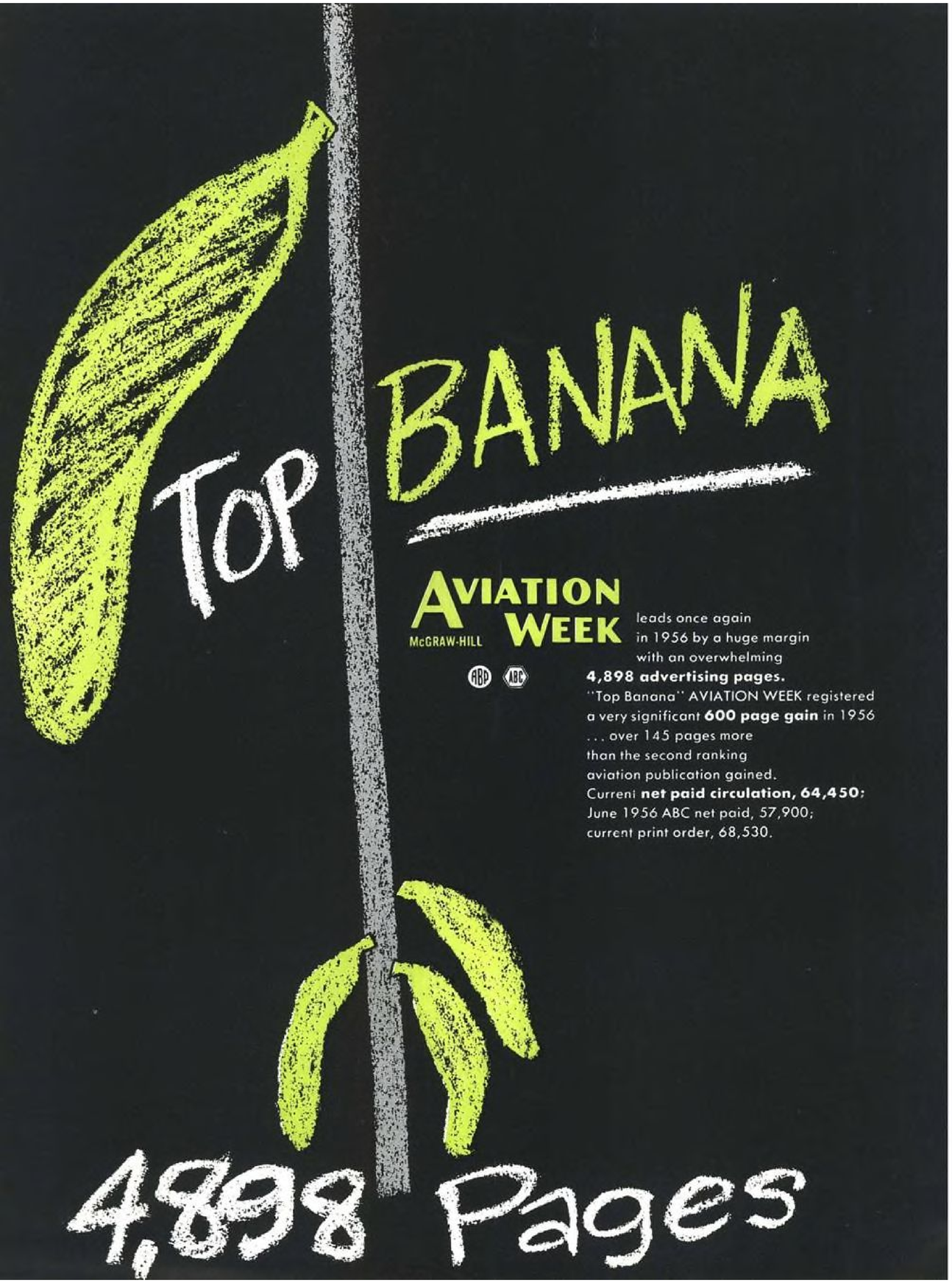

instrumentation and control systems and is already in use on missile systems and target drones. Case height is 1.5 in. Operating temperature range is from −50 C. to +100 C. Acceptable vibration range is from zero to 2,000 cps. to 10 G.

It is shock resistant to 40 G. It is available with connectors or solder terminals.

Humphrey Inc., 2805 Canon St., San Diego 6, Calif.

WHAT'S NEW

Reports Available

- **Investigation of the Effects of Incongruous Elements and the Interaction Effects of these Elements on High Temperature Strength of FE-CO-NI-CR Alloys (PB 121379)**—by T. J. Robertshaw and F. M. Richmond, Universal-Cyclops Steel Corp. for Wright Air Development Center, $1.75; 62pp.
- **Development of Heat Resistant Alloys by Powder Metallurgy Techniques (PB 121356)**—by G. Zuromsky and others, Sylvania Electric Products, Inc. for Wright Air Development Center, $2.00; 77pp.
- **Second Experimental Track Symposium** (PB 121406)— Seminar Reports and Abstracts of Papers, Research and Development Command, U. S. Air Force, $1.50; 55pp.
- **Vacuum Evaporation of Heavy Metallic Films** (PB 121175)—by W. R. Turner, Naval Ordnance Laboratory, $1.00; 34pp.
- **A Fundamental Study of Natural and Synthetic Films on Magnesium and its Alloys (PB 121322)**—Dow Chemical Company for Wright Air Development Center, $4.25; 168pp.
- **Development of Fluoro-Silicone Elastomers,** Part 2 (PB 121394)—by R. Tarrant and G. W. Dyckes, Peninsular Chemresearch, Inc. for Wright Air Development Center, 75 cents; 24 pp.
- **Elastomeric Polyphosphates,** Part 2 351)—by F. A. Bovey, Minnesota Mining and Manufacturing Co. for Wright Air Development Center, $1.25; 67pp.

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THERE'S A

• Critical magnetic and electric bias

TIC TRIMMER POT

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for every application

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• Fixed reference circuits

TIC manufactures in production quantities the most complete line of precision trimmer potentiometers in the industry. Common to all TIC trimmers is the unexcelled TIC quality construction and advanced design. The wide selection of sizes and shapes, in addition to the wide range of power and temperature capabilities, permit selection of units of maximum compatibility with a specific application.

The TIC Trimmer Potentiometer Line includes units from ⅛ inch to 1 inch in size . . . 50 to 100K ohms in resistance . . . . −55° C to +145° C temperature range . . . power ratings up to 4 watts. Advanced mechanical design provides extremely precise, stable adjustments under all forms of adverse environmental conditions.

TIC was the originator of the high stability subminiature trimmer pots. For example the original metal-film potentiometer, the TIC RFT Metlfilm, represents the outstanding advance high stability trimmer potentiometer design. The RFT contains a resistance element of metallic film that provides infinite resolution for ultra-fine trimming. Compactness of the RFT permits stacking 7 to the square inch. Latest addition to the TIC Trimmer Line is the new low cost RWT which, like the RFT, provides adjustment by use of a 25-turn lead screw.

Complete information on the TIC Trimmer Potentiometer Line is available upon request.

TECHNOLOGY INSTRUMENT CORP.

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West Coast Mail Address, Box 3941, No. Hollywood, Calif., POplar 5-8620

Ten Years Cost P2V Trim Shape

Operational necessity since the 1947 photograph of the Truculent Turtle at left was made have cluttered original clean lines of the Lockheed P2V. MAD gear stretched tail; searchlights, electronics, fuel meant adding tip tanks, and jet engines were mounted on underwing pods. Skiis for Polar operation, measuring 16 ft. long, 5 ft. wide on main gear, are latest extra.

Army Contracts

Following is a list of unclassified contracts for $25,000 and over, as released by Army Contracting Offices:

ROSSFORD ORDNANCE DEPOT, P. O. Box #877, Toledo, Ohio.

Sonoflux Div., Tubular Service & Engineering Co., 5815 Clinton Drive, Houston 20, Tex., kit, inspection, interim stk. no. 6635-I-000011, magnetic particle, consisting of the following nine items, 5950-I-000002 magnetizing unit, variable output, AC & DC, input 140 V, 60 cycle, single phase; Sonoflux Corp. no. 3100-SX or equal. 6625-I-000016 probe, DC, 600 V; Sonoflux Corp. no. 3185-SX or equal. 6145-I-000002 cable, remote control, 35' long, 300 V, SJO 18-2 cable, w/joy type 2A078F & 2A078M molded plugs; with Sonoflux Corp. no. 21835-SX or equal. 6145-I-000003 cable, output, 15' long, 600 v, cold test 10-2 cable, w/joy type 2-178F molded plug; Sonoflux Corp. no. 21015-SX or equal. 6145-I-000001 cable, output, 35' long, 600 V, cold test 10-2 cable with job type 2-187F & 2-187M molded plugs; Sonoflux Corp. no. A21035-SX or equal. 5950-I-000003 coil, AC & DC, 600 V, with joy type 2-187M molded plug, cold test 10-2 cable; Sonoflux Corp. no. 3137-SX or equal. 6110-I-000001 switch, remote control, hand, 300 V, SJO-18-2 cable with joy type 2A078F molded plugs; Sonoflux Corp. no. 137-SX or equal. 6145-I-000004 cable, remote control, 300 V, SJO 18-2 cable, w/joy type 2A078 molded plugs; Sonoflux Corp. No. 21815-SX or equal, 27 ea., $25650.

NEW YORK ORDNANCE DISTRICT, 180 Varick St., New York 14, N. Y.

Ford Instrument Co., Div. of Sperry Rand Corp., 31-10 Thomson Ave., Long Island City 1, N. Y., facilities contract DA-30-069-ORD-1820, $770000.

REDSTONE ARSENAL, Huntsville, Ala.

George M. Meriwether, 1712 7th Avenue, North, Birmingham, Ala., 3 items each, lathe, precision tool makers, with accessories (CS-12900-56), $27908.

Parson-Aerojet Co., P. O. Box 296, Azusa, Calif., design, fabrication and controls for guided missile test facilities, job, nr. (CS-13045-56), $173973.

CORPS OF ENGINEERS, U. S. Army, Philadelphia District, 2635 Abbottsford Ave., Philadelphia, Pa.

Willard, Inc., Germantown & Sedgley Avenue, Philadelphia 33, Pa., for construction of underground heating distribution lines and interior heating for 22 nose wing hangars at McGuire Air Force Base, Wrightstown, N. J., contract No. DA-36-109-eng-6251, job, $458610.

CORPS OF ENGINEERS, U. S. Army, Albuquerque District, P. O. Box 1538, Albuquerque, N. Mex.

C. H. Leavell & Co., 1900 Wyoming St., El Paso, Tex., construction of Missile Countermeasures Laboratory, White Sands Proving Ground, Las Cruces, N. Mex., contract DA-29-005-ENG-1737 (IFB ENG-29-005-56-86), job, $484274.

CORPS OF ENGINEERS, Los Angeles District, 751 S. Figueroa St., Los Angeles 17, Calif.

Peter Kiewit Sons, and Fredericksen & Kasler, 345 Kieways Ave., Arcadia, Cal., ATO propellant storage and distribution system (second increment of ATO test stand) (groups A and B), at Edwards Air Force Base, Edwards, Calif. (IFB ENG-04-353-56-105), job, $877676.

Navy Contracts

Following is a list of unclassified contracts of $25,000 and over as released by Navy Contracting Offices:

AVIATION SUPPLY OFFICE, 700 Robbins Ave., Philadelphia 11, Pa.

Gardo Radio Corp., 631 W. Seminary St., Charlotte, Mich., maintenance parts for support of radar test sets, (PREN-11-5189/56/SHIPS), various, $38318.

The Goodyear Tire & Rubber Co., Inc., 1144 E. Market St., Akron 16, Ohio, lining, brake, (383/2110-1871/52/AERO), 46294 ea., $115392.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., indicators, (383/2120-74-55/AERO), various, $56043.

Scheidl Mfg. Co., Inc., 1985 Great Neck Rd., Copiague, N. Y., glass, sliding cockpit canopy, (IFB 383-1399-56), 920 ea., $116180.

Titanine Inc., Morris & Elmwood Aves., Union, N. J., lacquer (JD-IFB-383-1367-56), 32502 gals., $55806.

McDonnell Aircraft Corp., P. O. Box 516 St. Louis 3, Mo., tank asys. (383/29011-125A1/2/56/AERO), 337 ea., $970142.

Douglas Aircraft Co., Inc., 3000 Ocean Park Blvd., Santa Monica, Calif., parts for R4D spares, (383/2110-2141A4/3/51), various, $44121.

Douglas Aircraft Co., Inc., 300 Ocean Park Blvd., Santa Monica, Calif., parts used on R5D spares, (383/2110-2144A4/3/51/AERO), var., $167812.

The Goodyear Tire and Rubber Co., Inc., 1144 E. Market St., Akron 16, Ohio, wheel asys. (383/2110-918/53/AERO, 383/2110-240/54/AERO, 383/2110-79/55/AERO), 907 ea., $193826.

General Radio Co., 275 Massachusetts Avenue, Cambridge 39, Mass., test equipment and components, (PREN11-5242/56), various, $31324.

North American Aviation, Inc., Columbus Div., 4300 E. Fifth Ave., Columbus, Ohio, ground handling equipment for FJ-2 aircraft, (383/29065-125S3/7/56/AERO), various, $46795.

DISTRICT PUBLIC WORKS OFFICE, First Naval District, 495 Summer St., Boston 10, Mass.

Herbert E. Callahan, Inc., 41 N. Main St., Auburn, Me., VHF-UHF transmitter facilities at the U. S. Naval Air Station, Brunswick, Me., (IFB spec. 48717 B), job, $45026.

PUBLIC WORKS OFFICE, Fifth Naval District, Norfolk 11, Va.

Blythe-Conner Co., P. O. Box 1076, Norfolk, Va., Guided Missiles School and Barracks, Fleet Air Defense Training Center, Dam Neck, Va., (IFB NOy-89488), contract, $1448400.

BUREAU OF YARDS AND DOCKS, 4th Naval District, U. S. Naval Base, Philadelphia 12, Pa.

N. DiTommaso Co., 542 E. Haines Street, Philadelphia, Pa., installation of simulated flight deck, building No. 653, Naval Air Material Center, Philadelphia, Pa. (IFB NBy-597), job, $26700.

OFFICE OF NAVAL RESEARCH, Washington 25, D. C.

University of Cincinnati, Cincinnati, Ohio, research on the toxicity of amines, $26000.

Hughes Aircraft Co., Culver City, Calif., research on electron tubes, $25000.

McGraw-Hill Book Co., Inc., New York, N. Y., editorial services for human engineering guide to equipment design, $65168.

Massachusetts Inst. of Technology, Cambridge, Mass., investigation of fundamental problems in dynamic meteorology, $130560.

Leland Stanford, Jr. University, Stanford University, Calif., research in connection with an investigation of high power pulsed clystrons, $100000.

NAVY PURCHASING OFFICE, U. S. Naval Supply Activities, Brooklyn 32, N. Y.

Anchor Mfg. Co., 377 W. Broadway, New York, N. Y., Nike 1 booster, N140(61339) 56831B, (IFB N140-1208056), 816 kits, $161220.

USAF Contracts

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

SAN ANTONIO AIR MATERIEL AREA, Kelly Air Force Base, Tex.

American Bosch Arma Corp., American Bosch Division, 3664 Main St., Springfield 7, Mass., screw, 4701-SC52212, 18,941 ea; screw, 4701-SC52213, 29911 ea; screw, 4701-SC52214, 19941 ea; screw, 4701-SC52215, 39881 ea. (P.R.: O3H-MA-597670 (complete), $35165.

OKLAHOMA CITY AIR MATERIEL AREA, Tinker Air Force Base, Okla.

Industrial Design Laboratories, Inc., 12120 Wagner Street, Culver City, Calif., gear assembly pinion, (RFP 516-03F-OC-690984), 73 items, $28652.

Janitrol Aircraft Automotive Div., Surface Combustion Corp., 400 Dublin Avenue, Columbus, Ohio, heater assembly, (RFP 480-03F-OC-547393), 4 items, $67737.

The New York Air Brake Co., Starbuck Ave., Watertown, N. Y., springcheck hyd pump, (RFP 294-031-3-OC-691686), 21 items, $33253.

The Paltier Corp., 1701 Kentucky Street, Michigan City, Ind., pallet-hardwood, (IFB 34-601-56-444), 5 items, $277211.

Libbey-Owens-Ford Glass Co., 608 Madison Avenue, Toledo 3, Ohio, panel-windshield, (OC665258), job, $420268.

Aeroquip Corp., 300 South East Avenue, Jackson, Mich., coupling half hyd self-sealing, (IFB 34-601-56-416), 23 items, $92849.

AiResearch Manufacturing Co., Division of The Garrett Corp., 9851-9951 Sepulveda Boulevard, Los Angeles 45, Calif., tube oil cooler, (IFB 34-601-56-371), 2 items, $351219.

MIDDLETOWN AIR MATERIEL AREA, Olmstead Air Force Base, Pa.

The John Stapf Corp., 3465 N. 6th St., Harrisburg, Pa., construction of reinforced concrete substructure and errection of Arctic type tower, vicinity of Benton, Pa., $61980, PR (MAMN) 56-285-1, IFB.

United Aircraft Corporation, Sikorsky Aircraft Division, Stratford, Conn., services for the repair and/or overhaul of H-34 helicopter major components, 90 ea., $84584, PR 598956, 598956-1, 598956-2, 598956-3.

WARNER ROBINS AIR MATERIAL AREA, Robins Air Force Base, Ga.

Motorola, Inc., 2710 N. Clybourn Ave., Chicago 4, Ill., modification kits for AN/APS-23 radar sets (PR-704542) 988 ea., $84336.

Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio, machine, flaring and beading, (IFB-469) 37 ea., $57709.

Sheridan-Punaro Co., P. O. Box 1333, Macon, Ga., modifications to bldg. 105 at Robins AF Base, Ga. (IFB-240, local purchase), $71486.

Mid-West Abrasive Co., 510 So. Washing-

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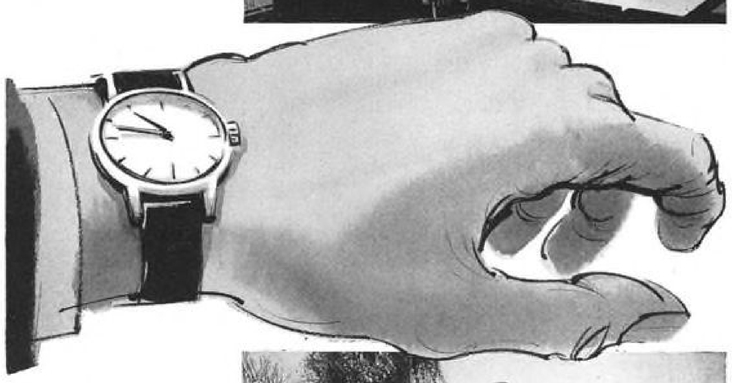

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ton St., Owosso, Mich., stone and shell assy., mounted (IFB-158, local purchase), $35281.

Geo. E. Viereck & Co., 1507 M St., N. W., Washington 5, D. C., honing machines, horizontal, floor type, (IFB-445) 79 ea., $80311.

Packaging Industries Ltd., 151 Pine St., Montclair, N. J., (representing Superior Hone Corp., Elkhart, Inc.), sealing machine, heat, portable, type 1, size 6, spec. MIL-S-4461A (IFB-486), 223 ea., $101354.

Packaging Industries Ltd., 151 Pine St., Montclair, N. J., sealing machine heat, bench type, type 3, size 12, spec. MIL-S-4461A (IFB-527), 170 ea., $102000.

GADSEN AIR FORCE DEPOT, Gadsen Air Force Station, Gasden, Ala.

Buffalo Metal Container Corp., Buffalo 11, N. Y., box, engine, shipping and storage steel enameled finish cylindrical design for mtg the engine with its longitudinal axis parallel to the base, spec. MIL-C-9282A dated 17 Jan 55 and engineering data, 865 ea., $131434, (IFB-01-608056055).

Intercontinental Manufacturing Company, Garland, Tex., box, engine shipping and storage steel enameled finish cylindrical designed for mtg the engine with its longitudinal axis parallel to the base, spec. MIL-C-982A dated 17 Jan 55 and engineering data, 504 ea., $96166, (IFB0910608056055).

Phoenix Steel Container Company, Bayonne, N. J., drum metal, new steel, enamel interior and exterior, with removable head, in accordance with MIL-C-6054A and drawings AN8025-1, AN802502, AN8026-2 and AN8027-1, 34000 ea., $76705, (IFB-01-608-56-58).

Al Goldsman, Philadelphia 22, Pa., case set, shipping and storage, small parts, type MF-1, plywood, 11½ in. deep, 15 in. wide, 20¾ in. high, C-O 2 cases fitted with a variety of plastic drawers with 2 flush handles, open in the middle for access to stored parts, capacity of each case 200 lbs., in accordance with spec. MIL-C-4710 (USAF) dated 18 Feb 54 and amendment 1 dated 17 Dec 54, 550 sets, $39473, (IFB-01-608-56-65).

MEMPHIS AIR FORCE DEPOT, Mallory Air Force Station, 3300 Jackson Avenue, Memphis 2, Tenn.

Balcrank, Inc., Disney Street, Cincinnati 9, Ohio, lubricating unit, RFP 40-604-56-193, 137 ea., $34785.

AMC, Wright-Patterson Air Force Base, Ohio.

Westinghouse Electric Corp., 32 North Main Street, Dayton, Ohio, generators, voltage regulators, control panels, transformers, spare parts and data, (PR 635562 Q), $1953419.

The Goodyear Tire and Rubber Co., 1144 East Market Street, Akron 16, Ohio, Wheel assemblies, 130 ea. brake assemblies, 620 ea. (PR PE 671310), $430266.

Red Bank Division of Bendix Aviation Corp., Eatontown, N. J., voltage regulator, 500 ea. (PR PE 635734), $94260.

The B. F. Goodrich Co., 803-4 Winters Bank Building, Dayton 2, Ohio, brake assemblies, 206 ea. (PR OO 497128), $68818.

The Goodyear Tire and Rubber Co., 1144 East Market Street, Akron 16, Ohio, wheel assemblies, 306 ea. (PR 497045 and 497045-1), $37411.

Sundstrand Machine Tool Co., Sundstrand Aviation, Rockford, Ill., frequency and load controllers, 378 ea. (PR PE 635659Q), $102816.

The Leland Electric Company Division, American Machine and Foundry, Dayton 1, Ohio, motor generators, 19 ea. (PR 635-731), $38000.

Engineering and Research Division, ACF Industries, Riverdale, Md., installation service for F-86K flight simulators, (PR PH-671795), $172190.

Republic Aviation Corporation, Farmingdale, N. Y., miscellaneous CCN's for aircraft and repair of damaged aircraft, S/N 5206931, (PR PA 210698 and PA 183956), $385362.

Ereo Division, ACF Industries, Riverdale, Md., cockpit procedure trainers for F-104A aircraft, (PR PH 671831), $88000.

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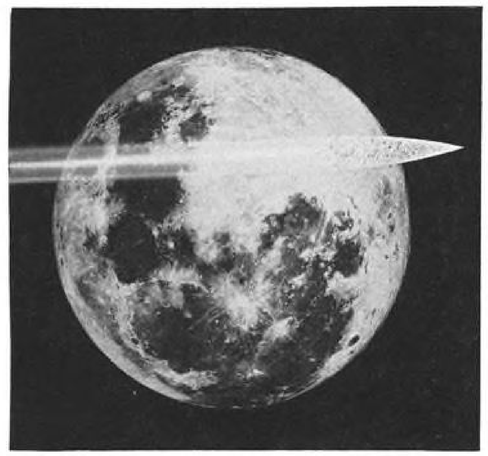

Ten years ago there was only a handful of men in the country who said it could be done. Today, more and more engineers—their technological noses scenting the fact that engineering history is in the making—are picking up the gauntlet of the greatest engineering challenge American ingenuity has ever faced—the race against time and the phenomena of long range guided missiles.

Dr. E. R. van DRIEST, Chief Scientist, is nationally recognized for his work in aerothermodynamics. He has a BS, Case Institute of Technology; MS, University of Iowa; Ph.D., Cal Tech; and Sc.D, Technisch Hochschule, Zurich, Switzerland. Around his home, in Whittier, he finds ideal opportunities for the pursuits he and his family like best—horseback-riding, archery and other outdoor activities—perfect complement to the absorbing mysteries of his work.

Research and development that would ordinarily take years is today—of necessity—being telescoped into months. Problems of aerodynamics, thermodynamics, high temperature materials, aeroelasticity—that a decade ago were only theory in textbooks are today being solved. What's more, the production techniques necessary to turn these solutions into hardware have been evolved.

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JIM THOMPSON's career in missile engineering at North American began in 1951. Today, Jim is Group Leader of Flight Instrumentation at the Missile Test Facility, Patrick Air Force Base, Florida. The tropical climate there is ideal for his favorite sports—fishing and golf.

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Missile Development Division, 12214 Lakewood Blvd., Downey, California.

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Box 2072, Riverside, Calif.

MOTOROLA

WHO'S WHERE

(Continued from page 23)

William D. Fowler, director-defense contracts, Whirlpool-Seeger Corp., St. Joseph, Mich.

Raymond H. Heller, sales department head, Aeronautical Division, Robertshaw-Fulton Controls Co., Anaheim, Calif.

Richard M. Osgood, manager, Waltham Laboratories, Sylvania Electric Products, Inc., Waltham, Mass. Mr. Osgood succeeds Dr. O. G. Haywood who has joined Emerson Electric Manufacturing Co., St. Louis.

Gordon Williams, public relations manager, Transport Division, Boeing Airplane Co., Seattle, Wash.

W. H. Toy, general superintendent, Tapered Air Products Corp., Lynwood, Calif.

Edward R. Randall, director of purchases, Walter Kidde & Co., Inc., Belleville, N. J.

Henry Blankenheim, production and factory manager, Piasecki Aircraft Corp., Philadelphia, Pa.

William A. Aberg, Washington, D. C. representative, All American Engineering Co., Wilmington, Del.

J. S. Haney, manager-Illumination Department of Crouse-Hinds Co., has been elected 1957 chairman of the Aviation Ground Lighting Section of the National Electrical Manufacturers Assn.

A. V. Tuccillo, manager-European service operations, Vertol Aircraft Corp., Morton, Pa. **Richard Leslie** succeeds Mr. Tuccillo as assistant service manager.

Dr. Richard J. Burke, head, telemetering department, Lockheed Missile Systems division, Van Nuys, Calif.

Charles E. Rees, Jr., assistant to the president-engineering, Gladden Products Corp., Glendale, Calif.

Paul K. Murphy, chief industrial engineer, Rocketdyne division, North American Aviation, Inc., Canoga Park, Calif.

Charles Chester, assistant manager-operations planning, Transport division sales, Boeing Airplane Co., Seattle, Wash.

James S. Pedler, to handle special assignments for the president, Cleveland Pneumatic Tool Co., Cleveland, Ohio.

Byron R. Bonnett, director-administrative services, Northrop Aircraft, Inc., Hawthorne, Calif.

Scott W. Donaldson, Washington, D. C. representative, Avien, Inc., Woodside, N. Y.

Maurice J. Coughlin, director-procurement, and **John T. Bailey,** quality manager, Weapon Systems Division, Bell Aircraft Corp., Buffalo, N. Y., also: **Norman A. Lomas,** purchasing manager, and **Raymond C. Sears,** quality manager, Bell's Aircraft Division.

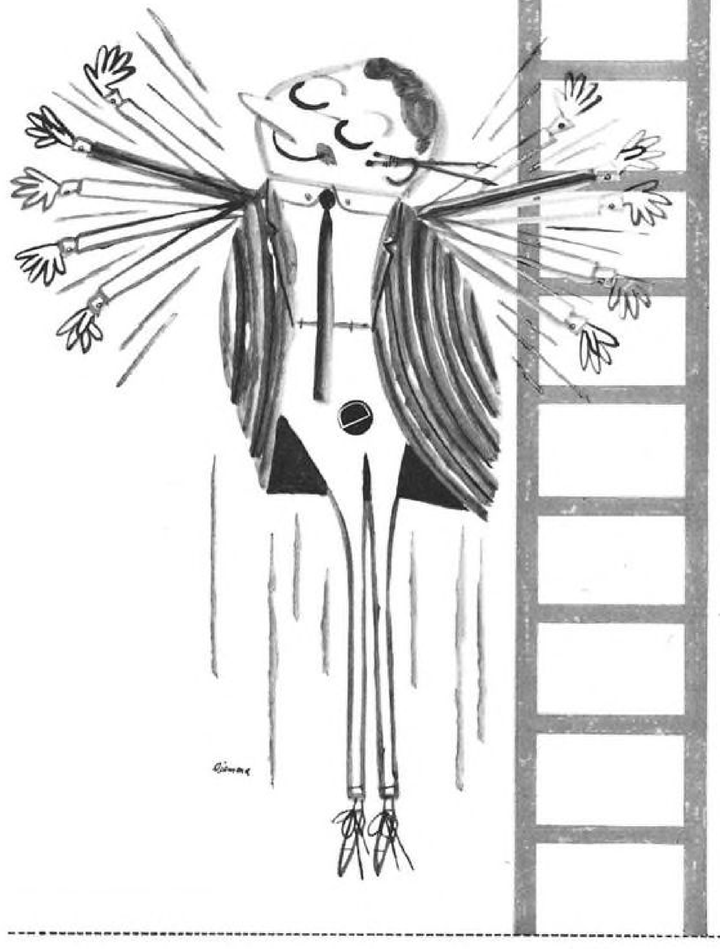
John W. Johnson, director-advertising, Chance Vought Aircraft, Inc., Dallas, Texas.

Dr. Charles R. St. Clair, Jr., senior scientist, Research and Advanced Development Division, Avco Manufacturing Corp., Lawrence, Mass. also: **Richard F. Howe,** manager-experimental manufacturing.

U. W. Richardson, defense products manager, American Machine & Foundry Co., Los Angeles, Calif. Mr. Richardson succeeds **Bennett W. Wright,** named general manager of AMF's Turbo Division, Pacoima.

How to make the most of your engineering career
ONE OF A SERIES

go where an engineer can rise to the top



In many companies, an engineer rises, but soon encounters a low ceiling. Promotions tend to go to non-engineering executives. And engineers (surveys show) find it difficult to make their ideas understood—or appreciated.

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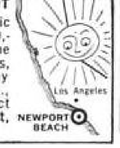

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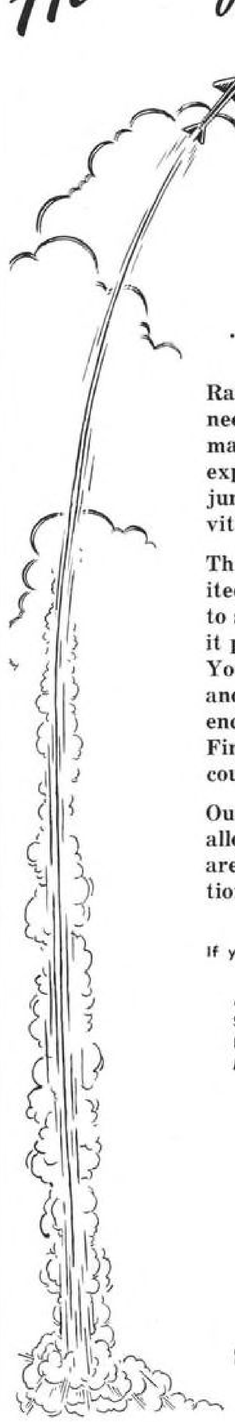

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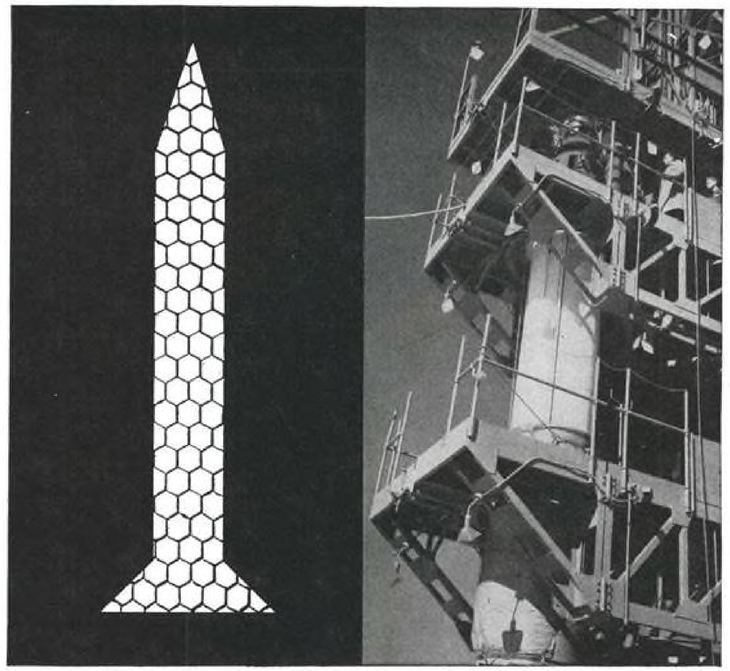

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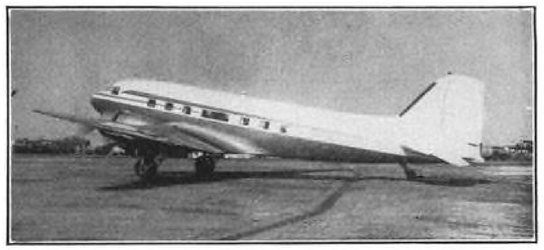

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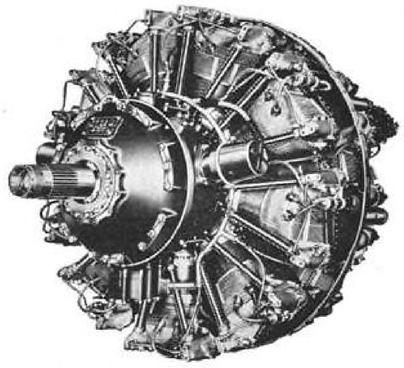

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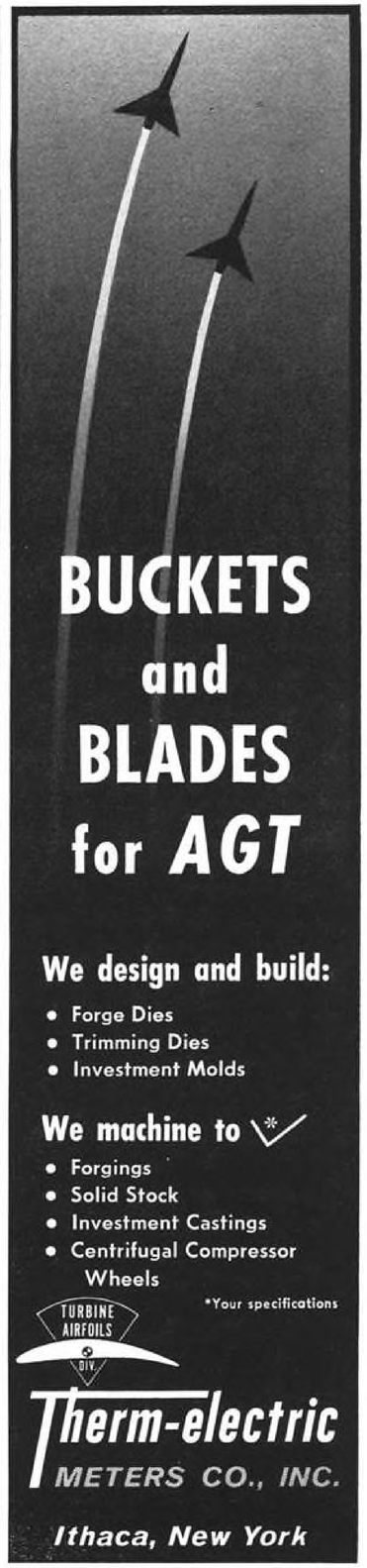

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LETTERS

Rockets Red Glare

You are an imaginative lily livered Yankee. Had there been any truth in "your nightmare" we could have taken it. We never sit on the fence as you sweepings of Europe did in two world wars and Suez.

G. Lloyd Thomas
St. Albans, Hants, England

(Editor's Note: Mr. Thomas imaginative letter was touched off by Aviation Week's editorial of Dec. 3 [p. 21] entitled 'Nuclear Sabre Rattling.')

Airport Spot Check

The item about halfway down page 45 in your Dec. 10 issue under the heading "Airline Observer" is slightly loused up. The group that did the general aviation spot-check at 900 airports over a two day period is the General Aviation Facilities Planning Group. This organization is not headed by Mr. Curtis. That particular project was handled by Booz, Allen and Hamilton, under contract to the General Aviation Facilities Planning group—which group itself is made up of all organizations concerned with general aviation.

Max Karant,
Vice President
Aircraft Owners and Pilots Association

New Air Museum

I am writing you so that you may be the first to know. We are erecting the first aviation museum on the West Coast.

Would you please be so kind as to announce the opening of "The Air Museum," 915 E. Foothill Blvd., Claremont, Calif. Claremont is 36 miles due east of Los Angeles.

It is a short one half hour ride from downtown Los Angeles. This is a private museum, and it will be the first of its kind out here.

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 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.

As you probably well know an aviation museum on the West Coast has been long overdue.

Edward Maloney
Head Curator, The Air Museum
Claremont, Calif.

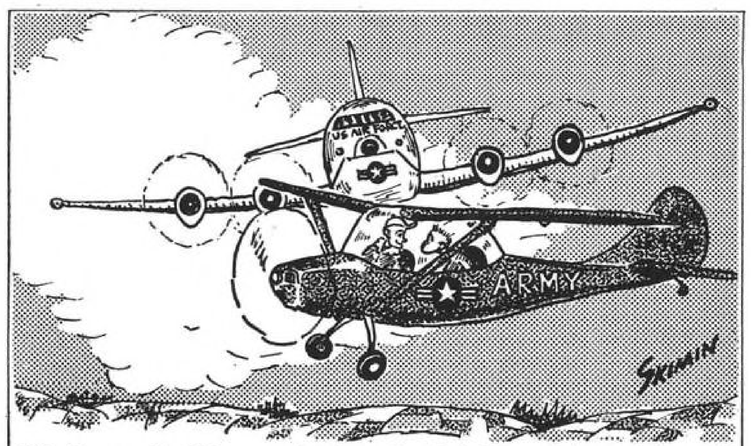
Climatic Testing

Your Nov. 19 issue contains a photograph (page 30) of the B-52 bomber being tested at —65F in the climatic hangar at Eglin Air Force Base, Florida. The caption of this picture states that Air Proving Ground Command uses the hangar to test aircraft at extreme temperatures.

In reality Air Proving Ground Command is responsible for the operation of the facility which provides the temperatures required for environmental tests. The testing of the B-52 shown is the responsibility of the Air Research and Development Command. These tests are engineered and conducted by our organization based at Wright Air Development Center.

The low temperature tests depicted are a preliminary to our actual flight tests conducted in the Arctic each winter. This year the C-130 transport and the F-104 fighter will be subjected to the gamut of Alaskan weather.

Capt. Richard M. Fernbaugh
Fifth Phase Test Branch
Test Engineering Division
Directorate of Flight and All-Weather Testing
Wright Air Development Center
Wright-Patterson AFB, Ohio



"It's this way, Mr. Witze . . . the Army aircraft fly low and slow and the . . ."

(In this cartoon from the unofficial magazine Army Aviation, Mr. Witze is Claude Witze, military editor of Aviation Week—Ed.)

Broken Runway Lights

I was very much interested in reading the complete report in your November 12 issue in which you discussed how broken runway lights caused a pilot landing at the Portland, Maine, municipal airport to land alongside the runway in deep snow. It is quite apparent from the report that the accident will result in airline personnel taking more pains in reporting the actual condition of the lights and possibly in having the city spend a larger sum in properly maintaining the lighting system after each snow removal operation.

It is also possible that there may be a damage suit against the city for failing to properly maintain the lights. This is a matter that should be fully reported in your magazine, as I feel it would be of great interest to the many small cities that are "maintaining" lighted airports where the city does not have sufficient traffic or funds to justify maintaining them up to proper standards.

No matter how often the lights are checked, however, or how much is spent on maintaining them, I cannot see how we can insure safety if boundary lights are operated parallel to the runway contact lights and are spaced approximately the same distance from the runway lights as are the two rows of runway lights. Aside from damage to a number of lights by snow removal or similar operations, there is always the possibility that an electrical failure could cause one row of lights to go out. Where four parallel rows are maintained with approximately equal distances between the rows, it is quite obvious that the pilot can be misled, as he was in this particular instance, and in some cases with more serious results.

To put it bluntly, I think that the persons who permitted the installation of the lighting system that could fail in a manner that would mislead the pilot, are equally at fault with those who failed to fully check the lighting system in reporting its condition.

In the first place, airport boundary lights should not be operated unless the entire area enclosed by the boundary lights is in safe condition for landing. Secondly, when there are runway lights marking the runway to to be landed on, I can see no particular advantage in having boundary lights parallel to them marking a greater area.

It would seem to me that wherever funds are limited, we should settle on the minimum amount of lighting that is adequate for the purpose, and see that that minimum is properly maintained.

Further, in the designing of a lighting system, we should always recognize the possibility of failure, and design on a "fail safe" basis so that the pilot will not be misled when one section of the lighting system fails.

I hope that other airports will benefit from the complete report of this accident that you furnished, as it certainly should be possible to avoid this type of occurrence.

H. K. Friedland
Aviation Consultant
Escondido, Calif.

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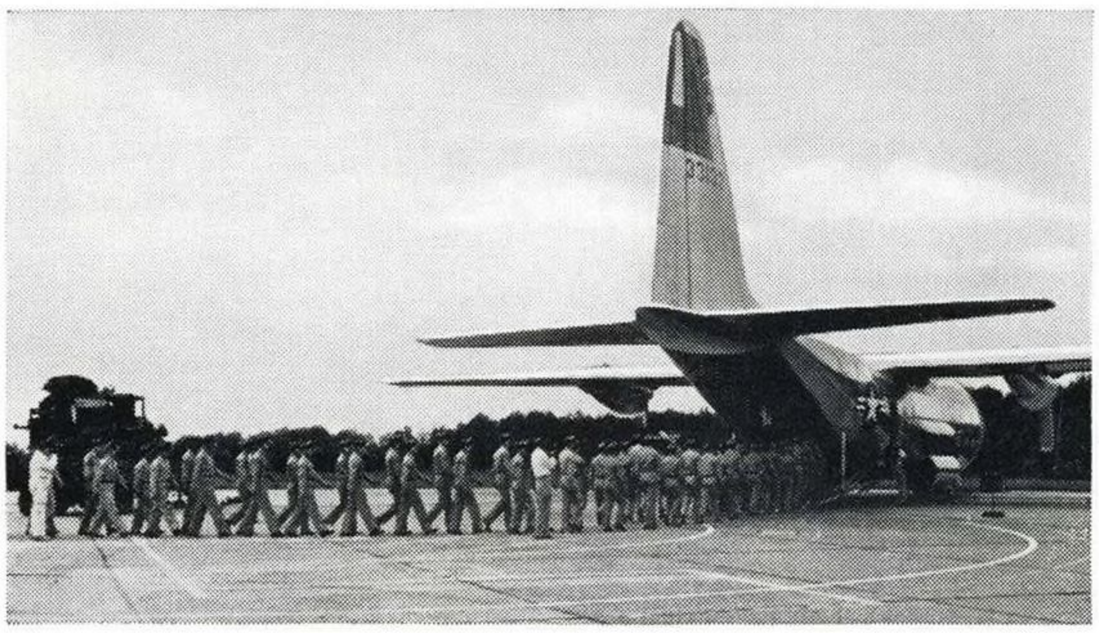

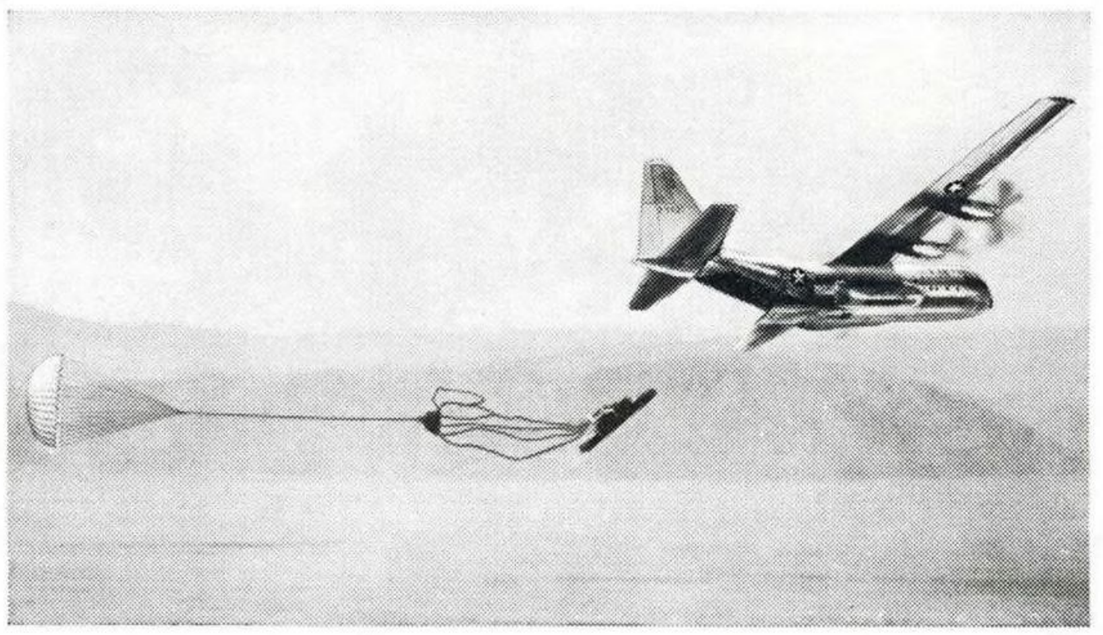

NEW "FLYING WORKHORSE" JOINS USAF

First Delivery of Lockheed C-130 Hercules with Allison Turbo-Prop Power

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It can airlift up to 20 tons of cargo swiftly and efficiently — and make parachute drops for on-the-spot aerial delivery.

It's the great new "workhorse" of the Air Force—Lockheed's versatile C-130 Hercules—now being delivered to the Tactical Air Command's 18th Air Force at Ardmore Air Force Base, Oklahoma.

Powered by four 3,750-horsepower Allison T56 Turbo-Prop engines driving three-bladed Aeroproducts Turbo-Propellers, the C-130 attains speeds of over 350 miles per hour—more than 100 miles per hour faster than other tactical transports. *And it does this at less than half the ton-mile cost of its nearest competitor.*

A commercial version of the T56—Allison's Model 501 Turbo-Prop engine powering the new Lockheed Electra—will bring jet-age speed and luxury to commercial service, with new smoothness and quiet on flights now serving 98% of the nation's commercial passenger traffic. 128 of these new luxury airliners have been ordered by six major airlines.

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