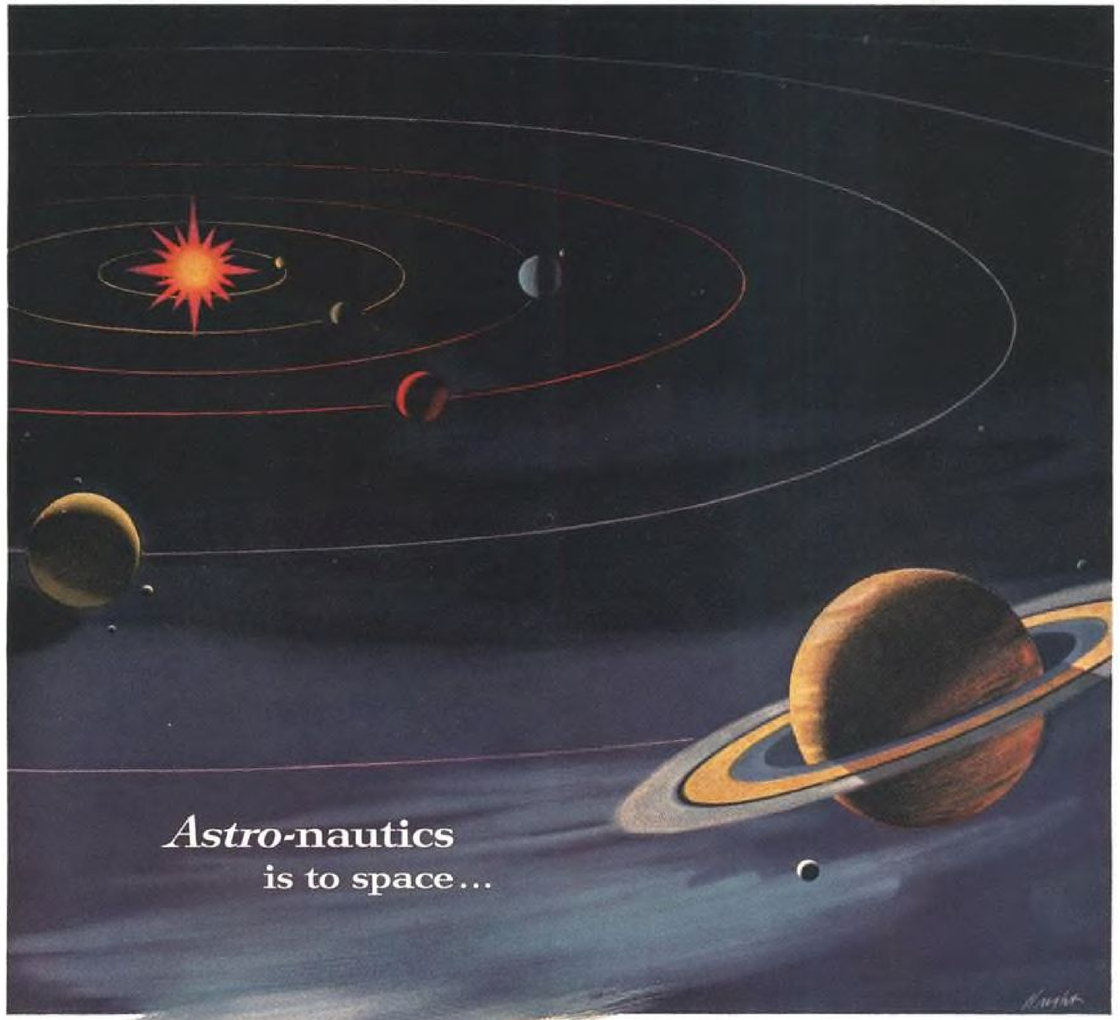
AVIATION WEEK
A McGRAW-HILL PUBLICATION

February 11, 1957 50 cents

Russians Revise Distortions of Aviation History

North American X-10

Crashes Stir Air Safety Investigation



as *Aero*-nautics is to earth

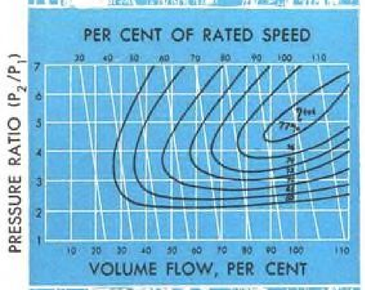
In the fields of both *AERO*-NAUTICS and *ASTRO*-NAUTICS Convair is showing outstanding leadership. **CONVAIR-*Astronautics*** is today building in San Diego, California, a complete facility for research, development and manufacturing of the Atlas Intercontinental Ballistic Missile, a top priority project of the U.S. Air Force. The Atlas is the first of many vital astronautical projects which will lead mankind toward a better understanding of the universe in which he lives.

CONVAIR

A DIVISION OF GENERAL DYNAMICS CORPORATION

The Heli-Rotor Compressor

Surge-free • Efficient • No Containment Problems



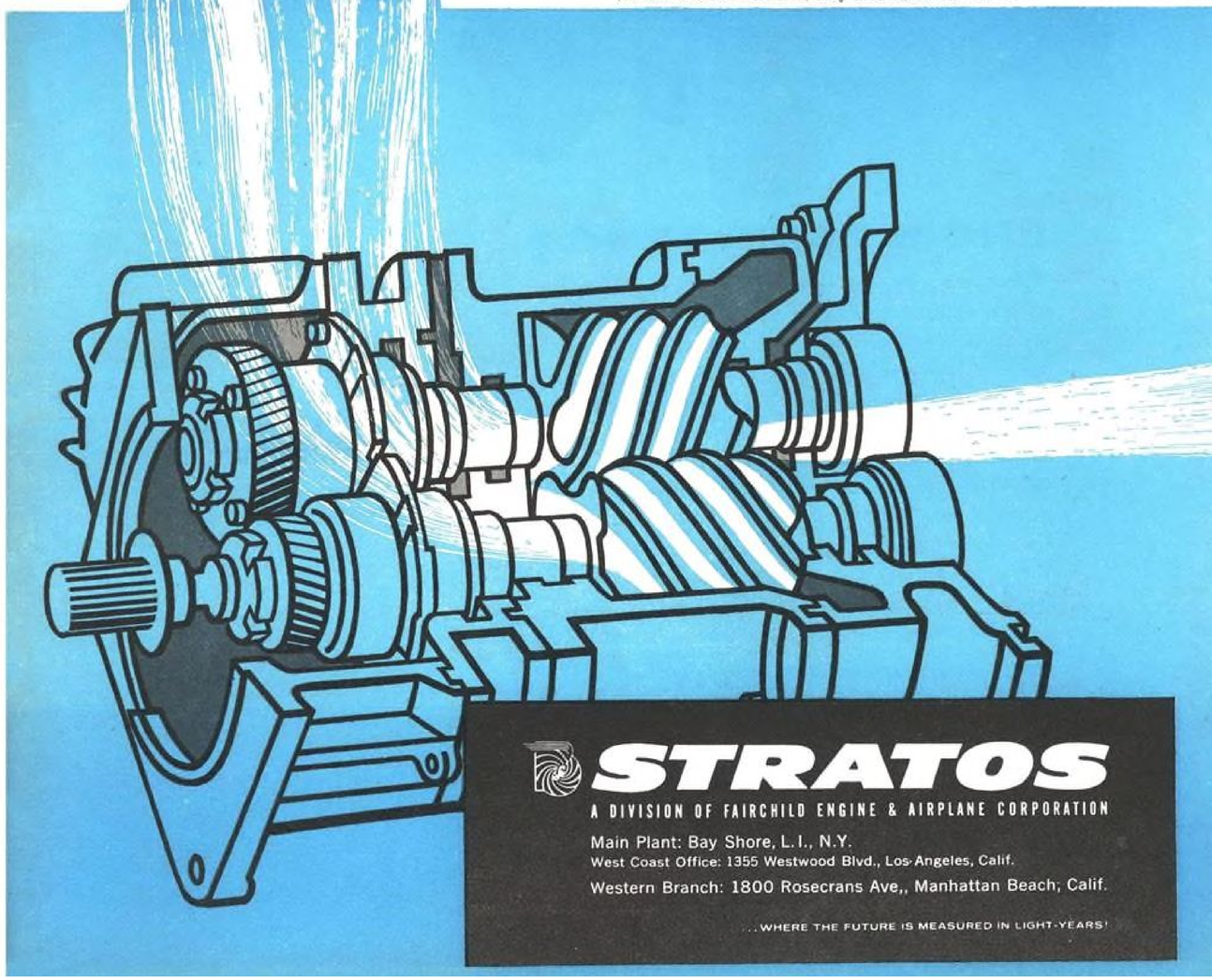
Now available for aircraft applications is a new type of rotary-positive displacement compressor offering these advantages:

- High specific delivery at high speed—up to 42000 rpm. Capacities 25 scfm to 25,000 scfm.
- High pressure ratios in single stage (up to 10:1) from small compact units.
- Surge-free operation with compression ratios independent of speed.
- High efficiencies resulting from built in pressure ratios.
- Suitable for high temperature operation—suitable for air, freon and other gases.
- Simple construction—simple control systems.

Heli-Rotor compressors are adaptable to a variety of drives: hermetically sealed electric, turbine, hydraulic or direct from an engine. The design of the Heli-Rotor compressor assures unusually long and trouble-free service life. Individual compressors have operated without stopping for as long as 3 years.

In these units, two helical lobe rotors trap the entering gas, compress it and deliver it to an exit port at design pressure. Two-stage machines with a 24 to 1 compression ratio have been designed. The patented design of the rotors is already proved in a variety of aircraft installations.

For more details on these efficient compressors write to:
STRATOS DIVISION, Bay Shore, L. I., N. Y.



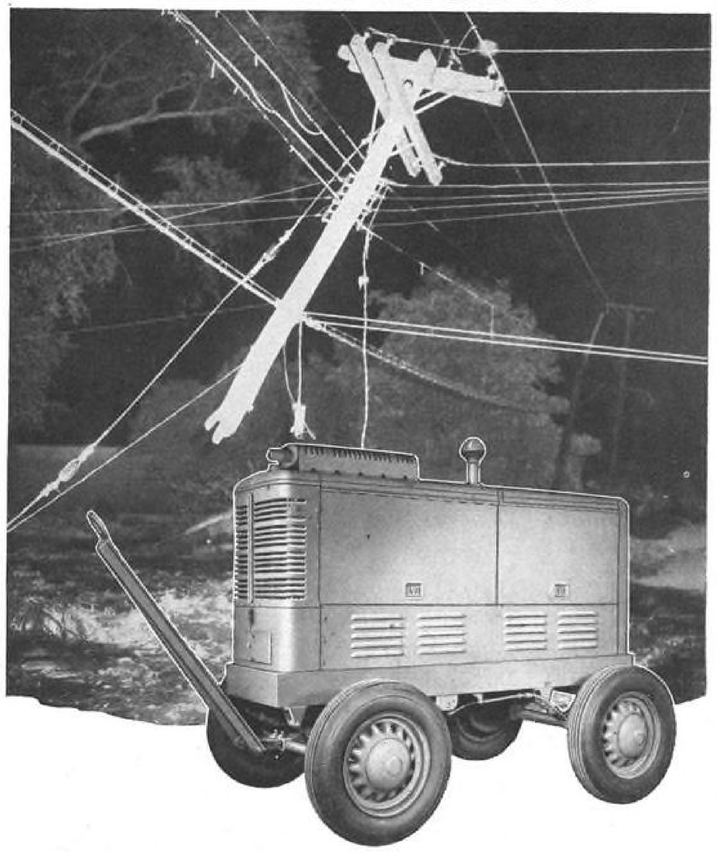
STRATOS

A DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION

Main Plant: Bay Shore, L. I., N.Y.
West Coast Office: 1355 Westwood Blvd., Los Angeles, Calif.
Western Branch: 1800 Rosecrans Ave,, Manhattan Beach, Calif.

...WHERE THE FUTURE IS MEASURED IN LIGHT-YEARS!

EMERGENCE . . .



FROM EMERGENCY

When emergency electrical power is available, the fears of flood or other natural ravages are quickly minimized. CONSOLIDATED designs and manufactures generator sets to provide **stand-by** power in the event of failure of normal power in hospitals, schools, police and fire stations, and other areas of need. ➤➤➤ Other generator sets of our design are available to supply **continuous** power where commercial power is unavailable. For the military, for instance, our sets furnish electrical power for perimeter radar defense warning lines and communications. ➤➤➤ Pictured above is a typical Consolidated diesel generator unit, 4 wheel trailer mounted, fully housed. If you have any electrical power requirements, our engineers are anxious to discuss your needs.

Free! Descriptive brochure of continuous and stand-by power units, write:

GENERATOR SET DIVISION

CONSOLIDATED

DIESEL ELECTRIC CORPORATION

STAMFORD, CONNECTICUT

BRANCHES DALLAS, TEX. • DAYTON, OHIO • SANTA ANA, CAL. • WASHINGTON, D. C.

IN CANADA · OTTAWA, ONT.

AVIATION CALENDAR

Feb. 12—Atlantic Commodity Rates Board, International Air Transport Assn., New York, N. Y.

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

Feb. 14-15—National Jet Age Conference, sponsored by the Air Force Assn., Sheraton Park Hotel, Washington, D. C.

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

Feb. 18—Helicopter Fares and Rates Working Group, International Air Transport Assn., New York, N. Y.

Feb. 18-20—First Astronautics Symposium, sponsored by USAF Office of Scientific Research, Air Research & Development Command and Convair (by invitation), El Cortez Hotel, San Diego, Calif.

Feb. 24-26—Sixth Annual Texas Agricultural Aviation Conference & Short Course on Pest Control, including aircraft and equipment displays, Memorial Student Center, Agricultural & Mechanical College of Texas, College Station. Fly-in participants may use Easterwood Field.

Feb. 25-26—Mid-Season Meeting, Canadian Aeronautical Institute, Ft. Garry Hotel, Winnipeg.

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

Mar. 5-7—Fifth Annual Air Safety Forum, Air Line Pilots Assn., Hotel Shoreland, Chicago, Ill.

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. 18-21—Pacific Coast Plastics Exposition, in conjunction with The Society for

(Continued on page 6)

AVIATION WEEK • FEBRUARY 11, 1957

Vol. 66, No.6

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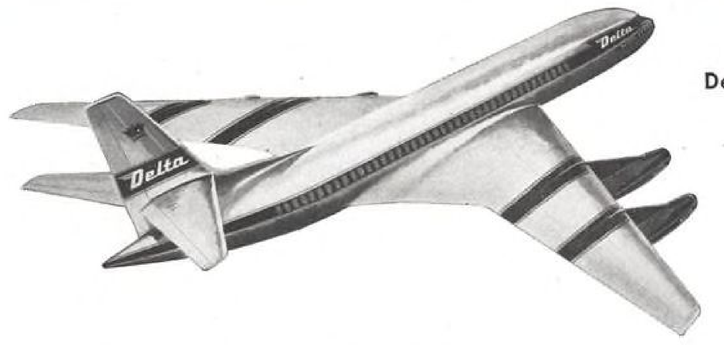
One in a series about users of Phillips 66 Aviation Products

Phillips 66

LOOKS AHEAD with DELTA

Faster new jet service for leading cities on its routes is being planned by Delta Air Lines, famous for its Southern Hospitality aloft. The new jet service will include Houston, New Orleans, Miami, St. Louis, Atlanta, New York, Washington, Chicago, Cincinnati and Dallas, among others. Delta, the fifth largest domestic carrier, is spending $110 million on new airliners.

Will cut travel time in half: Fast new DC-8 jet airliners, powered by Pratt & Whitney J-57s, will start service to many Delta key cities in the fall of 1959.



Delta's new Convair jet transports will cruise at 609 m.p.h.; will serve Delta cities on 200 to 3,000 mile flights; will cut travel time Chicago to Miami by 2½ hours.

Today, Phillips 66 Aviation Gasoline gives dependable, efficient performance to Delta and other leading air lines, as well as to the military air services.

In step with the future, Phillips is a leading producer of *super performance* Jet Fuels for the latest designs in turbo-props and jets. And Phillips research continues to lead the way for development of fuels for the aircraft of tomorrow.

AVIATION DIVISION • PHILLIPS PETROLEUM COMPANY • BARTLESVILLE, OKLAHOMA

NEW

Trans-Sonics*

"TAPE-ON" SURFACE TEMPERATURE RESISTORS

for Temperature Telemetering

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

Trans-Sonics Type 1371 "Tape-on" Surface Temperature Resistors are precision resistance thermometers with a platinum resistance winding as the sensing element. These resistors which are no thicker than a piece of tape 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 circuit modification. Each resistor is furnished with 6" long fibreglas-covered constantan leads. Write for Bulletin 1371 to Trans-Sonics, Inc., Dept. 7.

*Reg. Trademark

SPECIFICATIONS

SIZE: ¼" x 5/16"

Accuracy: ±2% of full scale range

Precision: ±0.5% of full scale range

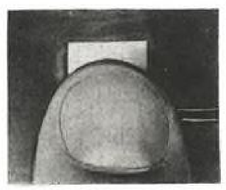
Maximum Continuous Current: 20 ma rms (averaged over 1 second)

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)

INSTANT INSTALLATION



As easy to apply as a thumb print.

For Transducers, See Trans-Sonics

Trans-Sonics, Inc.

P. O. BOX 328 LEXINGTON 73, MASSACHUSETTS

AVIATION CALENDAR

(Continued from page 4)

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. 18-21—First Military Automation Exposition, New York Trade Show Building, 500 Eighth Ave., New York. For details write: Richard Rimbach Associates, 845 Ridge Ave., Pittsburgh 12, Pa.

Mar. 25-29—Tenth Western Metal Congress, Ambassador Hotel, Los Angeles, Calif

Mar. 26-28—Sixth Weather Radar Conference, American Meteorological Society, Cambridge, Mass.

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

Apr. 2-5—National Aeronautic Meeting, Aeronautic Production Forum and Aircraft Engineering Display, sponsored by Society of Automotive Engineers, Hotel Commodore, New York.

Apr. 3-5—Spring Meeting, American Rocket Society, Sheraton Park Hotel, Washington, D. C.

Apr. 22-24—Second Annual Jet Engine Hydraulics Symposium, Hotel Statler, Detroit, Mich.

Apr. 30—Atlantic Rate Commodity Rate Board Meeting, International Air Transport Assn., Torquay, Devonshire, England.

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

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

May 13-15—National Conference on Aeronautical Electronics, sponsored by Institute of Radio Engineers, Dayton, Ohio.

May 20-23—Second Annual Design Conference, sponsored by the Machine Design Division of American Society of Mechanical Engineers, N. Y. Coliseum, New York City.

May 2-4—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.

July 12-13—British Lockheed International Aerobatic Competition, the National Air Races (third round) and the King's Cup Air Race, Coventry Civil Aerodrome, Bagington, England.

Aug. 20-23—Western Electronic Show & Convention Board of Directors, Cow Palace, San Francisco, Calif.

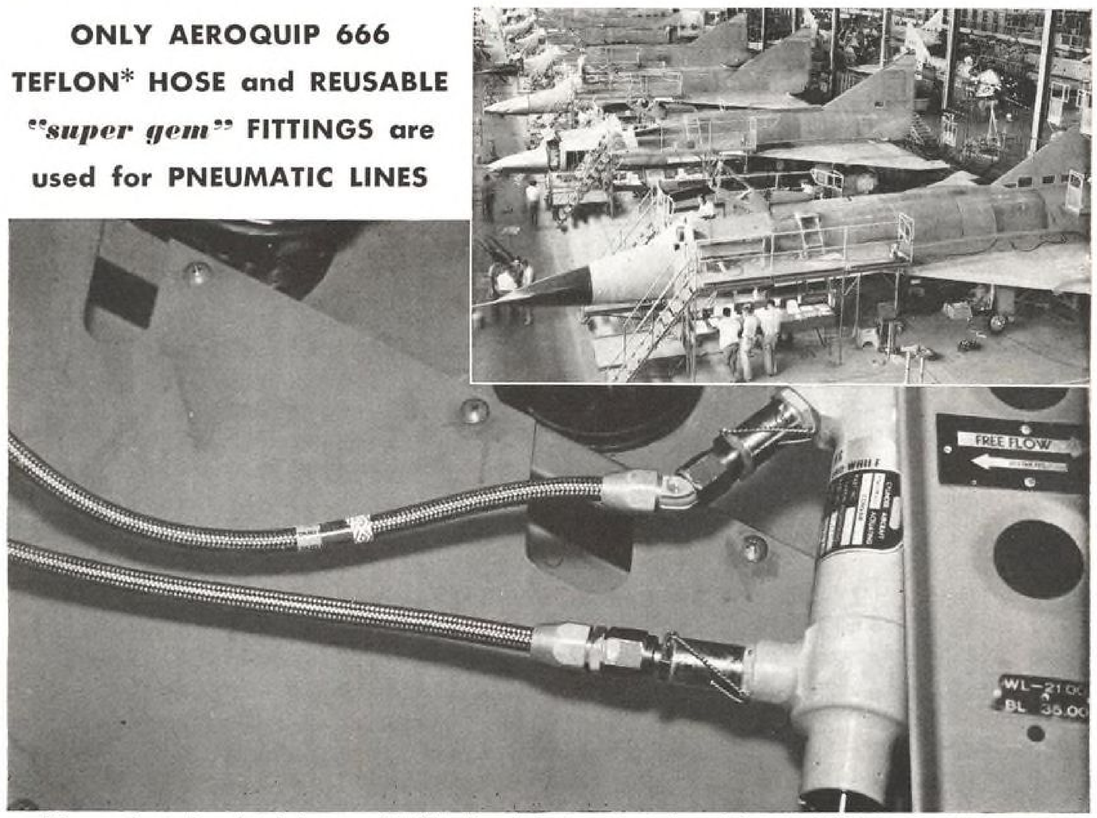
Sept. 1-6—Sixth International Aeronautical Conference, Royal Aeronautical Society and Institute of the Aeronautical Sciences, Folkstone and London, England.

Sept. 2-8—1957 Flying Display, Society of British Aircraft Constructors, Farnborough, England.

Sept. 9-13—13th Annual General Meeting, International Air Transport Assn., Madrid, Spain.

Aeroquip Teflon Hose on the F-102A

ONLY AEROQUIP 666 TEFLON* HOSE and REUSABLE *"super gem"* FITTINGS are used for PNEUMATIC LINES



This pneumatic actuating cylinder in the supersonic F-102A, all-weather jet interceptor, is shown with Aeroquip 666000 Hose Assemblies attached.

On Convair's fast new F-102A jet interceptor, now in quantity production, Aeroquip 666 Teflon Hose with *"super gem"* Fittings are used for pneumatic lines. Made to the highest quality standards in the industry, Aeroquip Teflon Hose Lines assure dependable performance—always.

Aeroquip *"super gem"* Fittings for Teflon Hose are detachable and reusable. They grip the reinforcing braid of the hose without harmful compression of the Teflon inner tube. This important design feature prevents leaks due to cold flow characteristics of Teflon.

Aeroquip 666 Teflon Hose and *"super gem"* Fittings simplify problems of production changes, engineering mock-ups, and greatly facilitate field maintenance. Hose and fittings can be *hand assembled* with bench tools.

Write today for Bulletin AEB-13 giving full engineering information on Aeroquip 666 Teflon Hose and *"super gem"* Fittings.

*DuPont trade name for tetrafluoroethylene resin. *"super gem"* is an Aeroquip Trademark.

Aeroquip
REG. TRADEMARK

AEROQUIP CORPORATION, JACKSON, MICHIGAN

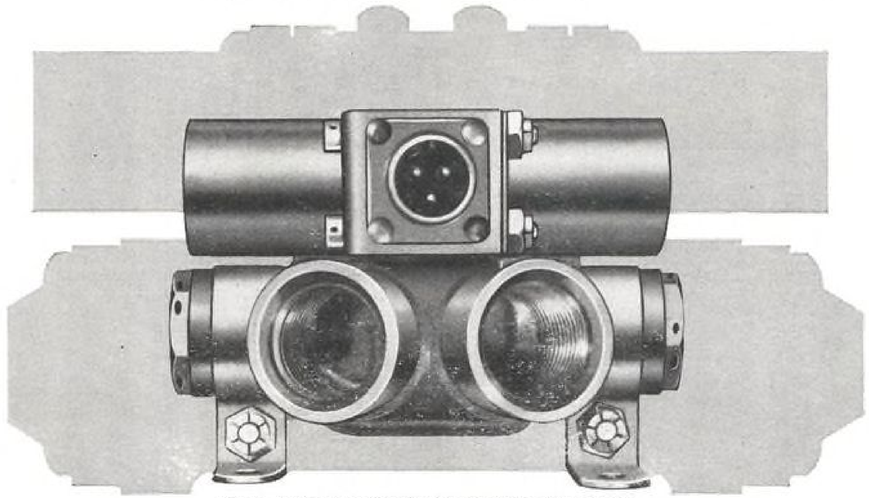
AEROQUIP CORPORATION, WESTERN DIVISION, BURBANK, CALIFORNIA

AEROQUIP (CANADA) LTD., TORONTO 10, ONTARIO (A Subsidiary of Aeroquip Corporation)

LOCAL REPRESENTATIVES IN PRINCIPAL CITIES IN U.S.A. AND ABROAD—AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A. AND ABROAD

ADEL "DESIGN SIMPLICITY" FOR PERFORMANCE RELIABILITY

New Steel Body, Miniature, Solenoid Operated Directional Control Valves



OLD AND NEW VALVES ACTUAL SIZE

SPECIFICATIONS

Non-Interflow, Low Surge Design Types I & II Sys. (—65°F to +160°F & +275°F) Corrosion Resistant Construction

Operating Pressure Range: 250 to 3000 PSI
Total Pressure Drop: 60 PSI at Rated Flow
Internal Leakage: 10 cc/ Min. Max. at 90°F

Solenoids: Continuous Duty, Single Dry Coil, 18 to 28 V dc operation at —60°F to +275°F
Current Drain: 1 Amp Max. at 28 V dc

Performance and qualification based upon Oil, Specification MIL-0-5606, but suitable for other fluids

Compared with similar valves having aluminum bodies and steel components, these new valves provide: ▶

- 1/5 number of seals
- 1/2 number of parts
- 1/2 space requirements
- 1/2 weight

DESIGNED FOR EXTENSIVE STANDARDIZATION OF PARTS

VARIATIONS

2 and 3 Position, 4 Way
2 and 3 Position, 4 Way with Solenoid Manual Override
3 Position, 4 Way with Piston Manual Override
Line Sizes: ¼, ⅜ and ½ inch Ports per AND 10050

Write today for new descriptive Brochure

Reliability

ADEL PRECISION PRODUCTS

A DIVISION OF GENERAL METALS CORPORATION

BURBANK, CALIFORNIA • HUNTINGTON, WEST VIRGINIA
DISTRICT OFFICES: MINEOLA • DAYTON • WICHITA • DALLAS • TORONTO

Designers, Developers, Manufacturers and Testers of Hydraulic, Pneumatic, Fuel, Mechanical and Electrical Equipment, and Line Supports

NEW GRID-CONTROLLED KLYSTRON NOW IN QUANTITY PRODUCTION

SAL-89 HIGH-POWER PULSE AMPLIFIER FOR AIR NAVIGATION SYSTEMS

In introducing the SAL-89, Sperry is offering the first production tube featuring grid-controlled pulse operation for ease of modulation. This tube, with its unique technological advances, was designed specifically for air navigation and traffic control service.

With grid control, Sperry has greatly eased the problem of modulating high-power klystrons. For example, only 575-volt pulses are now required to modulate the tube where previously 10,000-volt pulses were necessary. Specially shaped pulses are also easily applied to the tube.

SAL-89 incorporates space-charge focusing, another Sperry development, which eliminates large, heavy magnetic structures and simplifies cooling. Integral resonant cavities make external microwave circuits with their associated sliding contacts unnecessary.

For further information on this new tube, write our Electronic Tube Division.

GENERAL CHARACTERISTICS

Frequency Range	960 to 1215 mc
Peak Output Power	30 kw
Grid Bias (Negative)	1% of Beam Voltage
Grid Drive (Positive)	2.2% of Beam Voltage

TYPICAL PULSE OPERATION

Frequency	1100 mc
Grid Bias	—170 v
Grid Drive	575 v
R-f Input Peak Power	30 w
R-f Output Peak Power	25 kw
Duty Cycle	2.5%
Beam Voltage	17 kv

ELECTRONIC TUBE DIVISION

SPERRY GYROSCOPE COMPANY

Great Neck, New York

DIVISION OF SPERRY RAND CORPORATION

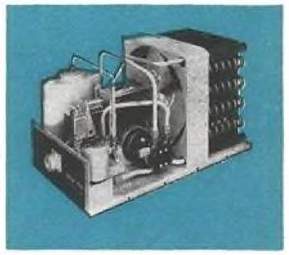
CLEVELAND • NEW ORLEANS • BROOKLYN
LOS ANGELES • SAN FRANCISCO • SEATTLE
IN CANADA: SPERRY GYROSCOPE COMPANY OF CANADA, LIMITED, MONTREAL, QUEBEC

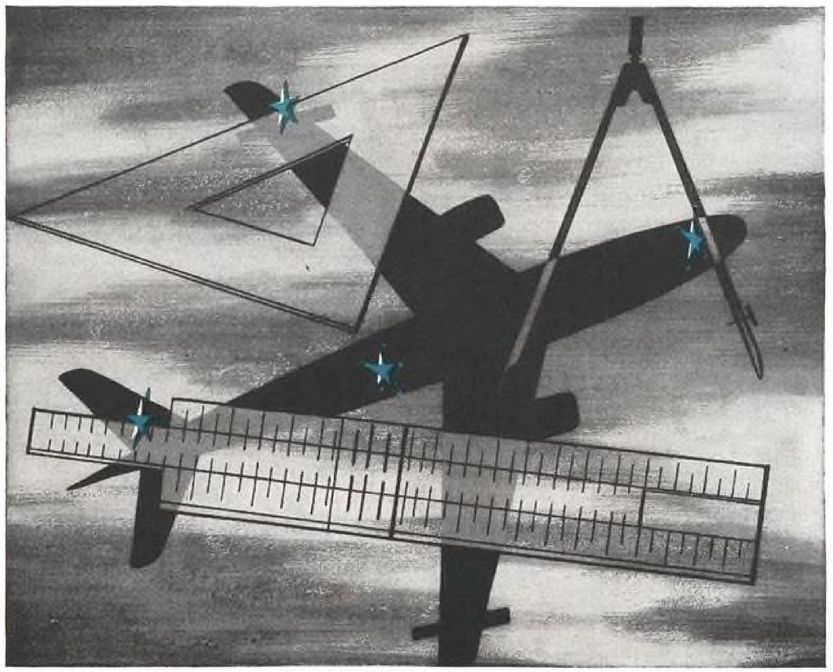
★ ***AIRCRAFT PUMPS***
Precision-built to rigid government specifications, a broad selection among Eastern pumps offers flexibility to your choice. Modifications can be made, or custom-made units designed to suit your project. Trim in size, light in weight, Eastern Aircraft Pumps give reliable long-term service.

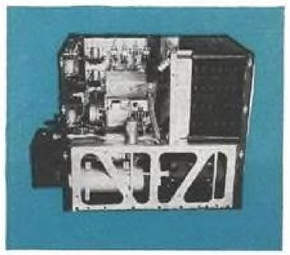
★ ***PRESSURIZATION***
Eastern pressurization units for airborne electronic equipment are available in many capacities to handle a broad range of requirements. Units consist of an air pump and motor assembly, pressure switch, check valve, tank valve, and terminal connectors. They meet government specifications and can be modified to your needs.

eliminate the "BUGS"

with Eastern aviation products







★ ***COOLING UNITS***
Hold temperatures to safe operating limits in liquid cooled electronic tubes or similiar devices. By virtue of long experience and using standard component parts, Eastern can suit your specific needs at a minimum cost for equipment.

★ ***REFRIGERATION-TYPE***
Enable specified components to be held to fairly constant temperatures by use of various types of refrigeration units. Because of the variation in methods possible, Eastern units fill every requirement where the use of a refrigeration cycle is called for.

★*SPECIAL UNITS*

Eastern's continual research and development program keeps pace with the growing aviation industry. As new problems occur with progress in aircraft development, Eastern units are constantly developed to fill their function as planes fly higher, or faster, or with greater load capacity.

Eastern welcomes the chance to help engineers "take out the bugs" with equipment that cools, pressurizes, or pumps. From the extensive line of existing units, new adaptations, or custom-made designs, Eastern is ready to meet every challenge for equipment that handles your needs *the best today . . . better tomorrow.*

Eastern
INDUSTRIES, INC.
100 SKIFF ST.
HAMDEN 14, CONN.

Write for Aviation Products Catalog, Bulletin 330.

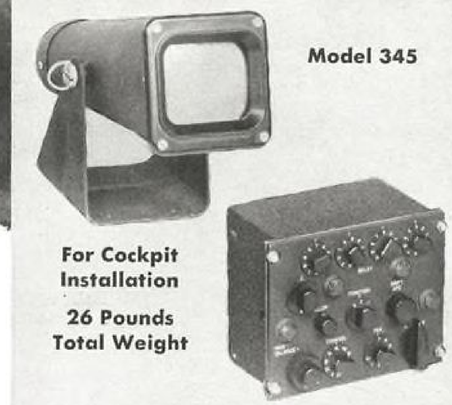
Now, the long-awaited aircraft loran, designed primarily to fill the needs of transoceanic flying and packaged for cockpit installation, is announced by EDO. Built specifically to meet airline requirements, this new lightweight unit is designed for instrument panel mounting, convenient to the pilot.

It's no longer necessary to pay a heavy weight penalty for the added safety and convenience of loran gear. Edo's new set weighs only 26 pounds completely installed.

Built to the highest electronic standards, the Edo Model 345 gives quick, directly read time difference readings for accurate plots in a matter of seconds. No calculation, no computations, no tables, no special training needed to operate. As simple to use as any other pilot-operated radio navigation aid.

A development of Edo's years of research, design and production of dependable marine loran sets and other high performance electronic equipment, the Model 345 contains the latest miniaturized circuitry. Its compact remote control console and clear, easily read 3-inch scope fit neatly into the restricted space of an airplane instrument panel.

If you are interested in detailed specifications and operating data, please write for particulars.



For Cockpit Installation

26 Pounds Total Weight

Compact scope and command control designed for cockpit installation. 34-tube receiver (not shown) occupies ¾ ATR rack.

FEATURES OF THE EDO MODEL 345

- 3-inch scope easily read even under bright light conditions. Does not require a special hood. Can be mounted directly in instrument panel, or other accessible spot.
- Pilot-operated command control gives directly read solution to problem. No calculations, no tables, no special training needed to operate.
- Loran receiver containing 34 tubes. Features low power consumption — only 175 watts, 115 v 400 cycles; 25 watts, 24 v DC.
- No-drift signal assured by special oscillator control.
- Highly accurate voltage regulation for dependable operation.
- Complete fail-safe feature.

BROCHURE AVAILABLE ON REQUEST

The Edo Corporation
College Point, Long Island, New York
Manufacturers of a Trusted Line of Marine and Airborne Electronic Equipment

"Little things" will mean big problems on the production line, too!

ELGIN can mass produce your miniaturized assemblies at lower cost

As more companies plan for miniaturized production they encounter the problem of handling small parts efficiently. Many leading producers solve this difficulty by letting Elgin "thread the needle" for them. Elgin has the broad experience and specialized facilities to produce small assemblies in volume at lower cost. After all, miniaturization has been our business for years.

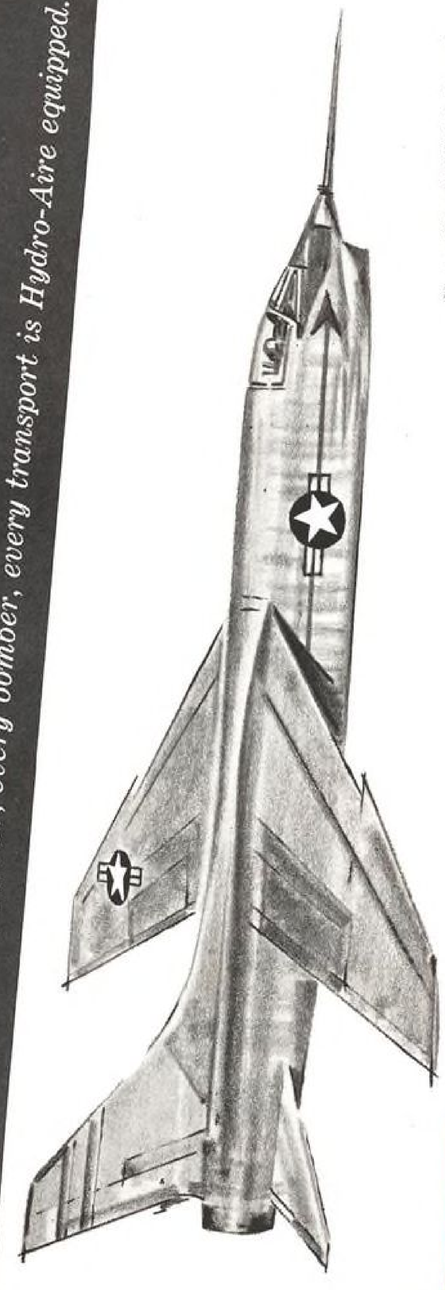
Read about Elgin's "Practical Miniaturization." Our booklet tells how Elgin has helped others . . . how Elgin can help you. Write today for your copy.

ELGIN NATIONAL WATCH COMPANY

MICRONICS DIVISION • ELGIN, ILLINOIS

for maximum confidence

every fighter, every bomber, every transport is Hydro-Aire equipped.



Chance Vought F8U-1 Crusader

Hy-v/l* Fuel Pumps are Standard Equipment on the F8U-1

HY-V/L* FUEL PUMPS

Up where the cost of failure is too high—where the low ambient pressure causes your fuel to boil and vaporize—for maximum confidence, the answer is HY-v/l Fuel Pumps.

Higher ceilings and faster rates of climb have accentuated the problem of boiling fuel vapor that locks the fuel supply and causes engine failure.

The answer is HY-v/l FUEL PUMP

- No Vapor Separator. The pump recondenses the vapor back into liquid.
- Low electrical consumption, especially at full flow. Light weight. Compact.
- Simplicity of design. Minimum number of parts. Easy to service.
- Handles many types of fuel.
- Recovers instantly if stopped and restarted.
- Recent 1200-hour "Dry Run" torture test proves **maximum reliability.** Needs no thermal protection device or switch.
- Has "Design Predictability", i.e., it can easily be tailored to your specific needs.

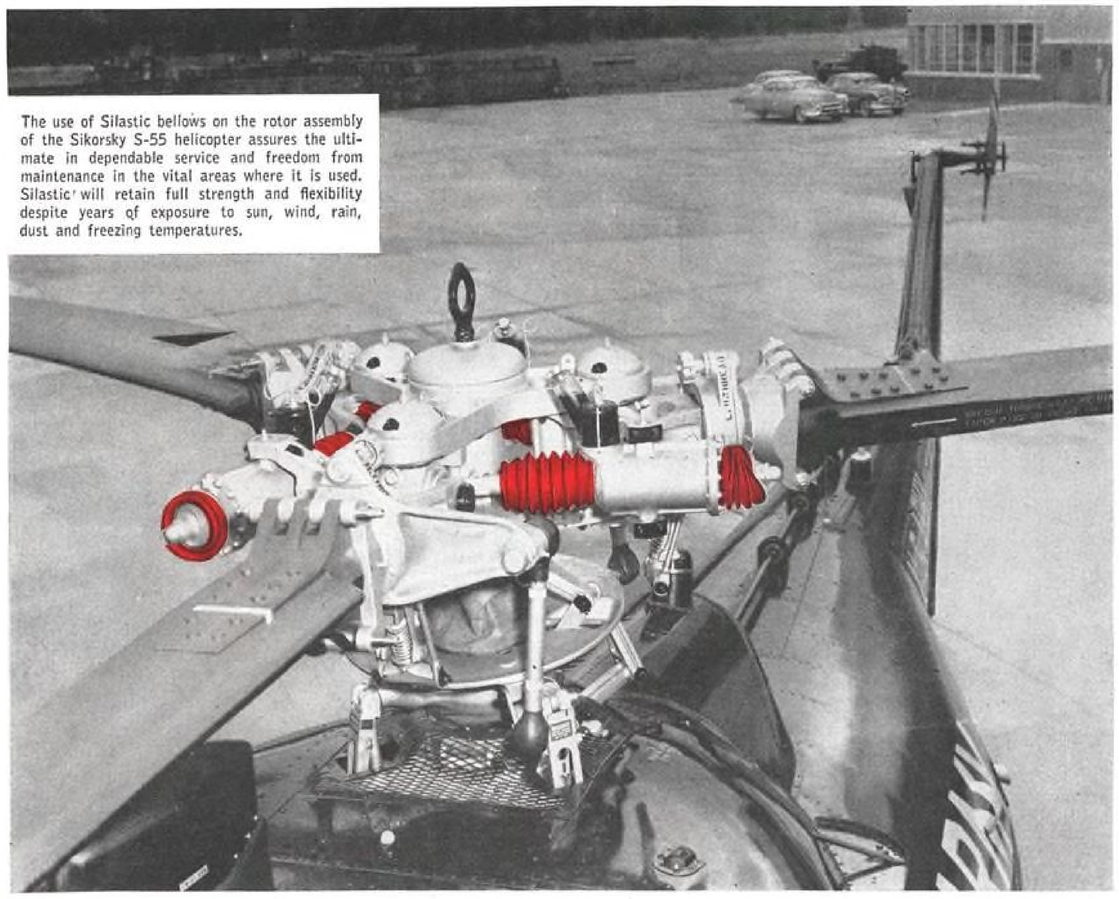
Write for complete details.

HYDRO-AIRE

3000 WINONA AVE., BURBANK, CALIF.

the aviation subsidiary of CRANE

*High Vapor/Liquid Ratio



The use of Silastic bellows on the rotor assembly of the Sikorsky S-55 helicopter assures the ultimate in dependable service and freedom from maintenance in the vital areas where it is used. Silastic will retain full strength and flexibility despite years of exposure to sun, wind, rain, dust and freezing temperatures.

SILASTIC SILICONE RUBBER molded parts resist weather aging

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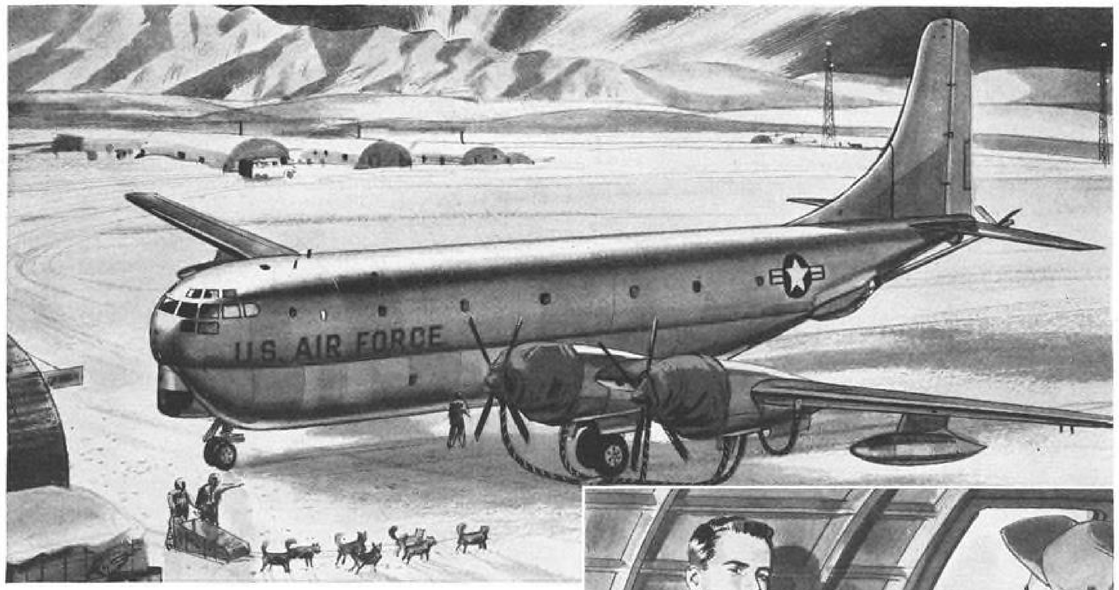

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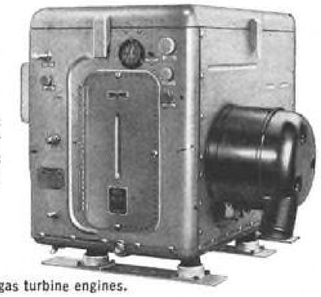

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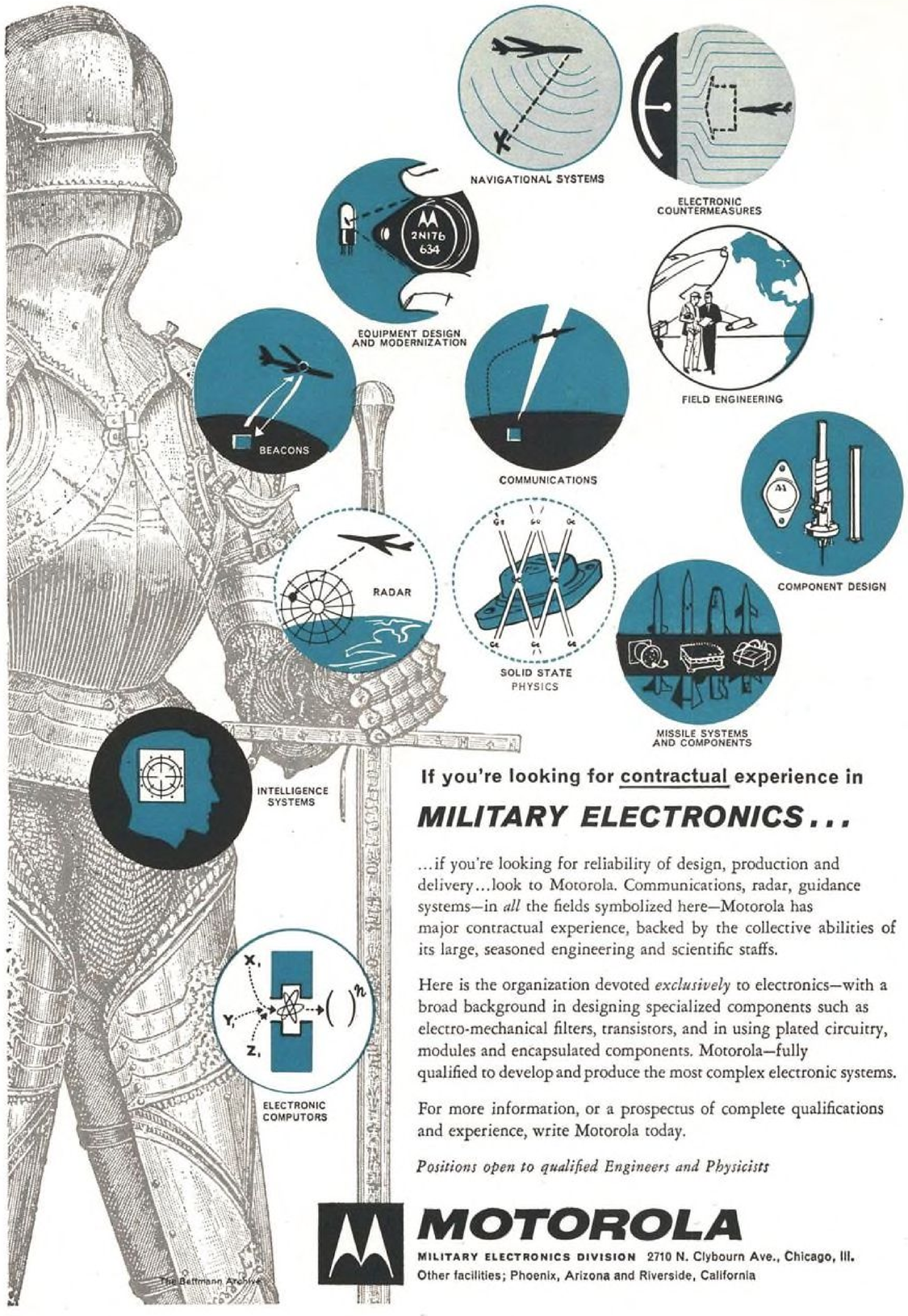

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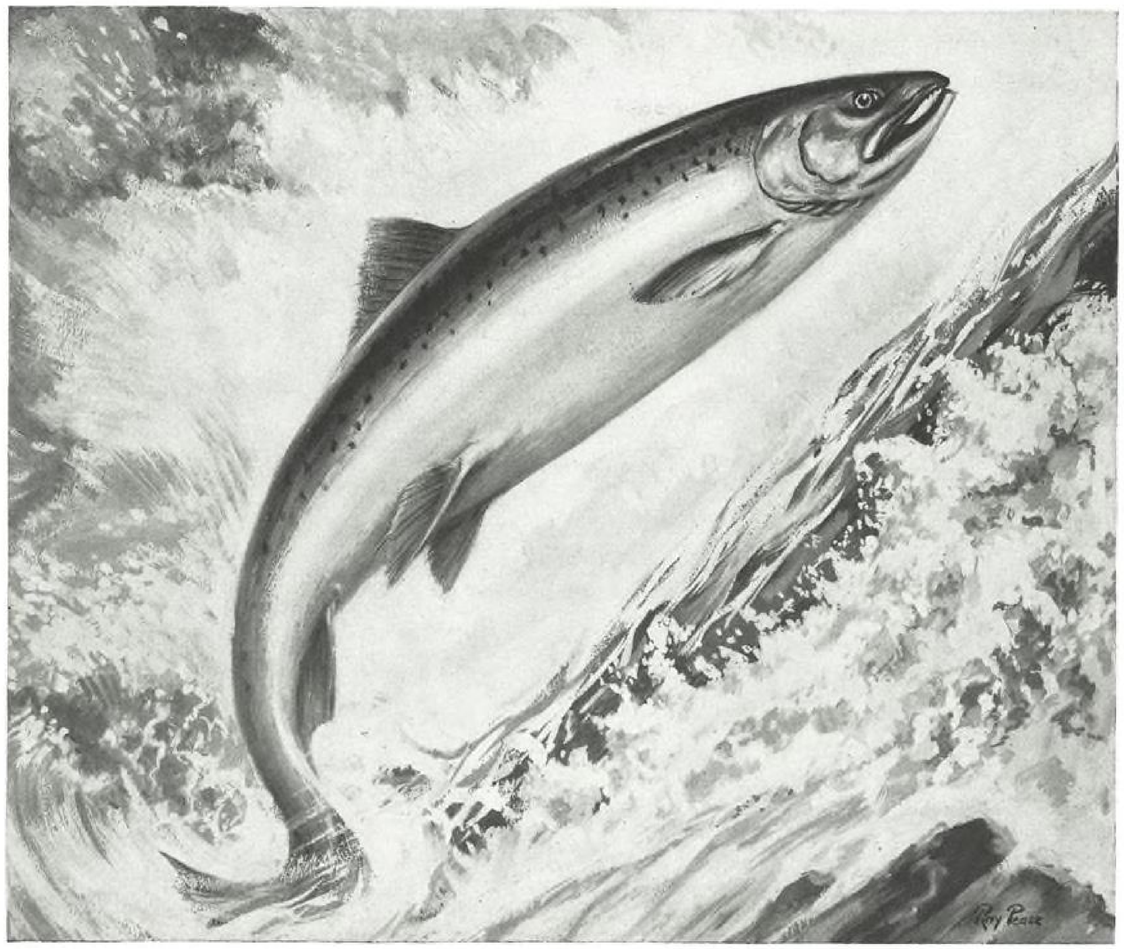

Upstream!

Most people watching a salmon swim upstream wonder how he does it. Seems like a lot of exertion to move from one wet spot to another. To the salmon, though, the compulsive drive upstream cannot be denied.

The titanium industry also has been fighting upstream these past five years. A succession of production rapids and metallurgical waterfalls have been surmounted. The dangerous hydrogen whirlpool was successfully skirted. The industry has now moved through the less white headwaters to fully competitive equality with other structural metals.

Titanium alloys of high strength, light weight and outstanding corrosion resistance are available from T.M.C.A. in all mill forms and in a full range of sizes and gages — sheet, bar, billet, extrusions, tubing and wire. Special heat-treated sheet of very close gage and flatness tolerances is in production for advanced aircraft and missiles.

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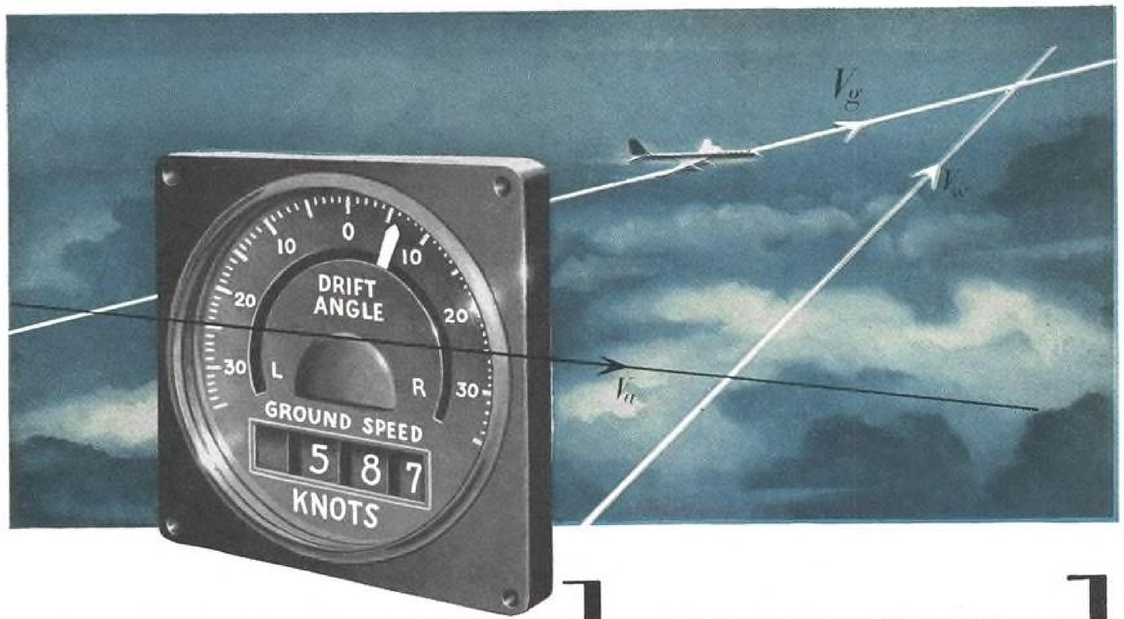

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VOL. 66, NO. 6

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Mary Whitney Fenton, Joan Read, Judith P. Wheeler

Canadair's CL-28 Designed for Endurance..... 26
► Maritime reconnaissance airplane, now officially named the Argus, will extend range of anti-submarine patrol.

New CAB Regulations Follow Air Tragedies..... 38
► CAB takes action as congressional pressure mounts for rules that will bring a halt to air tragedies.

Russians Revise Air History Distortions..... 59
► Russian historians say Soviet claims during Stalin era for firsts in aviation are not accurate.

MISSILE ENGINEERING
Bell Rascal Launching..... 28
Details of X-10..... 29
High Flying U-2..... 30
Latest Matador..... 32
Atomic Turbojet..... 34
U. K. May Use U. S. Missiles..... 37

AERONAUTICAL ENGINEERING
Defense Seeks Science Corps..... 30
House Hits R&D for Big Firms..... 33
F-106A Goes to Test Center..... 33
Russian Torpedo Bomber..... 63
New Larson Fighter..... 73
Red Schools Criticized..... 75
M.100 May Fit Army Role..... 77
Sperry Starts Armament Divisions... 77
Critical Air Report Studied..... 77
NACA's Loss of Scientists..... 86
Safe Flight Speed Control..... 89

AVIONICS
Anti-Collision Pessimism Grows..... 33
Airborne Computer Lessens Routine.. 97
Expansions in Avionics Industry..... 98
New Avionic Products..... 100

HUMAN FACTORS
Rearward Seating Safer..... 91
Trend Indicates Decreasing Escape... 92

TRANSPORT
United Asks Fare Hike..... 43
Airport Safety vs. Profit..... 52
Air Taxi Curtails Service..... 55
CAA Orders Inspection..... 55
Continental Leases DC-7B..... 57
Airline Traffic Table—1956..... 45
Shortlines..... 47
Airline Observer..... 47
Cockpit Viewpoint..... 51

BUSINESS FLYING
New Utility Aircraft..... 103
CAA Issues Lycoming Directive..... 105
New Zealand Aviation..... 105
U. S. Business Aircraft Earnings..... 105
Helicopter Homing Device..... 106
New Exam for Pilots..... 107
Cessna, Piper Sales Increase..... 107
Cessna 310 on Short Lease..... 108

MANAGEMENT
Unions Plan for 1958..... 31
UAW Charges Piasecki Lockout..... 31
Vinson Supports Budget..... 32
Who's Where.....23, 109
Industry Observer..... 23
Washington Roundup..... 25

Calendar.....4, 6
Letters..... 126

EDITORIAL
The Senate Airpower Report..... 21

COVER: North American Aviation X-10, shown in normal level flight attitude, is a test vehicle for Navaho long range missile. Latest Navaho has delta wing with large dihedral to supply stability and control (AW Feb. 4, p. 28). Two Westinghouse J40 turbojets power the X-10, which has been flown at high supersonic speeds. First test phase in SM-64 Navaho program was conducted on the NATIV, a 14 ft. test rocket, and the second research and development phase was accomplished on the X-10, proving out the missile's aerodynamic design as well as its guidance and control systems. Initial operations have begun on the XSM-64. For more on X-10 see page 29.

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AVIATION WEEK • FEBRUARY 11, 1957 • Vol. 66, No. 6
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EDITORIAL

The Senate Airpower Report

Report of the Senate Armed Services Subcommittee on the Air Force comes as an anti-climax to the 1,863 page record containing a million words of testimony under oath by the nation's top military and civilian leaders. Although considerable effort was made to keep the committee's work from becoming a purely political instrument, these efforts fell short of their goal. The final report is sharply split down orthodox party lines.

The Democratic majority of Senators Stuart Symington (chairman), Henry Jackson and Sam Ervin painted a thoroughly black picture of U.S. military airpower, while the Republican minority, whittled by the 1956 election to only Sen. Leverett Saltonstall, voiced undiluted optimism on the same subject. It is unfortunate that Sen. Saltonstall felt obliged to act, as he himself described it, "as counsel for the defense" in this effort, and that the Democratic majority let their zeal for the prosecution dissipate their objectivity in evaluating the evidence.

The American people badly need an objective view of their airpower program, particularly on its rate of progress in relation to that of the Soviet Union. The Senate subcommittee had an excellent opportunity to provide this objective view, but it has failed. The published record of testimony before the subcommittee now emerges as perhaps that group's most important contribution to a better understanding of the airpower issues.

We agree with the evaluation of USAF Secretary Donald A. Quarles who labeled this published testimony as "probably the most comprehensive compilation of expert opinion on U.S. airpower that has ever been assembled for distribution to the general public."

Another major weakness of the subcommittee report is that even the majority recommend no clear-cut course of action to solve the problems it outlines. After listing 23 conclusions, many of which are certainly valid, the majority report recommends only "that the deficiencies in military strength as pointed out in the conclusions be corrected as promptly as possible." By whom, to what degree and how, the majority report fails to say, and this is really the heart of the matter.

The majority report cites for special attention its conclusion that the American people are being deliberately fed misinformation on the airpower program and emphasizes "the importance of taking prompt steps to see that the American people are given more of the truth about the relative strength of the United States against that of the Communists."

The record of the past two years and the first public presentations of the Fiscal 1958 Defense Department budget have provided ample evidence that a policy of deliberate deception is being used to delude the American people on the accurate state of their airpower strength.

Another conclusion of the majority that would have gained additional clarity if it had not been painted on a totally black canvas is the relatively sad state of the research and development program. This program is being suffocated between the pressures generated by rising costs and the need for an expanded program on one side, and the administration philosophy of maintaining a constant-level research and development budget on the other. This artificial and irrational lid that is being placed on American technical progress cannot help but lead to ultimate disaster unless it is changed soon. As Courtland Perkins, chief scientist of the Air Force, recently pointed out, this policy simply achieves little technical progress at great expense.

As a result of the split subcommittee report, the U.S. citizen must now make a choice between the pessimism of the majority and the optimism of the minority. Based on the 1,863 page record of sworn testimony, there is ample cause for serious, if not complete, pessimism on the future of military airpower. There are vital deficiencies in the current and future military airpower programs but there are also areas, such as the air defense warning system and the equipping of the Air Defense Command with supersonic all-weather missile firing interceptors, where notable progress is being made.

One of the most vulnerable points in the administration's current airpower philosophy is that piloted aircraft can be replaced by unmanned missiles quickly and cheaply.

The administration is gambling on being able to skip the next generation of piloted aircraft such as Mach 3 missile-carrying interceptors; supersonic bombers armed with air-to-ground missiles, and such advances as the chemically-fueled bomber, the nuclear-powered bomber and a truly intercontinental bomber independent of aerial refueling. It hopes to jump immediately to the family of long range ballistic missiles. This admittedly will save a lot of money but, if the gamble fails and the ballistic missiles do not make the progress now being scheduled for them by administration optimists, this country may face a five-to-10 year period virtually defenseless against an enemy's new generation of long range supersonic aircraft.

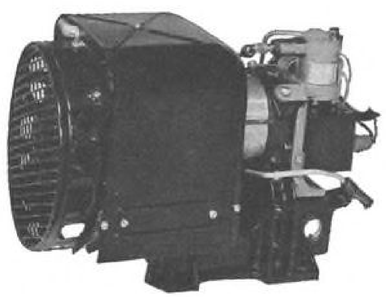
There is not much in his record to support Sen. Saltonstall's position as an airpower optimist of any substance. His most notable contribution to the cause of technical optimism in the current airpower controversy was his assurance to the American people more than a year ago that one source of our air strength was "a constantly increasing stockpile of intercontinental ballistic missiles." This was at a time when the first experimental prototype of such a missile had not yet been completed in this country. Clearly, there is little comfort for the U.S. citizen in Sen. Saltonstall's brand of uninformed optimism.

The Senate subcommittee got off to a fine start on its investigation of U.S. airpower. But it fizzled at the finish. The problem still remains.

The airpower problem now passes to the congressional appropriations committees who are considering the Fiscal 1958 defense budget submitted by the administration. Not since the days of the Presidential Air Policy Commission headed by Thomas K. Finletter in 1949 have these congressional groups had such a wealth of evidence on which to base their airpower decisions. In providing this record, the Senate subcommittee has performed a worthwhile public service.

—Robert Hotz

On the new F-27...a complete pneumatic system!



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Designed and built by Kidde engineers to Fairchild's exacting specifications, the Kidde pneumatic system saves approximately 100 pounds, is faster operating, is easier to maintain, and requires no flammable liquids.

Matching the smoothness of her Rolls-Royce prop jet engines, pneumatic power for the F-27 is furnished by two engine gear box driven Kidde 2 cfm air compressors. The air stored at 3300 psi is used for operation of nose wheel steering, wheel brakes and anti-skid system, landing gear, up locks, propeller brakes, tail bumper and emergency systems.

Design responsibility for the F-27 pneumatic system rests with Walter Kidde & Company, who can furnish complete pneumatic systems on an off-the-shelf basis, as well as the engineering talent to develop and produce special equipment on request. Get the answers to your pneumatics problems now . . . by writing Kidde today.

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Henry Zeigler, general manager, Breguet Co., Paris, France. Mr. Ziegler succeeds **Jean Gandilhon,** now a vice president of Westinghouse (France).

Honors and Elections

Dr. Ross A. McFarland, Associate Professor of Industrial Hygiene at the Harvard School of Public Health, received the 1956 John Jeffries Award of the Institute of the Aeronautical Sciences. The award is made annually "for outstanding contributions to the advancement of aeronautics through medical research."

Alan L. Morse, Chief, Aircraft Division, CAA Technical Development Center, Indianapolis, was presented the first "Frontiers of Flight" trophy for a "lifetime of service to aeronautical progress."

Charles H. Godschall, manager of Tooling and Tool Engineering, Government and Industrial Division of Philco Corp., was presented the Distinguished Service Award by Asst. Secretary of the Navy Raymond H. Fogler. The citation reads in part, "For outstanding service to the U. S. Navy. . . . By this outstanding performance, Mr. Godschall has distinguished himself in a manner deserving of the Navy's highest civilian award."

(*Continued on p. 109*)

INDUSTRY OBSERVER

► **Some F-104Bs have been fitted with a ventral fin to provide additional directional stability at high Mach numbers. Chord of fin is 5 ft., and it is 8 in. in span at the forward edge tapering to about 3 in. This extension below the fuselage as a solution to the blanking out of upper vertical tail surface by fuselage and wing at the high angle of attack in high altitude flight was suggested in an Aviation Week report (AW Oct. 31, 1955, p. 16).**

► Britain is now planning a supersonic research aircraft built entirely of stainless steel and using a straight, thin wing design for exploration of the Mach 2 to 3 speed range.

► **Blackburn and General Aircraft Ltd., Brough, England, is building a prototype supersonic naval bomber known as the N. A. 39.**

► USAF is interested in Grumman's F11F-1F jet fighter developed for the Navy. Powered by a General Electric J79 turbojet engine, the F11F-1F recently reached a speed of 1,220 mph. in level flight and flew to an altitude of 72,000 ft. (AW Dec. 24, p. 26). Air Force pilots have been flying the aircraft.

► **North American Navaho supersonic ramjet-powered missile uses a combination of celestial and inertial guidance systems. Celestial is used for en route guidance over the Navaho's 5,000 mile range with terminal guidance switching to an inertial system. Navaho is now being flight tested at USAF Missile Test Center, Cape Canaveral, Fla.**

► Information gained from Stanford Research Institute's studies on radio echoes from meteor trails (AW Nov. 26, p. 87) may be applied to global communications and ballistic missile tracking projects. The Stanford studies are under the sponsorship of the Rome Air Development Center.

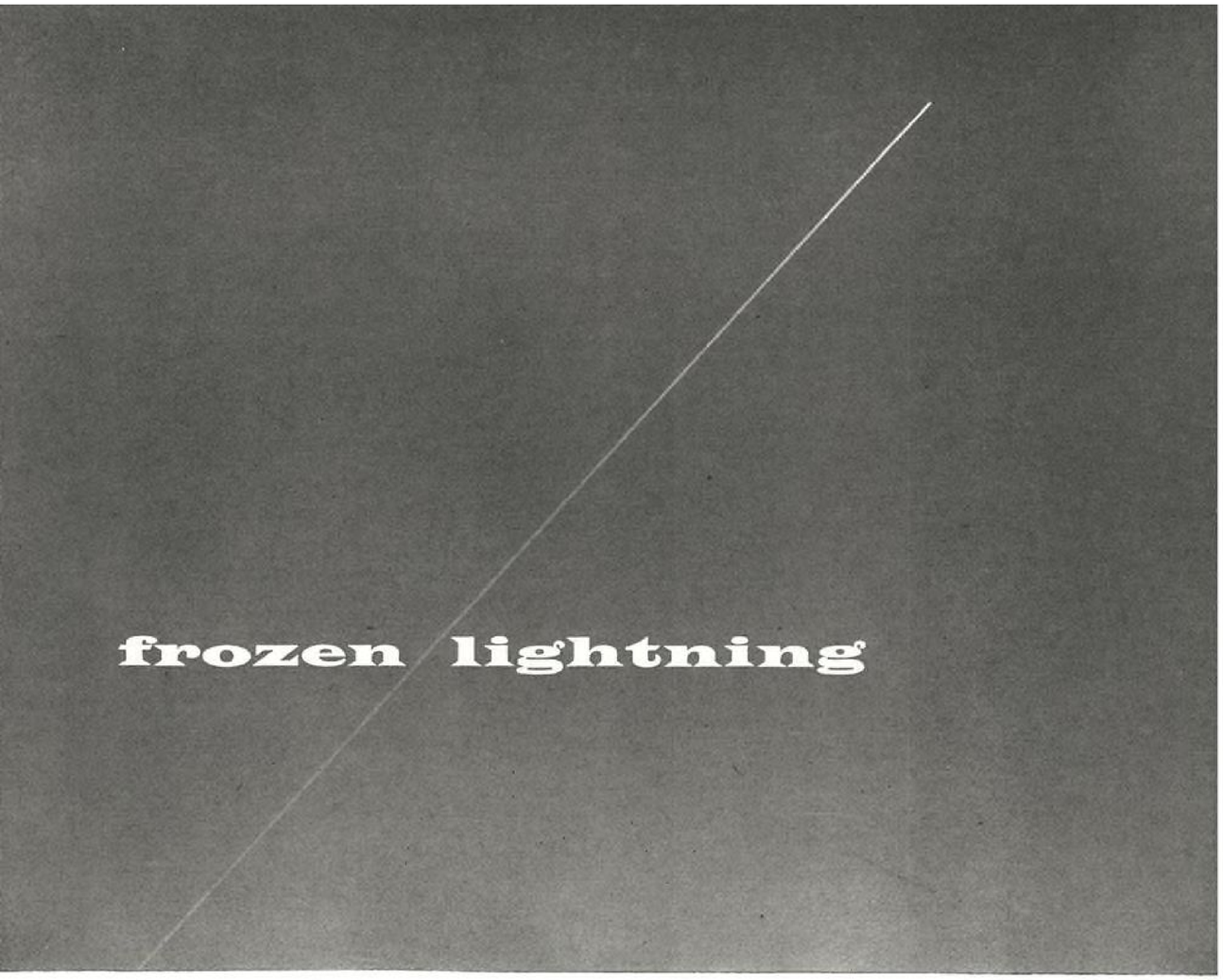
► **Army has laid 14 miles of communications wire in less than six minutes from a Sikorsky H-34 during tests at Fort Bragg, N. C. With Army-developed device consisting of six galvanized steel tubes, one H-34 can carry a total of 54 miles of combat ground wire and lay six lines at a time. In operation the device is suspended from the helicopter's sling mechanism.**

► Rotor Craft Corp., of Glendale, Calif., will conduct flight test evaluation of its rocket-powered, strap-on-the-back helicopter, the Model RH-1, under Navy Bureau of Aeronautics financing. Helicopter, which uses the pilot's legs for landing gear, already has been flown at altitudes of 8,000 ft. and speeds above 70 mph. BuAer is looking at the RH-1 with an eye towards possible use by the Marine Corps.

► **Rohr Aircraft Corp., Chula Vista, Calif., will produce 160 power packs for Convair's Model 880 jet transports. Packs will be built around the General Electric CJ805 turbojet engine, commercial version of the J79. First deliveries under the $7 million contract will go to Convair early next year. Last deliveries are scheduled for June 1960.**

► Research and development costs for prototype of Avro Aircraft's Mach 2 interceptor, the CF-105, are now estimated at $200 million, almost double the estimates made when the twin-engined aircraft first reached the planning stage. First flight of the CF-105 is scheduled for March 1958. Aircraft will be powered by Orenda Iroquois engines now being built in Toronto. Along with Royal Canadian Air Force, U. S., British and West German officials are interested in possible orders.

► **Sikorsky Aircraft is considering the development of a turbine-powered version of its S-58 helicopter embodying longer range and more carrying power. Aside from its military uses, one commercial application would be in offshore oil operations. The turbine-powered helicopter could carry special drilling rigs to long-range offshore sites, saving time and cost, as well as personnel, tools and living accommodations. Conventional helicopters will test the concept in short-range missions to be conducted in New Guinea (AW Dec. 31, p. 28).**



The Germans called the upper-atmosphere trails of their V-2 rockets "frozen lightning". When the Mach 4-5 aircraft now under development fly at 80-90,000 feet and higher, we'll be seeing frozen lightning in our own skies.

Not freezing but heating will be the *real* problem at these ultra high speeds. At 3000 mph, the skin and many structural components will be heated to over 1000°F, temperatures too high for alloys now used. Needed: materials strong up to 1200-1300°F for structural forgings and other stressed parts.

Engine builders, fastener manufacturers and forge shops are handling similar requirements right now, with Carpenter alloys. These alloys have gained an enviable reputation for uniform high quality, ability to meet tough specifications consistently, improved forgeability and exceptional cleanness. Forging tolerances can be tighter. Finishes are better. Rejects are far fewer.

Design properties and fabrication instructions for these alloys are summarized in our new booklet, "Carpenter Alloys for Elevated Temperature Service". For your copy drop us a line on your Company letterhead. The Carpenter Steel Company, 128 W. Bern Street, Reading, Pa.

Carpenter STEEL

Improved alloys for elevated temperature service

Washington Roundup

New Look at Airpower

The aircraft industry is in for another investigation, this one by a special Senate task force that will look into the programs of the three services on aircraft procurement, maintenance, operations, training and training facilities. The Senate group, formed by Sen. Lyndon Johnson (D.-Tex.), will be chairmanned by Sen. Stuart Symington (D.-Mo.). Johnson, Senate majority leader and chairman of the Senate Armed Services Preparedness Investigating Subcommittee, will also serve on the task force, giving it much more potential power than Symington's airpower subcommittee of last summer. This subcommittee has completed its study and filed its final report (AW Feb. 4, p. 32). Minority member of the new group will be Sen. Styles Bridges of New Hampshire.

'Piracy'?

Rep. James Davis (D.-Ga.), is charging defense contractors with "pirating" government and non-defense industries of engineers and technical personnel through excessive recruiting costs.

Davis has released a Navy report showing that 37 Navy contractors with a preponderance of defense business had an average recruiting cost of $1,317 per new engineering employe. One firm, the report says, averaged $15,328 per man.

Seventeen contractors with a preponderance of commercial business averaged only $985 per employe, according to the report. The defense contractors had a total annual sales volume of $3 billion, of which $2.8 billion was in government work, and spent $6.4 million for recruiting in the last half of 1956. The predominantly commercial firms had a total annual sales volume of $3.2 billion, of which $358 million was from government contracts. They spent only $613,956 on recruiting.

Rep. Davis, head of the Manpower Subcommittee of the House Post Office and Civil Service Committee, has also asked the Defense Department to establish precise standards on allowable costs for recruitment by contractors.

"Every day of delay . . . means greater demands for higher salaries for government engineers," he said. "These demands are hard to deny as long as this vicious cycle of the federal government competing with itself is permitted to continue."

Navy Views Advertising Costs

Navy says newspaper ads for skilled scientific personnel do not pay off. Navy proposed that contractor procurement advertising for technical personnel by defense contractors be restricted to technical and trade publications but was rebuffed by a conference of procurement secretaries.

Pounding the Budget

Watch for Sen. Stuart Symington (D.-Mo.) to use testimony made before his airpower subcommittee as an anvil on which to pound the administration's defense budget. He now says that Gen. Nathan F. Twining, USAF Chief of Staff, will be questioned on the budget in the light of his sworn testimony before the subcommittee last summer. If USAF's boss now holds that the Fiscal 1958 budget is adequate, Symington says the general is "unsuitable" to be Chief of Staff. The budget figure is substantially lower than the funds Twining told the subcommittee he would need. Sen. Symington, Democrat and former USAF Secretary, also told an NBC "Meet the Press" television audience that the idea that long-range guided missiles are just around the corner and near enough to production to warrant cutting aircraft order plans "is fantastic misinformation."

Classification Report

First advice on how to implement recommendations of the Coolidge Committee will be awaiting Defense Secretary Charles E. Wilson when he returns from vacation next week. The committee has suggested a number of changes to eliminate both overclassification of information and the unauthorized release of legitimately classified data (AW Nov. 19, p. 28).

Acting on these recommendations, Wilson appointed a Pentagon group to advise him on the suggested changes. Although the group does not expect to complete its proposals for a month and a half, it has decided to turn in the work it has done so far because of the intense interest in the matter shown by the House Government Information Subcommittee.

Airspace Investigation

Look for a congressional investigation into military airspace requirements and the amount of airspace over the U.S. now blocked off for military use.

Some senators are concerned that commercial traffic is being unnecessarily restricted to narrow bands of airways because thousands of square miles of airspace in many areas have been restricted to military use.

Also to come under questioning is the problem of jurisdiction in the allocation of airspace. According to a Civil Aeronautics Board official, the CAB can assign airspace for commercial purposes only after it has reached an agreement with the military services.

Pyle Confirmed

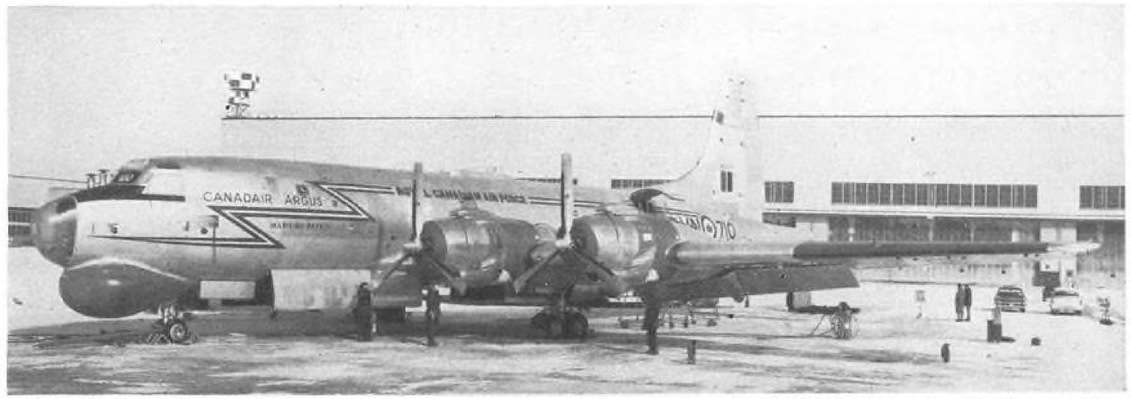
The Senate Commerce Committee last week unanimously approved the confirmation of James T. Pyle as Administrator of Civil Aeronautics. He has been serving as acting administrator since the death of Charles Lowen last September.

High Density Traffic Zones

The Civil Aeronautics Board has empowered Civil Aeronautics Administrator James Pyle to establish high density traffic zones around major airports throughout the U.S.

The CAB decision to adopt the high density ruling followed a public hearing on the high density experiments conducted by the CAA at Washington National Airport from Aug. 1, 1955, to last July 31. It sets a speed limit of 180 mph. within the zone and prohibits landings or takeoffs when visibility is less than one mile, regardless of VFR clearance. Under special circumstances, the visibility restriction can be lowered to a half mile. The rule also requires radio communication with the airport tower but permits operations to or from high density zones by planes without a radio if prior permission is obtained from the control tower.

—Washington staff



FIRST CANADAIR CL-28, parked in front of hangar at Canadair's Montreal plant, is painted with Royal Canadian Air Force markings, including new designation, Canadair Argus. Fuselage, with two bomb bays, marks major area of departure from Bristol Britannia design.

TAIL VIEW of CL-28 designated CP-107 by RCAF, shows moulded glass laminate housing on tail for MAD anti-submarine gear, and dielectric insert in vertical fin (dark horizontal line). Insert, with honeycomb fill of same material, is part of load carrying structure.

Canadair's CL-28 Designed for Range, Endurance

By William Gregory

Montreal—Canadair Ltd.'s CL-28 maritime reconnaissance airplane—now officially named the Argus—represents no fundamental break with the Bristol Britannia from which it was derived, but a vast job of detail engineering to produce a livable combat airplane.

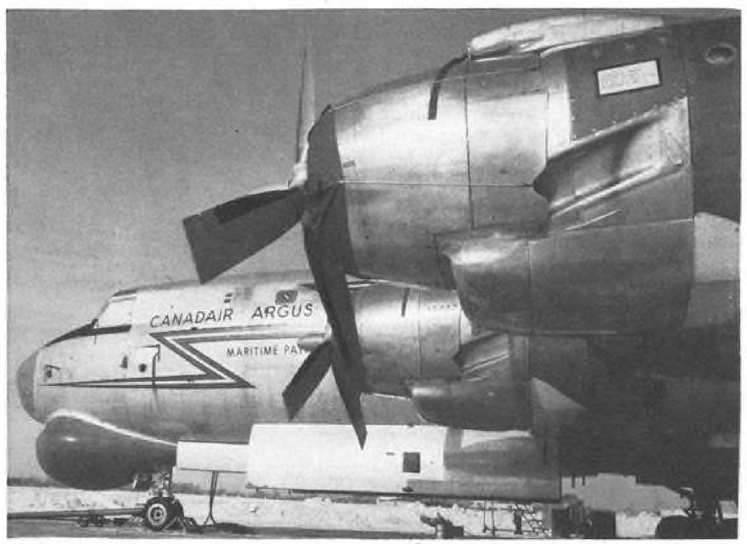
The Argus, designated the CP-107 by the Royal Canadian Air Force, is designed for 24 hr. endurance and range of more than 4,000 mi. to cover at low altitude the middle reaches of the Atlantic Ocean. These are areas which in World War II were beyond the range of land-based air cover and were the last lair from which German submarines attacked convoys after the U-boats had been driven from the coastal regions.

Wings and tail were taken from the Britannia virtually intact. In the fuselage, the principal Britannia legacy is its 12-ft. diameter. The major structural change was "the big cut," breaking the Britannia's full monocoque construction for the twin bomb bays.

In materials, the CL-28 has two noteworthy additions:

• **Titanium** is used for the skin and bulkheads in the firewall sections of all four nacelles, where steel otherwise would have been called for. Total of 2,700 lb. of titanium, all cold worked with no welding, was used, making for a weight saving of 900 lb.

• **Molded glass** laminate with honeycomb filling of the same material is used in the vertical fin as a structural member as well as a dielectric insulator for using the top fin section as an antenna.



TITANIUM skin panels (dark area on nacelle) and bulkheads were used in firewall section.

In overall redesign and execution, Canadair developed these guidelines:

• **Gross weight** as laid down in the original specifications was preserved in the final airplane, no mean achievement when much of the payload is fast-developing electronic gear.

• **Changes,** as numerous as they were, were held to essentials.

• **Crew comfort** was a prime consideration.

Holding the line on weight and holding the line on changes demanded the same viligance. As explained by Thomas A. Harvie, CL-28 project engineer, weight was a matter of horse-trading with the RCAF and change a matter of holding down on the enthusiasm of the engineers.

When the RCAF would come along with a new piece of electronic gear, careful redesign and installation was made to hold down weight. The RCAF also was asked to reconsider its requirement so that other equipment could be dropped to make up for any weight increases.

Gross weight of the airplane is considerably below that of the Britannia and empty weight is slightly below, Harvie said. The original figure for gross weight was given as about 145,000 lb., compared to 165,000 lb. for the Britannia 300 (AW June 7, 1954, p. 48).

Besides the numerous detail changes to fit the aircraft for combat and to bring materials to American standard usage, there also was a tendency on the part of the project engineers simply to make changes. If the Bristol way would serve, Harvie said, it was kept even if the project engineers had another preference.

Crew comfort became a big factor as the project progressed. First consideration was given for layout of the tactical compartment, and it was placed at the rear of the cabin, considered the most desirable from a low noise and vibration viewpoint.

"We threw out decibels," Harvie said. "Decibels may not mean anything in measuring comfort level. We just said, 'let's strive for a reasonable comfort level, decibels or no decibels'."

Canadair discussed the question with the RCAF and with the consulting firm of Bolt, Beranek & Newman, Cambridge, Mass. For solutions, Canadair used:

• **Aluminum foil** tape for panel damping, applying the tape directly to the skin.

• **Fibreglas insulation** in varying degrees throughout the cabin, depending on varying noise levels. Heaviest amounts were used in the section adjacent to the propellers, which, unfortunately, happens to be the rest area.

• **Rubber bushings** to mount any type of electronic gear or equipment which would rattle.

Effectiveness of these efforts will be ultimately determined when the airplane begins flight tests. Airplane No. 1, which was shown to the Canadian military and press recently, is scheduled to fly in April. This and Airplane No. 2 will be retained by Canadair for test, and the third airplane will be delivered to the RCAF later in the year. Static testing now is underway on a fuselage, tail and wing root segment.

The cabin arrangement, as seen in the first airplane, has ejector tubes for sonobuoys just aft of the rear door, the tubes eject through the bottom of the fuselage. Next are:

• **Tactical compartment.** This is the avionic control room, with the various gear and scopes mounted along each side, and rails set in the floor for movable chairs for operators. On the right at the rear of this compartment sits the tactical navigator, who takes over command of the airplane when a submarine contact is made.

• **Distribution area,** where power for various equipments is monitored.

• **Rest area.** This will include four bunks, or alternately two bunks and eight sleeperette seats; a dining table with seats for four, and a galley capable of cooking, not merely warming precooked foods as on airliners. Refrigeration also is provided.

• **Routine navigation compartment.** Routine navigation is distinguished from tactical navigation after a contact, and a panel with avionic navigation equipment is provided.

• **Flight deck.** This includes station for the flight engineer on the right behind the pilots, and his compartment is larger than that of the Britannia. The engineer's panel and flight panels are little like the Britannia, partly because of the change to piston engines. However, the control column was changed to conform to American practice, and the pilot's windshield area is larger both front and side. RCAF, for military use, asked for increased visibility ahead, upward and downward. Because of the larger windshields, the cabin loses the low-drag canopy characteristics of the Britannia.

• **Nose station,** for an observer or bombardier.

Operationally, the airplane will have a crew of 15—three pilots, three navigators, two flight engineers and seven communications and avionic gear operators. Two crewmen are provided for each station, for on long patrols the crew will rotate on watches as on a ship.

As a measure of the redesign necessary, there were about 19,000 drawings released, about 8,000 of them Americanized versions of the Bristol drawings. Once the basic manual was drawn up, conversion of the drawings moved along quickly.

Equal strength was the criterion in changing to American standards. Some gages were increased, others decreased, but overall the result averaged out to the same levels as the Britannia.

In the major change, the cuts for the two bomb bays, the wing carry-through remained much the same as the Britannia. The Britannia wing has two box spars, and in the CL-28 the forward spar is about 20 in. aft of the rear bulkhead of the forward bomb bay and the rear spar about the same distance ahead of the rear bomb bay forward bulkhead.

Outside the bomb bays, the fuselage structure, with the usual changes in standards, is much the same as the Britannia.

To carry the structural loads through the bomb bay cutouts, heavy channel section extrusions were run on each side of the bays, tapering off quickly fore and aft of this section. These longerons became the boundary members of the bomb bays, to which the doors were hung, and served as an attachment point for the wing. The inside main rib was moved outboard in the wing to serve as the wing attachment point.

Four roughly triangular shaped tor-

CL-28 Specifications

Length	128 ft. 3 in.
Wing Span	142 ft. 3.6 in.
Height	36 ft. 8½ in.
Cruising Range	More than 4,000 mi.
Cruising Speed	175-200 mph.
Maximum Speed	More than 290 mph.
Maximum Altitude	More than 20,000 ft.
Propulsion	Four Wright Turbo-Compound R3350 988TC18 EA1.
Number of Crew	15

sion cells were formed, one for each side of each bomb bay to carry the balance of the fuselage loads in these areas.

Besides the nacelle redesign necessary for the engine, various other alterations were performed:

• **Spoilers were added** outboard of the outer nacelle for better maneuverability in tactical situations and for probable addition of wing mounted stores. They are plain flap type.

• **Fuel cells were moved** outboard, because of the wing attachment changes, and made to conform to U.S. standard. The system consists basically of four tanks extending to the outer panel, and holds 6,700 gal. Range can be extended by reducing the operational load and addition of an internal bomb bay tank designed initially for ferry purposes.

• **Control system** is little changed from the Britannia, one change made for weight savings was in substitution of a ball screw jack mechanism for the Britannia's screw jack flap actuation, as a weight saving measure.

• **Bonding carried out** in less critical areas as in trailing edge outer wing panels, followed the Britannia, but Bloomingdale FM-47 was used as an adhesive instead of Redux in the Britannia. However, Canadair did not follow Convair choice for an adhesive either, using instead the preference of its own shop people.

Electrical generation is provided by four Westinghouse 40 KVA alternators, driven by Sundstrand drive units directly connected to the shaft of each engine.

Hydraulic gearbox absorbs any engine speed variation to give the system a constant speed drive. The total system, provides 160 KVA and capable of a 150% overload for 15 min., is mounted in parallel, and three alternators can maintain full airplane requirements.

Because of the large amount of avionic equipment, Canadair built a mockup of the electrical system, and is now testing simulated loads on the power sources.

The wiring was mounted on a metal similar to that in the airplane to determine whether there was any interference by inductance or from any of the individual instruments or equipment.

Structural static tests have yet to be passed by the dielectric tail insert.

Heating system for wing and control surface deicing, and for cabin heating to provide crew comfort in temperatures as low as −65F, uses four Janitrol units with a capacity of more than 2,000,000 BTU/hr.

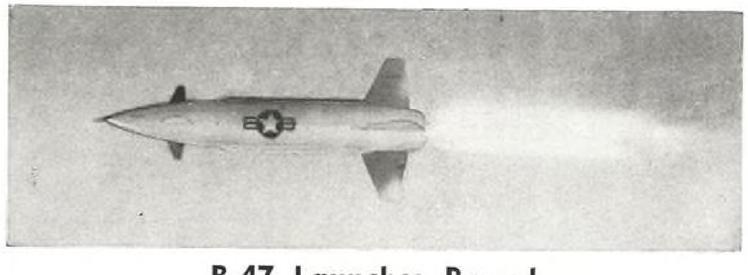
CL-28 Transport/Cargo

Canadair Ltd. has hopes of selling a transport/cargo version of its CL-28 maritime reconnaissance plane to commercial airlines, but feels the airlines now are too concerned with big jet transports to show interest in the project.

Best prospect for a commercial transport, Canadair's sales force believes, will be after the jets go into operation and demonstrate to the airlines a need for a supplementary, more economical long range airplane.

Potential capability of the CL-28 commercial transport version, equipped with Bristol BE.25 turboprop engines:

- Gross weight of 200,000 lb.
- Payload of 60,000 lb.
- Cost of 4-5 cents per ton-mile.



B-47 Launches Rascal

Propellant streams from Bell GAM-63 Rascal before light-off after launching from under wing pylon of B-47 (top). After light-off, in test flight at Holloman Air Development Center, N. M., Rascal is guided toward target at supersonic speed by electronic system. Rascal, designed to bombard ground targets from drop points out of reach of enemy fighters, has 100 mi. range, Mach 1.5 speed. It has both tail and canard control surfaces. Rocket engine, built by Bell, has three cylinders in vertical line (AW Feb. 4, p. 27). Fairings house plumbing system.

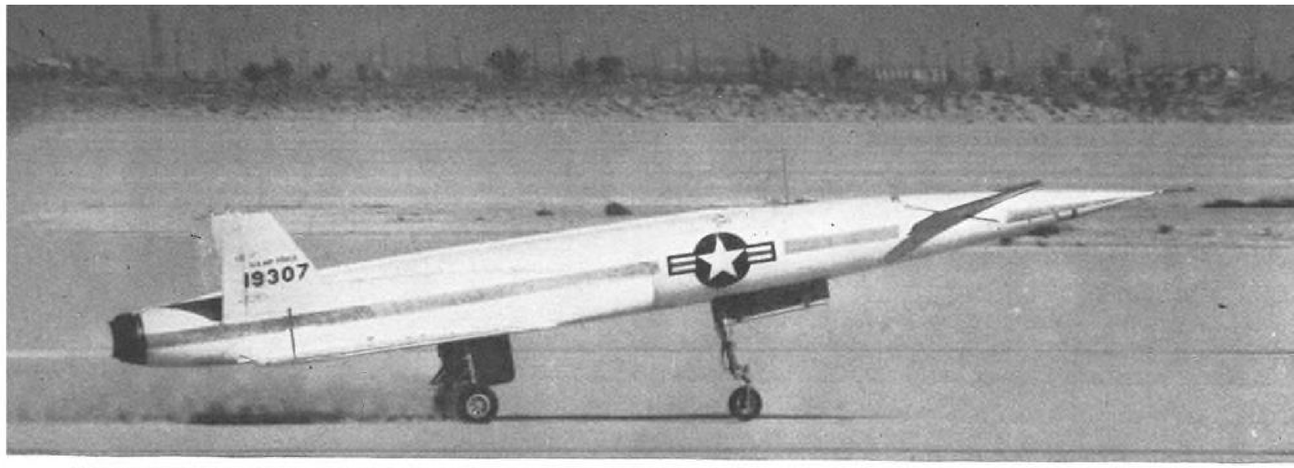
Nuclear Missile Sub Under Construction

Nuclear powered submarine for launching ballistic missiles, designated the SSN 588, is being built at Mare Island Naval Shipyard, Vallejo, Calif. One other, the SSN 591, is planned.

Both submarines will have single screws and follow hydrodynamic design principles tested on a streamlined experimental model, the Albacore. They probably will carry Navy's fleet ballistic missile, the Polaris (AW Jan. 7, p. 32), more than likely in internal hangar.

First conventional submarine with internal hangar is the USS Grayback, which will be launched at Mare Island early this summer. First atomic submarine with internal hangar is the USS Halibut, SSG(N) 587, whose keel will be laid at Mare Island by late spring. Both will carry Regulus missiles.

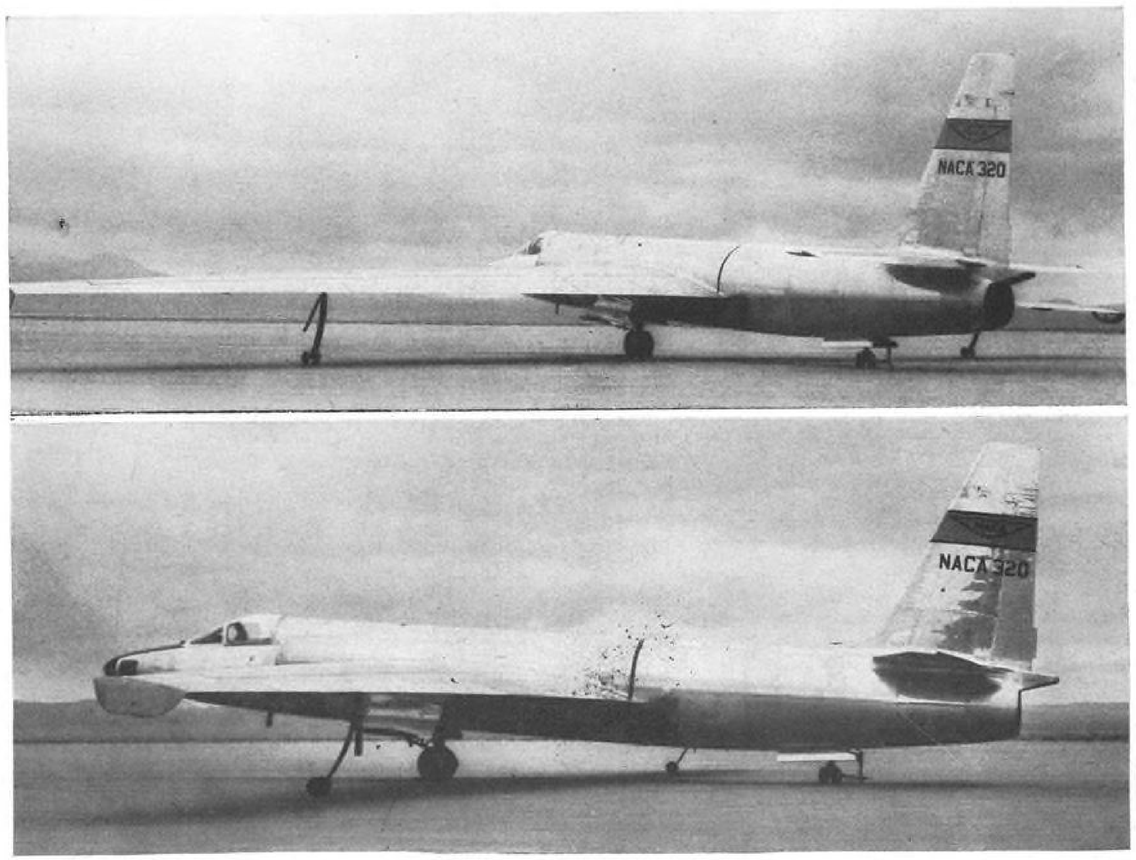
Navy has authorization for 15 nuclear subs now, is asking for four more in Fiscal 1958 budget.



NORTH AMERICAN X-10 unmanned test vehicle for SM-64 Navaho intercontinental cruise missile program has raised spine along fuselage top which probably contains wiring and plumbing between system components. Feature eases maintenance, cuts internal space requirements. X-10 is taking off in this photo. Flight testing of X-10 has been concluded by USAF and company.

Details of X-10 Navaho Test Vehicle

ANGLED lines on nose at root of canard surface apparently indicate full up and full down positions to ease interpretation of photo tracking films. External antennas insure better guidance, telemetering. Canard configuration of X-10 has been replaced in SM-64 by design with large dihedral delta wings providing all stability and control. SM-64 is powered by wing-root mounted ramjets.



High Flying U-2

First pictures of Lockheed U-2 high altitude research plane show the extremely high aspect ratio wing designed for sustained flight at altitudes above 55,000 ft. Landing gear consists of two double-wheeled, retractable assemblies plus two outriggers that are dropped after takeoff. Outriggers are used to prevent high aspect ratio wing from touching ground during takeoff run. U-2 carries airborne radar and is powered by a Pratt & Whitney J57 turbojet of about 11,000 lb. thrust. Right-angled wing tips are skids for landing purposes. U-2 was designed by Lockheed as a high altitude test bed for avionic and jet engine sub systems but is now being operated by civilian pilots under Lockheed contract for National Advisory Committee for Aeronautics and the Atomic Energy Commission, both in the U. S. and from USAF foreign bases. U-2 is used for sampling atomic radiation, clear air turbulence research and obtaining jet stream data.

Defense Builds Science Corps

Washington—Department of Defense is preparing to improve the pay, prestige and working conditions of its top civilian scientific, engineering and management personnel. Within a year, it will compete for this talent on a more equal basis with aircraft and related industries.

Recommendations of the Defense Advisory Committee on Professional and Technical Compensation (AW Feb. 4, p. 37) dealing with civilian employes have been accepted by Defense Secretary Charles E. Wilson and steps toward implementation are under way. The recommendations call for:

- **Expansion** of the cooperative education program.
- **Improved** civilian personnel job classification guides.
- **Formation** of an advisory committee on scientific personnel under the office of the Assistant Secretary of Defense for Research and Development.
- **Use of paid** advertising to recruit engineers and scientists.
- **Broadened** policy on travel to permit free attendance at professional and scientific meetings.
- **Revision** of the Classification Act of 1949 to give the Defense Department wider flexibility to establish pay rates within civil service grades.
- **Increase** in the number of senior jobs for scientists, engineers and management personnel.

The recommendations grew out of a nine-month study of the problems faced by the Defense Department in enrolling and retaining competent civilian personnel in the face of industry's attractive advantages. A group headed by Charles Hook, chairman of Armco Steel Corp., canvassed research and development establishments of Army, Navy and Air Force.

Major complaints of civilian personnel centered on the frustrations of competent scientists and management experts who become restless under civil service limitations which make time served in a job more important than competence or productivity in determining pay.

The suggested advisory committee would be charged with a study of the possibility of setting up a senior scientific and engineering service in the Defense Department.

Most of the recommendations have been sent to Wilson over the signature of Ralph J. Cordiner, chairman of the committee on compensation.

Unions Map United Front Plan for 1958

By Claude Witze

Washington — Aircraft production workers will mobilize this year for a frontal assault to achieve new union goals in 1958, including organization of the industry's engineers and a higher minimum wage.

With an eye toward next year's heavy wave of contract negotiations, delegates to the Seventh National Aircraft Conference of the United Automobile Workers have called for a joint meeting of their own district lodges and locals with those of the International Assn. of Machinists to map a new campaign.

For action, the conference recommended a three-point legislative program:

- **Federal requirement** that companies accepting defense contracts must establish adequate apprentice and training programs. A union spokesman said the goal is to have this stipulation written into all contracts.
- **New minimum wage** for the aircraft industry covered by U. S. contracts that is "very substantially increased" from the current $1.05 an hour.
- **Establishment** of a government policy that will deny federal contracts to a company at which an authorized strike is in progress.

Among future union objectives endorsed by the UAW conference:

- **Establishment** of the union shop as the common security clause in all union contracts.
- **Continued** efforts to revise industry's job evaluation system.
- **Wage increases** to "give recognition to the higher skills required."
- **Security against layoffs,** severance pay plans, supplemental unemployment benefits, extension of corporation-wide bargaining.

Leonard Woodcock, UAW vice-president and director of the union's Aircraft Department, told AVIATION WEEK there is no immediate prospect of UAW and the International Assn. of Machinists merging into a single union. He said, however, that the once-rival groups now are "one union in spirit" and close to an agreement on joint bargaining. Implementation of this program will get under way later this month.

UAW today claims about 220,000 of the industry's union members. IAM has about 500,000. Climaxing a year of interunion effort, Woodcock said, UAW will hold a special convention in January of 1958 to implement the union's demands to be pressed when major aircraft industry contracts come up for reconsideration. Single big contract to expire this year will be the UAW agreement with Bell Aircraft Corp., where negotiations start this month.

Woodcock places major emphasis on the union's ambition to organize aircraft industry engineers, along with office and technical workers. UAW holds that the grievances of engineers can be resolved only through union organization, despite the professional status of these career men. Woodcock said he anticipates they will be organized in a separate group, apart from the production workers, but will get support from all union members in pressing their demands.

Union spokesmen indicated they will make an intensive drive to organize aircraft plants which now have no collective bargaining, with some special emphasis on new plants being brought into the picture by the changing nature of aerial warfare and needs. Expansion of electronic firms into the missile business, for example, is viewed as a new challenge to the union's organizers.

Parallel with this is the shift in the aircraft industry that comes about in those companies where the emphasis is moving from airframes to pilotless weapon systems. UAW sees a need for increased employment security, because jobs are being changed and, in many cases, companies relocated at new sites.

Woodcock indicated UAW will use caution in approaching any situation where another union already is operating. He places the emphasis upon cooperation where there is possibility of a jurisdictional argument.

Second major part of the UAW's 1957 program is the demand for an industry-wide apprentice training program. Requirement for such programs would be written into Defense Department contracts.

One speaker at the UAW conference was Secretary of Labor James P. Mitchell, who reviewed a Labor Department report on the subject. The report said the aircraft industry is not preparing to fill its own manpower requirements and only about 10% of its employes receive training on the job.

Woodcock calls this "a major national scandal," and he has denounced the industry for laxity. The union already has begun a drive to interest Congress in the situation and is prepared to press the point as manpower becomes a leading issue before the legislators this year.

UAW Charges Piasecki Lockout

Washington—Charging a "lockout" of its members at the New Castle, Del., plant of Piasecki Aircraft Corp., the United Automobile Workers is pressing the Defense Department to halt contract payments to the company. The union says the "lockout" will be prolonged if the government gives the company financial assistance while production is being held up.

In a resolution adopted at UAW's Seventh Annual Aircraft Conference, the union accused company president Frank N. Piasecki of refusing to employ members of Local 840, which has had a contract in the plant since 1940 and includes members who have worked there for 28 years.

Piasecki, holding at least a dozen military contracts, purchased the facility from Bellanca Aircraft late last fall (AW Dec. 10, p. 68).

Founder, former president and board chairman of Vertol Aircraft Corp., Morton, Pa., Piasecki was condemned by the union for operating the Delaware factory with "scabs imported by buses from other states." He also was accused of trying to "intimidate and coerce" UAW members.

The union call for Defense Department action was made almost a month ago in a letter to Secretary Wilson.

Declaring that the financing of "Piasecki's anti-union tactics" appears to be an expense item on government contracts, UAW demanded that Wilson confirm this, if true. It also urged that the circumstances be called to the attention of procurement and renegotiation officials.

Union spokesmen say Piasecki Aircraft Corp. took over some Bellanca contracts with the plant. These are reported to include subcontracting for Fairchild Airplane Division, the Martin Co. and Melpar. They claim Piasecki has laid off all UAW members and is advertising for new employes. The union has accused the company of unfair labor practice before the National Labor Relations Board and filed a suit in Federal District Court for lost wages.

Piasecki, in turn, is suing the UAW members for $100,000 and seeks a court injunction to halt picketing. The union also charges the company is transporting workers back and forth daily by bus from its Philadelphia plant.

The UAW conference resolution calls upon the entire organization to support the New Castle local. The conference said it fears that, if Piasecki is successful, the pattern could lead to loss of bargaining rights and jobs in any plant that changes management.

Vinson Supports FY 1958 Budget

Washington—Rep. Carl Vinson (D-Ga.), chairman of the powerful House Armed Services Committee, has indicated that he will lend full support to the administration's $17.7 billion Air Force budget for Fiscal 1958 despite criticism that it is inadequate.

Vinson, after hearing testimony on the budget from the secretaries and chiefs of staff of the three services, termed present U.S. defense forces "the greatest concentration" in "our peacetime history." He also praised Defense Secretary Charles E. Wilson and his assistants for "making a record to be proud of."

Twining Testimony

Under questioning by committee members, USAF Chief of Staff Gen. Nathan Twining testified that he is "not unduly concerned" over the reduction in USAF's Fiscal 1958 budget from a "first flash" estimate of a need for $23.6 billion which he made last May.

He told the committee that the Air Force "can do a very fine job" and perform its missions with the $17.7 billion recommended by the President.

Air Force Secretary Donald A. Quarles told the committee that, under the administration's new computing methods, the Air Force will reach a goal of 137 wings by June.

The 137-wing figure—and the new administration goal of 128 wings—is gained by adding four troop assault wings and a wing equipped with Martin Matador missiles to the combat inventory. Previously, such wings have not been included as combat wings. Thus the 137 wings will be short lived.

In Fiscal 1958, five strategic fighter wings, one tactical bomb wing and three fighter-bomber wings will be dropped from the inventory to bring USAF's strength down to 128 wings.

Planned Reductions

The planned reductions, Quarles said, "are not arbitrary but stem from a thorough review of the task to be accomplished and the means at our disposal to get the job done.

Other Quarles' testimony:

• **Air Defense.** Modernization of our manned interceptors will continue by conversion to the supersonic Century series aircraft. This will afford, he said, "a very substantial increase in our defensive capability" and, "in addition, important progress is being made in the missile element of defense."

• **Tactical Air.** By mid-1958, "our tactical fighter-bomb and day-fighter wings will be completely equipped with supersonic Century series aircraft. Quarles said U. S. defense is also being bolstered because "our allies have greatly increased their forces and capabilities in the tactical field and are now able to accept greater responsibilities."

• **Airlift.** The programmed airlift forces, including the Civil Reserve Air Fleet, "are adequate to meet our essential wartime airlift requirements. . . ."

Quarles said procurement of the F-102 series will be accelerated. Single and dual-place interceptor fighter versions of the F-106 (redesignation of the F-102B) are being procured. Quarles added, however, that "the other Century series models have required the solutions of more engineering problems than we anticipated. We felt it prudent, therefore, not to accelerate to the degree originally contemplated in order to incorporate engineering fixes on a greater number of aircraft. . . .

"The F-101 program," he said, "has been reduced, and its production buildup slowed down for the incorporation of engineering changes developed from flight tests, as well as the incorporation of an improved engine in the majority of our production aircraft."

• **Research and Development.** During Fiscal 1958, the program will continue at approximately the same fiscal level. The $100 million additional voted by Congress last year (increasing USAF's Fiscal 1955 appropriation from $610 million requested to $710 million) has been programmed for use during both Fiscal 1957 and Fiscal 1958. USAF is requesting $661 million in new money for Fiscal 1958.

• **Warning Systems.** SAGE early-warning system is advancing on essentially the same schedule as last year.

• **Manpower.** The military manpower goal for mid-1958 has been reduced from 967,000 to 925,000.

At the close of the briefing sessions, Chairman Vinson commended the secretaries and chiefs of staff for their "forthright and revealing" testimony before the committee.

Budgetary Considerations

Gen. Twining told the committee that budgetary considerations "had nothing at all to do with the reduction" in the programmed wing strength of the Air Force from 137 to an actual figure of 120.

He added that the increased fire power of weapons and other factors indicate a further reduction in the number of wings over the next few years.

"I have no doubt," Twining said, "The 128 wing force will have far greater striking power than the 137 wing force we had planned earlier. I want to make clear that the better performance expected of our new equipment and the increased power planned in new weapons had already indicated to us that a reduction in the number of USAF combat wings was feasible and we proceeded to plan some reduction without regard to pressures."

Newest Matador

Latest version of USAF's Martin Matador (AW Jan. 28, p. 30), TM-61C, has new guidance system. It will soon start employment and suitability tests at Wheelus AFB, Tripoli, North Africa. Tests were to be made last spring by 11th Tactical Missile Squadron which was transferred to Europe when tests were suspended. Wheelus site was chosen to avoid having to move Squadron to U. S.

House Unit Hits Concentration Of R&D Funds Among Big Firms

Washington—House Small Business Committee last week said concentration of military research and development contracts among large firms "may well prove to be the kiss of death for independent small business."

In its final report on 1956 developments, the committee said the armed services—through research and development contracts—are giving "a disproportionate subsidy to bigness" which is "contributing immeasurably to an already dangerous degree of industrial concentration."

The committee pointed to figures for the three-year 1954-56 period, furnished by the Department of Defense, which show that:

• **300 contractors account for 94%** of the total dollar volume of military research and development contracts.

• **Of these, 239 private firms** received 85% of the total. The 61 universities and non-profit organizations included in the 300 total accounted for only 9% of the dollar-volume of research and development business.

Biggest commercial research and development contractor was North American Aviation, Inc., with a total of $421 million for the three-year period.

The biggest non-commercial contractor was Massachusetts Institute of Technology, with a total of $61 million.

Other major contractors included: General Electric Co., $338 million; Western Electric Co., $264 million; Boeing Airplane Co., $211 million; Hughes Aircraft Co., $203 million; General Dynamics Corp., $147 million; Glenn L. Martin Co., $136 million; Bell Aircraft Corp., $133 million; Aerojet General Corp., $115 million; Westinghouse Electric, $105 million; Northrop Aircraft, Inc., $105 million; Curtiss-Wright Corp., $98 million; Lockheed Aircraft Corp., $84 million; United Aircraft Corp., $67 million; Radioplane Co., $57 million; California Institute of Technology, $51 million.

Stating that it is "distressed by the ominous shadow which is cast on the future with the monopoly of technology by big business," the committee refuted arguments that small businesses are not suited to military research and development projects.

"The fact that only 20% of small firms have adequate personnel and facilities to contribute significantly to the program, and the additional fact that small concerns employ only 10% of the research engineers and scientists, would hardly indicate that only 5% of the research and development subsidy to such firms represents a wholesome distribution of the subsidy," the committee said.

"Moreover . . . a principal reason many small firms have not hired personnel and developed research facilities is simply that they have not had the money to do so. Given the opportunity to share in government research funds, small businesses could and would expand their facilities. The fact of present inequities is no defense for deliberately increasing the inequity."

The committee highlighted the "benefits" which go with research and development contracts: "The risk-free element of the cost-plus-fixed-fee basis, the foot-in-the-door advantage in obtaining subsequent research or procurement contracts, the advantage of subsequent commercial application, and the enormous advantages of having a working organization of top scientific personnel, a body of scientific know-how, and a generous patent policy."

Collision Device Pessimism Grows

Washington—Airline avionic engineers, pessimistic over the growing list of technical barriers to a self-contained collision warning device, share a growing belief that improved traffic control may be the quickest practical solution. Even so, Air Transport Assn. Plans another attempt to an airborne device.

Hughes Aircraft Co. has officially notified the ATA that it has stopped work on a self-contained anti-collision system as a result of extensive studies which show that this approach is not feasible with the present state of the art. The Hughes statement, confirming AVIATION WEEK's report (Jan. 14, p. 26), concurs with the earlier findings of Bendix Radio and Collins Radio.

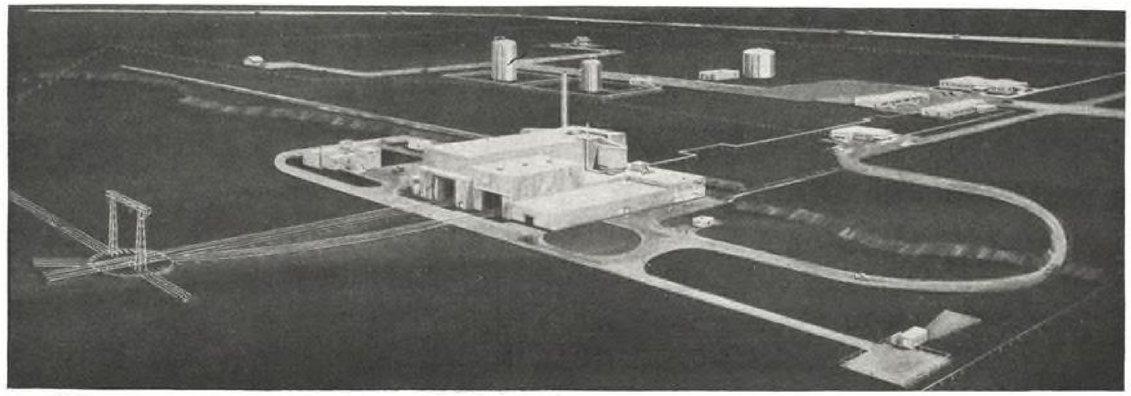
Hughes says that any further company work on the collision problem "will be based on the premise that a solution lies within the framework of air traffic control." Faced with the apparent impossibility of getting a fully automatic self-contained anti-collision system, and the difficulty of implementing a cooperative system which is not effective until a majority of all airspace users are equipped, more and more airline people are reaching the same conclusion as Hughes has.

Despite this, airline industry representatives who attended a recent ATA meeting on the problem indicated that they could not afford to sit back and wait for the improved air traffic control to provide a solution. This was underscored three days after the meeting when a Douglas DC-7B and F-89, collided over Los Angeles and refocused public attention on the problem.

The Air Transport Assn. expects to draw up a new operational and system requirement for anti-collision

F-106A Under Cover

Convair F-106A under tarpaulins and en route to the Air Force Flight Test Center from San Diego, shows some of its configuration changes through the shrouding fabric. F-106A has a conventional swept vertical tail of low aspect ratio, replacing the delta surface of the F-102 series from which this plane—formerly designated the F-102B—was developed. Other differences: elimination of blisters at fuselage rear, added because of the area rule fix but not required in the fuselage redesign; intake ducts cut back almost to the wing leading edge; single pair of missile bay doors replacing three sets on the F-102A. Armament is Douglas Ding-Dong air-to-air missile with atomic warhead. Powerplant of the F-106A is the Pratt & Whitney J75 turbojet. Pitot tube on fin distorts shroud outline.



devices, incorporating all the knowledge gained from the Bendix, Collins and Hughes studies. One ATA spokesman sums up the situation this way: "We are starting back where we were two years ago, except we know an awful lot more about the problem. . . ."

The ATA will ask the avionics industry to come up with its best proposals on two types of systems:

• **Self-contained** proximity warning indicator, similar to the original ATA Phase I equipment, but incorporating improved indication of an intruding aircraft's azimuth position together with some indication of the intruder's closing rate. The original Collins four-quadrant PWI system did not show whether an aircraft in the forward or rear quadrant was on the left or right side.

• **Cooperative proximity** warning indicator, with automatic collision avoidance provisions if possible. Two years ago ATA discouraged the cooperative system approach. Now it will take a fresh look at all such proposals.

The Hughes statement says: "Study of NACA reports on atmospheric turbulence indicates that random accelerations produced by gusts are sufficiently large to prohibit collision threat calculations in a significant fraction of cases.

"Even if degradation cited could be accepted, the system design would require use of pulse-Doppler techniques to minimize the deleterious effects of range scintillations and ground clutter. A pulse-Doppler system sufficiently versatile to acquire threatening aircraft in the presence of ground cutter, and to provide data required to calculate collision geometry, probably is not economically acceptable to the airlines at this time because of cost, weight and complexity," Hughes says.

Hughes studies also indicate that the FM-CW system proposed by Collins is not feasible even for the simple proximity warning indicator because of ground clutter and other problems.

There are serious doubts, however, whether a self-contained PWI can be designed to operate at altitudes below 10,000 feet because of ground clutter problems.

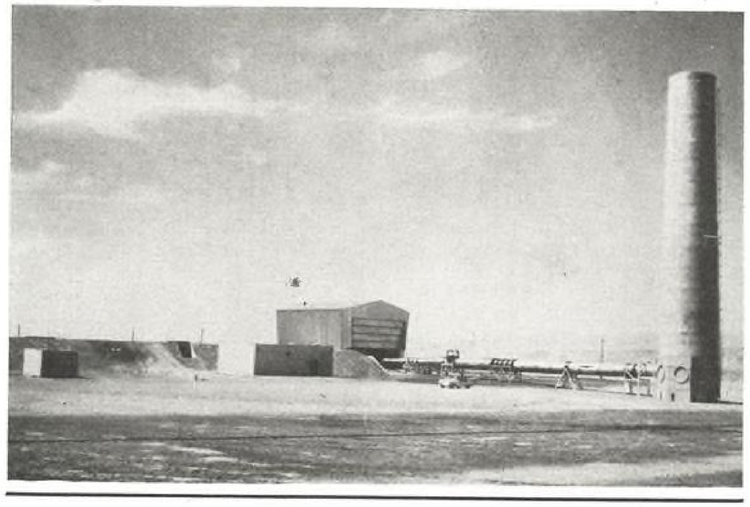
Navy Utility Helicopter

Washington—Navy's Bureau of Aeronautics announced last week that Kaman Aircraft Corp., Bloomfield, Conn., has been awarded a contract to develop its first single-rotor helicopter for the Navy as predicted by Aviation Week on Jan. 28 (p. 23).

Designated the HU2K-1, the aircraft will be powered by a General Electric T58 gas turbine engine. Kaman has pioneered in experiments with turbine power, but, in the past, has always built helicopters with intermeshing twin rotors. A second Kaman design submitted in the recent competition was a twin-rotor proposal. Size of the contract was not disclosed.

Atomic Powered Turbojets

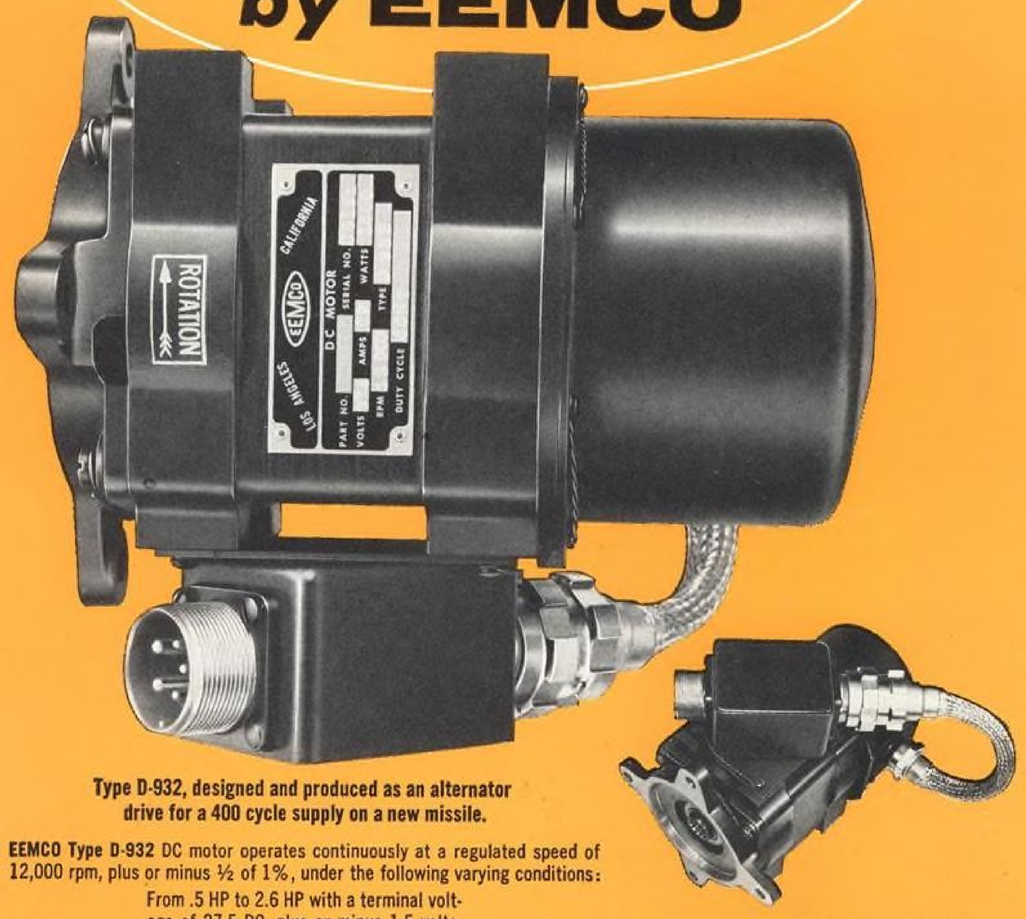
First turbojet engine to be powered exclusively by heat from an experimental atomic reactor (AW Feb. 4, p. 29) was developed by General Electric Co.'s Aircraft Nuclear Propulsion Department under Atomic Energy Commission supervision. Test occurred in initial test area at AEC's aircraft nuclear propulsion project at the National Reactor Testing Station, Idaho Falls, Idaho. GE's Aircraft Nuclear Propulsion Department is operating contractor for the initial test area (below) and the assembly and maintenance shops and administration area (above). Ralph M. Parsons Co., which did architect-engineering work on these areas, has since done similar work for a newer test building, shielded control and equipment building and supporting facilities for the aircraft project. Other facilities there include a runway and auxiliary facilities being designed by Porter, Urquhart, McCleary and O'Brien of San Francisco for AEC and Air Force, and "additional aircraft reactor test facilities" just announced by AEC. Architect-engineer for the new reactor facilities is Burns and Roe, Inc., of New York. Despite new construction and an AEC statement that turbojet test "marked a significant advance toward the goal of achieving atomic-powered flight," WS-125A nuclear bomber has been stretched out (AW Nov. 19, p. 27).



Here's another

New DC Motor

by EEMCO



Type D-932, designed and produced as an alternator drive for a 400 cycle supply on a new missile.

EEMCO Type D-932 DC motor operates continuously at a regulated speed of 12,000 rpm, plus or minus ½ of 1%, under the following varying conditions:

From .5 HP to 2.6 HP with a terminal voltage of 27.5 DC, plus or minus 1.5 volts.

The constant speed of 12,000 rpm is maintained by a frequency regulator that supplies the control field of the double-field stator of the motor. Type D-932 has an internal spline, and can be supplied with or without a radio noise filter, which is shown in the illustration.

Type D-932 is another in the series of new AC and DC motors being custom designed and produced currently by **EEMCO** for the latest missiles and supersonic jet aircraft. In fact, there is an **EEMCO** motor or actuator system on the majority of such new weapons now in production or projected for use by our Armed Forces.

This, we believe, is an expression of confidence in **EEMCO**, which for the past 15 years has specialized exclusively in the design and production of motors and actuators, both linear and rotary, for prime and subcontractors in the aircraft industry.

SPECIFICATIONS FOR TYPE D-932

Type: DC motor for alternator drive for 400 cycle supply on a missile.
Speed: Continuous at 12,000 rpm, plus or minus ½ of 1%.
Speed Control: By frequency regulator supplying control field.
Load: From .5 HP minimum to 2.6 HP maximum.
Terminal Voltage: 27.5 DC plus or minus 1½ volts.
Weight: With radio noise filter—13.9 lbs. Without same—12.4 lbs.

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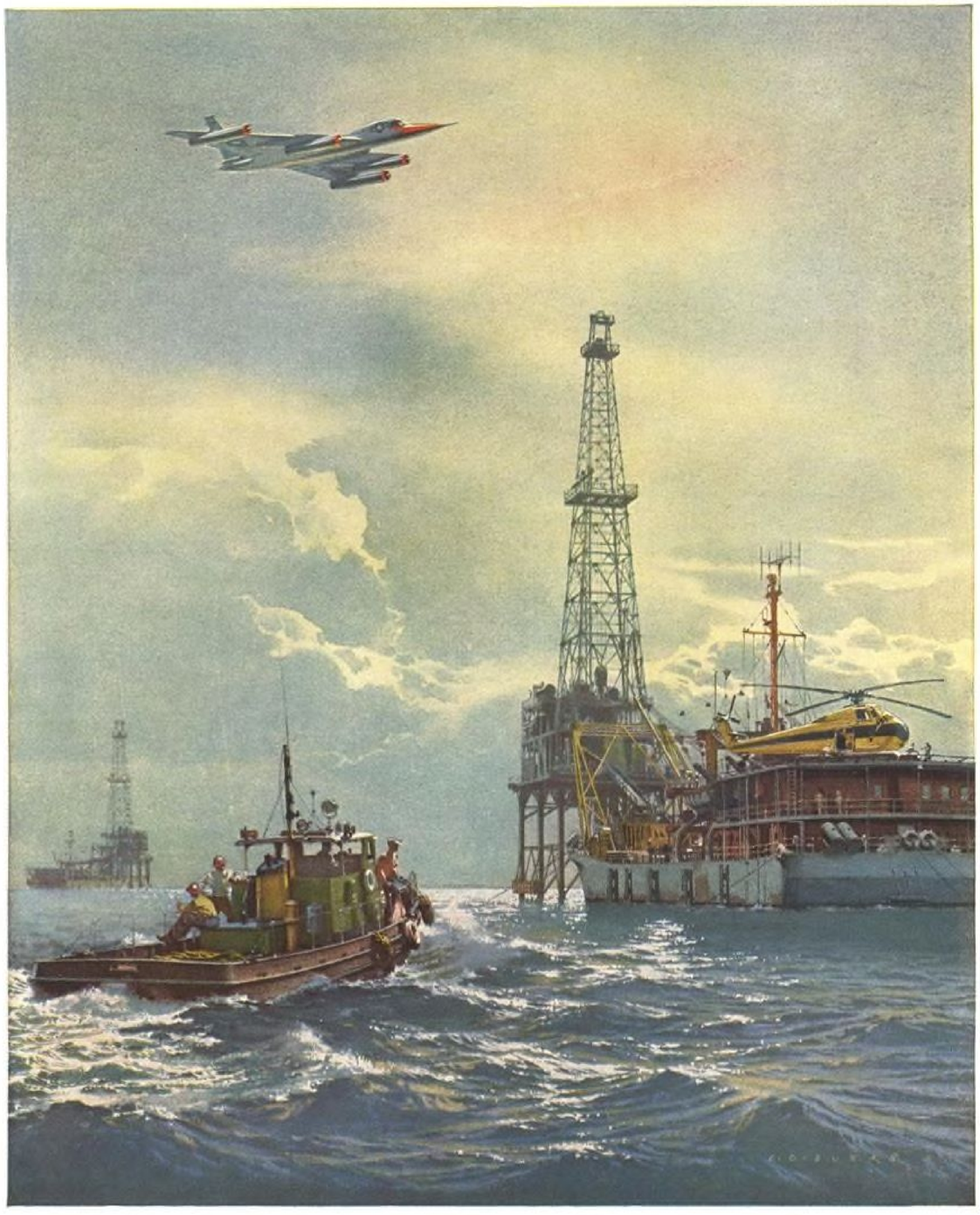

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WHEREVER MAN FLIES

HAMILTON STANDARD

Britain Probably Will Receive U.S. IRBM and Anti-Aircraft Missiles

London—Plans for British use of U.S. guided missiles are well advanced although not finally agreed upon, Defense Minister Duncan Sandys made clear to the House of Commons last week. Britain probably will be supplied with anti-aircraft missiles and intermediate range ballistic missiles such as Thor.

Sandys' report on his visit to Washington (AW Feb. 4, p. 25) was almost entirely devoid of any specific information on the various U.S. .and British commitments.

In response to a questioner who asserted that a great many people would be extremely unhappy if Britain became a massive rocket launching site, Sandys replied:

"I think that everybody agrees that this island must be defended. The only question is whether we are to have effective or ineffective weapons to defend it."

Red Scare

Although Sandys did not mention it, the Russian threat to use ballistic missiles against Britain during the Suez crisis caused a great deal more concern in defense circles here than is generally realized. This lies behind Britain's anxiety to be equipped with American IRBM to counter the Soviet menace. Britain's own work in this field is lagging seriously.

It was this deficiency almost as much as the desire for cuts in defense spending that led to Sandys' mission to Washington.

Britain also is eager to update its anti-aircraft defense system. Although possessing possibly the world's finest radar coverage, the United Kingdom lacks the operational missiles to make it an effective defense.

Sandys report on his Washington visit was so vague that some listeners questioned whether he was being sufficiently frank about its objectives and achievements.

Security Limit

"I have endeavored to be as frank as I can within the limits of security," the defense minister said. "It is not easy to talk absolutely frankly and freely about these things. Rockets, the size of forces, and so on, are not matters that one can bandy around very freely."

He said there had been a thorough exchange of views with U.S. defense authorities on a "wide range" of military matters. Discussion with Defense Secretary Wilson revealed full accord between the two governments on broad objectives of defense policy.

"We reviewed the arrangements previously made for collaboration between the United States and Britain in military research and development, with particular reference to guided rockets," Sandys said. "We discussed a possible scheme for the adoption by Britain of certain American weapons and this is now being examined by the two governments and their service staffs."

He made it clear he also had explained the reasons why Britain feels it is necessary to cut defense expenditures and that there was a "sympathetic understanding" of this objective.

No Concessions

When a member demanded to know what concessions had been made to the United States in return for the U.S. offer to cooperate in research and development of guided missiles, the defense minister said there was no concession whatever.

He assured the members of Parliament that the arrangement made with the U.S. would increase rather than reduce British know-how in the missile field.

When asked whether the U.S. was to supply Britain with intercontinental and intermediate range ballistic missiles, he said: "I do not think that I want to go into that point because . . . a tentative proposal for the adoption by Great Britain of certain American weapons was discussed in Washington and is now being further examined by the two governments until firm conclusions are reached. I think that it would be premature for me to make any statement of greater detail upon that to the House."

American Use

This also was his reply to the question of whether any conditions had been attached to the use of such missiles from American bases in Britain. The question was the first implication that U.S. missiles might be supplied to American units operating from British soil in much the same way that Strategic Air Command and Third Air Force now operate from bases in the U.K. Previously, it had been assumed that the Washington talks had been devoted to supply of American missiles to British units.

Sandys told Parliament that defense shifts will mean a delay in publication of the government's annual White Paper which outlines the defense program.

NORTHEAST AIRLINES DC-6A wreckage lies on Rikers Island near LaGuardia Airport in morning daylight. Previous night, in snow and fog, the leased Miami-bound airliner crashed after takeoff and burned. Twenty persons died, 64 others were hospitalized. Plane's crew of six, including Capt. Alva A. Marsh, pilot, survived. Background buildings are part of New York City penal institution, whose prisoners were released to aid in rescue efforts, helped a number of passengers from the burning plane.

Crash Spurs New Bans on Flight Tests

Washington—New regulations prohibiting flight tests over metropolitan areas were ordered into effect last week by the Civil Aeronautics Board.

Moving on a crash basis, the CAB took action as congressional pressure mounted for rules that would bring a halt to air tragedies such as the mid-air collision between a Northrop F-89J and a Douglas DC-7B transport near Van Nuys, Calif., on Jan. 31.

The crash of a Northeast Airlines DC-6A near LaGuardia Field, N. Y., on the following day intensified the demand for more stringent air traffic control regulations. The loss of the DC-6A cut Northeast's Miami flights from two to one a day.

In its rush to put the regulations into effect, the Board intentionally by-passed the usual rule-making procedure which calls for advance notice of its intentions to interested parties. However, it will consider written comments on the action submitted before March 21. Any relaxation of the regulations, however, is unlikely.

Highlights of Ruling

Here are the highlights of the Board's decision:

• **Civil Aeronautics Administrator** James Pyle is empowered to approve and designate flight test areas over open water or over more sparsely settled areas where air traffic is light. He also is authorized to prescribe air traffic rules within those areas. Pyle foresaw the need for such regulations when, shortly after the accident, he sent telegraphic instructions to six regional administrators to establish such areas on a voluntary basis.

• **Flight test is defined** as the operation of aircraft for the purpose of testing, observing or measuring the performance of aircraft, airframe, powerplant or propeller after its manufacture or major alteration, except for takeoff or landing and flight to or from flight test areas. This is the first time a definition of flight test has been included in civil air regulations.

• **Civil air regulations are amended** to provide that any flight operation requiring more than normal preoccupation with cockpit duties may constitute careless operation of an aircraft. Use of a competent observer or chase plane to warn off collision threats will be necessary to avoid infraction of this regulation.

The new rules fill a gap in civil air regulations by covering both military and civil aircraft for the first time. Civil aircraft lacking airworthiness certificates were previously forbidden from flying over heavily populated areas, except for landing or takeoff, by a clause included in the dealer's registration certificate used for production aircraft. However, no such restrictions were imposed on military aircraft, although the Air Force usually limited flight test activities to prescribed sparsely populated areas.

All manufacturers in Southern California use the same general test area. Except for landing and takeoffs at Santa Monica, Burbank and Los Angeles International Airport, company test pilots are instructed to avoid any heavily populated areas and tests are conducted over desert and ocean.

From the best information available, it is believed that the F-89J and DC-7B were flying at 25,000-ft. over mountains bordering the San Fernando Valley on the north at the time of the collision. The widespread locations of some 40 to 50 witnesses and their angle of view toward the collision will allow investigators to make a fair approximation of the collision site by triangulation on a ground map.

Oscar Bakke, director of CAB's Safety Bureau, told the House Commerce Committee last week that the jet fighter was completing a 90 degree turn when it struck the left wing of the Douglas transport, stripping off part of the wing-tip and possibly a piece of the horizontal stabilizer. Bakke said the crash was almost head-on at a combined airspeed of about 680 knots.

This report on the collision of a Northrop F-89J and a Douglas DC-7B near Van Nuys, Calif., the crash of a Northeast Airlines DC-6A near LaGuardia Field, N. Y., and the resultant moves to halt test flights over metropolitan areas was prepared by Transport Editor L. L. Doty from material gathered by Aviation Week transport editors in the Los Angeles, New York and Washington bureaus.

DC-7 Hits School

The F-89J apparently was flying in a southeasterly direction, and the CAB has determined that the DC-7B was generally following a south track in or on the edge of an airway. Both airplanes apparently traveled a considerable distance after impact before the transport plummeted into the Pacoima Junior High School playground to kill three students and injure some 70 other pupils. The Scorpion crashed into a nearby canyon. Lone aircrew survivor was radar operator Curtiss Adams of the F-89J.

Before last week's CAB ruling, civil air regulations prohibited "acrobatics" over congested areas or on civil airways but made no mention of normal test flights. In a joint statement issued after the accident, CAB chairman James Durfee and Pyle interpreted the civil air regulation on acrobatics or "unusual maneuvers" over congested areas to apply to flight tests.

Both aircraft involved in the collision were legally authorized to conduct flight tests according to most authorities, although the greater Los Angeles area over which the collision occurred is heavily populated. This could indicate a violation of the DC-7B's flight test authorization certificate.

Bakke told the committee neither aircraft was involved in unusual maneuvers in his opinion and said the jet turn maneuver was performed with "an unusually high order of precision."

Radar Operator's Report

The F-89J was a former F-89D and had been returned to Northrop for conversion to the J series. The flight was a functional check of the newer fire control system which is part of the J modification. It also was conducted to check radar performance, and a sister plane was accompanying the F-89J. The jet fighter was traveling at a true airspeed of 380 kts. at the time of the collision.

According to radar operator Adams, the radar was on search at the time of the collision, and there was no indication on the radar scope of another aircraft in the area. He said he saw nothing on the scope until the impact, which apparently appeared as just a blur. Radar in the J model has a 140-degree sweep.

Adams said he had no idea of the direction of the jet fighter nor could he recall its attitude of flight at the time of the accident. Pilot of the F-89J was Roland Owen.

Airspeed of the transport has been estimated at 300 knots. The aircraft were operating on different communication frequencies. There was no known correlation between the two companies with respect to the test flights and the area in which they were to be conducted.

Weather at the time of the collision was clear.

Loss for Continental

The DC-7B was the first of a fleet of five ordered by Continental Air Lines and was on its last check flight by Douglas pilots before its scheduled acceptance flight by Continental engineers.

The airliner was piloted by William Carr. Other crew members were co-pilot Archie Twitchell, Waldo Adams, flight engineer and Roy Nakazawa, radio operator.

Continental does not expect the loss of the transport to delay the inauguration of its luxury service between Los Angeles and Chicago, which is scheduled to start April 28. A second DC-7B will be delivered to Continental March 27 and a third on April 2.

The airline will operate its planned service with one plane short until a replacement is received. Last week, Continental President Robert Six visited the Douglas factory to discuss the replacement.

Civil Aeronautics Board recently had authorized Continental to lease its first DC-7B to Delta Air Lines from Feb. 5 to April 25. Presumably, Delta had planned to take over the aircraft following its acceptance by Continental officials. Continental crews have been checked-out in United Air Lines DC-7s at Denver.

The crash occurred at 11:18 A.M. following takeoff of the F-89J from Palmdale at 10:40 A.M.

CAB Investigation

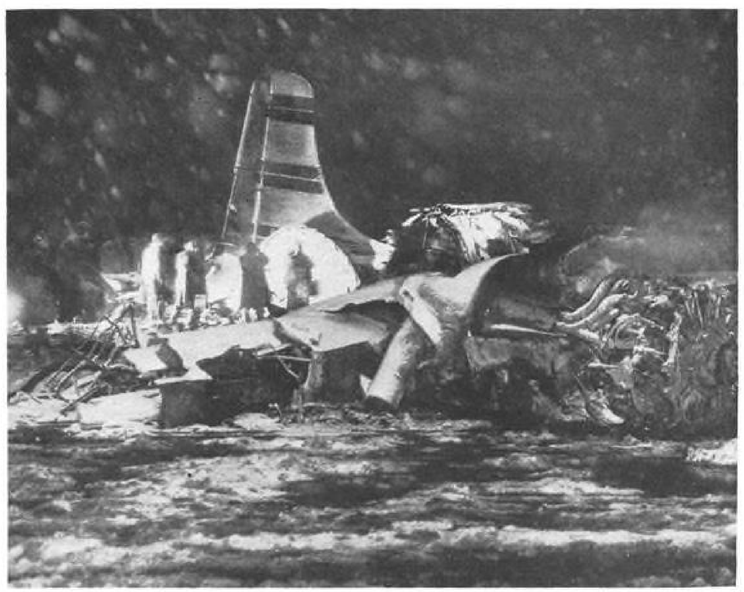
Pilot of the sister ship, James Bugbee, had made no public statements by late last week but he probably will be able to cast some light on the course and attitude of the colliding airplanes when public hearings are held in Los Angeles in about a month.

CAB investigators are assembling the DC-7B wreckage on a planform of the plane drawn on the floor of a Douglas warehouse at Culver City. A similar planform of the F-89J will be put together in the same building, and investigators believe they will be able to ascertain the attitude of each aircraft at the time of impact from the planforms.

Investigators also expect to learn from the planforms if parts of either or both aircraft failed at the time of collision, tore loose from airloads in uncontrolled speed dives or disintegrated at ground impact.

The CAB has been successful in wreckage recovery. Three helicopters flying at tree-top level along flight paths of both aircraft have culled a number of pieces. A radio appeal to souvenir hunters resulted in the return of many other parts.

Five teams consisting of CAB and company officials were placed in the



SNOW still falls on burned-out DC-6A in night scene at Rikers Island. Heavy snowfall had delayed flight several hours as ground crews removed snow and ice from wings.

CRASH-LANDED Globemaster is salvaged in Cook Inlet, Alaska with aid of Piasecki helicopters (background) used to blow chunks of ice out of the way. Men in boats attached lines from C-124 to bulldozers ashore. Crew of 13 survived. Plane carried cargo of engines.

field immediately after the accident to study structure, flight paths and powerplants and to interrogate witnesses. In all, 80 to 90 CAB and CAA investigators are involved.

Congressional pressure for a tightening of air control regulations governing flight tests was prompted in part by Pyle's Feb. 1 telegram to his six regional administrators.

In the telegram, Pyle "requested" that immediate action be taken to establish "voluntary" flight areas for all test flights. He defined flight tests in a phrasing similar to that adopted by the CAB in the revised Civil Air Regulations and suggested conferences with military and industry representatives to discuss the problem.

It was the word "voluntary" that touched off the fireworks in the Senate. Immediately after the accident, Sen. Thomas Kuchel (R.-Cal.) asked the Senate for "legislation with teeth in it" that would designate flight test areas.

After reading Pyle's telegram, he called the Senate's attention to a "directive that is couched in voluntary and cooperative terms rather than in the form of an enforcible regulation."

Sen. Warren Magnuson (D.-Wash.) told Kuchel that he had discussed the problem with the CAA and CAB legal staffs and found "there does not seem to be an uniformity of opinion as to whether a clear-cut authority or responsibility" exists on the designation of flight test areas.

Congressional Pressure

Other events in Washington leading to the CAB decision were:

• **Sen. Magnuson** introduced a resolution calling upon the CAB to use all authority it possesses to regulate air traffic over populated areas.

• **Sen. Magnuson** also directed an investigation of air space allocation and control by Sen. Mike Monroney's aviation subcommittee.

• **In the House,** Rep. Edgar Hiestand (R.-Cal.) introduced a similar resolution and added: If the CAB does not have the authority to make such regulations, it "should submit to the Congress its recommendations for appropriate legislation in granting such authority."

• **Rep. Oren Harris** (D.-Ark.) chairman of the House Commerce Committee, announced that his group would resume hearings first begun last July after the collision between two airliners over the Grand Canyon. Hearings were begun last Wednesday with the testimony of CAB's Oscar Bakke.

Northeast Crash

The Northeast Airlines accident at LaGuardia Field may draw a further review of Civil Air Regulations, depending upon the outcome of the CAB investigation.

For example, appropriate Civil Air Regulations covering maximum takeoff weight spells out such factors as temperature and runway gradient but does not mention runway surface conditions.

The instrument runway at LaGuardia was covered with three inches of snow when Capt. Alva A. Marsh, pilot of the Northeast DC-6A, took off at 6:01 P.M.

Maximum takeoff weight on runway No. 4 used by Marsh was 97,275-lb. for the particular airplane involved. This weight limitation is based on a CAA formula which does not consider condition of runway or weather as factors. The Northeast Airlines DC-6A grossed 96,187 at takeoff.

The airplane, on lease from the Flying Tiger Line (AW Jan. 7, p. 45), was two years old and had accumulated 8,313 hours of flight time. Scheduled departure was 2:45 P.M. The plane took off with 101 persons including a crew of six.

Weather at 5:53 P.M. was reported as 500-ft. ceiling and ¾ mile visibility with snow and fog. The airline's minimums at LaGuardia are 200-ft. and ½ mile.

The plane had been pulled into the hangar at 4:30 P.M. for ice and snow clearance and taxiied to the flight line at 5:30 P.M. While Marsh waited for takeoff clearance at the runway, the tower cleared eight landings and one takeoff.

The aircraft reached between 250 and 300 ft. altitude after takeoff and then veered sharply to the left in a turn of about 135 degrees. It crashed on the west end of Rikers Island. Twenty passengers were killed, and 64 of the survivors were hospitalized. The Northeast crew survived.

Marsh said he felt no loss of power at takeoff in a statement issued through Alfred Lane, Northeast vice president-operations. There was no snow or ice on the wings at the time of the crash and no electrical trouble before takeoff. Marsh said he was flying on instruments and was not aware that a crash was imminent.

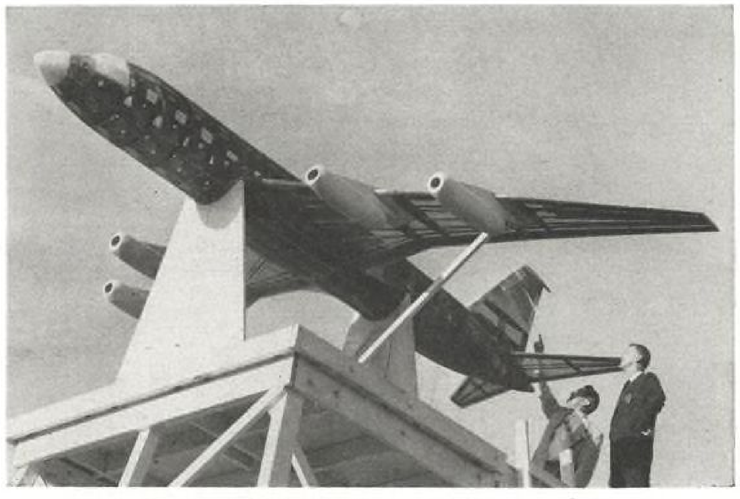
Marsh, 49, a veteran of more than one million air miles, has been involved in two previous accidents at LaGuardia. On Jan. 14, 1952, he pancaked a Northeast Convair 240 in the East River 300 yards from Rikers Island and, on Feb. 6, 1953, he crashed-landed another Convair as the result of propeller malfunctioning.

Northeast has 10 DC-6Bs on order, one of which had been delivered and was in service. The airline leased the Flying Tiger DC-6A in order to begin service early last month on its recently acquired New York-Florida route.

The DC-6A was operated on a single day coach round-trip flight between New York and Miami every day except Wednesday. It also was used as a night coach flight from Miami to New York on Tuesdays only and on a night coach flight on Thursdays only from LaGuardia to the Florida terminal.

The DC-6B added another daily flight to the airline's Miami route Jan. 20 but with the loss of the leased airplane, the company will revert to a one-flight daily basis until the second DC-6B is delivered on Feb. 20.

The damaged airplane was insured by Flying Tiger Line for $1,800,000.



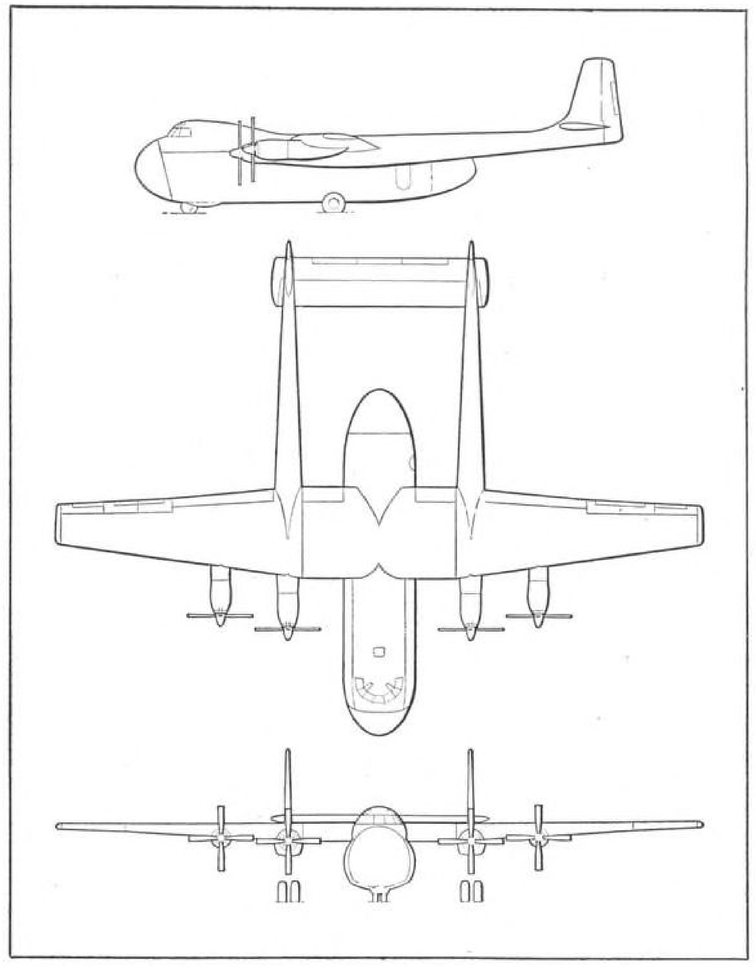
880 Antenna Test

Convair 880 model is used to test flush-type tail-cap antenna planned for the medium-range turbojet airliner. Top four feet of the 880's vertical fin will be used to excite entire airframe which serves as high frequency communications antenna. Model above has 17-foot wingspan, is covered with bronze screening to duplicate the airliner's electrical properties. Transmitter which generates test signals is contained in the model, mounted on top of engineering building at San Diego plant. G. S. Fletcher, left, antenna project engineer, and W. S. Ivans, chief electronics engineer at Convair-San Diego are pictured inspecting the 880 miniature.

Britannia Arrives for Cold Weather Trials

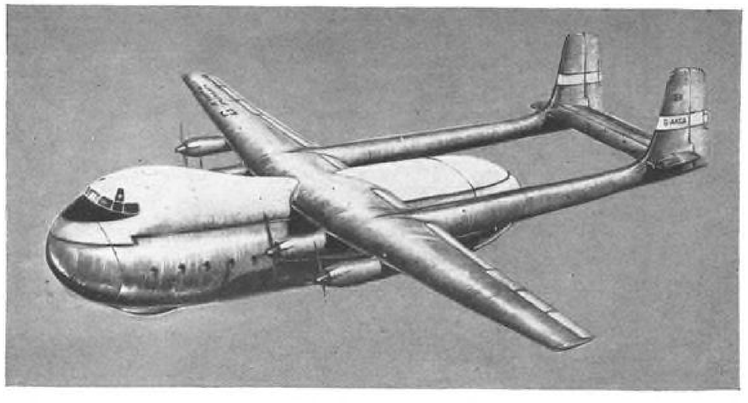
Winnipeg, Canada—A Bristol Britannia aircraft has arrived in Winnipeg after completing a non-stop flight from Prestwick, Scotland in 10 hours 52 minutes flying time. The actual "block-to-block" flight of the Britannia was 11 hours 10 minutes.

The plane will remain in Winnipeg for six weeks to undergo its cold weather trials.



New AW 650

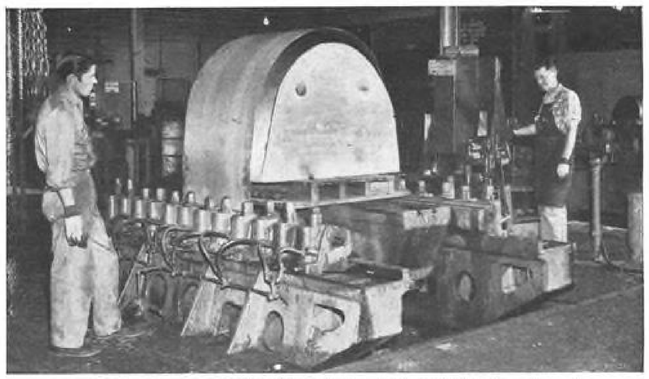
New Armstrong-Whitworth 650 turboprop freight/passenger carrier is being offered in four-engined and twin-engined versions and choice of fuselage length. Designer expects multiple versions will enable AW 650 to compete over 90% of world's air routes. It is designed for maximum economy and high utilization. Low pressure tires are planned for operation from sod fields. Flight of first prototype is scheduled before end of 1958 (AW Jan. 21, p. 41). Four-engined version will be powered by Rolls-Royce Dart 7 engines; twin-engined version, AW 651 with two Rolls-Royce Tyne engines. Company also is proposing a military version to be known as the AW 660, equipped with four darts.



Progress with TITANIUM

"In titanium stretch-forming, Mallory-Sharon material most consistent we have tried; simplifies fabrication"

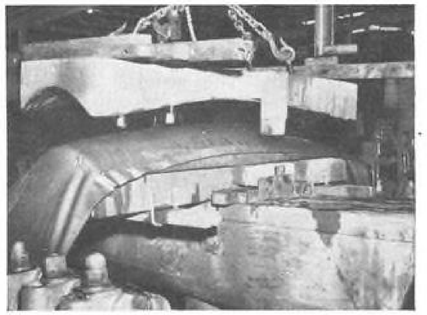
. . . reports
Hart Metal Products



1. Initial forming *of titanium sheet at Hart Metal for jet engine pod. Since Mallory-Sharon titanium is certified in a definite strength range, springback is predictable, and allowed for in dies.*

● Because of titanium's springback characteristics, uniformity is particularly important in simplifying forming. Here, Mallory-Sharon sheet is preferred material for its consistent properties, the result of strict quality control. Each heat of Mallory-Sharon commercially pure titanium is certified for average strength and limits. For dependable quality, call us for your requirements, and for technical help in application.

2. Formed sheet *is annealed to relieve stress. With sheet material in a consistent strength range, Hart Metal reports that two or three stress relieving operations are eliminated.*



3. Double contour *produced by stretch-forming. Heated dies aid in obtaining desired shape with minimum number of operations.*

4. Formed skins are *checked in fixture and given final inspection. Fabricator reports very low scrap loss with uniform strength material.*

MALLORY Ti SHARON

MALLORY-SHARON TITANIUM CORPORATION · NILES, OHIO

Producers of titanium and titanium alloy sheet, strip, plate, rod, bar, billets

Turboprop Super Constellation in Fast Flight

Lockheed YC-121F Super Constellation, powered by four 5,700 eshp. Pratt & Whitney T34 turboprop engines, flew 2,340 mi. from Long Beach, Calif., to Dover, Del., in 4 hr., 43 min., beating best propeller transport type time of 5 hr. 35 min. Speed averaged 490 mph. at 27,000 ft. Flight was part of MATS operational tests of engines and Hamilton Standard turbo hydromatic propellers. Two YC-121Fs are assigned to MATS Continental Division for program.

United, Capital Ask For Fare Increase

Washington—United Air Lines request to the Civil Aeronautics Board for a 6% general fare increase received strong support from the airline industry last week.

Although a number of carriers may not follow United's petition for a fare increase to "offset rising costs," the industry is expected to give unanimous backing to the airline's move.

Capital Airlines was the first carrier to join United's action. Capital asked for an additional $1 increase on all tickets, regardless of distance plus a general 6% raise in rates.

J. H. Carmichael, Capital president, termed's United's request "courageous and timely." The last fare raise the airlines received was an across-the-board $1 increase in 1952. Present coach fares average 4½ cents per mile; first-class fares about 6 cents.

In explaining his airline's request, President W. A. Patterson said, "United and the air transport industry have been facing the basic problem of rising costs . . . for the past 20 years." He added: "While other forms of transportation have increased as much as 83% during this period, it is a great tribute to the airline industry that we have continued to absorb rising costs with practically no increase in rates."

American Airlines made no formal petition to the CAB for a rate increase. However, C. R. Smith, president of the airline, said he is "hopeful that an increase in fares will be permitted as promptly as possible. Even with a modest fare adjustment, air travel will continue to be one of America's best bargains."

Thomas Armstrong, Eastern Air Lines president, praised the proposals of United and Capital and suggested that a 10% boost could be accomplished without adding any burden on the traveling public if the 10% excise tax were eliminated. Airline fares, he said, have increased only 3.2% since 1938.

Profit margins of most carriers for 1956 are expected to shrink as a result of rising costs and net operating profits for the airline industry declined slightly last year in the face of a 12% increase in revenues. C. R. Smith noted that "the costs of today cannot be met with the fare level of 15 years ago."

United Starts Building Facilities on Coast

San Francisco—United Air Lines will begin construction next month on a multi-million dollar expansion program near the San Francisco International Airport.

The program has been approved by the Public Utilities Commission and the San Francisco Art Commission. United will construct a large hangar for present and future aircraft, a new flight kitchen for preparation of in-flight meals, an additional employe cafeteria, a boiler plant, a wash rack for cleaning airplanes, and a 900 car parking lot for employes.

A line maintenance service area, with underground fueling lines which can service five planes simultaneously, also is included in the plan.

The project is expected to be completed by mid-year of 1958, and is in addition to the 93 acres presently occupied by United at the airport.

United's new facilities will be located on a 40 acre plot, due west of the airport terminal building. The airline currently is negotiating with the city to lease an additional 8.6 acres in the same area which is needed for the building program.

The new airline hangar will be a cantilever structure covering approximately 125,000 sq. ft., and capable of housing six airplanes at one time. Hangar measurements are 310 ft. x 365 ft. x 50 ft.

Special walls of anodized aluminum will give the building a light grey exterior finish, and radiant heated floors will be installed for the comfort of 1,200 United employes in the hangar.

United employs a total of 5,700 people at the airport.

Architects for the United Air Lines project are Skidmore, Owings, and Merrill of San Francisco.

UAL Earns $14.6 Million in 1956

United Air Lines earned $14,680,500 in 1956, an increase from $11,244,577 the previous year. Sale of surplus aircraft accounted for $4,339,400 of the 1956 total, compared with $80,548 in 1955 aircraft sales.

The 1956 earnings equal $4.57 per share of United stock, compared with $3.85 for the 1955 earnings. The airline has declared a quarterly cash dividend of 12½ cents per share and a stock dividend of 4%, payable June 15.

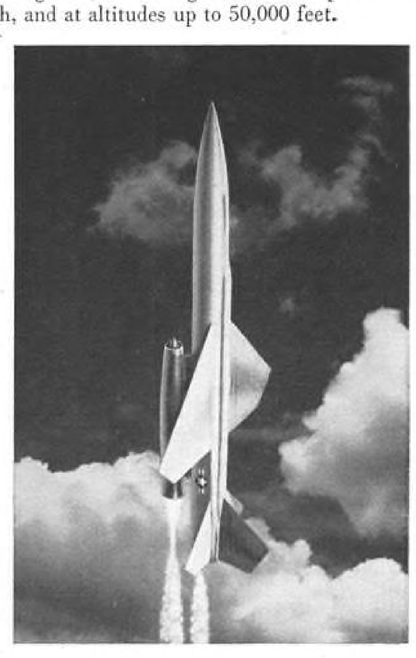
The low cash dividend, with the attendant dividend in stock, was attributed by UAL President W. A. Patterson to the need for prudence in keeping financially strong during transition to the jet age. Patterson also cited the current tight money market.

BULLETIN FROM **BOEING**

AMERICA'S RETALIATORY "REACH" was demonstrated when a Boeing B-52, refueled in flight, recently covered 16,000 miles, non-stop, in 31½ hours. The B-52, along with other Boeing Stratofortresses, wheeled over the North Pole, and circled the perimeter of most of Canada and the United States. Fully loaded for simulated bombing runs, the Boeing B-52s flew at speeds up to 650 mph, and at altitudes up to 50,000 feet.

WINGED REFUELING STATIONS, jet-powered KC-135s, are moving off Boeing production lines on schedule. In service, KC-135s will add thousands of miles of reach to jet-powered bombers and fighters, refueling them at speeds and altitudes best suited to jet operations.

AMERICA'S ONLY JET TRANSPORT, the Boeing 707, parks at Los Angeles airport after flying Civil Aeronautics Board officials down from Seattle. Return flight carried International Air Transport technicians, reached Seattle in 1 hour 50 minutes. The 707 is helping officials work out procedures and rules for commercial jet flight in the U. S.



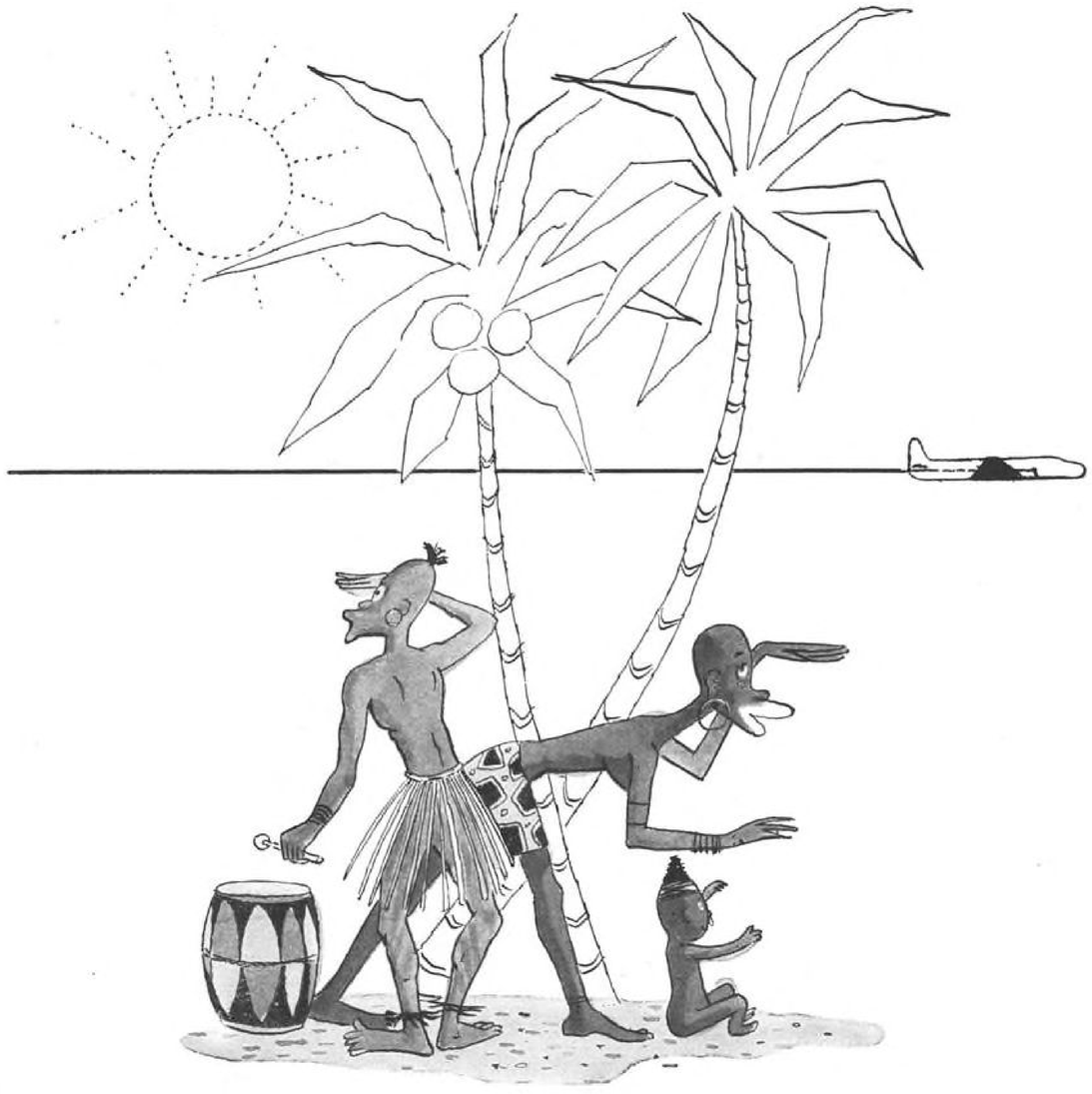
BOMARC. Boeing's Pilotless Aircraft Division is conducting successful firing tests of supersonic defense missiles. Boeing's BOMARC guided missile assignment includes development of electronic guidance, launching means, bases, supplies and maintenance.

BOEING

Airline Traffic—1956

	Revenue Passengers	Revenue Passenger-Miles (000)	Load Factor %	U. S. Mail	Express	Freight	Total Revenues Ton-Miles	Per Cent Revenue to Available Ton-Miles
DOMESTIC								
American	7,706,681	4,800,526	68.47	20,042,045	10,750,415	71,395,966	567,416,652	60.47
Braniff	1,788,172	721,617	60.87	2,595,777	1,541,194	4,104,646	77,386,438	53.16
Capital	2,984,410	1,021,564	60.17	3,257,633	2,261,523	3,562,260	106,817,136	45.92
Continental	707,938	259,595	54.31	871,246	316,589	1,242,554	27,331,309	46.20
Delta	2,371,183	1,127,109	60.12	3,824,223	3,219,837	7,228,971	122,679,183	55.59
Eastern*	.....	.....	.....	.....	.....	.....	.....	.....
National	1,358,000	949,171	65.91	3,289,957	703,367	4,986,205	105,954,298	65.16
Northeast	593,449	119,454	58.51	127,530	190,964	305,551	11,576,066	56.03
Northwest	1,319,933	872,000	61.25	4,642,008	2,720,771	7,755,427	101,370,777	53.84
Trans World	4,154,742	3,266,510	64.34	12,550,670	9,090,353	23,698,613	358,161,337	58.76
United	6,185,299	4,274,422	66.95	26,913,285	12,748,567	50,149,731	500,412,290	59.07
Western	928,746	458,131	61.90	2,211,731	805,483	1,649,995	48,480,929	56.25
INTERNATIONAL								
American	138,586	99,103	66.32	138,837	6,432	3,403,789	13,890,810	67.12
Braniff	32,501	69,669	47.97	271,407	.....	864,162	9,052,897	51.69
Caribbean Atlantic	182,084	13,295	58.67	15,233	.....	49,267	1,267,443	56.35
Delta	58,086	64,837	59.82	83,981	.....	562,087	7,340,884	48.47
Eastern*	.....	.....	.....	.....	.....	.....	.....	.....
National	108,457	62,216	52.71	103,254	48,089	327,372	6,911,916	54.89
Northwest	114,758	230,751	58.84	11,616,500	240,820	9,943,742	47,057,706	70.18
Pan American								
Alaska	77,700	90,974	63.61	470,451	.....	3,901,062	13,889,856	54.46
Atlantic	998,611	1,272,710	63.46	12,586,408	.....	24,282,437	169,854,069	61.93
Pacific	298,800	886,276	73.02	13,110,209	.....	15,759,233	122,144,822	69.29
Latin America	1,216,739	1,136,021	64.34	4,341,302	.....	39,585,298	153,794,923	61.99
Panagra	143,222	172,103	59.86	665,801	.....	4,029,161	23,228,317	59.32
Trans World	273,398	710,895	63.16	9,686,290	.....	9,112,014	93,618,524	69.45
United	98,410	244,527	69.63	1,270,837	.....	709,192	27,143,739	64.65
LOCAL SERVICE								
Allegheny	393,668	64,942	44.07	86,867	214,787	72,412	6,569,553	45.21
Bonanza	132,204	28,919	43.87	49,162	30,123	76,786	2,910,207	42.53
Central	107,758	19,760	33.78	46,835	29,631	67,783	2,033,980	30.42
Frontier	197,902	53,300	50.17	343,405	96,531	645,370	6,431,653	62.74
Lake Central	136,956	21,368	43.20	26,594	147,554	453	2,130,759	37.69
Mohawk*	.....	.....	.....	.....	.....	.....	.....	.....
North Central	551,775	85,659	51.65	226,220†	361,346	.....	8,775,078	46.41
Ozark	398,994	49,013	37.52	115,452	200,628	80,465††	4,980,197	38.66
Piedmont	405,153	77,136	52.83	172,230	153,487	144,474	7,854,801	52.80
Southern	191,080	33,752	44.89	101,542	155,411	.....	3,488,081	42.82
Southwest	289,240	59,398	49.72	95,993	56,768	101,724	5,909,876	48.34
Trans Texas	220,613	50,184	39.45	161,719	104,691	241,458	5,293,370	36.41
West Coast	214,874	38,134	45.51	47,240	27,007	63,772	3,626,285	50.04
HAWAIIAN								
Hawaiian	428,286	59,989	59.73	52,791	.....	1,343,072	6,623,115	55.49
Trans Pacific	209,109	26,260	53.44	11,948	.....	138,873	2,164,444	52.76
CARGO LINES								
Aerovias Sud-Americana*	.....	.....	.....	.....	.....	.....	.....	.....
Flying Tiger	61,178	223,764	98.67	365,187	298,616	67,617,048	90,657,208	75.59
Slick*	.....	.....	.....	.....	.....	.....	.....	.....
Riddle*	.....	.....	.....	.....	.....	.....	.....	.....
Seaboard & Western	48,957	231,276	100.00	.....	.....	15,531,146	38,658,836	87.34
HELICOPTER								
New York Airways	43,205	815	47.06	12,358	14,965	6,762	109,757	52.27
Los Angeles Airways	20,419	799	43.54	49,032	21,338	.....	140,756	48.58
Chicago Helicopter	876	14.04	22.35	28,906	.....	.....	30,246	37.30
ALASKAN								
Alaska Airlines	62,179	24,522	34.39	551,638	.....	5,422,175	8,762,131	47.94
Alaska Coast	47,258	4,303	62.43	48,166	.....	48,666	535,060	65.29
Cordova	17,849	3,028	48.53	39,625	.....	1,566,404	1,921,236	55.36
Ellis Airlines	61,542	3,124	53.18	24,350	.....	31,697	373,228	63.29

* Not available.
† Includes 7,385 ton miles of surface mail
†† 9 months.
Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board.



Around the equator 1,800,000 times!

Passengers on the scheduled air fleets of the world last year logged 45 billion miles—enough for one passenger to fly around the equator more than a million and three-quarter times! This figure represents a gain of 16% over total passenger miles flown in 1955. And this amazing record is expected to be broken again in 1957.

As more and more people fly more and more miles, new and better planes are being developed to serve them. To keep these planes flying, operators know they can rely on Esso Marketers for the finest in modern aviation fuels and lubricants—perfected through years of research—and for the finest in uniform, safe and efficient petroleum service along the airways of the world.

8 OUT OF 10 OF ALL THE WORLD'S INTERNATIONAL AIRLINES USE

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AVIATION PRODUCTS

SHORTLINES

► **Capital Airlines** opened a reservations-sales office in downtown Minneapolis. Company says telephone facilities are double those in former Wold-Chamberlain Airport location.

► **Trans World Airlines** expects a 15% rise this spring over last in traffic to Europe, basing the estimate on advance bookings. TWA will schedule 60 transatlantic flights daily April 1, will increase the total to 68 by June 1.

► **Qantas Empire Airways** will open new offices in New York in June, and is expanding its East Coast staff. The New York office will include a center for Australian tourism.

► **World-wide insurance** policy for air travelers is now available at most major U.S. and Canadian airports through Tele-Trip Co. machines and booths. The air trip insurance covers domestic, foreign segments in single policy.

► **Canadian Pacific Airlines** has ordered $755,000 electronic flight simulator for DC-6B pilot training. Device will be built in Montreal by Canadian Aviation Electronics Co. for summer, 1957 delivery.

► **Oakland International Airport** projects under bond issue recently approved by port commissioners include $1.25 million hangar for jet transports, 24 small plane hangars to cost $344,500, and $350,000 plant to be leased to an engine service company.

► **Ministry of Transport** awarded $2,630,000 contract for construction of Gatwick Airport terminal building. Award completes major contracts in airport's development plan. Terminal will be 330 ft. long and 110 ft. high and have direct access to railroad station and main London-Brighton road.

► **San Francisco** area's aviation facilities have been surveyed by the Bay Area Aviation Committee, and the survey has been published as a directory for private and business aircraft users.

► **Seattle-Tacoma** International Airport handled 86,325 passengers in November, an increase of 7% over the number handled in November 1955.

► **Trans Australian Airlines'** average daily utilization for its Viscounts was 8.96 hours during a recent 12-month period.

► **Delivery of two Convair** 240s was made to Trans Irania Airway by the Babb Company, Inc. Sale was made

AIRLINE OBSERVER

► Northwest Airlines will choose either the DC-8 or Boeing 707-320 for its jet fleet, which it wants by 1960, but probably will make no decision until financing problems are solved. Current bank credit of $38.5 million at 4.25% interest will be absorbed by $55 million purchase of 10 DC-6Bs and 14 DC-7Cs, with balance coming from retained earnings, depreciation and sale of four Super Constellations and eight DC-4s. Only U.S. trunkline that has placed no firm order for turbojet or turboprop transports Northwest does have 21 P&W J75 jet engines on order for 1960 delivery.

► **U.S. Court of Appeals has refused to stay a Civil Aeronautics Board order that revokes operating rights of Aero Finance Corp. and Peninsular Air Transport. The companies operated service between New York and Miami and Chicago and Miami. Latest CAB decision orders the irregular carriers to cease operations effective Mar. 2.**

► Robert Turner, who recently resigned as vice president-sales for Northeast Airlines, is expected to join the Air Transport Assn. as vice president-traffic.

► **Civil Aeronautics Board has held up its report on the probable cause of the mid-air collision over Grand Canyon last June. Report was about to be released when CAB received word that another person said he had witnessed the accident. Now it will be withheld while the CAB investigates to determine whether proceedings should be reopened.**

► British Overseas Airways Corp. has moved its Middle East headquarters to Istanbul because of the ban on British and French aircraft flying over Syrian territory. The airline probably will return to its original headquarters in Beirut if Syria rescinds the order.

► **Capital Airlines last year conducted 2,000 pilot check-outs on all equipment as a result of its Viscount program. Capital's pilot program required progressive training of crews on multiple aircraft to insure full crew coverage of both the Viscount and piston-engine fleets. New Viscount simulator—now being installed and expected to be ready for regular use within two weeks—will cut 1956 training costs by 65%.**

► International Civil Aviation Organization will adopt a convention to study problems of crimes and births on aircraft since it was found that there is no internationally recognized system for determining jurisdiction in such cases. The move was prompted by preliminary studies of a legal subcommittee of ICAO (AW Dec. 17, p. 45).

► **Air Transport Assn. has integrated the Airline Personnel Relations Conference into its organization and elected Joseph L. O'Brien vice president-personnel relations. O'Brien was previously executive director of the conference, an independent organization.**

► Trans World Airlines is mapping a program designed to revive tourist traffic in the Middle East. TWA officials in Cairo recently discussed new tourist projects with Egypt's Minister of National Guidance and the acting director-general of the Egyptian Tourist Administration.

► **Meteor Air Transport will lease two DC-4s and two C-46s from Los Angeles Air Service, following recent Civil Aeronautics Board approval. Each DC-4 is being leased for $17,000 per month. The C-46s carry a monthly rental of $3,500 each.**

► Air traffic controllers are protesting recent Civil Aeronautics Board ruling that discontinues the requirement for flashing navigation lights on aircraft on the ground. Controllers claim it is easier to follow aircraft using the flashing lights, while CAB officials fear that the lights distort the view of an aircraft's ground path of direction.

► **Air Line Pilots Assn. has postponed its threatened strike against Pan American World Airways following a second request from the National Mediation Board to defer any action until further mediation is conducted. Pilots seek higher pay and improvement of working conditions, which, they say, involves excessive on-duty time and time away from home.**

KAMAN HOK-1 SHOWS ITS MUSCLE

Undergoing U. S. Army evaluation tests including airlifting externally slung cargo, this Marine Corps HOK-1 demonstrates its ability. Shown here carrying a 2500 lb. jeep, it also takes artillery pieces, gas drums, ammo cases and other bulky materiel in stride.

HOK-1 general utility helicopters are already in service with the U. S. Navy and Marine Corps where they are used extensively for search and rescue missions, medical evacuation, personnel transport and cargo carrying.

The development and production of utility helicopers is but one of many contributions Kaman has made to our National Defense effort. We're proud to be of service.

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LIFELINE

••• --- ••• These are the "call letters" of the U. S. Coast Guard. Watching over more than half a million square miles of our coastal waters, the rescue record of this famous organization is one of the great air-sea sagas of war and peacetime service. Helping to extend the Coast Guard's far-flung lifeline is the Martin P5M and the new P5M-2G, providing long-range sea reconnaissance for any emergency. Also, in active service with both the Atlantic and Pacific fleets of the U. S. Navy, ten squadrons of this famous seaplane—specially armored for anti-submarine warfare—are in operation today, from Norfolk to the Mediterranean and from Washington to the Orient.

MARTIN

BALTIMORE·DENVER·ORLANDO

from a portion of the Convair fleet recently acquired by Babb from L.A.I. Italian Airlines in Rome.

▶ **Nandi Airport,** Fiji, will be considerably developed at so-far undisclosed cost to become a major landing field for trans-Pacific jet airline services from the United States. This decision was made at the Melbourne, Australia, meeting of the South Pacific Air Transport Council.

▶ **Royal Gull business amphibian** distributorship has been given Royal Aircraft Sales, Inc., General Mitchell Field, Milwaukee, Wis., by Trecker Aircraft Corp. (formerly Royal Aircraft Corp.). New outlet will cover Wisconsin, Minnesota, Iowa, North and South Dakota, Kansas, Missouri and Nebraska.

▶ **Air France** will install RCA-AVQ-10 weather radar on the ten Lockheed 1649A Constellations it has on order. The French carrier expects to receive its first 1649 next June.

▶ **Dickinson Air Service,** Dickinson, N. D., will operate a non-scheduled commercial international air service to Western Canada to include the cities of Virden, Brandon, Winnipeg, Swift Current, Saskatoon, Moose Jaw, Regina, Prince Albert, Estevan, Broadview, Calgary, Lethbridge and Medicine Hat. Aircraft are limited by Canadian Air Transport Board to types with a disposable load of less than 1,100 lbs.

▶ **Net operating revenues** of AEI-Air Express International and its subsidiaries—Air Express International Agency and Surface Freight Transportation—totaled $2,252,189 in 1956, an increase of 29% over 1955.

▶ **Reading Aviation Service, Inc.,** Reading Pa., will operate a charter commercial non-scheduled international service from Reading to Montreal, Ottawa, Toronto, North Bay, Muskoka and Parry Sound, under license granted by Canadian Air Transport Board.

▶ **Continental Air Lines** has decided to reinvest all earnings during "the current growth period" to help finance its $62 million expansion program. Future dividends will be in the form of stock rather than cash . . . Continental has signed a one year contract with the United Auto Workers providing for wage increases ranging from nine to 29 cents for 400 employes at the Denver headquarters.

▶ **Pan American World Airways'** Latin American Division flew 2,771,808 lb. of cargo to Latin America in November, an increase of 364,672 lb. over the traffic in November 1955.

School Days

In the next several years the airlines will be faced with many large problems concerning the introduction of the new breed of transports. Not the least of these will be the task of training the people who will operate these aircraft. Since these new vehicles are multi-million dollar pieces of precision machinery it behooves management to make certain that training is adequate.

Previously the transition to new equipment, and the training for it, just sort of "growed." Taken step by step, from the era of the DC-3 through the 4s and 6s and 7s, the change was gradual. Operating personnel had at most one or two new items per plane with which to contend. Now, however, many things are going to appear all at once. The jump will approximate one from a DC-3 to a DC-7. Can you imagine the task of acquainting people with the tricycle gear and nose wheel steering, with supercharged engines and reversible propellers, with water injection and pressurized cabins, and all the rest, in one fell swoop?

Things to Come

But, essentially, this is what is going to have to be done in the coming years. In fact, many feel it will be an even greater leap than from the 3 to the 7. Not only will we be faced with a raft of new devices but, in some areas, entirely new principles. This may mean complete revision of thought and action in order to change lifelong habits.

Probably most airlines will use expensive simulators for much of their ground training. This is good. Of even greater importance is the caliber of the instructor.

A competent teacher plus blackboard is of infinitely more value than the most elaborate electronic equipment under improper guidance. For many years the position of ground school instructor has been relegated to the minor leagues, receiving neither the attention nor the pay that the job deserves and consequently not attracting the highest skilled applicants for the work.

With the coming of jet powered aircraft the pilot finds himself more than ever in the position of a human monitor. He will not be performing so many physical actions—he will be watching automatic gadgets. Instead of turning on fuel pumps and energizers and starters, moving mixture controls and throttles to get under way, he may only move one lever and push one button.

The jet doesn't eliminate everything—it just does things automatically. Except when the automatic feature fails to function as per the brochure, then a counter measure is required. Unlike the piston engine, however, action is not required in several seconds but is required immediately.

Training Problems

Most any healthy young American male can trace a hydraulic line, or control cable, and understand the workings. Only jets are not hydraulically or cable controlled. Their machinery is electronic—sometimes a baffling subject for the same young man. This, too, is a problem in training. The tale of electronics will have to be given to the pilot in the language he understands and he must be given the things which are important to his job.

For instance, I can think of thousands of things about a given electronic circuit that I don't give a hang about. I couldn't use the information even if I understood it.

It might be an overstatement to say that ground training schools need a full Vice-President in Charge Of, but it is a sure bet that some elevating from present status is necessary. Smart airlines will begin now to gather a competent staff to man that little school room in the corner of the hangar. It is going to become a mighty important place.

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AERONAUTICAL DIVISION

Ski-Equipped C-130 Flies

First flight of Lockheed Aircraft Corp.'s C-130 Hercules equipped with 19½ ft. main skis was monitored by crew through a Farnsworth 600A wide angle lens automatic television camera mounted in 2 ft. diameter Fibreglas pod under right wing. The 51 min. flight in wheels-down skis-up configuration at low speeds also was monitored by T-33 chase plane. Stripes on skis are for visibility on 10-in. screen in cargo compartment. After skis-down wheels-up, and then wheels- and skis-retracted flights, C-130 will fly this month to Bemidji, Minn., for snow landings and takeoffs.

Airport Safety More Important Than Profit

London—British Minister of Civil Aviation says safety and service will have priority over profits at British airports.

Replying to parliamentary criticisms that he had failed to cut mounting losses at state-owned airports, Harold Watkinson said safety and service must come first.

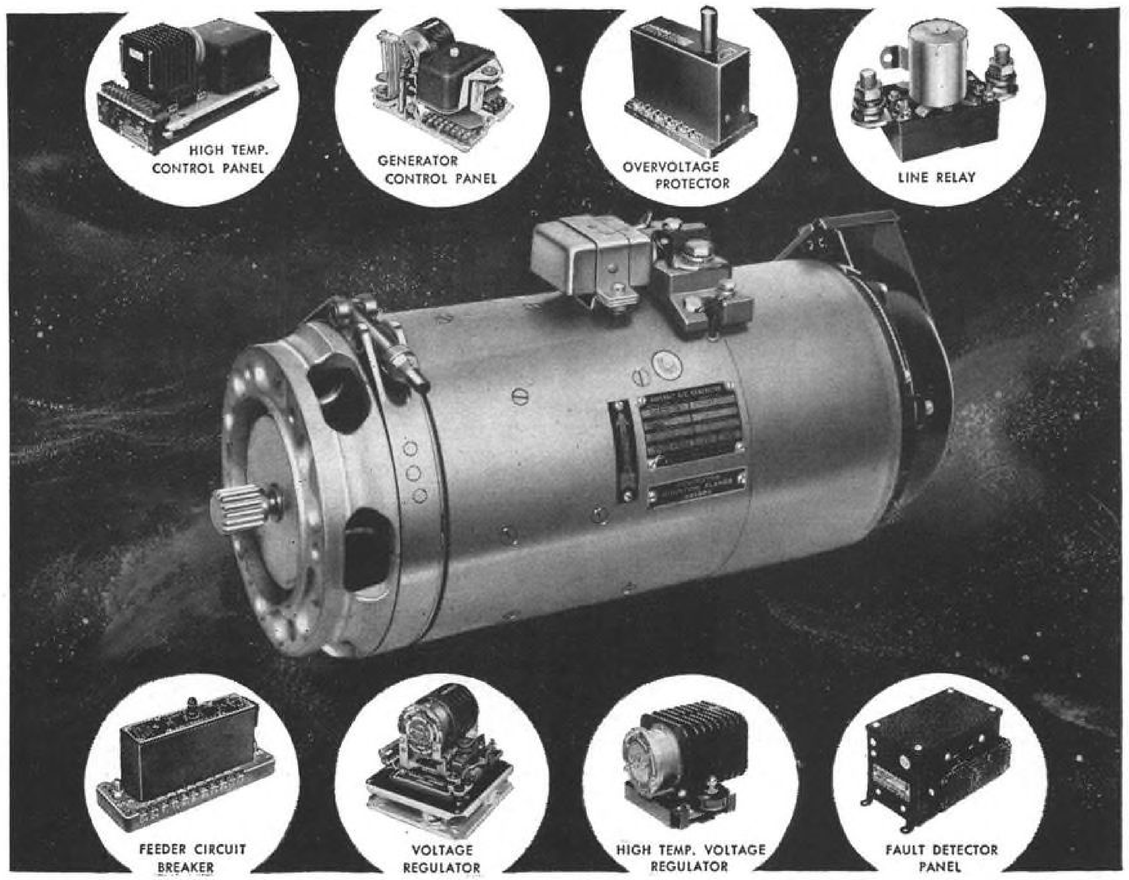
"If providing these in full measure means that the operating costs of these airports cannot be for the moment completely recovered by the charges which they can make then I remain completely unrepentant," the Minister asserted.

He said Britain is pioneering in all weather landing devices as well as providing first-class service on the ground for airline passengers.

"This isn't to say that we should not concentrate on a strictly commercial basis both so far as the operation of air transport is concerned and their parent airports," he said. "But I doubt

Honeywell Aero's HIG-6, one of the most precise gyros ever designed, is now in quantity production. With a drift rate of less than 0.1 degree, it represents the furthest advance yet made in a production, inertial-type gyro. The HIG-6 is applicable to both full inertial and aided-inertial systems. Standard models of this gyro can be delivered in as little as three months' time.

AERONAUTICAL DIVISION, MINNEAPOLIS-HONEYWELL



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30E22	50	4000–8500	50,000	16	—
30B24	50	4000–8500	50,000	14	—
30E16	100	2500–4500	50,000	40	52B6588
30B33*	100	4700–8000	35,000	28	MIL-S-9181
30E07	200	3350–8000	50,000	45	AN-3632
30E20	200—Class C 300—Class A	4000–8000	65,000	45	MA-1
30E02	300	3450–8500	25,000†	64	—
30B37	300—Class C 400—Class A	4000–8000	65,000	53	—
30E10	400	3100–8000	60,000	67	AN-3624
30B34	400	3100–8000	60,000	67	—
30B26	400—Class C 500—Class A	4000–8000	65,000	69	MA-11
30B35*	400—Class C 500—Class A	3500–8000	65,000	75	—

*These units are Starter-Generators. †Models also available for operation at 50,000 ft.

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whether anyone would wish to see at this stage savings made which might cut down the standards of safety or service."

The 1956 operating loss at London Airport was $1.1 million, more than twice that of the previous year. Taking depreciation, interest charges and administrative costs into account, the annual loss has been estimated at well over $8 million.

During the year, the airport handled nearly 2.8 million passengers and over 40,000 short tons of freight.

Cleveland Air Taxi Curtails Service

Cleveland—Cleveland Air Taxi, Inc., has discontinued passenger service between the city's downtown Lakefront Airport and Hopkins Municipal Airport, and 45 scattered helistops.

The company will, says Kenyon C. Bolton, president, continue to perform charter and contract work for industry and others on a flat fee basis.

The company faced, from inception of service Oct. 20, 1954, a money-losing economic situation but achieved a goal of gaining experience to support its pending application for a certificate from the CAB. Under such a certificate CAT would be privileged to carry passengers, mail and cargo over fixed routes.

The company is the owner of five helicopters, two of them presently operating in the Louisiana oil fields. Each of the helicopters has seating capacity for three, including the pilot.

AEI Sees Boost in International Cargo

Air Express International has launched its 1957 sales campaign with the objective of handling 7-million pounds of international cargo through its 11 AEI district offices during the year.

Charles L. Gallo, AEI president, explained the goal of forwarding 7-million pounds is not overly ambitious despite the fact the offices generated a volume of 1.7-million pounds last year. He believes that by converting business, where AEI acts only as agents for airlines and customs-carriers, to the full door-to-door forwarding service, the company can make up a good part of the difference.

Other factors which are expected to assist in the effort include:

• **The 5% increase** in commodity rates put into effect by the International Air Transport Association. AEI rates will remain the same, making them even more attractive to the shipper.

• **The increase** in the number of inland cities where AEI service will be available. Joint air cargo programs with domestic airlines have made possible this expansion.

• **An increased** advertising and sales promotion campaign intended to make businessmen more aware of the speed and economy advantages of AEI service.

CAA Orders Special Engine Inspection

Washington—Civil Aeronautics Administration last week issued an airworthiness directive calling for a special inspection and flight checks on aircraft equipped with Lycoming GO-480C and GSO-480A engines.

The order was issued to correct piston-burning problems experienced with the Lycoming engines and requires a special check before the next flight and every 50 hours thereafter.

Aircraft affected are the Aero Commander and Beech Models D50 and E50.

The purpose of the checks is to insure that the link of engine control mixture arm on the carburetor is in full rich position when the cockpit control is in full rich. The directive requires the placement of a placard on the instrument panel or control column warn-

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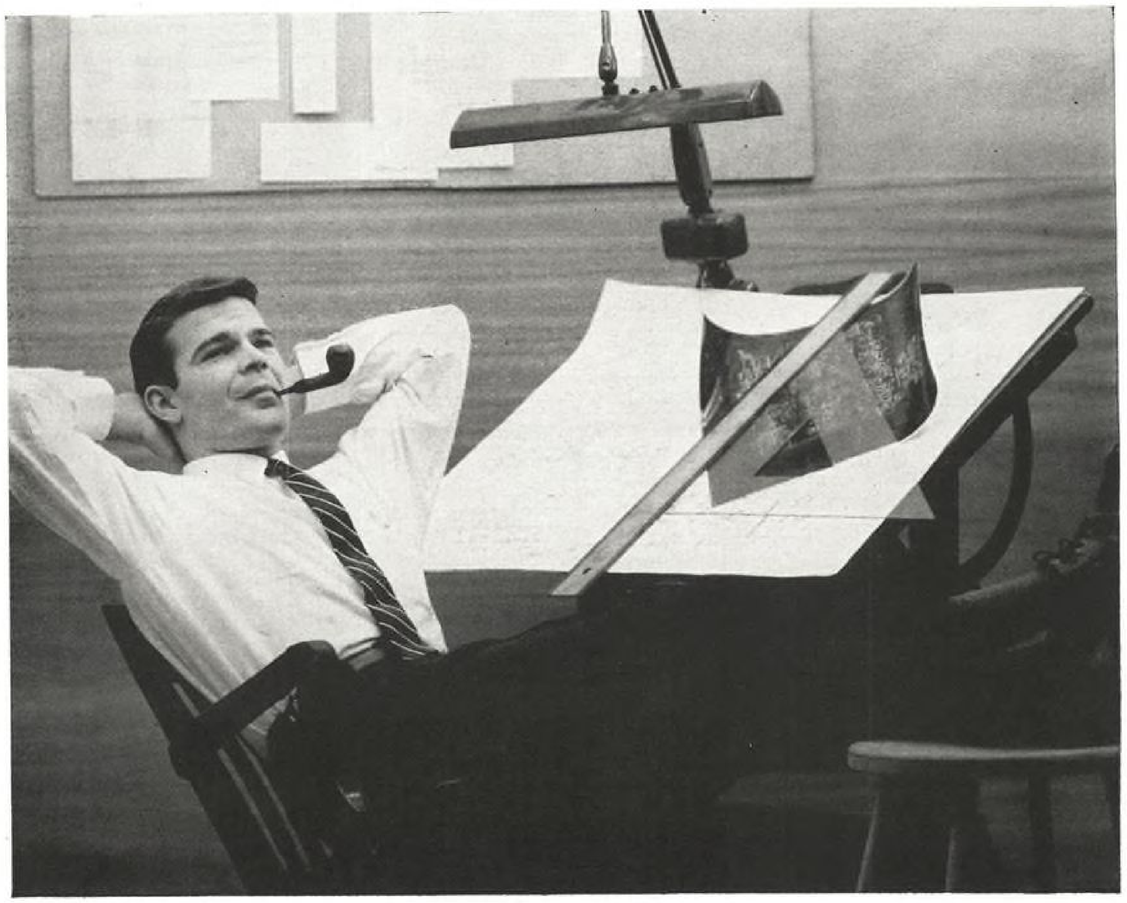

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ing that the engine mixture control must be kept in full rich position under all operating conditions.

Compliance date of the directive is Feb. 25 and at any time engine is changed or any part of aircraft or engine induction system is altered. Aircraft must be flight checked prior to the compliance date at 65% normal rated power in level flight to determine whether fuel consumption is within limits specified by Lycoming.

Continental Leases DC-7B to Delta

Continental Air Lines will lease its first Douglas DC-7B, scheduled for Feb. 1, delivery, to Delta Air Lines before putting the plane on its own Los Angeles-Chicago route in April.

The aircraft, according to Continental President Robert F. Six, would have "limited usefulness" until the new route is opened.

The unusual lease agreement covering the new plane, one of an order of five, calls for payment by Delta of $145 per hour of operation, plus additional rent of $1,456 per day for depreciation and profit. Continental's other four DC-7Bs in the $11,985,865 order will be delivered during March through July.

The entire DC-7B fleet will be used in the new service, scheduled for April 28 opening, to serve Los Angeles, Denver, Kansas City and Chicago.

KLM Increases Traffic in 1956

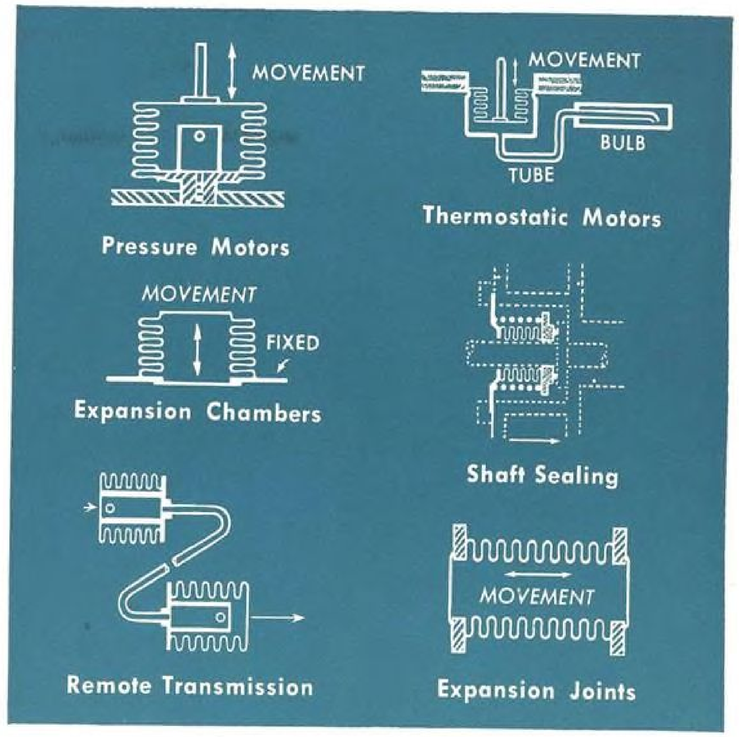
KLM Royal Dutch Airlines carried 820,000 passengers systemwide during 1956, an increase of 13%, the carrier reports. Revenue ton-miles totaled 172,346,000 for the year with an average load factor of 62%.

The airline carried 23,600 tons of freight, up from 20,300 tons in 1955. Air mail was up 14%. Tourist class passengers, up 24% from 1955, accounted for 618,000 of the passenger total.

Olympus 6 Completes 150-Hr. Test Run

London—Bristol's Olympus 6 turbojet has cleared its last step before production—completion of an officially observed 150-hr. type testing run at 16,000 lb. thrust.

Observed thrusts during the test run reached above 17,300 lb. Further development of the Olympus to these higher powers already is under way. The engine has been stripped for inspection prior to issuance of the official type test certificate.



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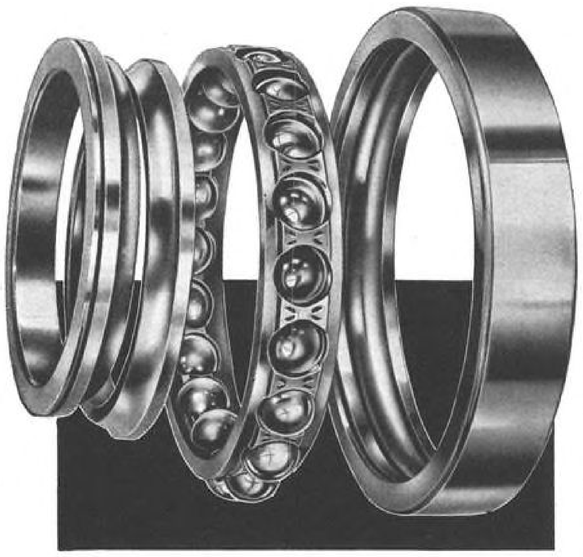

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LL36	7.0866	10.2362	1.614*
LL44	8.6614	12.5984	1.929*
L22	4.3307	7.0866	1.280*
L24	4.7244	7.4803	1.280*
L26	5.1181	7.8740	1.280*
L28	5.5118	8.6614	1.574*
L30	5.9055	8.5060	1.235*
L32	6.2992	9.4488	1.338
L34	6.6929	10.6299	1.815*
207	1.3780	2.8346	.669
209	1.7717	3.3465	.938*
212	2.3622	4.3307	.866
213	2.5591	4.7244	.905
214	2.7559	5.1181	1.023
215	2.9528	5.1181	1.181*
216	3.1496	5.5118	1.023
219	3.7402	6.6929	1.259
220	3.9353	7.0886	1.385*
222	4.3307	7.8740	1.771*
224	4.7244	8.4646	1.850*
228	5.5118	9.4488	2.007*
232	6.2992	10.1992	1.660
307	1.3780	3.1496	.826
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Russians Criticize Stalinist Air History

There can be no doubt that demonstration of our country's priority with regard to various inventions and advancements is of considerable importance. Motivated by the interests of scientific truth and noble patriotic impulses, Soviet historians have eliminated many fabrications which sought to deprecate the invaluable contributions of our country's inventors and scientists to Russian and world culture. However, there are also those "researchers" and men of letters who exploit the Soviet people's lively interest in the history of Russian science and technology and credit our country with discoveries and inventions which were actually made abroad.

The proof employed in such instances has nothing in common with authentic scientific research. In concocting fictitious priorities, such writers make false representations about the history of Russian and foreign science and technology and implant conceit. At the same time, these writers often display elementary technical ignorance. Occurrences of this type have become a real plague in our popular literature on aviation history and particularly with reference to literature regarding the famous Russian designer A. F. Mozhaisky.

First Airplane

The history of the remarkable creative work of A. F. Mozhaisky, who was the first person in the world to build an airplane that rose into the air carrying a man, did not receive proper attention in the pre-revolutionary press. There were brief reports about Mozhaisky's work in books written by Professors V. F. Naidenov and N. A. Yatsuk, in the "Military Encyclopedia," and elsewhere. Soviet authors—K. Veigelin, A. Rumyantsev, P. Duz, V. Popov and others—also wrote about A. F. Mozhaisky. However, the first flight by Mozhaisky's plane received hardly any attention in literature.

This, apparently, is explained by the fact that primary sources and authentic details of this event have not been found. In order to fill this void, N. A. Cheremnykh and I. F. Shipilov, the authors of the book "A. F. Mozhaisky—Creator of the World's First Airplane" (Military Publishing House, 1949), resorted to fabrication.

In their book (page 49 and further on) the date of the first flight by Mozhaisky's plane is given as "noon on July 20, 1882." The name of the mechanic who tested the plane is given as "Ivan Nikiforovich Golubyev." Yet it is apparent from such important sources as "Notes of the Russian Technical Society," the collected volume "100 Years of Aeronautics" edited by Academician M. A. Rykachev (1884), the "Military Encyclopedia" (1914) and other works that construction of Mozhaisky's plane had only begun by 1882 and that it was not finished until the end of 1883, by which time winter weather prevented tests from being carried on.

According to a comparison of indirect courses of information, the testing of A. F. Mozhaisky's plane took place in 1884. Just where did I. F. Shipilov and N. A. Cheremnykh get the date of July 20, 1882?

They timed the testing of the plane to coincide with "Saint Elijah's Day"—the pre-revolutionary holiday of Russian aeronauts. Then they collected the signatures of several inhabitants of Krasnoye Selo and Dudergof who were supposedly "eyewitnesses" of this event.

But a verifying investigation conducted by a special commission showed that the alleged "eye witnesses of the flight" actually saw no such tests: some of these "eye witnesses" were only two or three years old in 1882, while others had not even been born yet! Both the date and the name of the hero-mechanic who dared test the plane turned out to be fabrications.

N. A. Cheremnykh and I. F. Shipilov quote a speech allegedly delivered by Mozhaisky before the (first) flight. Actually this is not a speech by Mozhaisky but a re-phrased letter from Victor Hugo to the French aeronaut Felix Nadar and written early in 1864. Passages from this letter are printed in K. Veigelin's book "Notes on the History of Flying," published in 1940. I. F. Shipilov and N. A. Cheremnykh refer to a book by Pechkovsky which was published in 1882.

Mozhaisky's Models

This book includes several lines not about an airplane (as Shipilov and Cheremnykh suggest) but about Mozhaisky's models. The citation in parentheses quoted from this book by Shipilov and Cheremnykh is incorrect. The quotation from the speech by V. D. Spitsyn on November 9, 1883, is also distorted.

The speech said that Mozhaisky's flying machine "will be propelled with the aid of two steam engines." But Shipilov and Cheremnykh wrote: "is propelled" (putting it in the present tense).

Referring to the 1914 edition of the "Military Encyclopedia," Shipilov and Cheremnykh arbitrarily cut short a sentence taken from the encyclopedia, thereby omitting the years shown there for the flight. Shipilov and Cheremnykh wrote a special chapter titled "The Fate of the Second Airplane."

Yet all the documents known up to the present time show that A. F. Mozhaisky did not work out any plans for a second airplane. On page 64 (of the Shipilov-Cheremnykh book) it is indicated that "in his research Professor N. Ye. Zhukovsky fully confirmed all the conclusions made by A. F. Mozhaisky." Actually, N. Ye. Zhukovsky did not mention Mozhaisky in any of his works.

Wrights Not Involved

Further on, Shipilov and Cheremnykh say that the Frenchman Ader, the Englishmen Phillips and Maxim, and the Americans Langley and the Wright brothers tried to "reproduce" A. F. Mozhaisky's airplane.

In reality, the machines designed by these inventors had nothing in common with Mozhaisky's design plan. At the end of the same page, Shipilov and Cheremnykh assert that, "making use of A. F. Mozhaisky's experience, (foreign) inventors built biplanes. . . . This is how designs for the airplanes of Bleriot, Farman and the Voisin brothers came into being." But Mozhaisky's air-

Russian Claims

How accurate are Russian claims for "firsts" in aviation?

Not very, says this article translated from Voprosy Istorii, official Russian historical journal. Claims for the early work of Mozhaisky and Nesterov, among others, made by some of the USSR's leading aviation writers in high official positions, are exposed as fabrications from the whole cloth.

Not only popular articles, but textbooks and reference works were falsified during the Stalinist period to squelch any contradiction to the official line. Now that the political wheel has swung full circle—and perhaps through a little more than 360 degrees—the debunking of the claims has begun.

But history rewritten once may be rewritten again. It will be interesting to watch for the pendulum to swing back, and see whether there will be a second rewriting.

The article in Voprosy Istorii was written by Ye. Burche and I. Ye. Mosolov.

Where do you belong in

Computer Circuit Design Engineers plan electronic circuitry for advanced airborne analog and digital computers . . . design linear and pulse circuits employing transistors, tubes, magnetic devices. Opportunities also exist in airborne power supply design, or to develop new techniques for marginally checking computer performance. *Do you belong on this team?*

Computer Logical Design Engineers determine the systems outline of a computer and its inter-connection with external equipment. Close liaison is maintained with mathematical support, circuit design, packaging and test engineers. Computer speed, memory size, configuration and arithmetic structure are tailored to requirements of weapons systems. *Do you belong on this team?*

Systems Evaluation Engineers test and evaluate electronic analog and transistorized digital computer systems design for aircraft; evaluate new systems and improvements to insure compliance with specifications and Air Force requirements. Other assignments: tie-in testing of peripheral equipment, liaison with design, development and field engineering. *Do you belong on this team?*

Harry Branning (center): B.S.E.E. 1950, Syracuse. Design Engineer in circuit design, 1951; October, 1954, promoted to Associate Engineer; April, 1956, promoted to Staff Engineer, Systems Planning. In June, 1956, appointed Project Engineer and Manager of the 110 Computer Circuit Design Department; discussing the performance and packaging details of a transistorized read amplifier.

William Dunn (standing): M.E. 1950, M.S.E.E. 1952, Stevens Institute. Technical Engineer, 1955; April, 1956, promoted to Associate Engineer; August, 1956, transferred to Development Engineering in charge of Logical Design for digital computers in advanced weapons systems; here discussing Boolean Algebra method of optimizing the logical design of an airborne digital computer.

Eli Wood (left): B.S.E.E. 1950, Connecticut. IBM Customer Engineer, July, 1950; September, 1952, transferred to ACL Field Engineering. February, 1954, in charge of Field Engineering at Hunter AFB; May, 1955, Associate Engineer; appointed Project Engineer, Manager of Systems Evaluation in August, 1956; here investigating a problem in radar data presentation set evaluation testing.

The brief records of the men cited above indicate only a few of the exciting activities right now in IBM Military Products. This division, organized 18 months ago, has grown enormously. A small-company atmosphere prevails. Men work in small teams . . . individual contributions are instantly recognized. Promotions occur frequently.

As a member of IBM Military Products, you'll enjoy physical surroundings and equipment second to none. Educational programs at IBM expense lead to advanced degrees. Salaries and benefits are excellent. Stability is guaranteed by IBM's history of consistent achievement—underlined by the fact that the rate of turnover at IBM is only one-sixth the national average.

Throughout the length and breadth of the United States IBM has built modern plants and laboratories. This map points out the various locations where you might live as an IBM employee. IBM Military Products include the Airborne Computer Laboratories located in Owego, N. Y., and the Project SAGE installations directed from Kingston, New York.

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590 Madison Ave., New York 22, N. Y.

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IBM Military Products?

Systems Engineers oversee the engineering support provided by the Systems Coordination and Specification Group to the factory on the AN/ASB-4 Bombing-Navigational System. Air Force requirements are analyzed and the resulting engineering changes evaluated to determine effect on system performance and accuracy. Mathematical error analyses are run. *Do you belong on this team?*

Systems Analysts anticipate performance and recommend design criteria before and during development of equipment. Later, they compare dynamic performance accuracy and reliability characteristics with what has been anticipated. Other assignments include Digital Computer Systems Engineering, Input-Output and Analog-Digital Conversion Engineering. *Do you belong on this team?*

Quentin Marble (left): B.S.M.E. 1951, Syracuse. Joined IBM in 1951; promoted to Design Engineer in 1952; May, 1955, promoted to Associate Engineer, and then to Project Engineer, Manager of the Systems Coordination and Specification Group, Production Engineering Department, in February, 1956; shown here describing a unique cooling design to a new employee in his group.

Monroe Dickinson (left): B.S.E.E. 1952, W.P.I.; M.S.E.E. 1954, M.I.T. Technical Engineer in analog and alternate computer techniques for weapons systems, 1952; Associate Engineer responsible for systems design and analysis, 1954; December, 1955, Staff Engineer, responsible for research planning; here reviewing set-up on laboratory analog computer of a sampled data control problem.

Exceptional career opportunities are now open in IBM Military Products for E.E.'s, M.E.'s, physicists, and mathematicians, in the following fields:

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ELECTRONIC PACKAGING
PROGRAMMING
FIELD ENGINEERING
RELIABILITY
COMPONENTS
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Valve Talk

FOR WM. R. WHITTAKER CO., LTD.
BY MARVIN MILES

It was way back about 1932-33 when Rod Campbell, assistant to Barney Moss, Whittaker's vice-president engineering, designed his first aircraft unit, a hydraulic hand pump for a new Northrop airplane.

Rod had never done any aircraft work before, but he was a mechanical engineer — and a journeyman mechanic — of long experience and he figured he might as well give this new field a try.

The job was easy for Rod, as a matter of fact, and he came up with a lightweight pump that extended the flaps on the Northrop design in eight hand strokes to replace a heavy, cumbersome unit that required 125 hand-turned revolutions of a gear.

Now 65, Rod doesn't look a day over 50, with close-cropped gray hair, a small moustache, a healthy tan and dark eyes that take a quick interest in everything through a pair of half-rim glasses.

Rod Campbell
Asst. to Vice-President
Engineering

As a mechanical engineer, he has worked on everything from locomotives to watches, and as a success in his field he can tick off the names of scores of airplanes that flew — and many of them are still flying — with his valves aboard. Or he can point to more than 20 patents he holds and a book he has written, a treatise on aircraft hydraulic systems that was used by the Navy throughout World War II.

Rod's specialties are brake valves and pressure reducers, but his work has run the gamut of selectors, shut-off and mixing valves, shuttle types, cylinders of all kinds and automatic pressure regulators.

Born in Toledo, Ohio, he attended Toledo University for a year and a half before circumstances forced him into correspondence school work which he pursued with astounding vigor year after year, long after other students figured they were fully educated. At the same time he labored in any shop that could teach him anything, and became a journeyman mechanic as well as an engineer.

Rod's many years of experience started with the Kent-Owens Machine Co. and then the DeVilbis Manufacturing Co., both in Toledo. Coming West in 1928, he spent eight months in San Francisco before starting the Sharp Manufacturing Co. to turn out paint spray equipment in Los Angeles.

This venture continued for four years, then he took on various engineering assignments for such concerns as the Omega Shoe Polish Co. and the Research Products Co., and it was also in this period that he undertook the design of the Northrop pump. Its success led to his formation of the Rodney B. Campbell Co. for the production of aircraft valves, with Air Associates acting as his sales agency.

The company continued in business for four years; then, as Rod puts it: "I went broke because I over-extended in experimentation."

In 1937, with some associates, he founded the Aircraft Accessories Corp. and served as its chief engineer. His valve and systems designs went into such famed aircraft as the Lockheed Model 14, the Consolidated B-24 bomber and the Lockheed P-38 Lightning.

Rod withdrew from the Aircraft Accessories Corp. in 1942 and organized a hydraulic division for the Booth Manufacturing Co. to produce his emergency brake valve design for Boeing's B-29 Superfortress. In this period he also designed the hydraulic system for Ryan's Fireball fighter and the brake valve system for North American's B-45 jet bomber.

Booth subsequently went out of business, and Rod found himself designing brake valves and pressure reducers for Hanson-Lynn. Then, in June 1950, he contacted Bob Whittaker and was given the job of setting up a special hydraulic department for the Whittaker Co.

Rod had known Bob since 1941 when they rode horseback together from time to time, but in those days there was little business talk between the two men because they were competitors.

With Whittaker, Rod bounced up the line rapidly, including brief service as plant manager before he was made assistant to Chief Engineer Joe Globig, predecessor to Barney Moss. Today he shoulders much of the load for Barney, supervises the plant area, coordinates the laboratories and handles all patent matters for Whittaker.

In addition, he devotes some time each day to design work, with a full-time engineer to help develop his ideas.

Rod lives engineering and always will. The thrill of design and development is ever greater for him day by day.

But his first two loves are in a new home in the Glendale Hills — his wife, Jerry, and the apple of his eye, a three-year-old daughter, Robin Jeannine.

craft was a monoplane, and it was impossible to build biplanes modeled after it.

A second "corrected and supplemented" edition of the book on Mozhaisky by N. Cheremnykh and I. Shipilov came out in 1955. Some of the authors' fabrications are written up in more careful form in this edition, but new items of fiction are added.

O. S. Kostovich (who initiated the organization of the first Russian aeronautics society), Admiral N. M. Sokovnin and others are omitted from the list of Russian pioneers who conquered the air.

On page 27, the sketch of Mozhaisky's airplane, taken from the collected work "100 Years of Aeronautics," is pawned off as a (real) picture of Mozhaisky's model. On page 30 it is asserted that the design for (Mozhaisky's) plane was superior to all of the designs which had been suggested abroad. Nothing was said concerning the outstanding designs of Penaud and Tatin.

Wrong Date

On pages 67-71, in referring to an article by N. Myasoyedov, Shipilov and Cheremnykh declare that construction of A. F. Mozhaisky's airplane began in 1880 with Mozhaisky himself participating in the work. Actually, Mozhaisky was out of the country at this time. There is no reference to any of the sources which showed that construction of Mozhaisky's plane didn't begin until the summer of 1882.

In supporting the fictitious date of the first flight—July 20, 1882—reference is made to the meteorological "Chronicles of the Chief Physical Observatory," but nothing is said about the fact that since 1870 the Russian meteorological service dated its documents in accordance with the new style (calendar) and, therefore, the meteorological data for August 1 rather than July 20 should have been examined.

On that date (August 1) there was rainy weather, a thunderstorm and such a strong wind that it is senseless to talk about the world's first airplane test taking place.

On pages 77-78, the meaning of the citation from the archives' copy of "Medelkovsky's Memorandum" is corrupted, and the final part of the citation is omitted. The full text of this memorandum says that the (Mozhaisky) plane could not take off during the first tests.

This document is dated 1884, and there is nothing to give any indication that tests were conducted earlier. On page 78 there is a reference to a Russian translation of a book by Tissandier, in which mention is made of a flight by Mozhaisky's plane at a speed of 17 feet per second.

Shipilov and Cheremnykh assert without any basis that this refers not to a

Russian Navy Torpedo Bombers

FIRST PICTURE of Russian Tu-12 Bosun (above) confirms earlier details of its configuration; plane is used with Il-28 (below) by Red Navy as land-based torpedo bombers. First interior photograph of the the Il-28 (left) shows the navigator-bombardier. These planes are attached to a naval training squadron.

model but to the plane itself. On the same page, while noting that Mozhaisky's application for authorization to make the tests was postponed from 1881 to 1882, Shipilov and Cheremnykh are silent about the fact that the 1882 authorization was postponed to 1883 and then to 1884, after which it was not further postponed.

Attacks Made

In the second edition of their book, Shipilov and Cheremnykh make scandalous attacks against Academician B. N. Yuryev and engineer V. A. Popov and defame the "News of the USSR Academy of Sciences," the Great Soviet Encyclopedia and other publications in which the history of aviation is set forth correctly.

Authors who do not agree with the fabrications of Shipilov and Cheremnykh are regarded by the latter as belonging to an unstable strata of our intelligentsia. "Such people," write Shipilov and Cheremnykh, "provide sustenance for foreign intelligence activity." It is inconceivable how the Military Publishing House could allow such insults to be directed at Soviet patriots and honest scholars.

The story of the picture of A. F. Mozhaisky used by Shipilov and Cheremnykh is typical of the fabrications. In opening the first edition of the book on Mozhaisky you see a bearded individual wearing what seem to be crudely drawn-in admiral's epaulets. It is indicated under the picture that this is Aleksander Fedorovich Mozhaisky.

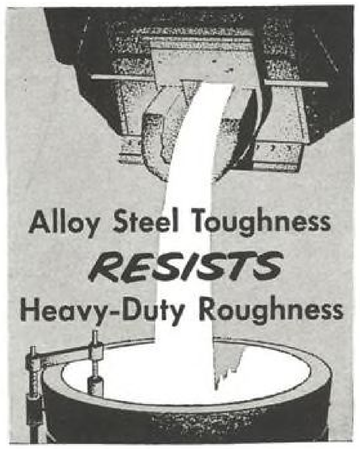
But an entirely different picture of A. F. Mozhaisky is found in the second edition of this book. It shows a strong, intelligent face trimmed with whiskers but without a beard. Why did the features of the inventor change in such a striking way? The fact of the matter is that in the 1949 edition authors Shipilov and Cheremnykh, being unable to find a picture of A. F. Mozhaisky, published the picture of his son, A. A. Mozhaisky, a deputy to the Fourth State Duma.

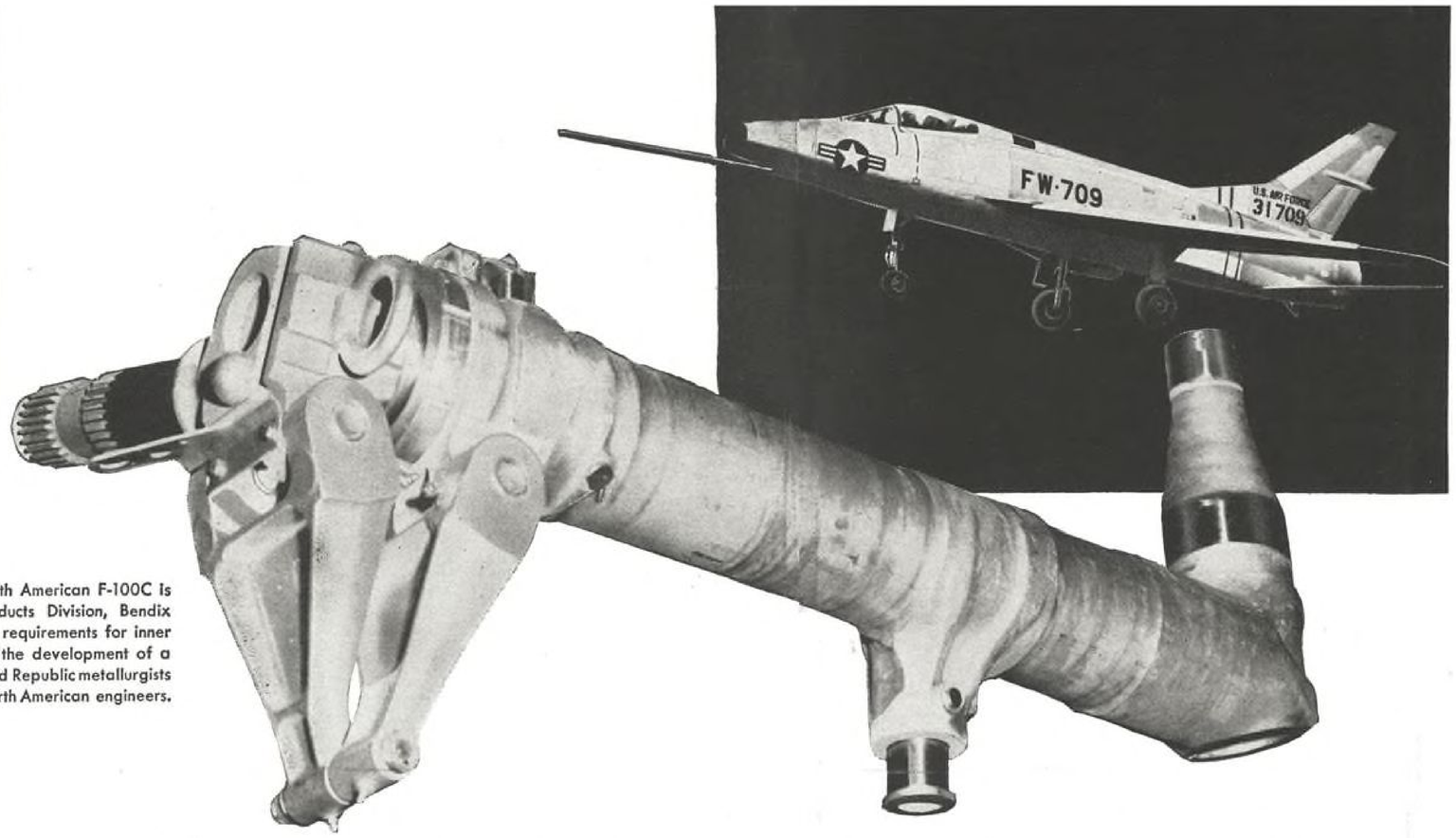
This picture (taken of the subject in civilian clothes) had appeared as an authentic picture of the inventor himself in articles written by Shipilov and Cheremnykh for a number of magazines and newspapers.

Soon after, an old inhabitant of the city of Vologda sent in a letter enclosing a page from the "Vologda Yearly Gubernia" for 1913 in which a picture and biography of A. A. Mozhaisky (the inventor's son) was published. Then Shipilov and Cheremnykh indulged in their second falsification. They made a print by reversing the previous negative and drew in epaulets on the picture, which now faced in the other direction. Behold the appearance of "Admiral" Mozhaisky (the airplane inventor)! It is this picture that was printed by N. A. Cheremnykh and I. F. Shipilov in the first edition of their book.

Many Fabrications

There are also many fabrications and scientific and technical errors in two editions of a brochure about Mozhaisky written by the self-same I. Shipilov. This brochure was put out by the Society for Dissemination of Political and Scientific Knowledge under the title "The Airplane—A Russian Invention." The following is written on page 8 of





Landing-gear strut for the North American F-100C is manufactured by Bendix Products Division, Bendix Aviation Corporation. Exacting requirements for inner and outer cylinders resulted in the development of a new grade of steel by Bendix and Republic metallurgists working in cooperation with North American engineers.

How Metallurgical Teamwork Developed the Super Sabre's Tough, Strong, Alloy Steel Landing Gear

When a new grade of steel is born, there's sure to be an interesting story behind it.

In this case, it's the story of close cooperation between metallurgical teams from Bendix and Republic. Their common goal: development of a tough, strong, alloy steel to withstand the shock, impact, strain and vibration of tons of aircraft hitting the runway at speeds in excess of 100 miles per hour.

It starts after World War II, when Bendix metallurgists undertook a program to correct certain characteristics and improve processing deficiencies of steels commonly used for aircraft landing gear.

Several leading steel companies, including Republic, were consulted and the program outlined. Republic immediately put its 3-Dimension Metallurgical Service Team on the problem.

The field metallurgist worked closely with Bendix metallurgists and engineers right in their own plant under actual operating conditions. Their findings were supplemented and coordinated by the other two members of the Republic team—the laboratory and mill metallurgists.

The result: development of a new grade of steel that was found ideal for application in the strength range of 220,000-240,000 psi. This steel, designated AMS 6427 by the SAE, offers maximum resistance to fatigue. Provides an exceptionally high strength-to-weight ratio. Maintains its great strength at wide temperature extremes. Responds uniformly to heat-treatment, producing hard, wear-resistant surfaces around tough cores.

Are you sure you are using the right steel? Why not make sure by using Republic's 3-D Metallurgical Service to assist you in a check-up? It's confidential. There's no obligation. Just send us the coupon.

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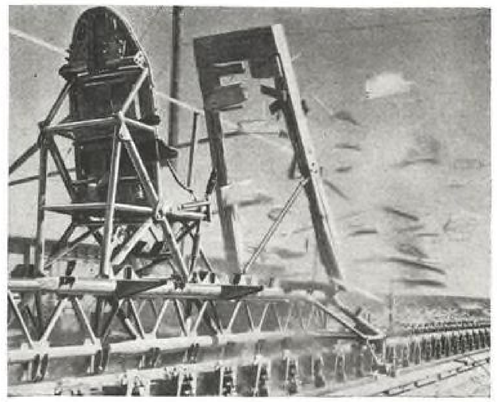

WHERE STRENGTH IS AN IMPORTANT REQUIREMENT—such as this rocket sled for deceleration tests—manufacturers choose tubing for basic construction. At any given weight, tubing is strongest of all mechanical shapes . . . as a beam . . . in torsion . . . under compressive loads. Republic ELECTRUNITE® Steel Mechanical Tubing, the original electric resistance welded tube is well known for quality and performance. It's available in carbon and stainless steel in a wide variety of sizes, shapes and gages. Send coupon for more facts.

HIGH STRENGTH AND LIGHTWEIGHT ADVANTAGES of Republic Titanium are adding range, speed and maneuverability to both military and commercial aircraft. In the Navy's HOK-1, sections fabricated from Republic Titanium, Type RS-70 Annealed are used as the firewall between pilot and engine compartments. But, titanium should not be looked upon as strictly an aircraft or military metal. Its extremely high resistance to most forms of corrosion makes it attractive for use in processing and chemical equipment, heat exchangers, dehydration trays, anodizing racks, etc. Mail coupon for more information.

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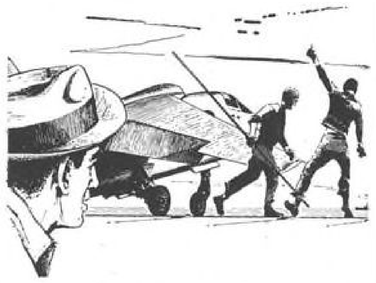

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Senior Surfaces Design Engineer. To create production design of wing, tail and control surfaces for missiles and fighter aircraft. Engineering degree and four years design experience.

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Designer for Pilot Escape System. Requires Engineering degree and at least three years work with pilot escape mechanisms, plus other related practical design experience.

To arrange for a personal interview, or for a prompt, confidential report on these openings, write to:

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Dept. A-2

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Firebird

Navy's Ryan KDA (USAF Q-2A) Firebird is suspended from external stores pylon of Navy P2V mother ship. The 1,800 lb. Firebird is capable of a speed of Mach 0.9 and a range of 770 mi. Powerplant is a Fairchild J44-R-20 turbojet developing 1,000 lb. thrust at sea level.

the first edition of the brochure: "Relying on the research of the great Russian scholars Lomonosov and Mendeleyev and of Kryakutny, the creator of the world's first balloon, Mozhaisky undertook solution of the problem of building a heavier-than-air apparatus."

But how is it possible to place Lomonosov and Mendeleyev alongside the clerk from Ryazan (Kryakutny), whose very existence has been placed in doubt by leading scholars! Just how is it possible to build an airplane by drawing from experience obtained in making a balloon?

Two-Cylinder Engine

On page 21 of the first edition it is alleged that in 1879 Mozhaisky designed and built a two-cylinder internal combustion engine. To support this statement, a distorted quotation from references made by the chief mechanical engineer of the Navy is cited. Actually the document that is quoted makes reference not to Mozhaisky's engine but to one built by Brighton. Mozhaisky only looked into the problem of using such an engine in an airplane.

At the end of the brochure, on page 28, it is alleged that Mozhaisky's steam engines were in every way more advanced than the internal combustion engine developed 20 years later by the Wright brothers. This is completely contrary to the facts.

In the collected works of the Military Publishing House titled "For the Honor of the Fatherland's Science and Technology" (published in 1948 and compiled by B. Simakov and I. Shipilov) it is asserted that the famous Russian designer A. F. Mozhaisky conceived the idea of warping airplane wings and invented ailerons (rudders for lateral stability). Actually Mozhaisky didn't invent either wing warping or ailerons.

In the collected works it is alleged that the patent issued to A. F. Mozhaisky in 1881 was the world's first for an airplane, whereas the Englishman Henson and some of his countrymen received such a patent as early as 1842.

In an article written by I. F. Shipilov in the No. 3, 1952, issue of the "Air Force Journal," it is reported that Mozhaisky's airplane "repeatedly" rose into the air between 1882 and 1886, and that it flew at a speed of 17 feet per second.

Actually the old publications cited to support these statements referred to a model plane since no aircraft can take off at a speed of about 15 kilometers per hour.

The article says that the planes of Maxim and Ader "could not and did not rise into the air," although their takeoffs were officially established: the first in 1894 and the second in 1897.

Errors and Distortions

Many errors and distortions were also tolerated in I. F. Shipilov's brochure titled "The Outstanding Russian Aviator P. N. Nesterov" (Military Publishing House, 1952). On page 8 of the brochure it is asserted that Nesterov developed plans for a fighter plane.

But even the idea of fighter aircraft didn't exist at that time. The design of Nesterov's plane differed from other designs as the result of a new control arrangement (there were no vertical rudders).

On the very same page it says that thanks to Nesterov Russian flyers were the first to master such figures as the "combat turn and the wing-over." Nesterov didn't make such figures and could not make them in the airplane which he flew in 1913.

On page 50, the possible flight trajectories worked out by N. Zhukovsky are

A Vought Vignette
FIRST IN A NEW SERIES

The Aircraft Designer Who Went to Sea . . .

IT WAS A ROUTINE CRUISE for the *Bon Homme Richard*. But for Wayne Burch, it was a memorable climax to months of hard work. Aboard the carrier with the Chance Vought design specialist was the white-lacquered fighter he'd worked on so long.

★

Wayne had joined the Crusader dayfighter project in Preliminary Design, on alighting and arresting gear. He'd transposed his initial drawings into detail design and, later, he'd watched his gear pass jig and aircraft drop tests. At the Navy Test Center, the Crusader's gear absorbed maximum sink speeds and arresting tension, and Burch once more was there.

★

Now, Navy pilots on the *Bon Homme Richard* were taking the Crusader to sea, and Burch was going along. This time his assignment was simply to watch, and this time the Crusader was to be just part of the picture. Vought wanted him to experience carrier life and to see how his new weapon fitted in. For Wayne, whose sea log began and ended with one day's fishing from a 20-foot launch, it promised to be an eye-opening voyage.

For six days the designer shared quarters with Navy fighter pilots and had coffee with maintenance men. He studied aircraft spotting and catapulting, and he learned the sign language of the LSO (Landing Signal Officer). He marveled at the fingersnap timing of the Navy's deck handlers and at the *Bon Homme Richard's* mid-voyage refueling of two bobbing destroyers.

★

Wayne calls it "one of the most enjoyable weeks of my life" . . . and, as other sea-going Vought engineers have discovered, "one of the most profitable, too.

"Now I know the pilot's job, what maintenance wants . . . how really big the operation is.

"It's something you don't get if you stick too close to design.

"I guess you'd call it *perspective*."

At Chance Vought the designer stays in touch with his product . . . Contact begins in development, extends through test and includes, when possible, a study by the designer of the tactical environment in which his weapon will serve.

CHANCE VOUGHT AIRCRAFT
INCORPORATED · DALLAS, TEXAS

presented as if they had already been accomplished.

On page 71, the caption beneath the drawing says that the sketch depicts a plane of Nesterov's own design, when, as a matter of fact, this is a "Nieuport" on which Nesterov only made alterations in the tail assembly.

One page 68, the ideas on which the plans for Nesterov's plane are based are described in completely erroneous fashion.

On the same page it says that "in his (Nesterov's) glider flights he verified the correctness of his design concepts for building an airplane." But Nesterov's glider was a biplane, while the airplane was a monoplane!

The glider was of the "balancing" type and didn't have rudders, while the main feature of Nesterov's airplane project was its original system of control (steering)—without a vertical fin and turning rudder and wath a variable wing angle.

Spin Danger

On page 90 it says that "the danger of coming out of a spin was decreased considerably," whereas the danger lay not in coming out of the spin but in being unable to come out of the spin. It was the latter situation that resulted in the death of many pilots.

Pioneer

Santa Monica, Calif.—A woman pioneer in the aircraft industry has ended a career with the Douglas Aircraft company that began 36 years ago.

Mrs. St. Clair, 69, was the first woman employe of the Douglas company in 1920.

An expert in fabric covering, her career began with the wooden "Cloudster", first airplane produced by Douglas, and extended to the ultra-modern DC-8 jet airliner, latest in the Douglas series of commercial transports.

Her total years in airplane manufacturing are believed to surpass those of any other woman in the nation.

On this very same page it is said that priority in performing the "Immelmann" turn belongs to Russian flyers. In later articles Shipilov comes right out and asserts that Nesterov performed this figure for the first time. He even went so far as to rename the figure itself the "Nesterov half-loop."

Actually, this figure was first executed by the German flyer Immelmann in the middle of the first World War when Nesterov was no longer alive. Furthermore, it was absolutely impossible to execute this figure in a "Nieuport-4," the plane Nesterov flew.

On page 93 it says that the famous Russian flyer Ye. N. Kruten demanded that fighter groups be composed of monoplanes exclusively. Kruten's pamphlet did not say this. Instead it referred to "monoplace" aircraft, which, in French, means "single seat."

On page 115 it is said that on May 15, 1942, "for the first time in the world," a jet plane designed by V. F. Bolkhovitinov and equipped with a liquid jet engine rose into the air. It is known that experiments with such an engine were carried on in our country as early as 1934 by a specially-constituted Group for the Study of Jet Propulsion (GIRD), and that in 1940 pilot V. P. Federov successfully flew in a plane designed by S. P. Korolev which had a liquid jet engine. This was before the Caproni-Campini flights in Italy in 1940 and considerably before G. Bakhchivandzhi's flight in the plane designed by V. F. Bolkhovitinov.

German Uniform Used

In I. F. Shipilov's pamphlet on P. N. Nesterov, published in 1951 by the Society for Dissemination of Political and Scientific Knowledge, a picture is printed of this pioneer flyer (Nesterov) which bears no resemblance at all to the original. Besides that, in redrawing the picture from a photograph, the artist reclothed Nesterov in a German uniform of the first World War period—

SAC

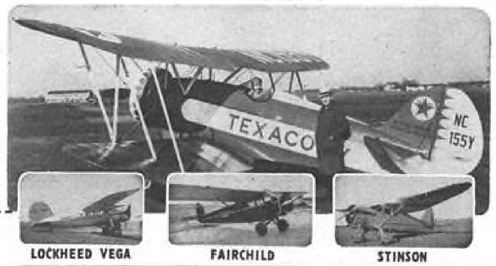
Silver Jubilee Newsreel

by JACK PATTON

Men, Moxey & Machines

Old Friends .. New Concepts

A salute to three old friends: Hal Henning (cockpit), Maj. W. F. Long (standing), and The Texas Company! Henning flew this Texaco Waco when, in late '33, he joined Doc Booth as partner. Today, SAC—Booth-Henning's offspring—and Texaco still are close co-workers in business aviation. Bill Long is our good neighbor, and Hal Henning is the much-admired chief of GMC air transport ops, Detroit.



LOCKHEED VEGA FAIRCHILD STINSON

New Friends .. Old Traditions

Booth-Henning began the SAC tradition of versatility in top-quality service for anything with wings, such as the early business planes seen above. For business flying, the military, and the airlines, quality and versatility remain synonomous with Southwest Airmotive. Here's a typical modern ramp scene.

1932 A QUARTER CENTURY OF LEADERSHIP 1957

Southwest Airmotive Co.

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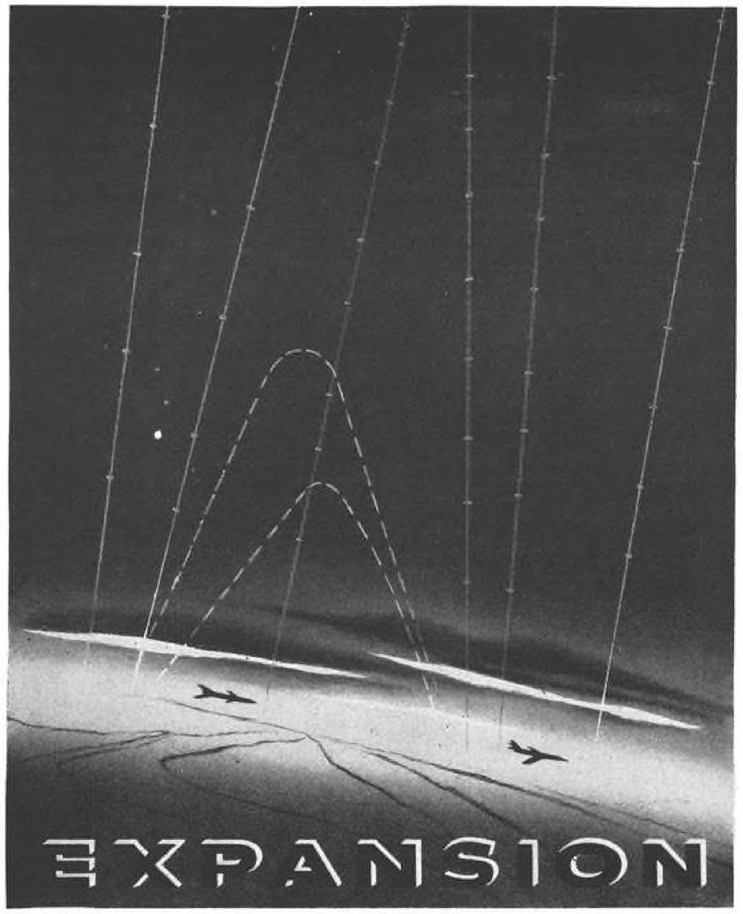

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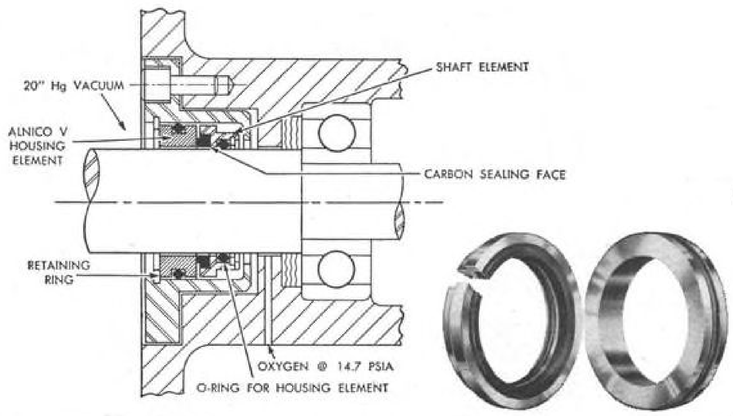

Fig. 1 — Magnetic shaft seal isolates pure oxygen at atmospheric pressure from 20" Hg. vacuum. Eliminates explosion hazard — no lubricant is required.

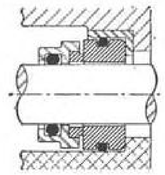

Fig. 3 – LOW PRESSURE MAGNETIC SEAL

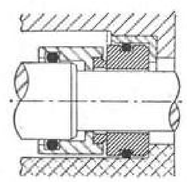

Fig. 4 – HIGH PRESSURE MAGNETIC SEAL

Effective Sealing of Oxygen Against Vacuum Accomplished by Magnetics

Gas leakage eliminated, despite extreme pressure differential — 20" Hg to 14.7 psia.

by **E. A. Steeves**

Isolating gas at atmospheric pressure from a high vacuum is a problem which puts a shaft seal to ultimate test. It calls for the highest degree of reliability over long operating periods.

Similar, though usually less critical problems arise in handling gases of all kinds. The small, penetrative molecular structure of all gases render most types of seals ineffective after very short operating periods.

By applying magnetics to this problem, designers have come up with an effective solution *(Fig. 1)*. Magnetic attraction between shaft element and housing element, evenly distributed around the circumference, provides even sealing force, immediate effective sealing, and prolonged life as the seal "wears in".

Operating Principle (Fig. 2)

A magnetized ring of Alnico V, with an O-ring gasket on its outer surface, is inserted in the housing. Another ring is mounted on the shaft and held firmly against the Alnico element by magnetic force. A carbon ring in the face of the shaft element contacts the lapped surface of the magnet and forms a permanent, self-adjusting face seal.

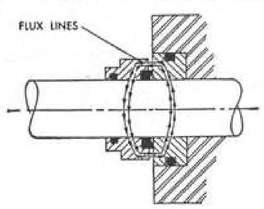

Fig. 2 — Operating principle.

An O-ring mounted inside the shaft element prevents the confined fluid or gas from escaping along the shaft. The O-ring on the magnetic element keeps the fluid from leaking out the housing.

Standard Magnetic Seals Available

Standard magnetic shaft seals are available to seal liquids or gases at high or low pressure differentials across the seal. Shaft diameters up to 2½" can be accommodated by low pressure model #10 *(Fig. 3)* and high pressure model #20 *(Fig. 4)*. There is also a standard model, number 30, for shafts over 2½".

Advantages of Magnetic Shaft Seals

Reliable, effective sealing is characteristic of the magnetic shaft seal. One of the elements of the seal is permanent magnet, so the sealing force is "built-in". No springs or screws are required . . . the sealing force is evenly distributed over the faces of the seal. There's no face leakage initially, and the seal "wears in" over its entire life . . . in many cases longer than the life of the shaft.

It is more compact in design and lighter in weight than any conventional seal.

The carbon sealing face is self-lubricating — runs cool and wears slowly.

Typical Application of Magnetic Shaft Seal (Fig. 1)

Leiman Bros., Inc., of Newark, N.J., manufacturers of air pumps, were requested to build a pump with pure oxygen at atmospheric pressure on one side and 20" Hg vacuum on the other side. The shaft sealing problem called for dry contact between shaft, seal and housing owing to the possibility of explosion that use of a lubricant would present.

No conventional seal could be found that would function in this critical application without leakage.

However, a magnetic seal was designed that proved to be the ideal solution. It formed a reliable seal for 500-hour operating periods. There was no need for lubricant since the carbon face is self-lubricating. The successful design also embodied a cartridge so that the seal could be applied to pumps that were already in use in the field.

Magnetic Shaft Seal Specification

	Outside	Inside
Fluid or Gas		Oxygen
Pressure (max.)	20" Hg. Vac.	14.7 psia
Temp °F (max.)	250	
Shaft Dia. (in.)	1	
Material	Steel-SAE 4140	

Additional Technical Information is Available.

Send for complete brochure on magnetic shaft seal.

magnetic seal corp.

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BARRINGTON, R.I.

with two cockades on his cap, the single-headed Prussian eagle on his chest, and a single-breasted jacket without breast pockets and a stand-up collar!

The reader also finds many ignorant statements in the reference book "Dates in the History of the Fatherland's Aviation and Aeronautics" published by the Voluntary Society for Cooperation With the Armed Forces in 1953 (author—L. Shesterikova, editor—T. Kozhevnikova). Such a book has been needed for a long time. But it came out with a multitude of errors and omissions and, at the same time, has no source references, which are indispensable for a reference publication of this type.

Lomonosov Myth

We will cite several examples. On page 9 it says that "the source of development of modern jet engines stemmed from the 'Rocket Institute' established in Moscow in 1680."(!). Farther down the same page it asserts that "the propeller blades on the helicopter model invented by M. V. Lomonosov were similar in form to the blades of ventilating machines used in mines." Page 11 even shows a drawing of Lomonosov's model. Yet the design of Lomonosov's model has, in fact, not been found up to the present time.

The drawing is a fantasy created by a modern-day artist. The text says that Lomonosov built and tested this model on June 12, 1754. Overlooking the fact that the model could not have been built and tested on one and the same day, the date itself is not correct. The demonstration was in July, not in June.

On page 22, where reference is made to M. T. Lavrentyev's flight to an altitude of 6000 meters, the most important point is omitted. At this height the balloon burst due to expansion of the gas. But Lavrentyev was able to descend safely, using pieces of the balloon's bag as a parachute.

French First

On the same page it says that in 1876 A. F. Mozhaisky was the first person in the world to make an ascent in a kite. Actually, Mozhaisky began his ascents in a kite-glider in 1873. But this was done in France still earlier, in 1857, by Le Bris.

On page 24 there is no mention of Lavrentyev's very interesting flights over the sea in 1879 or of A. F. Mozhaisky's presentation of an application for issuance of a patent on his airplane. It is asserted that the first flight by the Wright brothers in 1903 lasted two seconds when, as a matter of fact, the first flight lasted 16 seconds and on later flights the very same day the endurance reached 59 seconds.

The reference book passes over the fact that Mozhaisky's models were dem-

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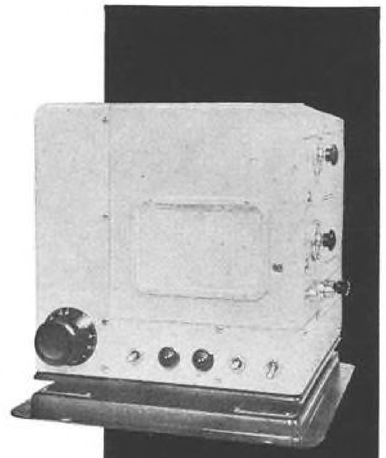

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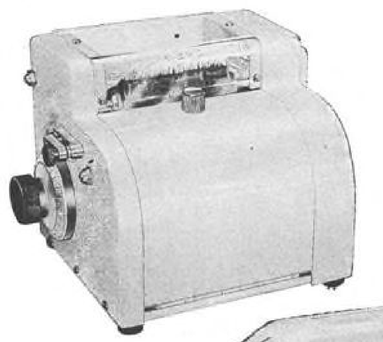
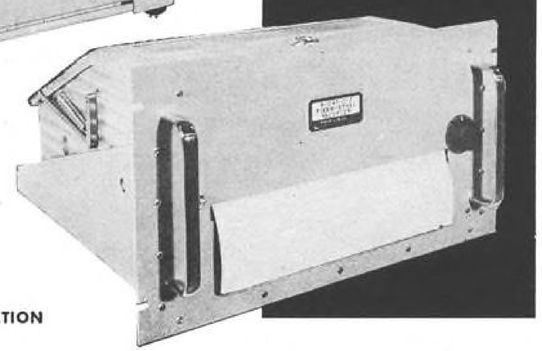


MODEL R1021-D [5-INCH]

MODEL R1021-1B [5-INCH]

MODEL R-1047-10 [12-INCH]



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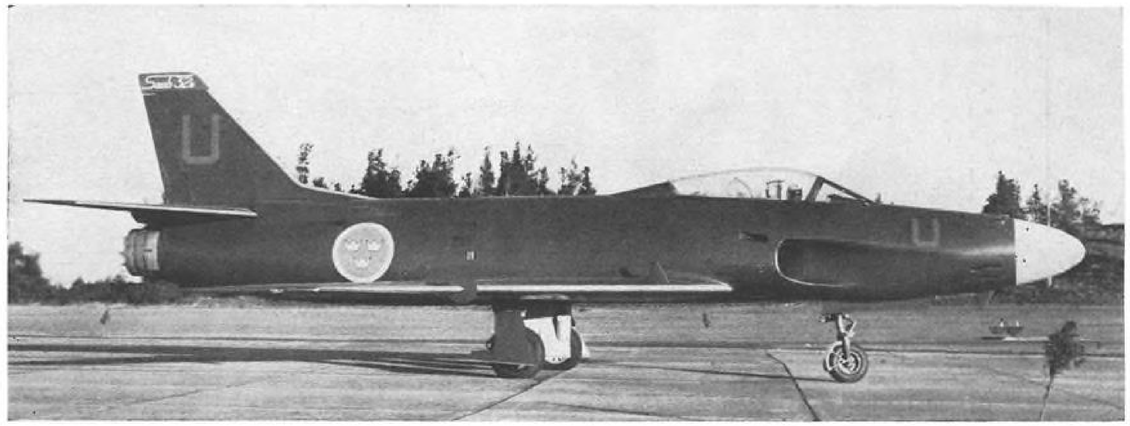


Latest Lansen

Sweden's J 32B Lansen interceptor is latest version of two-seater all-weather designs. J 32A was attack version and is in service and production. Three major changes mark the 32B design: late-model Rolls-Royce Avon produced under license in Sweden with afterburner designed and developed by Royal Swedish Air Board and Svenska Flygmotor; new and powerful armament for night-fighting; new navigation and fire control equipment. Lansen is built by Saab Aircraft Company, makers of the double-delta wing J 35 interceptor.

onstrated in 1883 in the Russian Technical Society. This omission was apparently made because this fact refutes the possibility of an airplane flight (by Mozhaisky) in 1882.

On page 28 the date is incorrectly given for the first free flight of Russian military aeronauts. The start of K. E. Tsiolkovsky's work in the field of aeronautics is dated two years earlier than it should be. Mention of A. Ewald's experiments with models equipped with rocket engines is omitted.

Skis Tested

The reference book asserts that in 1913 "for the first time in the world," N. Lobanov's skis were tested for airplane takeoffs from snow. Yet as early as 1909 the Russian inventor Yu. Kremp took off from the snow on skis, and in 1910-1911 takeoffs on skis were made at the Sevastopol Aviation School.

On page 77 nothing is said about organization of the Moscow Aviation School—the main training center for Soviet aviation cadets—or about the very important experimental flights made by Professor V. P. Vetchinkin. Nothing is said about the organization in March 1918, of the first detachment of Soviet "Muromets" war planes.

On page 92 all of the figures regarding the first airline between Moscow and Nizhni Novgorod are incorrect. Omitted are such facts as the opening of the Aerial Gunnery and Bombing School and the testing of the first Soviet twin-engine plane—the "Khioni-4."

Enumeration of the omissions, errors and inaccuracies in "Dates in the History of the Fatherland's Aviation and Aeronautics" could be continued. They appear on almost every page. But what has been mentioned is sufficient to realize that this reference book can only lead the reader astray.

Unfortunately, our press not only has failed to notice all these errors but has heaped lavish praise on the above-mentioned books. Ye. Andreyev, editor of the book written by Shipilov and Cheremnykh (second edition), published a laudatory review about it in the magazine "Tekhnika Molodezhi" (Technics for Youth) although he, along with the authors, bears the responsibility for its errors.

"Vestnik Vozdushnovo Flota" (Air Force Journal); "Krylya Rodiny" (Wings of the Fatherland), which is the magazine of the Voluntary Society for Cooperation With the Armed Forces; and the newspaper "Red Star" (official organ of the USSR Ministry of Defense) refused to publish a critical review of the Shipilov-Cheremnykh book.

This critical review was written by members of the Section for Propagandizing the History of Aviation and Aeronautics.

Not Criticized

Not one of the books listed above was subjected to criticism in the press. This led to a situation where the mistakes made by Shipilov, Cheremnykh and Shesterikova are being repeated in other publications.

Thus, for example, most of the errors in the Aeroflot "Desk Calendar" for 1954 repeat the errors in Shesterikova's book "Dates in the History of the Fatherland's Aviation and Aeronautics."

G. Lipovan's book "Trayan Vuiya," published in 1956 in Rumania, sets forth the history of Mozhaisky's airplane as Cheremnykh and Shipilov have told it.

The fabrications which Cheremnykh and Shipilov put in circulation have been repeated in 1956 by the authors of many other articles and books, even including school textbooks on physics.

Just why are such depraved books not criticized in the press? It is because the authors of these books work on the editorial boards of aviation publications. I. Shipilov is the assistant editor of "Air Force Journal" and is a member of the editorial board of the magazine "Wings of the Fatherland." His co-author B. Simakov, is editor of "Wings of the Fatherland." N. Cheremnykh is chief of the editorial-publishing department of the Air Force.

Taking advantage of their official positions, these people support each other; they see to it that each other's books get laudatory reviews; and they bar publication of critical articles and works by other authors.

It is necessary to terminate this monopoly, to increase the public's role in discussing manuscripts and reviews being prepared for publication, to fight against all kinds of falsifications and fabrications, and to produce good books on aviation history.

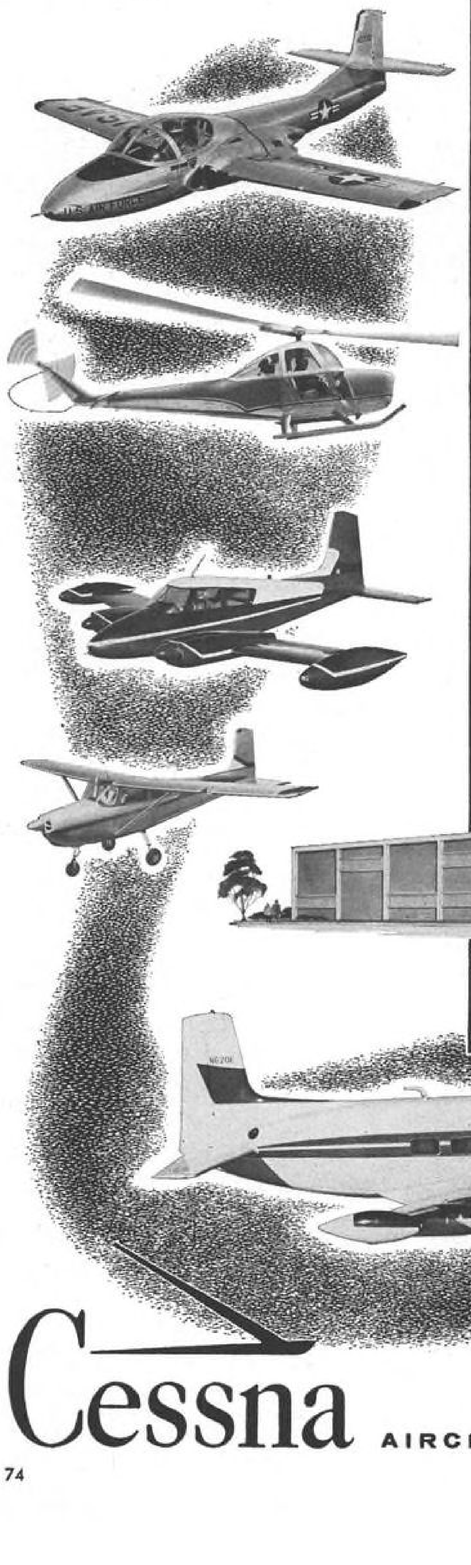
Republic Contracts for Wind Tunnel Facility

Farmingdale, N. Y.—Republic Aviation has signed a contract for the design of a new million-dollar wind tunnel facility to aid in designing aircraft.

Mundy I. Peale, president of Republic, said that the design contract with Burns and Roe, Inc., New York Engineering and construction firm, amounts to approximately $200,000.

He said it calls for detail design and

engineers:



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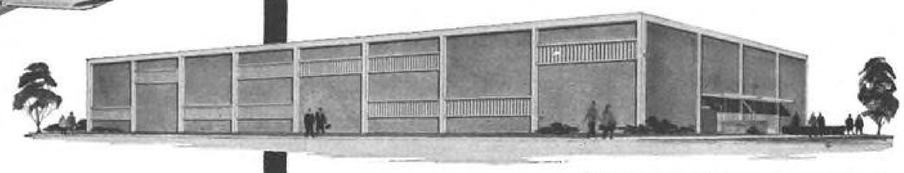

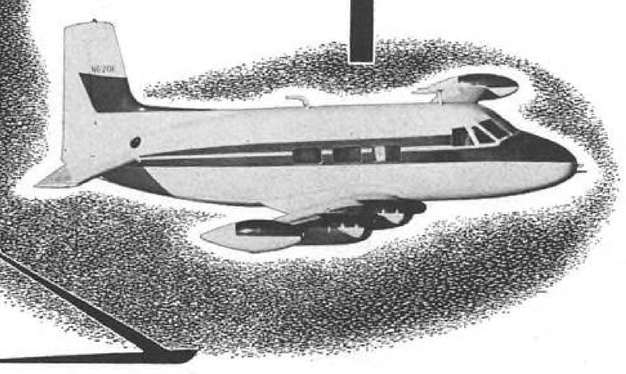

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Plastic Bag Lift

Removal operation of American Airlines DC-6B which sank through deteriorated concrete at Pueblo Airport was aided by plastic bags flown from the Denver Naval Air Station. Bags were inflated under wings to lift wheels from bog.

supervision of construction of two tunnels, in one of which models of proposed aircraft can be tested at Mach 4, or four times the speed of sound which is 760 mph. at sea level.

The tunnel facility will be housed in a building 72 ft. by 82 ft. at the company's main plant in Farmingdale. There will be two tunnels of the intermittent blow-down type, one transonic and the other supersonic. They will be housed in the one building.

The supersonic tunnel will permit Republic scientists to experiment with aircraft in flight at speeds up to Mach 4. The transonic tunnel will be capable of testing models at Mach .85 to 1.4. The facility will be designed so that the capacity of either tunnel can be expanded readily.

Red Air Force Training Schools Accused of Instruction Deficiencies

Russia has charged that several of its air force training institutes are failing to give their students well-rounded instruction. Even worse, Soviet military chiefs complain, is the lack of initiative often apparent in young officers who have just left an "overly-protective" flying school environment.

According to Red Star, official organ of the USSR Ministry of Defense, some air force training school commanders "erroneously believe they have fulfilled their responsibility by teaching the students aeronautical theory. They seem to think their graduates will get all the practical flight training they need after assignment to an air force unit."

As a result of this attitude, the paper explained, newly-commissioned flight officers can glibly tell all about the location and design of various aircraft and engine parts and components. "But when it comes to actual flying, they don't do well."

Red Star said that an entire student flying group of the Kachinsk Aviation Institute found itself in just such an "unenviable" position.

"The students in the group were well qualified with regard to their knowledge of an aircraft's physical parts. They also understood flight theory. Yet they made a poor showing when it came to elementary problems of aerodynamics and operation of equipment in the air and on the ground.

"Of course, theoretical studies must be given an important place in the program for training future pilots, navigators and aviation specialists. But practical flying instruction and training in the use of armament and instruments under varying combat conditions must be provided."

There have been times, Red Star declared, when certain flying groups have failed to pay necessary attention to tactical training. Consequently, during flying instruction the students often act in a stereotyped fashion.

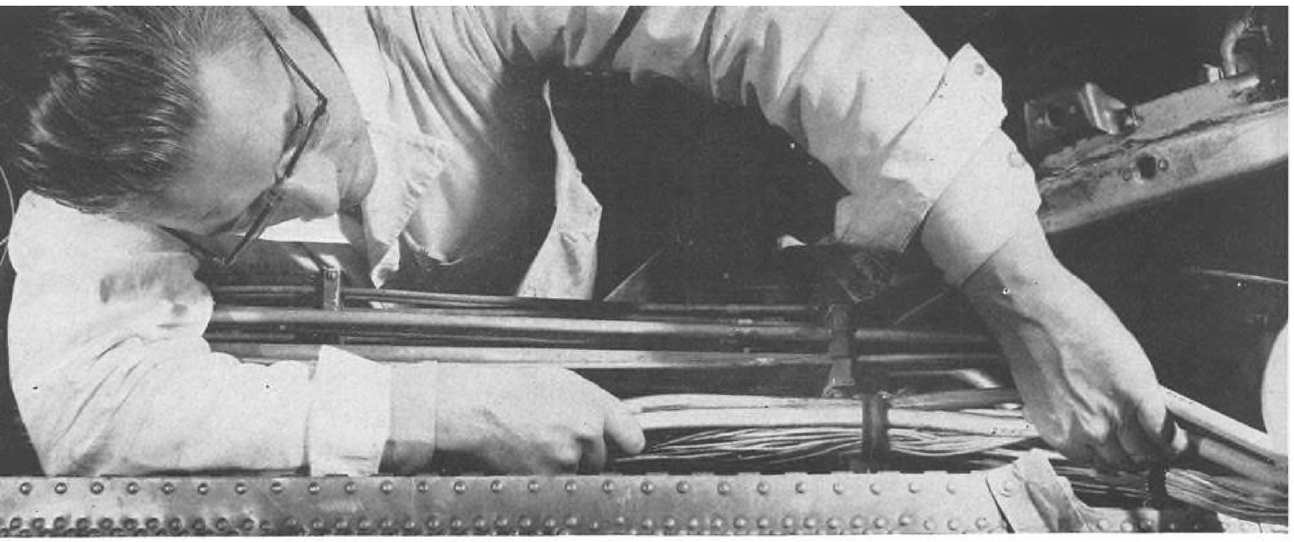
They are not always able to evaluate correctly a situation that develops in the air and therefore, can't make a proper decision.

"Blame for this serious deficiency in student training must be borne primarily by the flight and tactics instructors. Not all of these instructors are concerned about incalculating in their students such qualities as independence and initiative in choosing tactical procedures.

"They don't emphasize the need for daring and tenacity in carrying out various decisions.

"It has been shown that some instructors teach their students without taking into consideration the enormous changes which have been made in combat methods during recent years by military developments in general and aviation technology in particular."

Red Star demanded that students get more training during winter months, especially under difficult weather conditions. It called on training squadron



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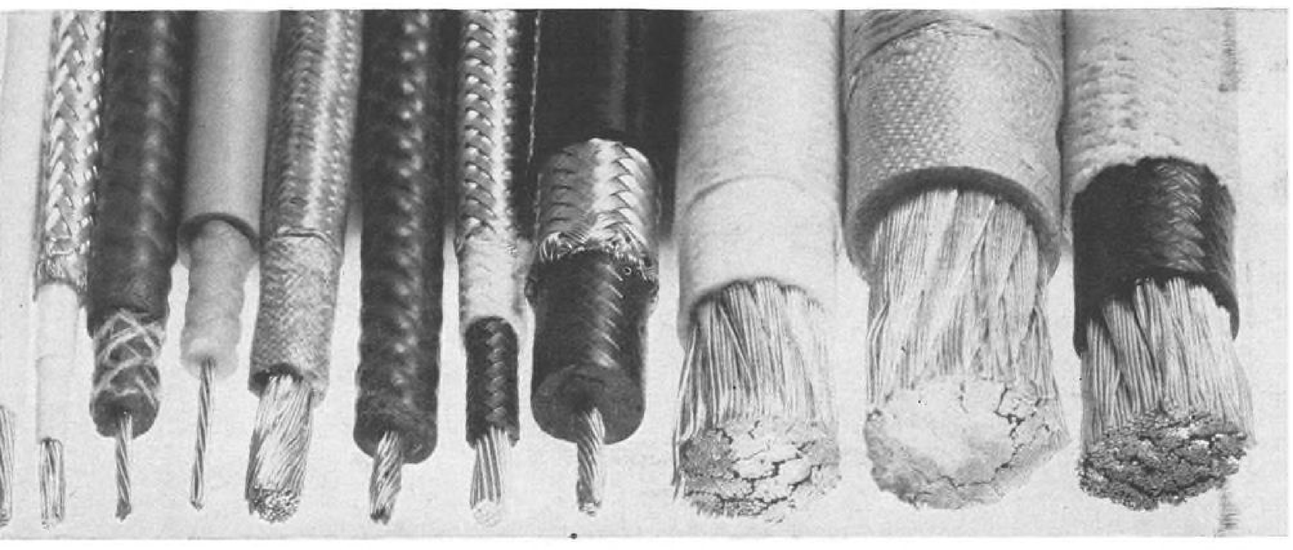

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commanders to stop being "needlessly over-cautious" and "excessively-protective" of their students.

"Such a tendency also deprives trainees of initiative. There have been instances where student pilots, even at the end of their instruction, were not allowed to make a single takeoff or landing without prompting from the flight leader."

Miles M.100 May Fit Army Support Role

London—U. S. Army has expressed interest in a new jet trainer designed by F. G. Miles Ltd. which is due for its first flight at Shoreham airport early in March.

Army officials say the M.100 Student (AW Aug. 29, 1955, p. 25) might fill an Army requirement for a ground-support aircraft.

First prototype of the jet trainer, which is designed for either one or two jet engines mounted aft of the pilot, will be equipped with a single Turbomeca Marbore. The second prototype will have either a Marbore or two Palouste engines.

Third prototype is to have a lightweight Rolls-Royce engine now under development which would increase its performance by 100 mph.

Initial cost of $36,400 including engine is half that of Britain's only other basic jet trainer, according to Miles.

The cost figure is based on a production of 200 aircraft.

Delivery could begin within 18 months of placing an order, it is estimated.

Sperry Starts New Armament Divisions

Lake Success, N. Y.—Sperry Gyroscope Co. will establish two new divisions—Air Armament Division and Surface Armament Division.

New divisions will conduct engineering and manufacturing activities at Sperry's Lake Success plant, with supplementary facilities being scattered over Long Island and other sections of the country.

Samuel Agabian, former works manager, was named manager of the Air Armament Division and Myron D. Lockwood, former engineering director of surface systems, was named manager of the Surface Armament Division.

Guided missile projects will be among the development and production assignments of the new groups.

Critical Air Report Studied by Ministry

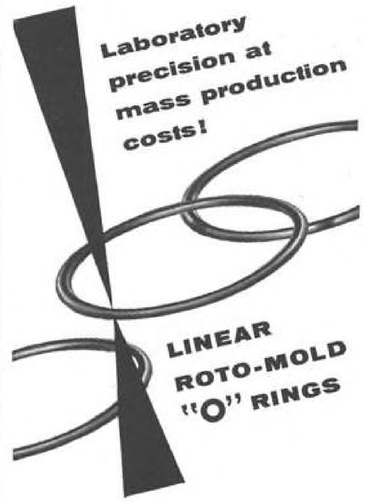
London—Parliamentary report severely criticizing government methods of military aircraft procurement is being closely studied at Britain's Ministry of Supply.

That information was given to the House of Commons by Supply Minister Aubrey Jones, who indicated he may have a later statement to make on the subject.

Jones had been pressed from the back benches to explain what action he is taking to implement recommendations of the House Select Committee on Estimates, which called for a complete overhaul of government procurement

New Marine Copter

First of new U. S. Marine Corps HUS helicopters, development of Sikorsky S-58, is scheduled for flight delivery to Marine Corps Air Facility at Santa Ana, Calif. Copter is 12-passenger aircraft capable of hauling two-ton payload, is powered by Lycoming-built Wright R-1820. It has automatic stabilization, cabin usable for troops or supply, rescue hoist and external cargo sling.



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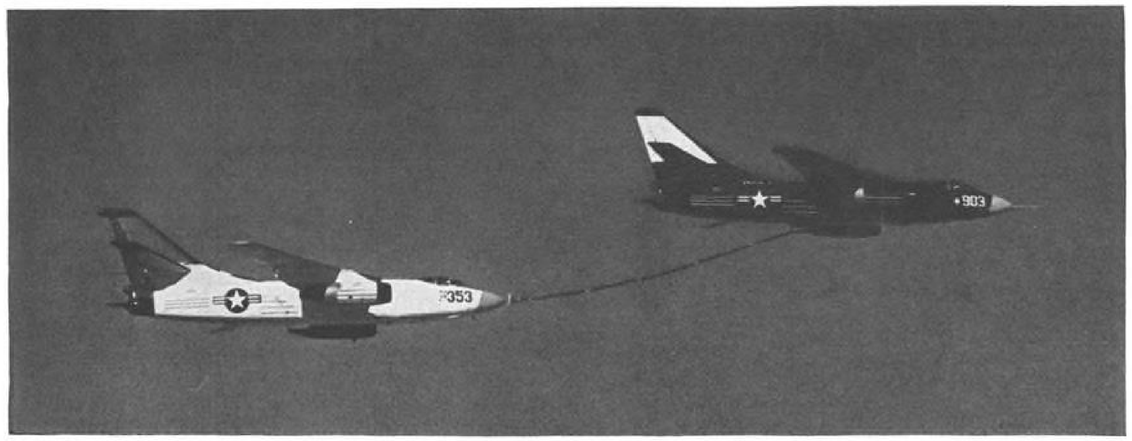


A3D Modified as Tanker

Douglas Aircraft Co. is converting A3D Skywarrior twin jet bombers to carrier-based aerial tankers. Flight Refueling, Inc., Baltimore, Md., was awarded a $2 million contract by Douglas for design and production of the hose reel installations for the A3D to complete the probe and drogue system already in Navy use. Tanker unit will be essentially complete in itself within the bomb bay except for a power source and remote controls. Reel, hose, drogue and dump line are in kit form for installation with large fuel tanks in the bomb bay.

methods (AW Jan. 28, p. 26).

"Some of the recommendations of the report are statements of the ideal, with which nobody would quarrel," Jones said. "Of course it would be wrong to overload the aircraft industry, but the question of practical judgment whether this or that item is justifiable is quite different. That can be decided upon only after much more detailed investigation."

One member asked the supply minister what steps he was taking to cut down the disproportionate number of helicopter projects reported by the committee.

"The comments . . . about the helicopter projects relate mainly to the program as it was some time ago," Jones replied. He said that at present only four helicopters are under development.

When a questioner demanded to know whether practical economies now are being made in the ministry, Jones answered, "to arrive at that degree of satisfaction after only a week in office would be rather too much to expect."

Although only four helicopters are under development, he said, the justification for expenditure on those four will have to be looked at in the light of the defense program that will be outlined in the forthcoming defense White Paper.

This is expected to call for a considerable cutback in Britain's military expenditures.

Super Accelerator to Be Installed at Redstone

Huntsville, Ala.—A 2-million-volt Van de Graaff particle accelerator for fundamental chemical and physical research related to guided missiles and rockets will be installed at the U.S. Army Ordnance Corps' Redstone Arsenal.

Built by High Voltage Engineering Corp., Burlington, Mass., the machine will be used in the Redstone Research Laboratories, part of the facility's extensive Ordnance Missile Laboratories.

Programs utilizing the Van de Graaff, as well as other specialized equipment, are under direction of Dr. Eugene Miller and James E. Norman, chief and deputy chief respectively of the Research Laboratories.

Greer Hydraulics Awarded AF Contract

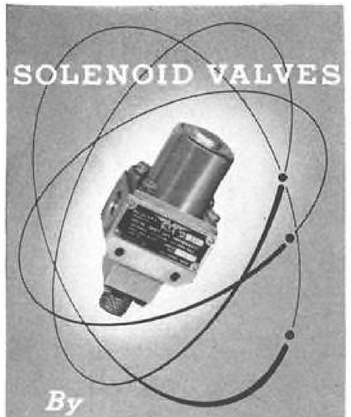
New York—Greer Hydraulics, Inc., New York International Airport, was awarded an Air Force contract for $1,334,119.

The contract is for manufacture of propeller governor test stands to test the performance and operating characteristics of electric and hydraulic propeller governors by simulating conditions encountered in actual flight.

No Hands

One-man, rocket-powered helicopter so stable it can be flown "no hands" recently made its first public flight demonstration in Philadelphia. Manufactured by Kellett Aircraft Corp., unique aircraft's good stability and maneuverability is provided by gyro system. Weighing only 230 lb. empty, 640 lb. in flight, copter has rocket engines mounted in tips of rotor blades. Fuel of 90% hydrogen peroxide is stored in spherical fuel tanks at pilot's side.

SOLENOID VALVES



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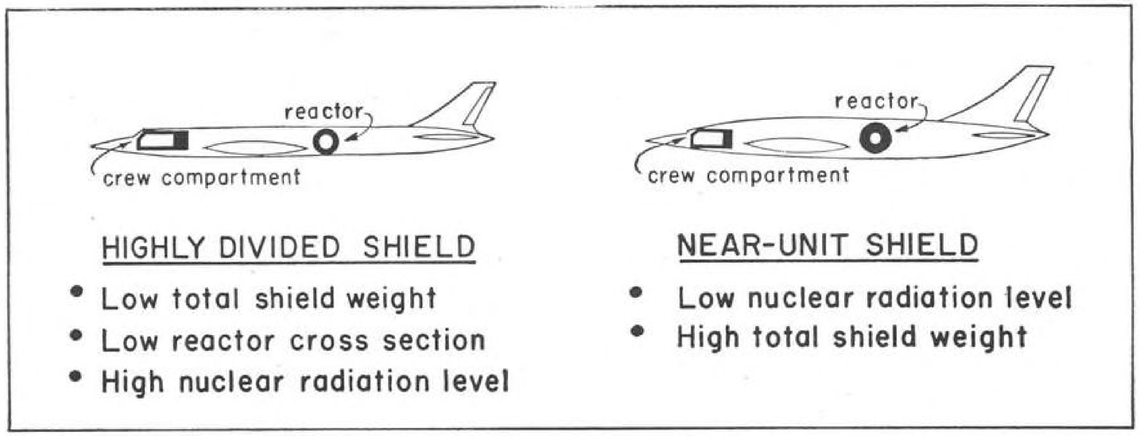


HIGHLY divided shield for atomic-powered weapon system allows slimmer fuselage silhouette (left) than near-unit shield (right).

Materials Problems Result From New Environments

By George L. Christian

New York—Three new operational environments now being simultaneously imposed on military aircraft are creating a series of serious materials dilemmas.

• **Aerodynamic heating** — Sun-surface temperatures of 10,000F associated with missile reentry into the earth's atmosphere are already in sight. This is almost double the highest melting point (graphite disintegrates slightly over 6,000F) of any material known that would be usable in aircraft fabrication.

• **High sonic intensities**—noise pressures of 150 decibels have created sonic damage to structures in such aircraft as the McDonnell F-101 Voodoo fighter and the Boeing B-52 Stratofortress heavy bomber.

• **Nuclear radiation**—the threshold of radiation damage to a whole group of very critical aircraft materials is about 10^{15} gamma photons/cm^2. It will be difficult to restrict radiation in nuclear-powered weapon systems (such as the WS-125A) to this level because of the large amounts of very heavy shielding required around the reactor.

These three new and challenging operational environments affect every component of an aircraft—its airframe and powerplants, its systems, its lubricants and fluids, and its vulnerable elastomeric materials.

The dependence of weapons systems development on materials development was underlined by Major Frederick C. Krug at a materials session of the 25th Institute of Aeronautical Sciences meeting.

He said: "For any weapon systems design undertaken, the key to significant progress will be the materials of construction." Major Krug is in the Equipment and Materials division, Headquarters, Air Research and Development Command, USAF.

Heat Headaches

Three principal sources of heat in supersonic aircraft are aerodynamic phenomena, the powerplant, and the equipment. Temperatures generated by the first two are increasing as speeds rise and powers grow. Equipment heating—at least avionic—is being held in check by the increasing use of cool-operating transistors in place of heat-generating vacuum tubes.

To date, the increasing heat in aircraft has been looked at as a serious liability because heat sinks are rapidly disappearing. But, as speeds continue to climb, heat may turn into a productive asset. For instance, it may become possible to use the high heat loadings imposed by hypersonic boundary layers for propulsion.

Three solutions to excessive heating are:

• **Heat-resistant materials** such as ceramics, cermets and intermetallics. But these materials present serious drawbacks to airframe and engine manufacturers because their thermal shock resistance is relatively low. Since most thermal shock data is quite empirical, considerable theoretical refinement will be necessary to solve problems associated with the phenomenon.

Impurities play a very important part in the overall gross physical properties of these materials and are linked with the problems of lattice vacancies and interstitials. Studies must be initiated to determine the effects of impurities on these highly heat resistant materials, and fundamental solid state physics theory must be applied to these problems.

Carbon, despite its many structural disadvantages, stands alone as a high temperature material.

• **Insulation materials to protect** aircraft components form excessive heat. Refractory oxides possess low thermal conductivities useful in insulation. Recent developments point to other insulation methods. A thin film (0.01 in.) of amorphous carbon deposited on a rocket engine liner can reduce the heat transfer rate by a factor of ten.

Preferred orientations of refractory crystals can make important differences in heat conductivity.

Heat reflection from surfaces has only recently been considered by engineers as an insulating method.

Combining these principles with an extension of present aircraft fabrication techniques—use of lamination and honeycomb structure—may provide significant advancements in this field.

• **Cooling means to reduce** excessive heat. Three progressively new methods present themselves.

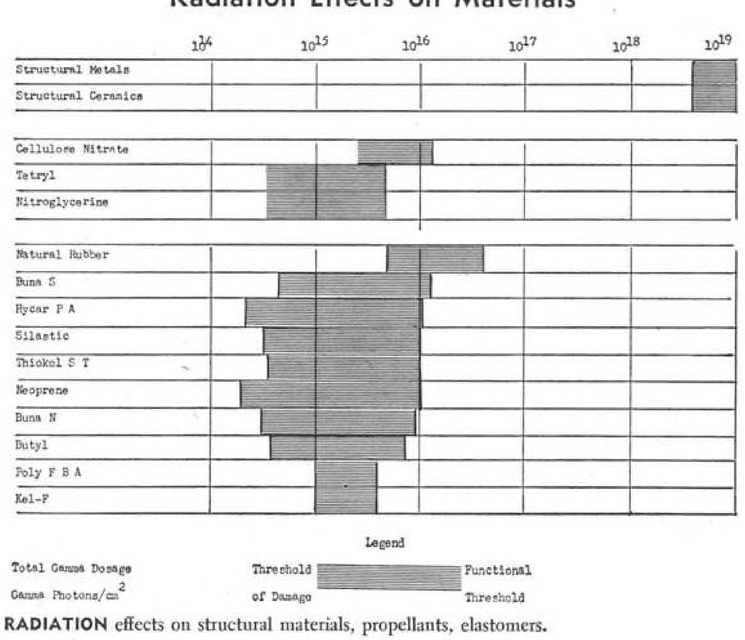
Regenerative cooling has long been used to cool liquid rocket engines. Recent developments in fabricating techniques promise significant advances in this method. It also holds out the very attractive possibility of using frictional heating for propulsive purposes.

Transpiration cooling is not new. But mechanisms for accomplishing this job need considerable development, according to ARDC spokesmen.

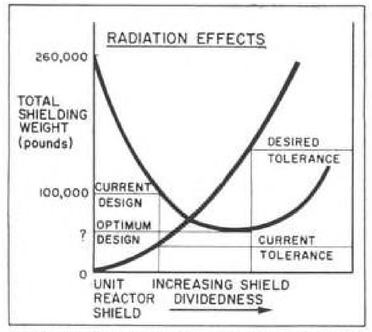
Diffusion cooling is a new cooling concept which derives from the peculiar ability of liquid hydrogen to diffuse through many metals. The thermodynamic properties of liquid hydrogen make it attractive as a cooling medium.

Materials & Outer Space

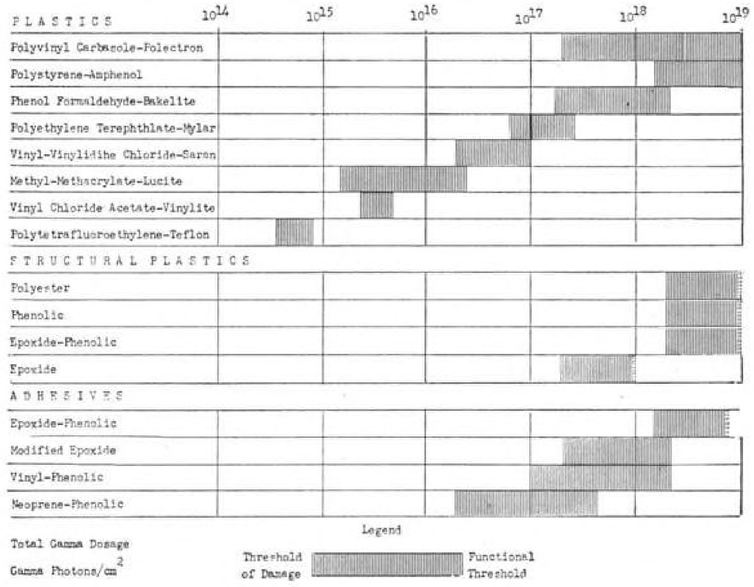
In satellite and space travel peculiar materials problems arise. Because of the lack of air molecules at extremely

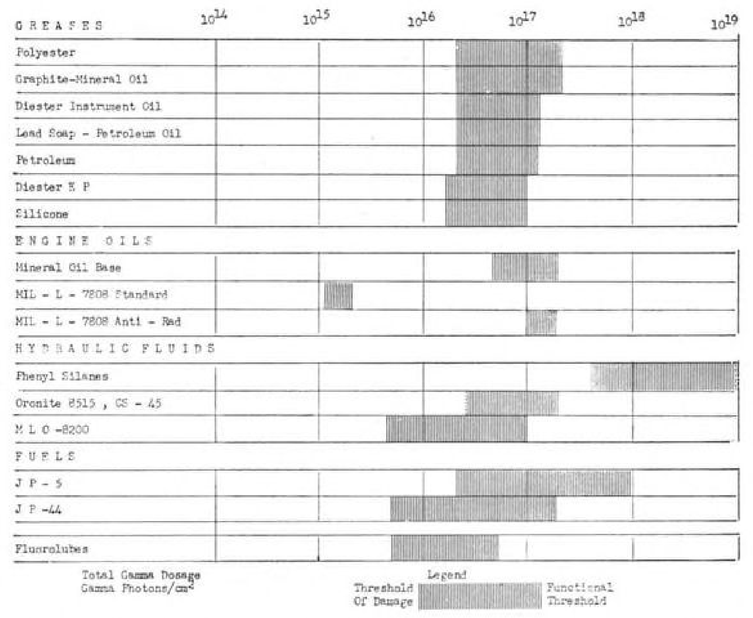


RADIATION effects on structural materials, propellants, elastomers.



CURVES show that by using a unit shield radiation effects would be non-existant, but the aircraft would not fly (see extreme left. total shielding weight goes to 260,000 lb.). At point of minimum shield weight, radiation effects would be high.





THE TWO CHARTS (above) show radiation effects on a number of important aircraft materials such as plastics, structural plastics, adhesives, greases, engine oils and hydraulic oils.

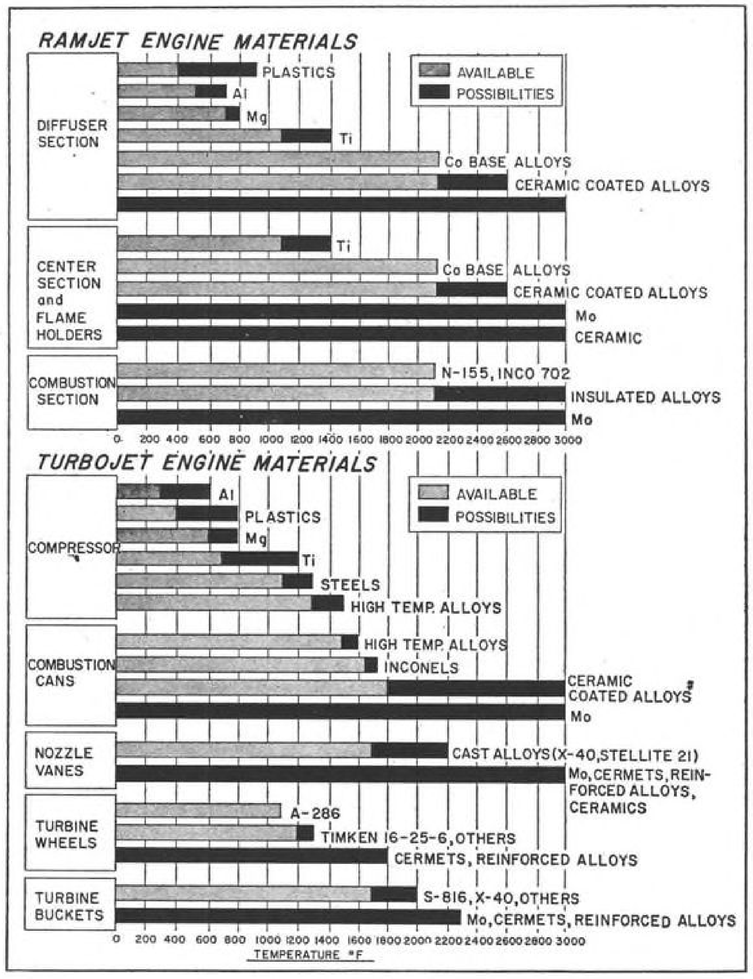


CHART shows heat resistance of various ram jet and turbojet materials.

high altitudes, emissivity becomes the primary method of heat transfer of a material (emissivity is a material's capability to radiate energy when hot). Because of the growing importance of a material's emissivity, programs are under way to measure emissivity values for nearly all aircraft structural metals.

At extreme altitudes, the surfaces of a vehicle exposed to solar energy become furnace-hot, those away from the sun infinitely cold. Destructive overheating could be combatted by using an opaque vapor between the boundary layer and the missile to significantly reduce radiation heat transfer.

The cold surfaces create problems requiring application of cryogenic technology—the technology of temperatures approaching absolute zero (—459F).

H. C. Sullivan of the Materials Laboratory, Wright Air Development Center, summed up his paper, "Materials Approach to Advanced Weapon Systems," this way:

"Certainly some design concepts will change because, in many applications, ultimate performance is limited by the physical properties of materials and the natural environment.

"Because of this, the future will require materials engineers working closely with design engineers so that new environmental conditions can be met with new processes and new phenomena that will enable materials to advance progress rather than to limit it.

"Materials development is entering a new phase where gross physical properties must be augmented with properties and phenomena associated with molecular and atomic structure."

The most perplexing airframe problems are directly associated with heat, according to and ARDC spokesman.

Already steels and nickels have become basic airframe materials. The Bell X-2, which flew 1,900 mph., had stainless steel wings and tail mounted on a K-Monel fuselage.

There has been considerable debate about the relative merits of stainless steels and titanium alloys for airframe use in the 300F-800F temperature range. ARDC researchers state that currently it appears some recently-developed titanium alloys such as 6Al-4Va may be slightly superior to such stainless steels as 17-7PH from a strength/weight point of view.

However, steel alloys become increasingly superior to present titanium alloys at temperatures exceeding 850F.

Fatigue and creep properties of metals are also important considerations for an airframe designer.

Research Logging

Research in fatigue seems to be lagging behind materials development and is one of the most perplexing and damaging enemies to optimum design and performance of today's aircraft. The superimposition of noise and high temperatures upon normal vibrational causes of fatigue damage has seriously complicated the problem faced by materials scientists and development engineers.

Creep—the slow expansion or contraction of a solid under a steady load —may be the determining factor of supersonic aircraft structures. This phenomenon can cause failures at stresses well below those considered to be the safe operating loads. The fundamental aspects of creep are still not clearly known.

It is known, however, that creep is accelerated by long exposure to a load at high temperatures. One of the reasons titanium alloys may only be serviceable to 700F is their rapid drop in creep strength above this temperature.

Other titanium deficiencies cited by ARDC scientists: forgings are susceptible to embrittlement, weldability is still a problem, and thin gage sheet lacks uniformity. Effect of the latter deficiency is indicated by the fact that over 10,000 lb. of titanium is being used in the construction of the Navaho missile. Much (about 43%) of this titanium is 0.060 sheet. This heavy gage sheet is being used at a severe weight penalty because lighter gage weldable sheet is not available. Precipitation hardening of titanium alloys now under development may help solve this problem.

Other potential 1,000F materials are the martensitic stainless steels and the coated lean-alloy steels. Main problem of the former is sheet formability.

Protective coatings against oxidation and corrosion which possess thermal, mechanical and erosion resistance are a prime requirement. If ceramic coatings with these qualities were available, they would make it possible to use many materials at temperatures up to 2,500F. This is particularly true of molybdenum alloys which retain their strength but are extremely susceptible to oxidation at these temperatures.

Heat problems of aircraft powerplant materials are quite similar to those associated with the airframe.

Lubricants and Hydraulic Fluids

An ARDC officer had this to say about lubricants and hydraulic fluids which must operate in the environments of extreme heat and nuclear radiation: "When the environment in which future lubricants will operate is examined, it becomes clear that radical changes must take place in our present thinking with regard to engine oils and hydraulic fluids.

"We must develop vastly different lubricants if we are to solve the lubrication problems of the future."

The Air Force puts prime importance on fluids and lubricants having thermal stability at temperatures of 700F. The importance of attaining this goal is such that the service is willing to relax its low temperature requirements for fluids (currently set at —65F) to gain improvements at the high temperature and of the scale.

Also, lubricants and fluids must be able to operate satisfactorily in a nuclear environment.

Promising developments in engine lubricants include chlorinated materials, aromatics and silicones. These are being studied for use in engines with a bulk oil temperature of 500F, bearing temperature of 750F, and hot spot temperature of 850F-900F.

Among radical concepts and lubrication techniques being investigated by the Air Force is using the properties of certain materials to react at high temperatures and provide a dry lubricating film for anti-friction bearings.

Hydraulic fluids in the chemical catagory of silicate esters with additives have an estimated temperature capability of —56F to +400F.

In the 700F range, the Air Force is concentrating on the development of chlorinated silicones and is aiming at a fluid with a life of 10-20 hours at that temperature.

An ARDC spokesman said that preliminary studies of silicones have shown that these fluids possess good short-term thermal stability at 700F and show good possibility of improvement by additives.

He added that "in the 800F range, the prospect of obtaining a stable organic material for immediate development is practically nil. However, data from test tube quantities of materials, synthesized in basic chemical studies, indicate that semi-organic materials should not be discounted for 800F operation in the near future.

"Above 800F we are in a range where the life of the organic bonds is fleeting and other approaches to fluid power

HOK-1 Evaluation

Kaman HOK-1 helicopter undergoing evaluation by U. S. Army at Fort Rucker, Ala., carries a 2,500-lb. Army jeep on its external cargo sling. HOK is being evaluated for medical evacuation, personnel transportation, general battle and utility operations.

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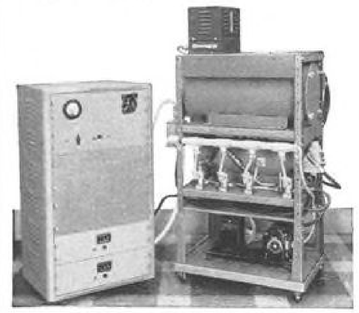

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transmission show more promise. We are greatly interested in the use of unusual methods to solve this problem.

In regard to greases, he had this to say: "In preparation for development and evaluation of 700F greases, high melting point organic and inorganic materials are being screened as potential thickening agents. The uninhibited nature of this research is indicated by the fact that we have recently made acceptable greases using glass fibres as oil thickening agents.

"In general support of all our effort in the lubricants and hydraulic fluids development, a long range program of synthesis of new molecules has been undertaken. These include: organs-silanes, alkyl-aromatics, aryl ethers, semi-organics, and modified silicone polymers.

"High thermal stability and a wide liquid range have been the first considerations. All these classes have provided test tube quantities of fluids meeting these catagories. Gallon quantities. of certain silianes are being procured for full bench test evaluations."

Elastomers are the most environment-sensitive of all engineering materials. They lose their strength, abrasion and wear resistance and other rubber-like properties at high temperatures and in chemical and nuclear environments.

Although elastomers rank low in the total weight of a modern aircraft, they rank close to the top when measured by the catastrophic results of their functional failure.

The many uses of elastomers in a plane include: fuel oil and oxygen system hose, grommets, seals, diaphragms, electrical insulation, nose cone or radome coatings, tires, fuel tanks and O-rings. In a single, modern fighter there are over 500 O-rings.

Moreover, the pilot is largely encased in rubber.

The use of elastomers in tomorrow's very hot and nuclear-powered aircraft remains in doubt, according to ARDC scientists.

As they point out, commercially available polymers exhibit basic limitations which cannot be overcome by compounding. New and versatile monomers and polymers must be developed and unique methods of polymerization must be investigated and exploited. However, even if the most optimistic advancements in this technical area are achieved, many future weapon systems may have to depend on designing around the elastomeric materials and developing components completely devoid of the materials to meet the heat and radiation environments which will exist in tomorrow's weapon systems.

This last, drastic approach will only be accomplished at the expense of weight, ease of fabrication and maintenance, and reliability.

Short Sunderland Retired from Duty

London—The Short Sunderland flying boat has been retired from the Coastal Command of the Royal Air Force, marking the end of operational service for a flying boat which was first delivered to the RAF in 1938.

A total of 748 Sunderlands were built, the last in October, 1945. It was the first flying boat to be equipped with power-operated turrets and during World War II a Sunderland engaged eight German fighters and shot down three before the enemy broke off the engagement.

The aircraft also had an outstanding record on anti-submarine patrol throughout the war as well as in air-sea rescue work.

Although retired by the RAF, Sunderlands still are on duty with the Royal New Zealand Air Force and the French Naval Air Service.

Kaman Forms New Nuclear Division

Bloomfield, Conn.—Kaman Aircraft Corp. is forming a Nuclear Division to be located in Alburquerque, N. M., for systems analysis and research in the fields of nuclear ordnance and propulsion.

Heading up the company's new division as vice president and general manager will be Dr. Kenneth W. Erickson, recently chief of experimental weapons research for the Sandia Corp.

Northrop Workers Receive Pay Boost

Hawthorne, Calif.—Approximately 13,000 hourly-rated personnel of Northrop Aircraft, Inc., received a six cents an hour pay increase as of Jan. 28 under the company's newly reestablished cost-of-living program.

This was the first adjustment under an escalator pay plan geared to the rise or fall in the Consumer's Price Index. It will add more than $140,000 monthly to the Hawthorne airframe manufacturer's payroll.

USAF Awards $16 Million Contract to Aeroproducts

Dayton, Ohio—USAF contract of $16 million was awarded Aeroproducts Operations as a follow-on order for additional propellers for the Lockheed C-130 Hercules.

Aeroproducts three-way military propeller was certificated by the CAA after qualification test in August, 1955.

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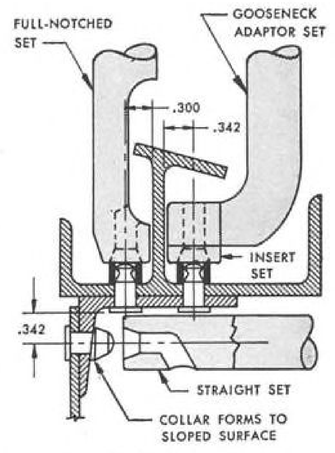

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NACA Says Loss of Scientists Threatens U.S. Lead

By Evert Clark

Washington – National Advisory Committee for Aeronautics is making its strongest appeal yet for Congress to help stop the loss of top research scientists and engineers–a loss that threatens the "leadership in aeronautical science and American supremacy in the air," according to Chairman Jerome C. Hunsaker.

Recruiting and retaining scientists and engineers has become more and more difficult for all the government agencies as industry competition for their skills has increased. This has been particularly true since 1950.

Value of NACA's Work

NACA is a prime target for simple reasons–the quality and the importance of its work. A great part of NACA's research is done at the very frontiers of aeronautics.

Rapid expansion and progress in missile and aircraft design and production have placed the skills of these "frontiersmen" in great demand.

Unfortunately for aeronautical science as a whole, many leading scientists who transfer from NACA to industry shift from fundamental research to design and manufacturing. Replacing them is no easy matter, either in the immediate or the long-range future–because industry, with its higher salaries and fringe benefits, attracts not only top and middle level researchers and engineers, but an increasing percentage of new graduates.

Equal Pay Urged

Although some steps have been taken to help remedy the situation, more are needed. In a letter to the President accompanying NACA's 42nd annual report to Congress, Dr. Hunsaker said "the simplest and the best" way to meet the problem is legislation authorizing the government "to pay the going rates for engineers and scientists."

Since the end of World War II, there have been a number of government studies on the question of attracting and keeping scientific manpower. More are in progress.

Almost without exception, they find that the largest single problem is pay.

Various motivations will keep a scientist or an engineer in government work at a lower salary than he would receive in industry–but generally this ceases to be true as soon as the spread between the salaries and other financial benefits becomes too large and, therefore, too tempting.

Until shortly before 1950, NACA almost literally had its pick of graduating scientists and technicians, and its pay scales were more nearly in line with industry's. Korean war expansion and continued high employment in the aircraft industry–plus the fact that aviation's starting rates are among the highest for all industries–changed the picture.

Government-Industry Scales

In 1951, when industry was paying beginning scientists and engineers a little more than $300 a month to start, the government was paying about $255. By 1952, the difference was about $340 to $285. For the next two years, industry levels climbed to approximately $375 while the government's hiring salary remained constant.

From 1954 to 1955, government's rate-of-increase curve rose more sharply than industry's–but was still far behind in total pay. In 1956, the industry starting salary was almost to $450, while government's was just below $375.

Disparities are somewhat greater for top-level scientists, even when bonuses and stock plans are not considered (see chart).

Of even more concern to NACA is the effect industry's higher pay and unlimited recruiting techniques have had on the quality of personnel.

In 1951, 70% of NACA's engineering recruits came from the top quarter of their classes. By 1953, the figure had dropped to 60%; by 1954, it had fallen to almost 50%. In 1955, it stood just above 40%, and for 1956 it had reached approximately 34%.

Rate of turnover in NACA scientists and engineers in a salary range from about $6,500 to $13,000 rose from around 8% in 1951 to approximately 38% in 1956.

NACA hires few employes in the middle salary ranges, and even fewer at the top. Most of its top men are researchers who gained the bulk of their experience in NACA's own laboratories.

Accompanying this loss at the top is a decrease in hiring at the bottom of the scale. The federal government employs approximately 10% of the nation's engineers. Based on that figure, it should hire about 10% of the graduating engineers in any year. In 1956, it got only 4%. NACA's figure is about the same as the governmentwide figure.

Dr. Hunsaker made it clear in a letter to Congress accompanying his annual report that "we do not quarrel with the salaries paid by industry."

But he said the "attractiveness of public service has been critically depreciated" by salaries and "fringe benefits" offered by industry.

"We must . . . not only provide additional fringe benefits but also offer rates of compensation sufficient to recruit and to hold the scientists and engineers necessary to perform the fundamental research that governs progress," he said.

NACA's career scientists "have made large contributions to the advancement of aeronautics" over the years at a very small cost "compared with the value of the results" Dr. Hunsaker said.

"We are confident that NACA can continue to show the way to important advances . . . if the Congress will provide the required support."

NACA is now auhorized to employ some 8,100 people. Because of budget limitations and to a lesser degree, the difficulty in obtaining the quality of personnel it would like, it employs only 7,700. In the Fiscal 1958 budget, it has asked authority for 9,000–but the employment level of NACA scientists and engineers has lagged farther and farther behind its authorization since 1951.

About 1,700 of NACA's total are research personnel. Some 500 are supporting engineers and physical scientists, responsible for designing, building and maintaining NACA's complex of laboratories, wind tunnels and other equipment.

Another 3,300 are wage earners in the trades and crafts–and these are the only employes paid on a dollar-for-dollar basis with industry. The remainder of the 7,700 are administrative and supporting personnel.

What Loss Means

The effects of the loss of creative talent on NACA's efforts are felt each time an important researcher leaves. NACA has made a careful and extensive survey of this question. Some of its findings:

• **Loss of creative talent.** A key researcher into transition and aerodynamic heating on intercontinental missiles left NACA recently for approximately 50% more than he was being paid. He can expect 100% more than his NACA salary after a reasonable period.

• **Curtailment of essential research.** A relatively new, highly complicated and important field of research at another laboratory was cut back considerably because the most important man in the work went to industry.

• **Inability to explore** new developments adequately. Important research related to Richard T. Whitcomb's "area rule" was curtailed seriously after one project scientist was transferred to other work and the next two men assigned to the project moved to industry for higher pay.

• **Loss of effective research direction.** An internationally known propulsion expert went to industry for a substantial salary increase after 25 years with NACA. His loss, NACA says, causes "a significant void in the breadth of approach and far-flung scientific insight" needed for research in his field. The committee also loses "his unique ability to train and develop men to follow in his footsteps," and the loss results in the "abandoning of an integrated laboratory approach."

• **Disbanding of effective** research teams. Loss of the chief of a wind-tunnel team will have the effect, at least for a time, of "destroying an efficient research team and reducing the output of the entire group."

NACA last year had 28 "super-grade" jobs, in which it could pay its top researchers above $13,000 a year. It asked the Congress for 50 new positions under Public Law 313, which exempts employes from certain salary restrictions imposed by the Classification Act, although they remain within the Civil Service. NACA already had 10 P.L. 313 positions.

Passage of the bill would have made a total of 60 P.L. 313 positions, in which NACA could have paid from $12,500 to $19,000. Congress approved only 20 new positions, giving NACA a total of 30. Some personnel in the "super-grade" positions were shifted to P.L. 313 jobs, and NACA may not retain all 28 "super-grade" positions in addition to its P.L. 313 jobs.

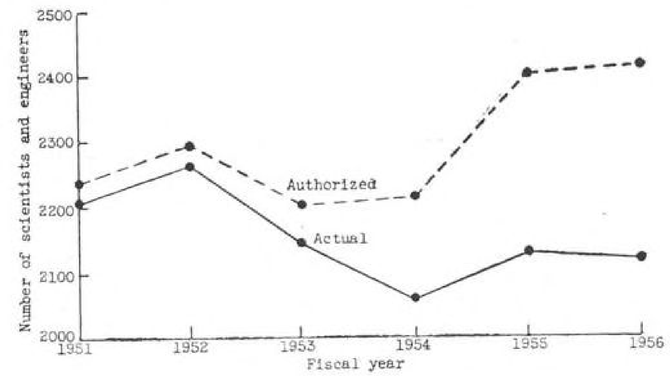
What NACA Wants

To make the "further advances in the art and science" that Dr. Hunsaker says are "essential to our national security" and are needed "at a greatly accelerated rate," NACA and possibly other government agencies faced with the technological manpower shortage will ask Congress this year for:

• **Revision of federal pay system** for scientists and engineers to provide flexibility to adjust salaries to meet competition and to recognize individual differences in ability and demonstrated performance; adequate pay for top executives to enable them to continue government service without financial sacrifice, and to encourage young scientists to pursue government careers.

• **Removal of limitations** on professional recruiting techniques to enable federal agencies to use paid advertising, pay applicants for travel to interviews, pay travel to the first job, including moving of household goods; and to permit use of employment agencies.

NACA Employment of Scientists



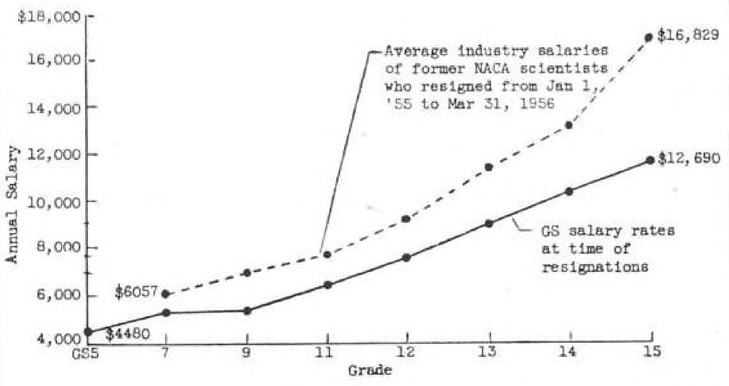
Personnel Losses

	Calendar 1955			Calendar 1956		
	Employes	Number Lost	% of Loss	Employes	Number Lost	% of Loss
Top Research Leaders	92	6	6.5	86	12	14.0
All Research Personnel	1,600	134	8.4	1,752	241	13.7

Where They Go

	15 Mo. Period, 1955-56	16 Mo. Period, 1950-51
	Petage	Petage
Industry	72	42
Military Service	10	14
Other Govt. Agencies	9	24
Returned to School	4.5	10
Miscellaneous or Unknown	4.5	10

And Why



L. K. Edwards (center), head of the Advanced Design and Systems Analysis Department, discusses atmosphere effects on missile guidance with L. Lowell (right), Advanced Design Staff Engineer, and W. F. Wright, head of the Analysis, Plans and Reports Section.

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Safe Flight Speed Control Indicator Evaluated by Royal Canadian Navy

The Royal Canadian Navy is evaluating Safe Flight Instrument Corporation's Speed Control Indicator for installation on all 40 of their McDonnell F2H Banshee carrier fighters. The slow speed and relatively small size of the HMCS Bonaventure, soon to be the only RCN aircraft carrier, demand unusually precise control of landing approach speed.

Minimum approach speed for the F2H is about 105 knots. Landing speeds greater than 90 knots relative to the deck impose unacceptable loads on the arresting gear. The Bonaventure launches and recovers aircraft at 18 knots.

Maximum Speed

This means that the maximum approach speed which the Canadian Banshees can use in no wind conditions is 108 knots. The 1.0% sensitivity claimed for the Speed Control Indicator is needed if the average carrier pilot is to stay within the three knot envelope between minimum and maximum approach speeds. The indicator is mounted above the left side of the instrument panel where it is close to the line of sight from the pilot to the mirror landing aid or landing signal officer. One needle-width deflection represents a 2.2 knot variation from the calibrated value. Range of the indicator is 36 knots from peg to peg.

The SCI is an extension of the principle used in the manufacturer's vane-type stall indicator. It works by measuring movement of the stagnation point on the wing lower leading edge as angle of attack changes.

In the lower part of the air speed scale where angle of attack varies more with speed changes, the movement of the stagnation point is a more critical measure of lift than the air speed indication.

This is true because air speed is only one of the variables which effect lift while the position of the stagnation point is sensitive to all variables except in some cases to a change in the configuration of the wing caused by extending the flaps.

Since gross weight and density altitude are among the factors which affect the position of the stagnation point in steady state flight, the pilot is freed of the necessity of computing the right air speed for variations in these factors.

Feeds Signal

A flap position potentiometer feeds in a signal to modify the output from the variable reluctance transducer of the leading edge vane. This is necessary because the lift increment from the flaps and the position of the stag-

Jeep By Air

Army's newest and biggest helicopter, Sikorsky H-37A, delivers a jeep to Continental Army Command at Fort Monroe, Va. Twin-engine aircraft has clamshell loading doors and ramp, can accommodate 36 fully-equipped men, equipment up to 105mm. howitzer, weighs 10,000 lb. Copter is being user-tested by Army's Aviation Test Board, Fort Rucker, Ala.

Bell XV-3 Modified for Testing

Bell XV-3 is modified for test program with underwing lift struts and further lengthening of mast height. Struts provided damping arrangement for dynamic test, and were a temporary installation. Change in mast length also is for dynamic flight test purposes. Other changes are likely, including installation of two-bladed rotors. This is the first aircraft.

nation point are not always directly related.

The flap position potentiometer must be calibrated in flight in all configurations to insure that its output is proportional to the lift increment.

The SCI with a stick-shaker stall warning has been ordered for all of the RCN's de Havilland CS2F (Grumman S2F) carrier-borne anti-submarine aircraft. It is also in service in many private and USAF airplanes.

In propeller-driven aircraft, an accelerometer measures thrust changes as an indication of the lift increment from propeller wash over the wing. The outputs from the leading edge vane transducer, the thrust accelerometer and the flap position potentiometer are integrated by a lift computer. The unit intended for multi-engined aircraft weighs six pounds and is available for use with 27.5 VDC and 12 VDC systems.

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USAF Reports Rearward Seating Safer

By Robert I. Stanfield

An Air Force study, covering all USAF transport aircraft involved in accidents over a two-and-a-half-year period, shows that injuries to those facing forward were seven times greater than received by those facing to the rear.

Preliminary data covering injuries in relation to seating on transport aircraft was presented at the annual meeting of the Institute of the Aeronautical Sciences by Col. H. G. Mosely, chief of the USAF's Aero Medical Safety Division, Directorate of Flight Safety Research. Complete report will be presented at the annual meeting of the Aero Medical Assn. in Denver, May 6-8.

The study covered alternate yearly periods so as to include comparisons among all types of AF passenger-carrying aircraft. It indicated that head injuries were the most frequent cause of death in survivable accidents—except that in these cases there were no fatal head injuries to occupants of rearward facing seats. Predominant major injuries received by passengers facing aft were generally injuries to extremities.

High-impact transport accidents, involving 517 people over the 30-month period, resulted in 499 major or fatal injuries. Though this type accident breeds highest number of fatalities, greatest percentage of those surviving, but with major injuries, were 12.5% of standees—usually crew members.

Injuries in Relation to Seating/Transport Aircraft
All USAF Transport Accidents—2½ Year Period

	Not Injured		Injured Major		Injured Fatal		Total	
	No.	%	No.	%	No.	%	No.	%
Standing	113	79.5	15	10.6	14	9.9	29	20.5
Seated Facing Front	924	84.4	49	4.5	122	11.1	171	15.6
Seated Facing Rear	286	98.3	2	.7	3	1.0	5	1.7
Seated Facing Sides	579	94.6	27	4.4	6	1.0	33	5.4
Seating Unknown*	1106	74.5	22	1.5	357	24.0	379	25.5
Total (3,625)	3008	83.0	115	3.2	502	13.8	617	17.0

(*Position unknown due to incomplete reports or lack of survivors. Evidence indicates that probable distribution in this category was 20% forward, 75% sideward and less than 5% standing or rearward.)

Survivable Accidents

Of 3,108 occupants covered in all survivable transport accidents, 2,990 suffered no injuries, including almost 100% of those facing to the rear. By comparison, 4% of those facing front received major injuries and 1.3% were fatalities.

Figures for all accidents (high impact and survivable) indicated that 98.3% of passengers facing rearward suffered no injuries. Of those facing front, 11.1% were fatalities and 4.5% received major injuries. Passengers seated facing the sides had mortality rate of 1%; of these, 4.4% received major injuries.

Most individuals involved in USAF transport accidents were passengers, not crew.

Lap belts were ordinarily in use. In some accidents crew members also wore shoulder harnesses. Protective helmets were seldom, if ever, in use. Fatalities included all type injuries, including burns.

USAF now has rearward facing seats in all aircraft used strictly for passengers.

Majority of injuries incurred in aircraft accidents are either due to occupant being thrown upon impact or due to inadequate restraint of head or extremities with their resultant flailing during abrupt deceleration.

Passenger Tie-Down

While AF feels that rearward facing seats save lives and injuries, Colonel Mosely emphasized importance of passenger tie-down-seats must hold.

A British study of the relative merits of aft and forward facing seats also reported strongly in favor of those facing backward. However, Aviation Crash Injury Research of Cornell University favors forward facing seating (AW Nov. 5, p. 69).

Av-CIR believes that when seat attachments fail and the occupied seat tumbles down the length of the cabin, the head of the aft facing passenger is foremost and is smashed against debris and structure. That failure of the seat tie-down is considered more likely with aft-facing seats or shoulder straps. Av-CIR also feels that the value of shoulder straps for passengers in airliners has been overrated.

Poor Flight Planning

Turning to accidents involving all types aircraft, Colonel Mosely said that poor flight planning and poor in-flight discipline are the most frequent causes of in-flight collisions. Hypoxia is probable cause of high-altitude, power-on dives. Accidents as result of mishandling aircraft upon landing, takeoff or go-around are usually due to inattention and experience, especially the latter, he said.

He stated that the fatigue-illness factor is usually unpredictable and there is no particular pattern as to the type of accident which might result.

Capt. Carl E. Wilbur, head of the Navy's Aero-Medical Section, Aviation Safety Division, stated that 64% of the Navy's aircraft accidents in 1955 were attributed to pilot error; 50% of all accidents occur in the landing phase. He said the error might be one "we have failed to eliminate from or, in fact, built into the environment of our supersonic aircraft."

A. Howard Hasbrook, director, Av-CIR, noted that some of our civil jet aircraft flying in 1958 will be exposing as many as 227 people to injury per accident.

He pointed out that accidents involving civil jet transport will expose more people per aircraft, per accident, than are exposed in the DC-3, CV-240 and DC-4 type aircraft whose maximum capacities range from 20 to 50 people.

Accident data, said Hasbrook, must be presented so that it is a usable form for the engineer concerned with design of ejection seats. Av-CIR uses special code for this work, covering three primary areas:

- **Six degrees** of incident condition, (angle and velocity of impact, etc.).
- **Six degrees** of impact damage to the inhabitable areas of the aircraft.
- **Ten degrees** of injury, of which four concern "the seriousness of fatality."

Code aims at ensuring effective design improvements.

Deficiencies of design or maintenance, he stated, often cause injuries in survivable type accidents. Examples of this occurred in accidents wherein seats tore free, spear-like tube uprights in seat-back punctured the skulls of facing occupants, hat-rack structure pushed down on passengers, etc.

Role of Pathologist

Role of the pathologist in aircraft accident investigations was stressed by Col. F. M. Townsend, USAF (MC), Deputy Director, Armed Forces Institute of Pathology. He cited some major problems that still must be overcome:

- **Lack of interest** in post mortem examination of body recovered from aircraft accident.
- **Lack of specific** guidelines for the performance of such operations.

Trend Toward Less Time Indicates Decreasing Possibility of Escape

Successful bail-outs and successful ejections from high performance aircraft are reducing with progress. The percentage of successful bail-outs was less than 40% in 1955. During the same year an ejection seat escape of but 60% was realized. By comparison, during the period 1913 to 1940, successful bail-outs were obtained in 11 out of every 12 attempts.

Trend in escape versus time, coupled to high-speed, high-altitude aircraft, indicates an ever-decreasing possibility of attaining a successful escape. Limiting condition on present escape system was presented by Thomas G. Kilgariff, F5D Project Test Pilot, Douglas Aircraft Co., at the annual meeting of the Institute of Aeronautical Sciences.

During the past six years airspeeds have jumped from 100 to 200 knots per year. Quoting Dr. Fritz Haber, Kilgariff also stated that future increases in airspeed will necessitate a linear increase in altitude resulting in Mach 6 at approximately 200,000 ft.

Critical Airspeeds

As things stand now, bail-outs at equivalent airspeeds in excess of 200 kts. result in an abnormal decrease in successful escapes. And while the ejection system has been referred to as effective at 600 knots and above, experience shows that at airspeeds in excess of 450 kts. there is less than 50% chance for a successful escape. The successful escape also becomes more critical in altitudes above 35,000 ft., said Mr. Kilgariff.

This condition, he told AVIATION WEEK, is capable of engineering solution—a matter of applying talent to correct the problem. At present Douglas Aircraft is working on a long-range program towards a solution. Short-range programs are currently in being at Lockheed, on downward ejection, and Convair, on upward ejection.

Engineering effort is aimed at solution of following problems:

- **Clearing the airplane** structure—airspeeds in excess of 450 kts. are critical for upward ejection.
- **Reducing deceleration,** tumbling windblast effects, and parachute opening shock to within limits of human tolerance.

Although ejection seat is designed for maximum of 20G acceleration, Kilgariff noted that fractures of the spine have occurred as low as 9G due to alignment and position of vertebra column. Solutions must also be provided to problems of preventing anoxia, frost-bite and aeroembolism.

Operational statistics, said Kilgariff, show that 76% of actual emergency conditions necessitate an immediate escape rather than a controlled one.

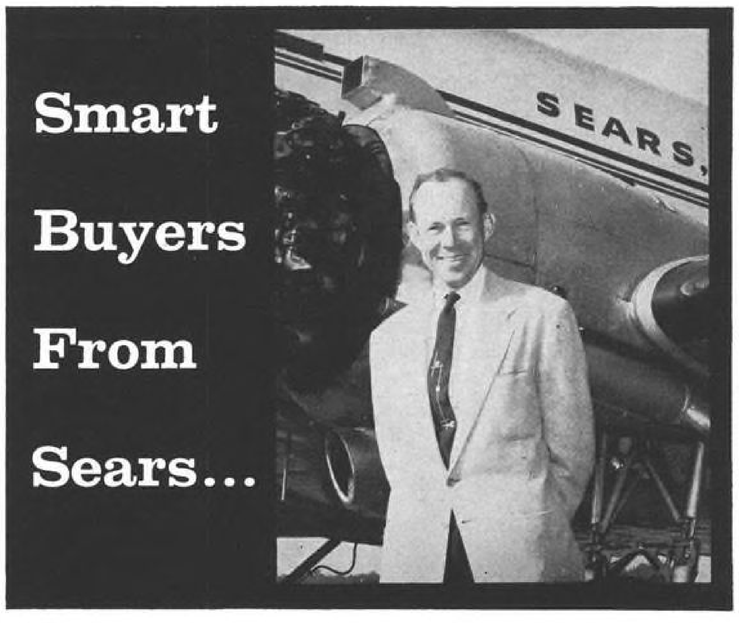
Pilot-Opinion Data

The importance of pilot-opinion data, and factors involved in obtaining, understanding, and interpreting reliable pilot opinion, was discussed by George E. Cooper, Chief Aeronautical Research pilot, Ames Aeronautical Laboratory, National Advisory Committee for Aeronautics.

Need for a more universal calibration of pilot opinion, through a standardized adjective rating system, was stressed by Cooper.

Aircraft characteristics that still must be judged by "pilot opinion" include pitch-up, roll-off, ease of handling in a tracking task, buffet intensity, magnitude of stall warning, etc. Situation imposes on test pilot the responsibility for opinions on which design decisions can be based.

In order to assure validity and con-



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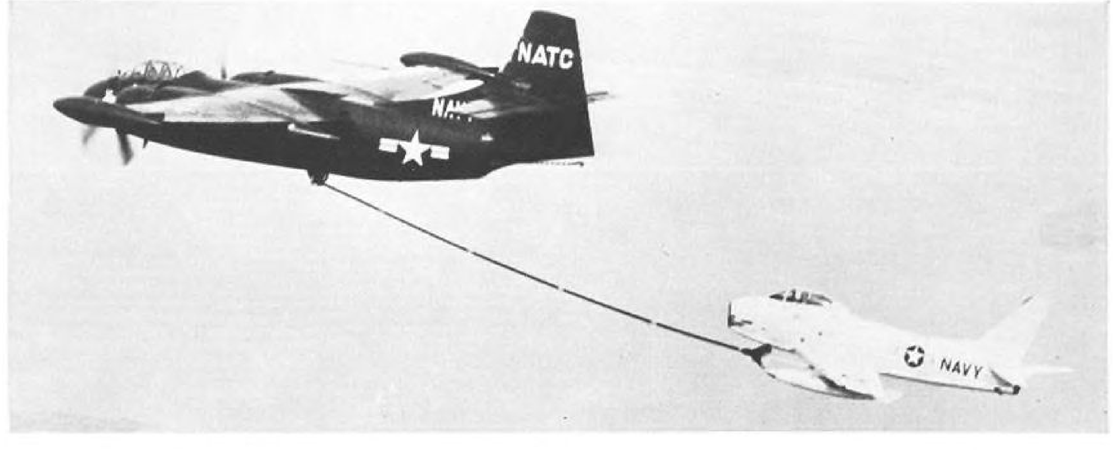

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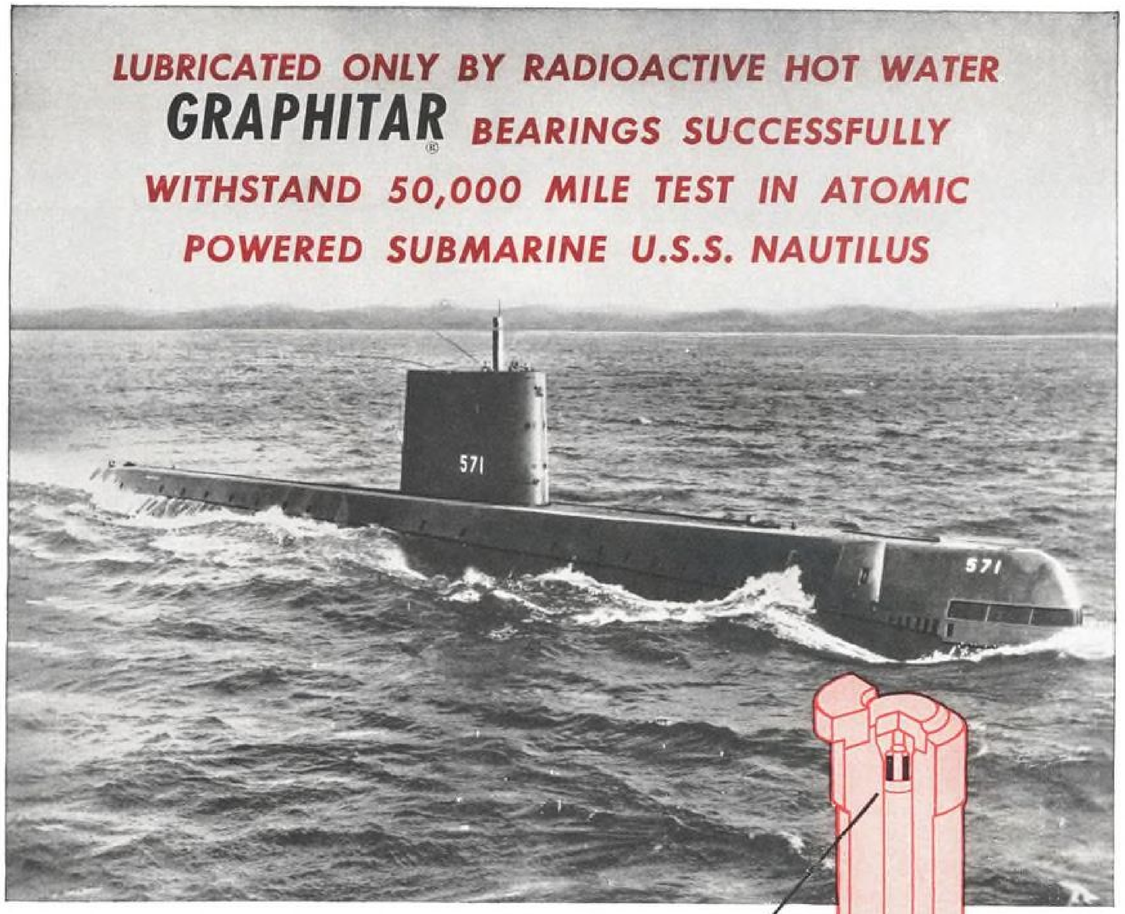

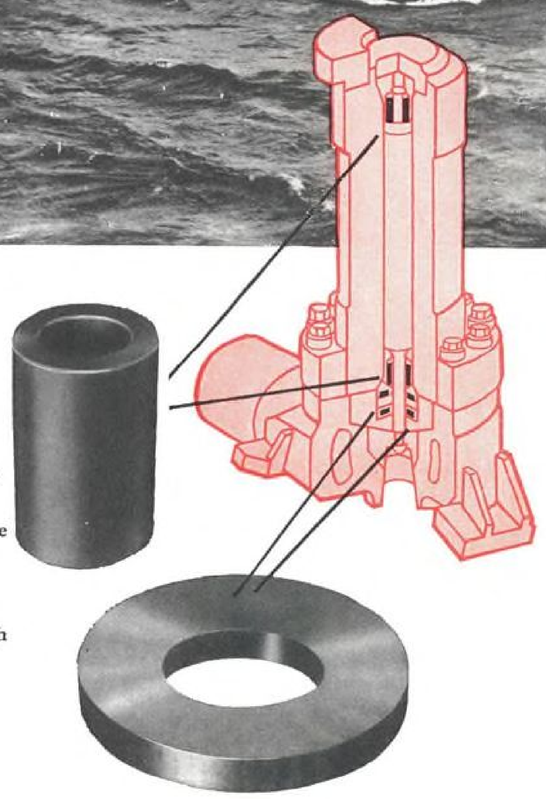

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sistency of such pilot opinion data, Cooper suggests:

• **Rewording of questions.** Questionnaires must be specific enough that a minimum on interpretation is necessary after pilot's opinion is given.

• **Assignment of adjective** rating system. If pilots were to report their opinions on a common scale, wealth of data would be obtained on adequacy or inadequacy of our present specifications.

• **Initial and final impressions.** Opinions expressed by a test pilot during first few flights of airplane or modification may reflect more accurately what will be the reaction of the operational pilot than his opinion after complete familiarity is obtained. NACA records and evaluates separately the initial and resultant opinions at completion of program.

Ground Simulators

Ground simulators can potentially furnish a means for evaluating a particular airplane, or control-system characteristic, well in advance of actual flight. At Ames, for example, ground studies were conducted in relation to aircraft pitch-up characteristics and in determining minimum comfortable landing approach speeds of specific aircraft.

Simulators, emphasized Cooper, cannot include all factors that influence pilot reaction or opinion and alone can lead to an invalid evaluation.

Air Associates Changes Name

Teterboro, N. J.—Air Associates, Inc. has changed its name to Electronic Communications, Inc., recognizing a shift in emphasis in the company's operations. The Aviation Supply Division with eight bases throughout the country will continue to go by the old name as a subsidiary of ECI.

Avionics and electronics work accounted for about 40% of the company's business in 1956 and is expected to reach about 75% by 1960. ECI President Frank W. Godsey, Jr., who joined the company in July, said, "The aviation supply business is still expanding and will probably continue to be our bread and butter for awhile."

Headquarters and production operations will move from Teterboro, N. J. to Pinellas County International Airport, St. Petersburg, Fla. The move will be made gradually, project by project, and is expected to be complete by the end of the year. The engineering staff will be moved to St. Petersburg from Orange, N. J. by the end of 1958.

Godsey said that the bigger part of the engineering staff will probably move with the company but most of the manufacturing people will be hired locally.

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Circuit breakers

Airborne Computer Would Lessen Routine

By Philip J. Klass

New York—A proposal to replace the multitude of analog computers now used aboard airliners with a single central digital computer which could relieve the flight crew of many routine "how-goes-it" computations now performed manually was made at the recent meeting of the Institute of the Aeronautical Sciences.

The suggestion that the airlines adopt a current military philosophy of integrating all computational functions in a single digital computer came from Vernon I. Weihe of the Air Transport Association and Melpar.

Weihe proposed that the airlines form an operational group to define their needs, then work out the feasibility and economics with avionic equipment and airborne digital computer manufacturers.

Digital Computer Advantages

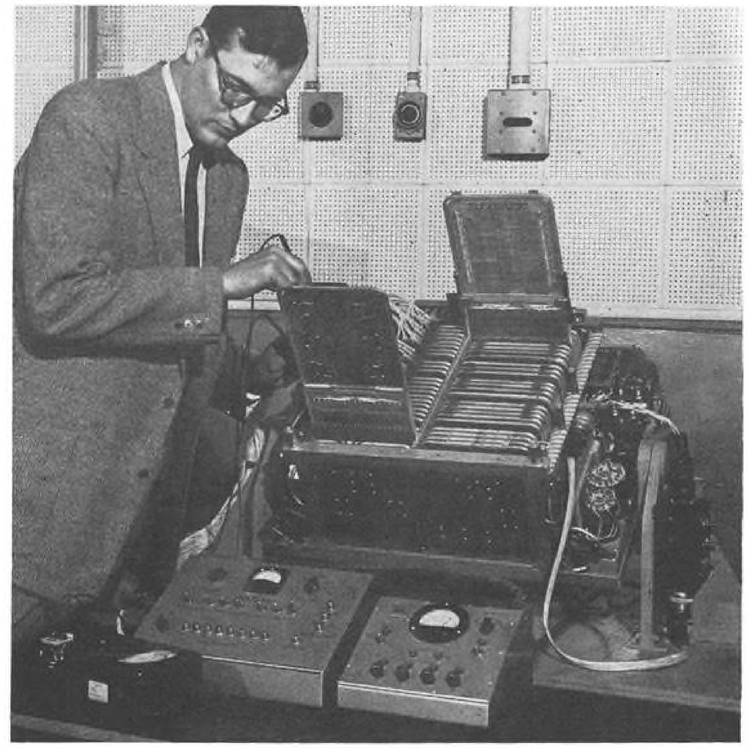
The principal advantages of the digital computer over the analog type are its great versatality and tremendous computational speed which enable it to solve a variety of different problems, almost simultaneously as far as flight needs are concerned.

Weihe cited the following examples of tasks, now performed manually by the flight crew, which could be easily handled by an airborne digital computer working from automatic input data provided by altitude, airspeed, heading, fuel flow, temperature and other sensors.

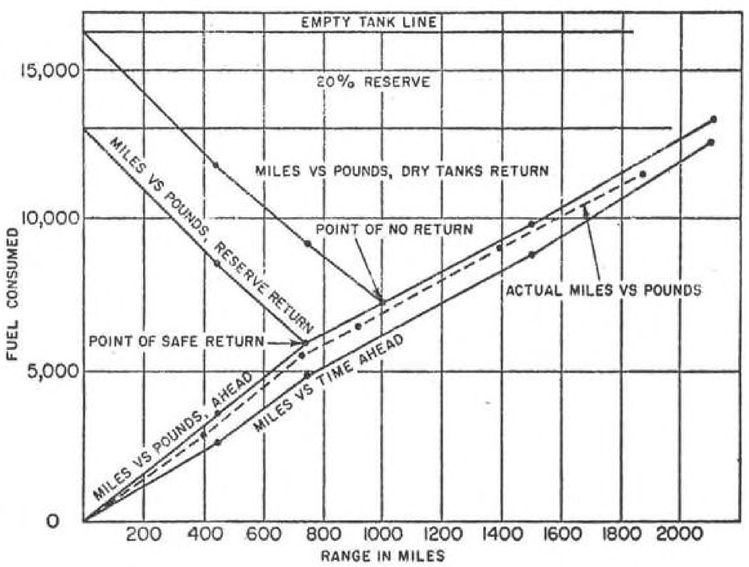
- **Dead reckoning** and off-airways navigation.
- **Cruise control**, determining most efficient throttle setting. When new jetliners go into service, efficient cruise control will become even more important.
- **How-goes-it** information on point of safe return with fuel reserves and point of no return, both for normal and emergency (engine out) conditions.
- **Celestial navigation** triangulation.

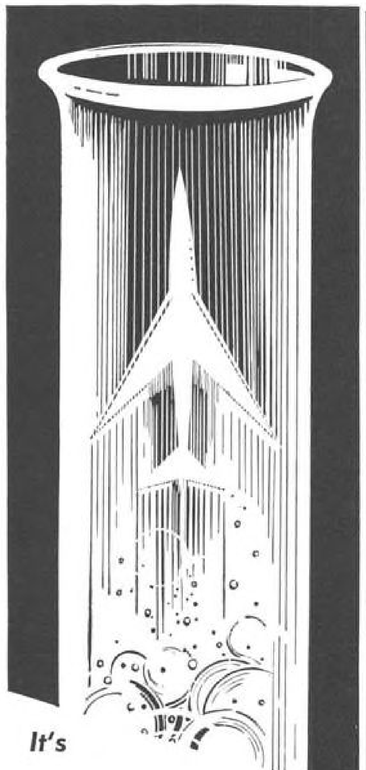
Anti-Collision Use

One of the most important applications for an airborne digital computer is in anti-collision systems, Weihe said. If such systems are to be effective, they must be able to compute the possibility of collision between own-ship and two or more targets simultaneously. This is a natural for a digital computer which can compute the collision threat for a number of targets in the time it takes



AIRLINE use of airborne digital computers, like North American unit shown above, has been proposed to perform functions of existing individual analog computers and to relieve flight crew of routine manual computations, like "how-goes-it" chart below.





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Curtis on Progress

Edward P. Curtis, the President's special assistant for Aviation Facilities Planning will discuss the progress of his group's year-long study of the nation's requirements for the next 20 years at a luncheon meeting on March 19 in New York.

The meeting is jointly sponsored by the Institute of Radio Engineers' Professional Groups on Aeronautical & Navigational Electronics (PGANE) and Military Electronics (PGMIL), and will be held during the national IRE convention. Tickets, priced at $4.00, are available from William McNally, 475 10th Ave., New York City.

an analog computer to solve the problem for one, Weihe indicated.

A digital computer could perform the ILS instrument approach function, now required for flight directors and autopilots, and probably do it with more refinement and accuracy than the present analog computers, Weihe believes. If the airlines adopt Doppler radar auto-navigators, the digital computer could perform this function too.

Emergency Features

The digital computer is so versatile, Weihe believes, that it could continuously monitor the flight crew. For instance, if the pilot should attempt to lower the landing gear when aircraft speed is too high, the computer could sound an alarm.

During final approach the digital computer might be programmed to run through a check list, double-checking the flight crew. If temperature were below a certain value, the computer might call for closing of the cowl flaps or carburetor heat. Monitoring the flight crew is particularly advantageous under emergency conditions, Weihe pointed out.

Pilot Reaction

IAS panel moderator David Little of American Airlines, himself a pilot, made the following comment on possible pilot reactions to Weihe's proposal: "Even in today's aircraft, more than anything else this pilot needs time to think. Anything that relieves the flight crew of routine cockpit duties will be welcomed."

The progress made in the past several years in miniaturizing and transistoring digital computers for airborne use should make it possible to install a central digital computer, and a duplicate for standby, at no increase in size, weight or cost over existing analog computers, Weihe said.

There are a number of companies working in the airborne digital computer field. Hughes Aircraft Co. is building a central digital computer for later versions of the F-102. Litton Industries is developing a similar computer for the Navy and Douglas Aircraft which also will include many cockpit instrumentation and display functions. Librascope, North American, Philco and Ramo-Wooldridge also are active in the field.

Weihe believes that airline requirements are far less demanding than military interception-fire control needs and this should permit the use of less costly equipment.

Expansions, Changes In Avionics Industry

Electronic Associates, Inc, Long Branch, N. J., will open an analog computation center in Brussels, Belgium, early this summer, making the new facilities available to Western European industry. Company now has computation centers at Princeton, N. J. and in Los Angeles.

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

• **Radiation, Inc.,** Melbourne and Orlando, Fla., has formed new subsidiary, Dikewood Corp., in Albuquerque, N. M. to serve primarily as consulting agency for the missile and avionics industry. Dr. Sheldon H. Dike and Dr. Walter D. Wood, both formerly with Sandia Corp., will be president and vice president of new firm.

• **Systron Corp.,** Concord, Calif., is name of newly formed company which will design and manufacture control and data processing systems. Company is headed by G. H. Bruns, Jr., former general manager of the Berkeley division of Beckman Instruments, Inc .

• **Detectolab, Inc.,** Chicago, affiliate of Borg-Warner Corp., has been consolidated into BJ Electronics, B-W's electronics division at Santa Ana, Calif. Detectolab makes nuclear instrumentation.

• **Waldorf Instrument Division** of F. C. Huyck & Sons has opened new $2 million facility at Dix Hills, Huntington, L. I., N. Y. Facility will be used for development and manufacture of precision hydraulic and electronic equipment.

• **C. P. Clare & Co.,** Chicago relay manufacturer has opened new field engineering and sales office in Los Angeles at 6047 Hollywood Blvd., headed by J. R. Stone.

• **Airborne Accessories Corp.,** Hillside, N. J., maker of actuators and avionic sub-systems, has opened branch office in Los Angeles at 8402½ Lincoln Blvd.

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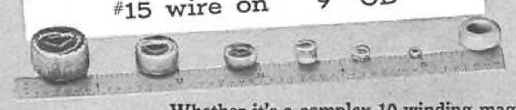

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Gyro Flight Stabilizers
Navigation & Stabilization Systems

Division of American-Standard

• **Kelvin Electric Co.,** Van Nuys, Calif., is name of newly formed company which will make precision wire-wound resistors and resistive networks. Company is headed by W. I. Elliott and K. T. Eckardt, formerly president and vice president, respectively, of Hycor Co., Inc. Kelvin's address: 5907 Noble Ave.

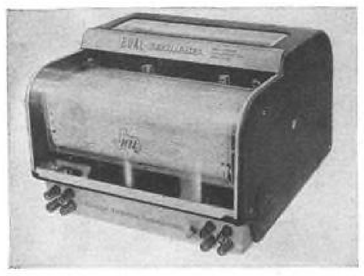
• **Rheem Manufacturing Co.** has opened enlarged electronics research laboratory and manufacturing facility, more than twice previous area, at 7777 Industry Ave., Rivera, Calif.

• **North American Aviation's Autonetics Division,** Downey, Calif., and **Qualitron, Inc.,** Burbank, Calif., have been elected to membership in the Radio Technical Commission for Aeronautics.

NEW AVIONIC PRODUCTS

Instrumentation

• **Rectilinear recorder,** two-channel uses galvanometer type recording elements with 0.25 sec. full scale rise time. Full scale deflection is 4½ in. Meter movements with sensitivities of 1, 5, 10 or 25 ma. input for full scale deflection are



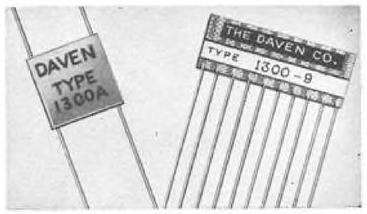
available, with d.c. accuracy of 1% full scale. Small gear shift permits selection of any one of 10 chart speeds. Texas Instruments, Inc., Industrial Instrumentation Div., Houston, Texas.

• **Transistorized instrument translator** permits use of variable reluctance pick-offs instead of potentiometers without

modifying test set-up. Translator operates from a.c. or d.c. power, and when connected to suitable a.c. variable reluctance transducer produces a d.c. or a.c. signal proportional to transducer measurements. Crescent Engineering & Research Co., 5440 North Peck Road, El Monte, Calif.

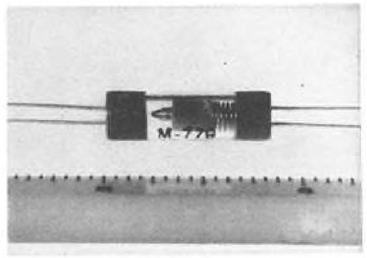
Components & Devices

• **Card-type wire-wound resistor,** Type 1300A, encapsulated, for miniaturized circuit use, measures ⅝x⅜x⅜ in., comes in resistances up to 500,000 ohms,



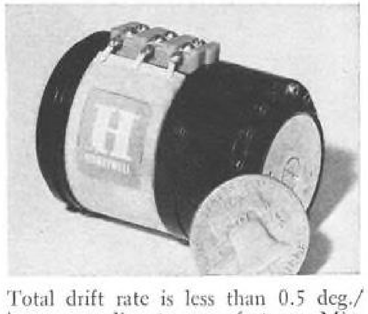
rated 0.6 watt, in tolerances of 0.1 to 1%. The Daven Co., 530 West Mt. Pleasant Ave., Livingston, N. J.

• **Miniature thermal relay,** operates on fuse-burnout principle and can withstand 200G shock, vibration between



20 and 3,000 cps., over temperature range of −100F to 450F. Networks Electronic Corp., 14806 Oxnard St., Van Nuys, Calif.

• **Miniature floated integrating gyro,** called MIG for short, has angular momentum of the larger HIG-5 (10^5 gm.-$cm.^2$/sec.), yet measures only 1¾ in. dia. x 2½ in. long and weighs less than ½ lb.



Total drift rate is less than 0.5 deg./hour, according to manufacturer. Minneapolis-Honeywell, Aeronautical Division, 2600 Ridgway Road, Minneapolis.

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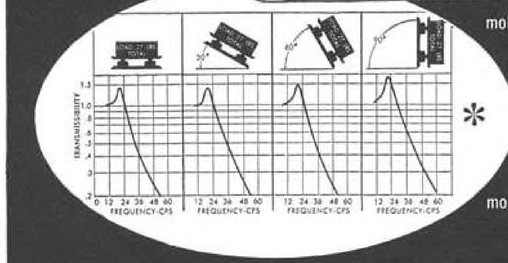
loads up to 40 lbs. per mount



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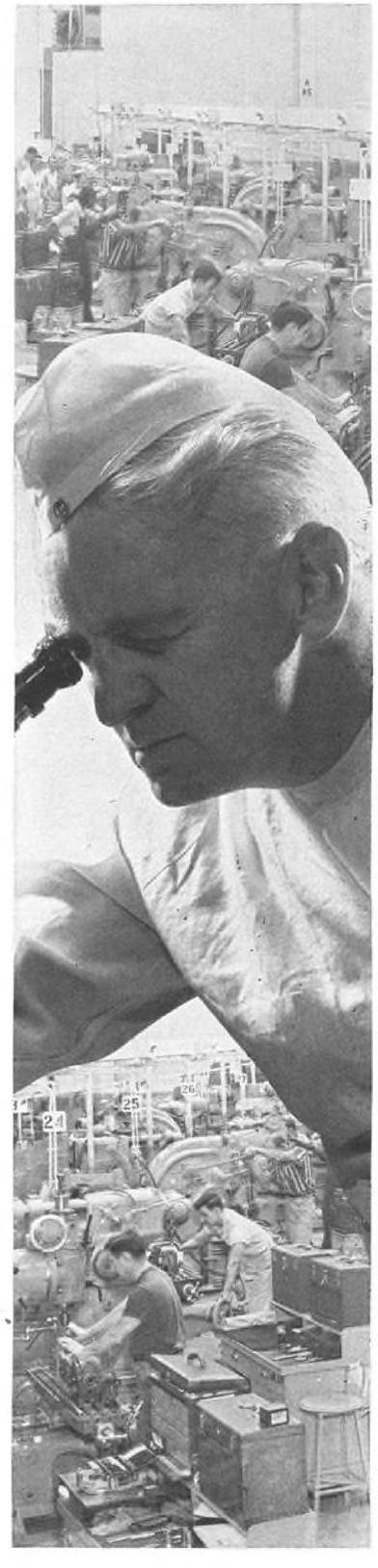

THREE AUTONETICS ENGINEERS ON THEIR WAY UP

In just 6 years, Elliott Buxton has risen from Servo Research Analyst to Group Leader responsible for Preliminary Engineering in Autonetics' Flight Control Program. Among his other professional achievements, "Buck" has several patents filed in his name – including an aircraft maneuver stabilizer and a load-factor anticipation switch.

Ronald Greenslade (BSEE Michigan) is Group Leader in charge of development and design of electro-mechanical components for aircraft armament control systems at Autonetics. From Southern California's many fine residential communities, Ronald chose Long Beach, where he lives with his wife and two young daughters.

Dave Kimball joined Autonetics in 1950 with a BSEE from the University of New Mexico. Only 29, he is already Group Leader in the challenging field of Inertial Guidance Engineering. Dave lives with his wife and two children in nearby Fullerton, California – an ideal center for his favorite diversions: softball, bowling and skin-diving.

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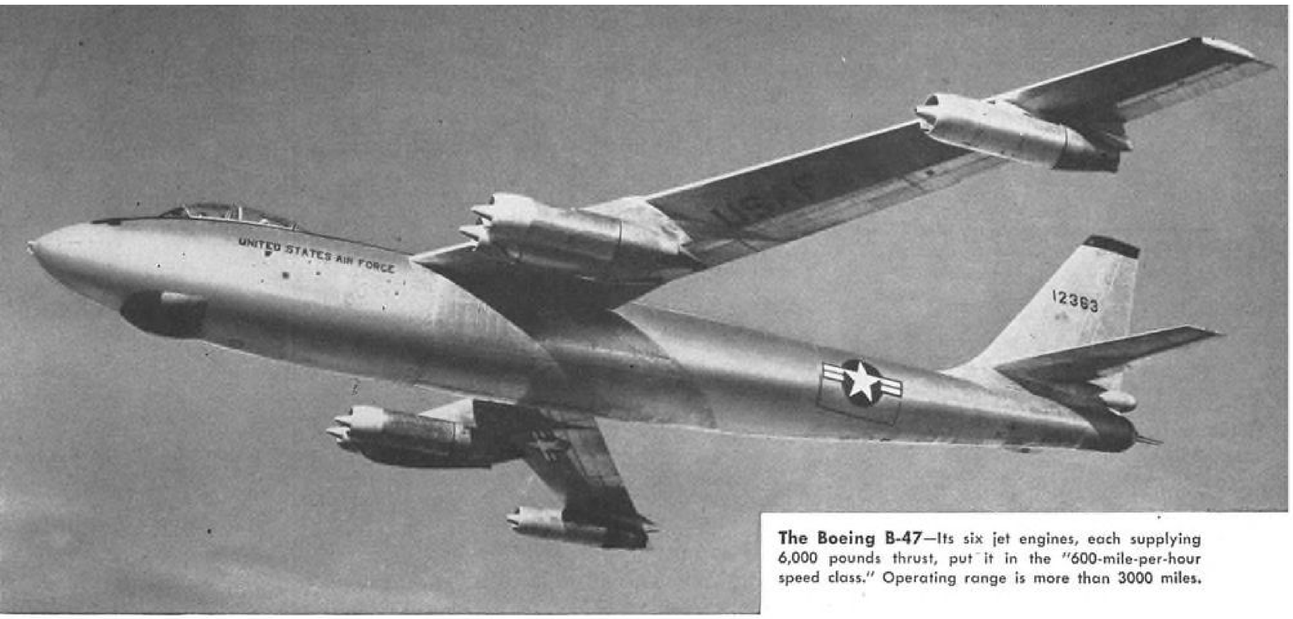
BUSINESS FLYING

AUXILIARY rocket engine submerged in belly of North American B-25 executive transport (right) provide a total of 3,000 lb. additional thrust in emergency, weigh 140 lb. each loaded. On this installation by AiResearch Aviation Service Division, the standby Aerojet rocket powerplants are mounted at 16½ deg. to the B-25's thrust line, keeping thrust application within c.g. limits of mean aerodynamic chord.

AUSTER AGRICOLA farm plane (left) takes on a load of fertilizer through a hopper mounted on a truck during top dressing operations in New Zealand. The Agricola can carry three-quarters of a ton of fertilizer, is designed for simplicity of operation and maintenance. It is estimated to have direct operating costs of $18-$21/hr. Powered by a 240-hp. engine, the plane gets off the ground in 555 ft. at 3,675 lb. gross weight, has an initial rate of climb of 610 fpm. Hopper, located behind and below the pilot can carry 1,680 lb.; spray tank system holds 173 gal. of chemicals.

HOMEBUILT SINGLE-PLACE sport plane, (right) designed and assembled by Braathens SAFE Airlines' chief pilot Carl Larsen, Norway, is stated to have an 11.5 hr. endurance with auxiliary 15-gal. tiptanks. Of all-metal construction, the plane is powered by a 90-hp. Continental and has a cruise speed of 145 mph. Empty weight is just over 660 lb. and gross weight is 900 lb. Span is 22 ft., length 20 ft., height is seven feet. Wings utilize NACA 23012-23009 airfoil section. Retractable tricycle landing gear is hydraulically actuated and is spring loaded to provide positive down lock in event of system failure.

LIGHTWEIGHT TRAINER (left) undergoing tests in Germany is M-150 Burgfalke Schulmeister (Schoolteacher), a twin-boom pusher powered by either a 65 or 90-hp. Continental or 55 or 75 hp. Porsche. Cruise speed is 90 mph., top speed 108. Empty weight is 770 lb., gross weight is 1,298 lb. Normal range is 310 mi., adding auxiliary tanks increases this to 527 mi.



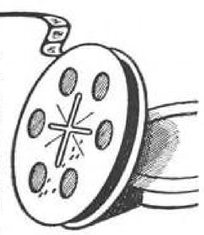
The Boeing B-47—Its six jet engines, each supplying 6,000 pounds thrust, put it in the "600-mile-per-hour speed class." Operating range is more than 3000 miles.

Cold drawn Shelby Seamless Tubes provide *high strength, low weight* outrigger struts for B-47 Stratojet

The landing gear of the 100-ton B-47 Stratojet consists of dual main wheels in tandem with single outriggers attached to the inboard engine pods. The outer cylinder of each of the outrigger struts is fabricated from cold drawn USS Shelby Mechanical Tubing.

Shelby Seamless is extremely strong and shock absorbent in proportion to its weight. Thus, it is ideal for incorporation into landing gears, engine mounts, longerons, wing spars, fuselage struts, and tail assemblies. Moreover, with Shelby Seamless Tubing, *the basic shape* for myriad aircraft parts is already made—and each section of tubing is as sound as the solid steel forging from which it is pierced. Thoroughly uniform and dimensionally accurate, Shelby Seamless Tubing is easy to bend, shape, machine and weld.

Shelby Seamless is produced to exacting aircraft standards, in a wide range of diameters, wall thicknesses and steel analyses. For further information or for help in applying Shelby Seamless Mechanical Tubing to your design specifications, write to National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.



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WALLS WITHOUT WELDS

UNITED STATES STEEL

CAA Issues Directive Covering Lycomings

New operational procedures have been ordered by Civil Aeronautics Administration covering the Lycoming GO480-C high-compression and GSO-480-A series supercharged engines pending discovery of the cause of piston problems encountered by some users.

Aircraft with these powerplants include the Aero Design 560-A(HC), 680; Beech D50 and E50; Royal Gull P-13612.

Burned pistons resulting in some cases in single-engine emergency landings are involved. However, Lycoming has been unable to duplicate the condition on the test stand or by flying a leased Aero Commander round-the-clock at its Williamsport, Pa., plant.

The CAA airworthiness directive (57-2-2) outlines three requirements by operators of aircraft with the above engines:

1. Prior to next flight and every 50 hr. thereafter, check the linkage of the mixture control arm to ensure that the lever arm on the carburetor is in the full rich position when the cockpit control is set in this position.

2. Prior to next flight the following placard must be placed in a prominent position on the instrument panel or control pedestal: "This aircraft must be operated with engine controls in the FULL RICH position under all operating conditions. Manual leaning is not permitted. Move the mixture control out of full rich only when stopping the engine."

3. Compliance required by Feb. 25, and thereafter any time an engine is changed or any part of the aircraft or engine induction system is altered.

Flight check at 65% normal rated power in level flight to ensure that fuel consumption of each engine is within the limits specified on the Lycoming power and fuel chart for the particular engine model. This check may be conducted with an accurate fuel flowmeter or by any other accurate method of determining actual fuel consumption. Engines which do not conform to these limits will not be considered airworthy until the carburetor has been readjusted to provide the specified inflight fuel flow. Carburetor flow bench readings are not acceptable for this check.

Otters to Work With UN in Suez

One of four de Havilland-Canada Otters assigned to work with the United Nations Emergency Forces in Egypt for reconnaissance, short-range communications and supply duties among UN ground units. Numerous aerials indicate that the aircraft is well equipped with communications gear. The four UN Otters, wearing UN insignia, were shipped to Port Said aboard Royal Canadian Navy carrier Magnificent.

New Zealand Aviation Shows Rapid Growth

Melbourne—New Zealand has rapidly increased the number of light aircraft engaged in aerial farming and air freighting and has reached a position where it has more commercial aircraft in relation to population than any country in the world except Australia.

Its principal domestic airline, National Airways Corp., will order three Vickers Viscounts for delivery starting in 1958. The decision has been hotly criticized because some airports appear to be inadequate to accommodate such aircraft. This applies in particular to New Zealand's capital, Wellington.

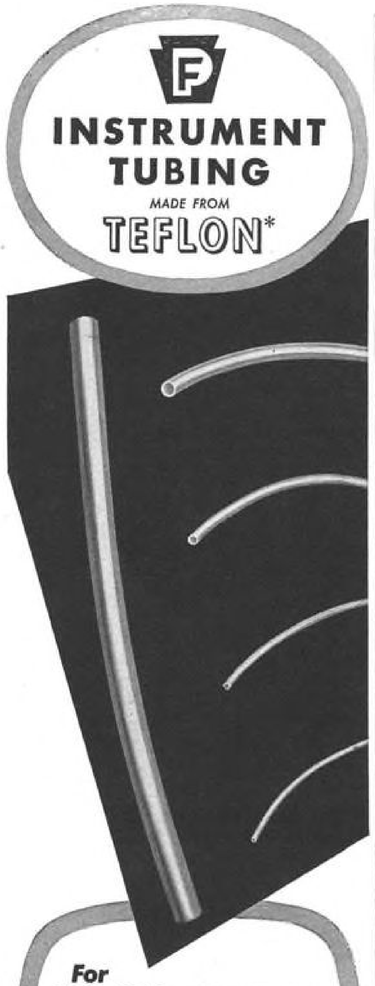
Of the smaller operators, Straits Air Express, Ltd., has lodged an application to operate an air ferry across Cook Strait for motor vehicles. The demand has also increased in New Zealand for charter and air-taxi work.

New Zealand's aerial farming operations are expanding. The agricultural fleet now numbers 272 aircraft, of

U.S. Business Aircraft Manufacturers' Fiscal 1956 Sales and Earnings

	Beech[1]		Cessna[1]		Piper[1]	
	1956	1955	1956	1955	1956	1955
Total sales	$74,538,948	$76,966,496	$66,266,927	$50,001,409	$25,083,705	$16,812,804
Commercial sales	$32,091,761	$27,245,940	$37,703,472[3]	$21,647,311[3]	$24,818,398[5]	$14,839,400[5]
Net earnings	$3,331,327	$3,586,510	$4,205,830	$2,839,083	$2,554,000	$1,401,000
Dividends paid	$899,147	$734,672	$877,000	$731,000	$704,677	$370,787
Per share	$1.20	$.98	$1.20	$1.00	$.80	$.40
Total salaries & wages	$30,559,079	$29,757,699	$24,780,465	$20,642,687	$6,800,000	$4,900,000
Number of employes	6,447	6,293	5,257	4,392	1,677	1,495
Net plant & equipment	$3,702,070	$3,828,590	$4,714,000	$3,659,000	$1,601,525	$817,000
Working capital	$11,548,165	$8,938,277	$14,467,000	$7,779,000	$4,125,000	$3,082,000
Backlog	$103,000,000[2]	$63,866,180	$56,000,000[4]	$36,500,000	$7,162,000	$10,799,000

Source: Compiled by AVIATION WEEK from manufacturers' annual reports.
[1] Fiscal years ending Sept. 30. [2] Commercial and military as of Oct. 31. [3] Commercial aircraft sales. In addition, Hydraulics Division reported sales of $3,945,208 in FY 1956; $2,737,744 in FY 1955. Sundry sales added $91,882 in FY 1956; $82,017 in FY 1955. [4] Military backlog as of Dec. 31, 1956. [5] Includes $1,216,857 in commercial spares in FY 1956; $710,080 in commercial spares in FY 1955.



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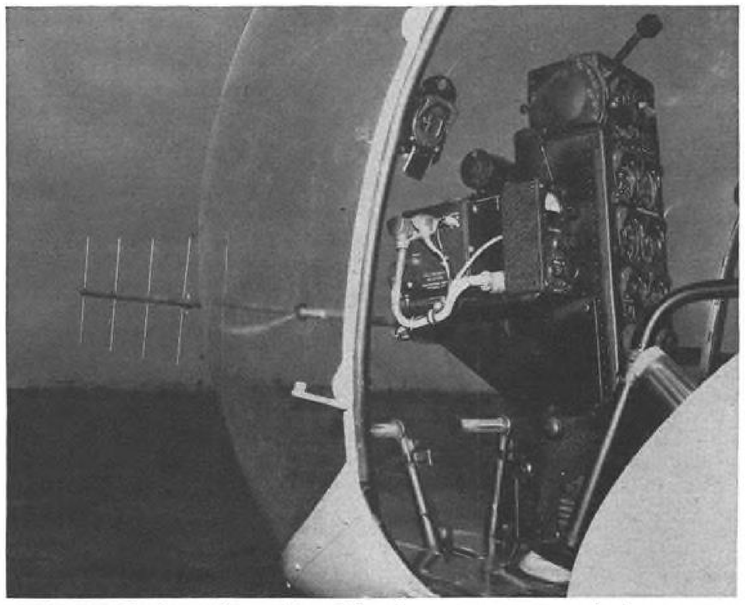
EVergreen 6-7680
*"Teflon"—Du Pont trade name for Tetrafluoroethylene resin

which 150 are Tiger Moth D.H. 82s, 34 are Cessnas, 33 Fletcher F.U.-24s, 22 Pipers and 21 Austers. Latest estimates indicate that agricultural aviation operations will enable treatment with fertilizers of about 13 million acres of undeveloped hill country, much of which is deteriorating and raising serious erosion problems.

Last year, New Zealand's production of fertilizers reached 1.1 million tons and 40% of that quantity was distributed by planes over an area of 3.9 million acres. Average cost of aerial distribution was about $8.50 per ton.

Figures covering 10-year span show New Zealand's rapidly growing interest in aviation. Number of aircraft on civil register rose from 54 in 1946 to 604 in 1956. In the same period, number of passengers carried on domestic scheduled services rose from 60,193 to 430,466. Freight rose from 151 tons in 1946 to 32,441 tons in 1956 (figure applies only to domestic scheduled services). Charter and taxi operations carried additional 33,686 passengers and 4,324 tons of freight.



HELICOPTER homing equipment is used by oil company operators who fly over water. Equipment was developed by Clover Field Radio Supply, Santa Monica.

Helicopter Homing Device Tested

Dallas, Tex.—Homing equipment, conceived by offshore oil helicopter operators to provide safer flying over water, is now under evaluation by a number of rotary wing services. In addition the U. S. Army has scheduled a demonstration of the equipment at Ft. Rucker, Ala.

Originally, the equipment called for the transmitter to be installed on each offshore drilling rig to send out the homing signals. However, some companies operate numerous rigs and might be reluctant to invest in $1,500 per transmitter.

An adaptation of the antenna and a dual installation on the front and rear of the helicopter proved the answer, permitting installation of a transmitter at the shore base. Since the bearings of the rigs are static, it is only necessary for the transmitter to send a new bearing every time the helicopter wants to head for another rig, the pilot circling until he picks up the bearing on his tail antenna and homes to the rig on it. Heading for shore, he uses the nose antenna. The equipment operates on the UHF range 460-470 mc., to over-ride interference from lightning, powerplants, generators and the like.

Equipment was developed by Clover Field Radio Supply Co., Santa Monica, Calif. under the direction of Frank H. (Bud) Kelley, executive vice president, Hawk Helicopters and Sam Willis, chief pilot, Magnolia Petroleum Co.

Hawk has three Helihomers and Magnolia has another. The former operator is the sole distributor. Package installation of base station transmitter and antenna is priced at $1,500. The system works on 110 v. a.c. Helicopter installation, with receiver, dynamo (24 v. system) and two antennas, installed, costs $1,495. The distributor reports interest from numerous other helicopter operators and Bell Helicopter Corp.

New Written Exam For Private Pilots

A new written examination for private pilots involving a theoretical flight between actual points will be given applicants beginning Mar. 15.

The test will consist of 50 questions with four alternative answers to each; at least 35 must be answered correctly.

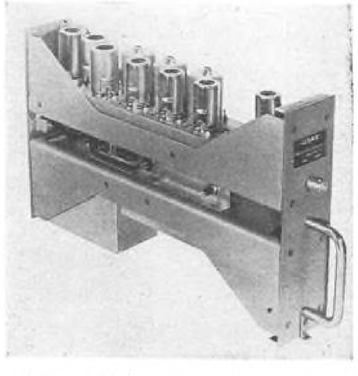
Feature of the test is introductory material inserted between questions designed to teach as well as test.

For example: "After determining that it is safe to do so, you enter the traffic pattern at a 45-deg. angle downwind turn on base leg, and then turn on final approach. You maintain adequate speed since you know that effective control depends on maintaining a certain minimum airspeed. Upon landing at Philipsburg, your altimeter (if properly calibrated and set at the correct 'altimeter setting') will indicate the elevation of your airplane above sea level."

A study guide for the new test will be available for sale to the public later this year; material will be available at Civil Aeronautics Administration district safety offices in the meantime.

Cessna, Piper Sales Increase

Wichita—Sales of $15,004,000 for the first quarter of the fiscal year, which ended Dec. 31, are reported by Cessna Aircraft Co. This compared with sales of $16,368,000 for the similar period last year. Lower sales in the recently concluded quarter were due to a lowering of military volume; this is expected



New Marker Beacon

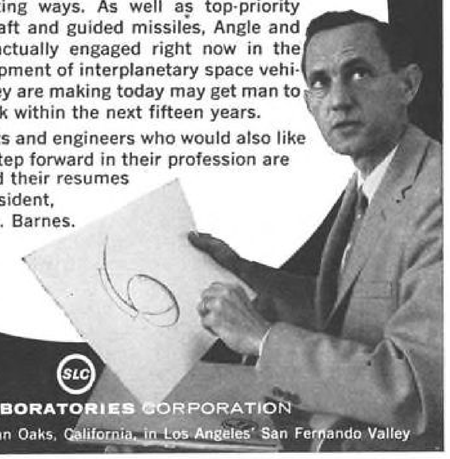
Transistorized DMB-3 marker beacon weighs 4.5 lb. and fits the short ½ ATR rack. Basically a three-light unit, it may also be used as a one-light receiver. Use of transistors in a multivibrator circuit eliminates need for the usual power supply dynamotor and vibrator. Maker is Dare, Inc., Troy, Ohio.

MEN and the **MOON**

During the twelve years he has been working in the guided missile field, Ellwyn Angle's experience has covered everything from configuration design to flight test analysis, with emphasis on the dynamical problems of earth satellites and long-range extra-atmospheric missiles.

At Systems Laboratories Corporation, this experience is being used in exciting ways. As well as top-priority assignments in aircraft and guided missiles, Angle and his associates are actually engaged right now in the research and development of interplanetary space vehicles. The studies they are making today may get man to the moon and back within the next fifteen years.

Qualified scientists and engineers who would also like to take a giant step forward in their profession are invited to send their resumes to SLC's president, Dr. John L. Barnes.



SLC
SYSTEMS LABORATORIES CORPORATION
15016 Ventura Boulevard, Sherman Oaks, California, in Los Angeles' San Fernando Valley

Flight Test Operations
for ICBM and IRBM

Technical Staff and Project Engineering opportunities are open on the R-W Staff at the Air Force Missile Test Center, Florida.

Ballistic missile test operations for ICBM and IRBM will explore new frontiers of missile flight. Providing technical direction in connection with these test programs is a significant aspect of R-W's systems engineering responsibility for these Air Force missiles.

The scope of R-W's assignment requires a Flight Test Staff of unusual breadth. Applicable technical fields include: geophysics . . . missile aerodynamics . . . propulsion . . . electronic and optical tracking systems . . . radio and inertial guidance . . . test data reduction and analysis . . . instrumentation systems . . . and ground support systems.

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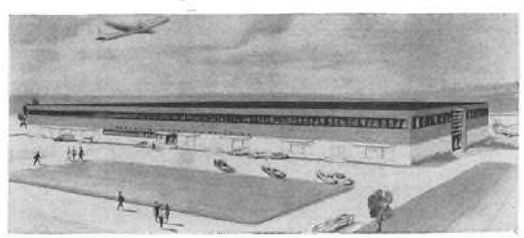
TAL it's new in '57

The Timmins Aviation Building at Montreal Airport, presently under construction alongside the Domestic Terminal, will be Canada's first air freight terminal built specifically for that purpose. When it opens this Spring, it will mark another progressive step by Timmins Aviation Limited. The entire ground floor warehouse section was contracted for by seven international air carriers, and Canadian Customs, before construction was initiated.

Measuring 480 by 80 feet, its top floor will be devoted entirely to quality office accommodation, and a number of well designed office suites are still available for rental to companies associated with the aviation industry.

For information, inquire:



TIMMINS AVIATION LIMITED

MONTREAL AIRPORT MONTREAL 33, QUE.

to climb as deliveries of the twin-jet T-37A jet trainer are increased.

In addition to the regular 35-cent cash dividend to be paid Feb. 28th to shareholders, Cessna will distribute a five percent stock dividend Mar. 12th. To do this, the firm will distribute 36,556 shares to stockholders, who presently hold 731,109 shares.

Piper Aircraft Corp. reports sales totaling $6,456,133 in the first quarter of its fiscal year 1957, representing a 21% increase over the corresponding period last year. Net profits after taxes were $681,394 compared to $475,079 for 1956's first quarter.

Military sales were down in the 1957 first quarter, but commercial sales were up 32%. Piper sold 543 units in the first quarter accounting for 40% of the business aircraft industry's output.

Cessna 310 Offered On Short-Lease Terms

Wichita—A short-term lease plan making it possible for companies to gain air operations experience at low-cost, using a Cessna 310 twin in their business for 30, 60 or 90 days, is now being offered by Cessna dealers.

Plan is aimed at providing companies with actual data on the values of using a 310 in their operations without the necessity for making a heavy initial investment. As developed by Cessna's subsidiary, National Aero Finance Co., a firm can operate a 310 for approximately $2,000 monthly including hull insurance, all maintenance and taxes.

If, at the end of the lease, the customer decides to buy the airplane, he receives credit at the rate of $1,200 a month of his lease payments toward the purchase price.

The agreement provides for 50 hr. monthly flying time; time over this figure will be billed at the rate of $40 per additional flying hour.

Airplanes will be provided to dealers by the factory through Nafco, which will maintain a 310 pool, to which the dealers will return the airplanes if they are not sold.

Airplanes will be the latest model with auxiliary fuel tanks and Group 2-C accessories including an oxygen system, Lear L-2 autopilot with automatic approach coupler and altitude controller, and dual Aircraft Radio Corp. omni. List price of this version run slightly over $75,000.

The new lease plan should prove a boon to dealers, a Cessna outlet representative told AVIATION WEEK, primarily because he doesn't see how any dealer could offer these terms on his own; he estimates that it would cost a prospect another $1,000 or $1,500 monthly if he handled a somewhat similar deal.

WHO'S WHERE

(*Continued from page 23*)

Changes

James L. Murray, administrative assistant to the president, Republic Aviation Corp., Farmingdale, N. Y. Also: **Henry Grady Beaird, Jr.**, chief experimental test pilot.

H. A. Storms, chief engineer, Los Angeles Division, North American Aviation, Inc., Los Angeles, Calif. Also: **J. Raymond Berry, Jr.**, Washington representative for North American's Missile Development and Rocketdyne Divisions.

Andrew A. Nargizian, assistant to the president, Avion Division, ACF Industries, Inc., Paramus, N. J.

Alfred H. Grebe, chief research and development engineer, Filtors, Inc., Port Washington, N. Y.

Paul T. Cullen, assistant to the president and general manager, Sperry Gyroscope Co., Division of Sperry Rand Corp., Great Neck, N. Y.

Rear Adm. J. B. Cochran (USN, ret.), development administrator, Atlantic Research Corp., Alexandria, Va. Also: **Philip K. Reily, Jr.**, assistant to the president; **Michael W. Maresca, Jr.** and **Forrest E. Logan** have joined the Chemistry Division.

Harry M. St. John, manager-sales, Sundstrand Aviation, Denver, Colo.

Claude V. Hawk, assistant chief engineer, Harrison Radiator Division, General Motors Corp., Lockport, N. Y.

Edward D. Jackson, manager, newly established aviation manufacturing facility of Axelson Manufacturing Co., Los Angeles, Calif.

A. Keith Singer, general communications manager, Trans World Airlines, Inc. Also: **Vernon Radcliff**, director-economic research.

George Louis Curtis, systems planning engineer, Federal Telecommunication Laboratories, Palo Alto, Calif.

Mel E. Maurer, general manager, newly acquired Flex-O-Tube Division (Inkster, Mich.), Flexonics Corp., Maywood, Ill.

B. Lazich, director-research and engineering division, Filtors, Inc., Port Washington, N. Y.

Frank F. Kates, director-research and development, Advance Industries, Inc., Cambridge, Mass.

Roy Hughes, manager, Monrovia Aviation Division, Carrier Corp., Monrovia, Calif.

Henry J. Hamm, sales manager, Aircraft Radio Division, Transval Engineering Corp., Culver City, Calif.

Raymond Carl Wagner, contracts administrator (military sales), Servo Corporation of America, New Hyde Park, N. Y.

Orville L. Wilkinson, sales manager-new products, Hydro-Aire, Inc., Burbank, Calif.

Robert S. Thompson, general sales manager, The Cornelius Co., Minneapolis, Minn. Also: **J. W. Mahanay**, manager-aircraft equipment sales, and **L. John Buyse**, sales engineer-aircraft equipment division.

R. A. Powley, division assistant general manager, Aircraft Engine Division, Ford Motor Co., Chicago, Ill. Also: **John A. McCabe**, general manufacturing manager.

Melvin H. Murphy, assistant chief project engineer, Technical Products Division, Packard-Bell Electronics Corp., Los Angeles, Calif.

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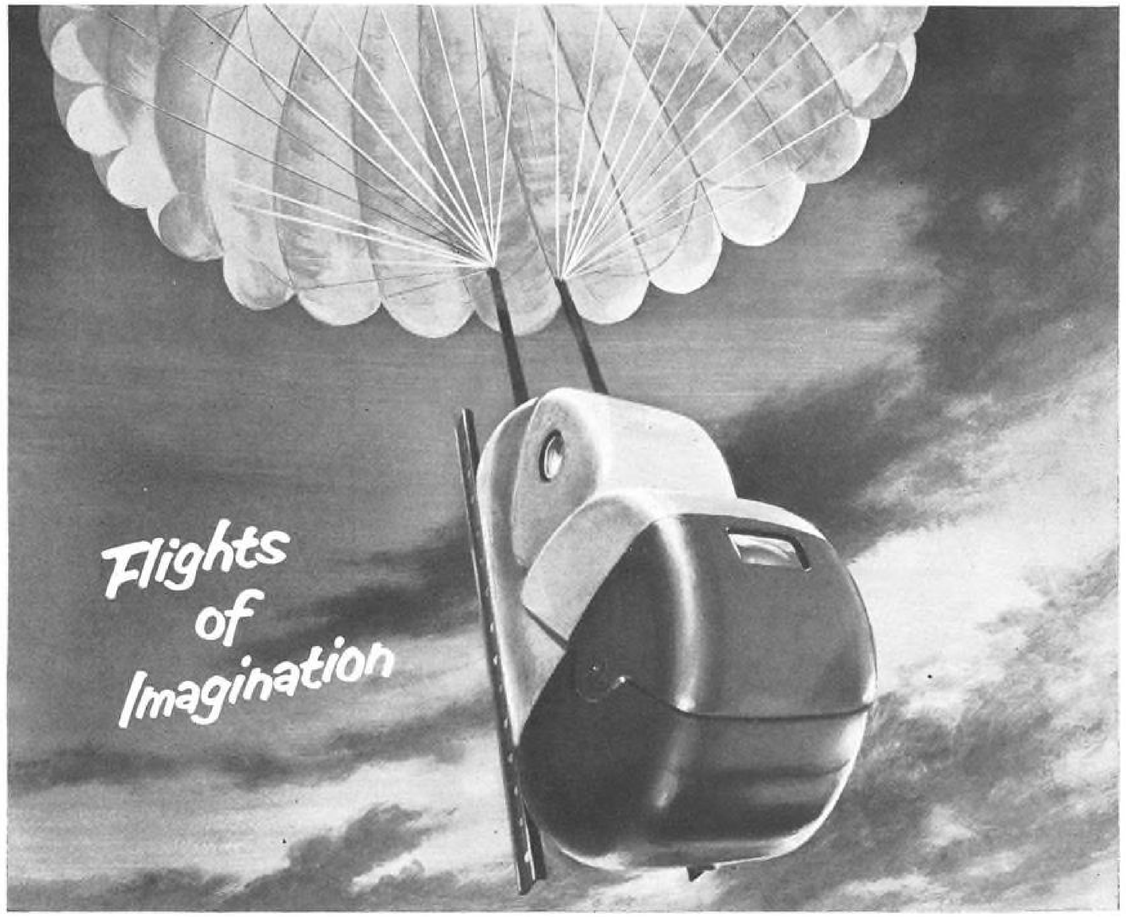
Please send your resume including details of technical background to:

Mr. George Hickman
Engineering Employment Manager

REPUBLIC AVIATION
Farmingdale, L. I., N. Y.



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Salaries and benefits are, of course, liberal. And if you wish to continue your academic studies, company-paid tuition courses leading to advanced degrees are available at nearby colleges.

For further information on your career opportunities at Goodyear Aircraft, write: Mr. C. G. Jones, Personnel Dept., Goodyear Aircraft Corporation, Akron 15, Ohio.

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2.5 Air Traffic Control
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2.7 Stabilizing Devices
2.8 Submarine Fire Control
2.9 Electronic Test Equipment

3.0 FIELD EVALUATION
3.1 Data Handling
3.2 Telemetry
3.3 Data Reduction
3.4 Test Equipment
3.5 Field Site Planning

4.0 SYSTEMS ENGINEERING
4.1 Trajectory Analysis
4.2 Airframe Performance
4.3 Weapons Control
4.4 Operations Research
4.5 Radar
4.6 Error Analysis
4.7 Reliability

5.0 COMPONENTS
5.1 Transistors
5.2 Magnetic Amplifiers
5.3 Synchros
5.4 Tachometers
5.5 Accelerometers
5.6 Resolvers
5.7 Integrators

6.0 RADAR
6.1 CW Doppler Systems
6.2 Antenna Design
6.3 Components
6.4 Pulse Circuitry
6.5 Countermeasures
6.6 Laboratory Evaluation

7.0 PROJECT ADMINISTRATION
7.1 Project Planning & Control
7.2 Sub-Contracted Liaison
7.3 Contracts Evaluation
7.4 Project Coordination

8.0 DIGITAL COMPUTERS
8.1 Logical Design
8.2 Dynamic Analysis
8.3 Circuit Development
8.4 Component Development
8.5 Packaging
8.6 Field Evaluation

9.0 ENVIRONMENTAL
9.1 Vibration
9.2 Shock
9.3 System Test
9.4 Component Test
9.5 Materials Analysis
9.6 Dynamics

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Technical Personnel Department 2-674

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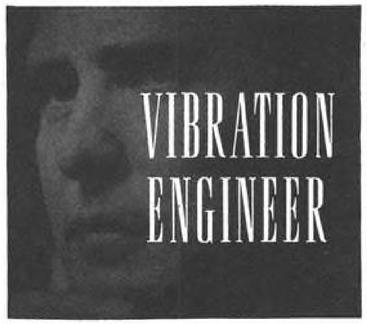

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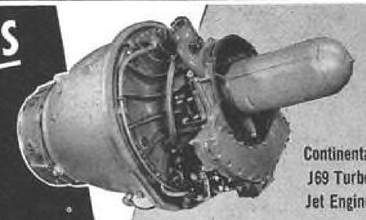

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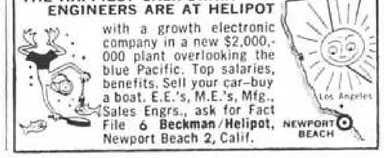

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ADVERTISERS IN THIS ISSUE

AVIATION WEEK, FEBRUARY 11, 1957

ADEL PRECISION PRODUCTS, DIV. OF GENERAL METALS CORP. 8
Agency—The McCarty Company
AEROQUIP CORPORATION 7
Agency—The Fred M. Randall Company
AIRCRAFT EQUIPMENT TESTING COMPANY... 98
Agency—Mahood Advertising, Inc.
AIR FRAME & MISSILES DIV. NORTH AMERICAN AVIATION, INC. 84
Agency—Batten, Barton, Durstine & Osborn, Inc.
AIRWORK CORPORATION 92
Agency—Gene Wyble Advertising
AVIATION WEEK 122, 123
AUTONETICS DIV. NORTH AMERICAN AVIATION, INC. 102
Agency—Batten, Barton, Durstine & Osborn, Inc.

BARRY CONTROLS, INCORPORATED 101
Agency—Engineered Advertising
BELL AIRCRAFT CORP. 69
Agency—Baldwin, Bowers & Strachan, Inc.
BOEING AIRPLANE COMPANY 44
Agency—Calkins & Holden, Inc.
BRIDGEPORT THERMOSTAT DIV., ROBERTSHAW-FULTON CONTROLS CO. 57
Agency—Arndt-Preston-Chapin-Lamb & Keen, Inc.

CALIFORNIA TECHNICAL INDUSTRIES 83
Agency—Sturges & Associates
CARPENTER STEEL CO., THE 24
Agency—Beaumont, Heller & Sperling, Inc.
CELCO CONSTANTINE ENGINEERING LABORATORIES CO. 100
Agency—John Philips Adv. Co.
CESSNA AIRCRAFT COMPANY 74
Agency—Lago & Whitehead Adv.
CHANCE VOUGHT AIRCRAFT, INC. 66, 67
Agency—Tracy-Locke Adv.
COLOR TELEVISION, INCORPORATED 83
Agency—Sturges & Associates
COLUMBUS DIV. NORTH AMERICAN AVIATION, INC. 124
Agency—Batten, Barton, Durstine & Osborn, Inc.
CONSOLIDATED DIESEL ELECTRIC CORP. 4
Agency—DeGarmo, Inc.
CONVAIR A DIV. OF GENERAL DYNAMICS CORP. ..... 2nd Cover
Agency—Buchanan & Co., Inc.

DETROIT CONTROLS CORP., CONTROL ENGINEERING UNIT 100
Agency—S. Gunnar Myrbeck & Co.
DOW CORNING CORPORATION 14
Agency—Church & Guisewite, Adv.

EASTERN INDUSTRIES, INC. 10
Agency—Remsen Adv. Agency, Inc.
EDO CORPORATION 11
Agency—Davis, Parsons & Strohmeier, Inc.
ELASTIC STOP NUT CORP. OF AMERICA..4th Cover
Agency—G. M. Basford Company
ELECTRICAL ENGINEERING & MFG. CORP. 35
Agency—West-Marquis, Inc.
ELGIN NATIONAL WATCH CO. ORDNANCE DIV. 12
Agency—Waldie & Briggs, Inc.
ESSO EXPORT CORPORATION 46
Agency—McCann-Erickson, Inc.

FAIRCHILD ENGINE & AIRPLANE CORP. 95
Agency—Gaynor, Colman, Prentis & Varley, Inc.
FLIGHT REFUELING, INC. 93
Agency—Davis, Parsons & Strohmeier, Inc.
FOSTER MFG. CO., JOHN J. 78
Agency—Rhea Advertising

GABB SPECIAL PRODUCTS 63
Agency—Charles Palm & Co., Inc.
GENERAL MILLS, INC., MECHANICAL DIV. 55
Agency—Knox Reeves Adv.
GENERAL PRECISION LABORATORY, INCORPORATED 18
Agency—Geer, Du Bois & Co., Inc.
GOODRICH CO., THE B. F. AVIATION PRODUCTS DIV. 20
Agency—Batten, Barton, Durstine & Osborn, Inc.

HAMILTON STANDARD DIV. UNITED AIRCRAFT CORP. 36
Agency—Lennen & Newell, Inc.
HAMILTON STANDARD DIV., UNITED AIRCRAFT CORP. 37
Agency—Chambers-Wiswell, Inc.
HEINEMANN ELECTRIC COMPANY 96
Agency—Thomas R. Sundheim Adv.
HI-SHEAR RIVET TOOL COMPANY, THE 85
HYDRO-AIRE, INC. 13
Agency—Byron H. Brown & Staff

INTERNATIONAL BUSINESS MACHINES CORP. 60, 61
Agency—Benton & Bowles, Inc.

KAMAN AIRCRAFT CORP., THE 48, 49
Agency—Charles Palm & Co., Inc.
KIDDE & CO., INC., WALTER 22
Agency—Cunningham & Walsh, Inc.

LINEAR, INC. 77
Agency—The Allen-Kinnett Co., Adv.
LOCKHEED AIRCRAFT CORP., MISSILES SYSTEMS DIV. 88, 89
Agency—Hal Stebbins Adv.

MAGNETIC SEAL CORPORATION 70
Agency—Shattuck, Clifford & McMillan, Inc.
MALLORY SHARON TITANIUM CORPORATION.. 42
Agency—The Griswold-Eshleman Co.
MARTIN CO., THE GLENN L. 50
Agency—Vansant, Duzhaic & Co., Inc.
McDONNELL AIRCRAFT CORPORATION 72
M. C. MANUFACTURING CO. 79
Agency—St. Claire Adv. Agency
MINNEAPOLIS-HONEYWELL REGULATOR CO. 52, 53
Agency—Foote, Cone & Belding

MOOG VALVE CO., INC. 125
Agency—Warman, Robbins & Gorham, Inc.
MOTOROLA, INC., COMM. & ELEC. DIV. 16
Agency—Kolb & Abrahani Adv.

NEW DEPARTURE DIV., GENERAL MOTORS CORP. 58
Agency—D. P. Brother & Co., Inc.

PACKARD ELECTRIC DIV., GENERAL MOTORS CORP. 76
Agency—Campbell-Ewald Co.
PENNSYLVANIA FLUOROCARBON CO., INC. 106
Agency—John B. Ferguson Jr. Adv.
PHILLIPS PETROLEUM CO. 5
Agency—Lambert & Feasley, Inc.

RADIATION, INC. 71
Agency—Willard E. Botts Adv., Inc.
RAMO-WOOLDRIDGE CORP. 107
Agency—The McCarty Company
RED BANK DIV., BENDIX AVIATION CORP. 54
Agency—McManus, John & Adams, Inc.
REPUBLIC STEEL CORP. 64, 65
Agency—Meldrum & Fewsmith, Inc.
RYAN AERONAUTICAL COMPANY 108
Agency—Batten, Barton, Durstine & Osborn, Inc.
RYERSON & SON, INC., JOSEPH T. 100
Agency—Calkins, Holden, Carlock, McClinton & Smith, Inc.

SEARCHLIGHT SECTION 110-121
SIKORSKY AIRCRAFT DIV., UNITED AIRCRAFT CORP. 109
Agency—G. F. Sweet & Co., Inc.
SOLAR AIRCRAFT COMPANY 15
Agency—The Phillips-Ramsey Co., Adv.
SOUTHWEST AIRMOTIVE CO. 68
Agency—Don L. Baxter, Inc.
SPERRY GYROSCOPE CO., DIV. OF SPERRY RAND CORP. ..... 3rd Cover 9
Agency—Resch, Yates & Mattoon, Inc.
SPRAGUE ELECTRIC CO. 56
Agency—The Harry P. Bridge Co.
STANDARD FACTORS CORPORATION 90
Agency—Newby & Peron, Ltd.
STRATOS DIV. OF FAIRCHILD ENGINE & AIRPLANE CORP. 3
Agency—Gaynor, Colman, Prentis & Varley, Inc.
STROMBERG-CARLSON CO., DIV. GENERAL DYNAMICS CORP. 99
Agency—Charles L. Rumrill & Co., Inc.
SYSTEMS LABORATORIES CORP. 107
Agency—Davis Parry & Associates

TIMMINS AVIATION LIMITED 108
Agency—Ronald Bellveau Adv.
TITANIUM METALS CORP. OF AMERICA 17
Agency—W. L. Towne Adv.
TRANS-SONICS, INC. 6
Agency—Louis K. Frank Co.

UNITED STATES GRAPHITE CO., DIV. OF THE WICKES CORP. 94
Agency—Price, Tanner & Willox, Inc.
UNITED STATES STEEL CORP. 104
Agency—Batten, Barton, Durstine & Osborn, Inc.

WHITTAKER CO., LTD., W. R. 62
Agency—Mogge-Privett, Inc.

CLASSIFIED ADVERTISING

F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 110-118

EQUIPMENT (Used or Surplus New) For Sale 118-121

WANTED Equipment 121

ADVERTISERS INDEX

A A X I C O. 120
Aero Parts Supply 120
Aircraft Service, Inc. 120
Arma 112
Atwood Vacuum Machine Co. 117
Bell Aircraft Corp. 117
Collins Eng. Corp. 120
Continental Aviation & Eng. Corp. 116
Engine Works 121
Fidelity Personnel Service 116
Flying Tiger Line 114
Friendship Airport 121
Galbreath & Co., John W. 120
General Electric, Inc. 114, 116, 118
General Motors Corp. 110, 113
Goodyear Aircraft Corp. 111
Harrell, R. G. 120
Helipot Corp. 117
International Aircraft Maintenance Co. 119
Lear, Inc. 117
Lee Co., The 117
Leeward Aeronautical Sales, Inc. 119
Long Beach Airmotive 119
Mark XII Inc. 121
McDonnell Aircraft Corp. 117
Milwaukee County Civil Service Comm. 117
Navco, Inc. 119
Pac Aero Engineering Corp. 118
Page Airways, Inc. 121
Raytheon Mfg. Co. 114
Reaction Motors Inc. 115
Remmert-Werner, Inc. 121
Republic Aviation Corp. 110
Rotor-Aids, Inc. 116
Steward-Davis, Inc. 118
Sunstrand Aviation 117
Trade Ayer Co. 119, 120
Trans-International Airlines, Inc. 120
Welsch Aviation Co. 120
Wold Assoc., Wm. C. 119, 120
Zep Aero 121

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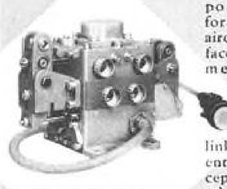

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LETTERS

NACA Wage Squeeze

I am prompted by your editorial of Jan. 21 on the NACA budget to comment on a difficulty with which the NACA is saddled, one no less basic than that of the budget. In the competition for talent the NACA and other governmental laboratories are hamstrung by the Civil Service salary schedule. They are unable to make near-competitive salary offers to the brighter graduates who have promise of research ability. And they are unable to counter the sizable temptations offered to their more capable senior research people by industrial firms. The traditional "edge" of Civil Service in fringe benefits has completely disappeared, so this no longer may be counted upon to attract or hold people.

Tradition requires some sacrifice on the part of a man in a research career. This tradition may perhaps be desirable, but unless the sacrifice is small the quality of research must certainly suffer. Some steps have been taken to improve this situation in government service, but these steps have been largely inadequate. The methods of circumventing Civil Service through private contractors have limitations and disadvantages; these methods are not available to the NACA in any case. The dangers are clear—any government laboratory is subject to attrition of its senior staff and to difficulty in getting in "new blood." Under such conditions morale suffers, and truly original research may decrease or stop.

Your editorial approval of the projected NACA budget should be tempered by editorial caution on this problem which all government agencies have in meeting salary competition. NACA's "40 years of steady and often spectacular additions to the basic knowledge" of aeronautics was not based upon the size of its budget, but rather upon the imaginative and resourceful individuals comprising its staff.

WALLACE D. HAYES
Princeton University
School of Engineering
Princeton, N. J.

Sud-Est Alouette II

In the Dec. 3 issue of AVIATION WEEK, p. 23, you write: "Ouest Aviation is sending three Alouette II helicopters to Boufarik, Algeria, for extensive testing."

I have the pleasure in informing you that the turbine helicopter Alouette II, the holder of the world altitude record of 8,209 meters, is manufactured by Sud-Est Aviation, Societe Nationale de Constructions Aeronautiques, and telling you that in your note you have shown an extraordinary perspicacity anticipating a merger of Ouest Aviation and Sud-Est Aviation, which is presently in the process of being completed.

The result of the merger will be a corporation employing 22,000 people (9th in the world) with a powerful concentration of production means which will increase the rate of production of the aircraft manufactured by the corporation among which I should like to mention the Caravelle, medium jet transport, the Alouette II, a 5-seat turbine helicopter, and the 2-seat Djinn jet helicopter.

J. JAKIMIUK
Director of Sales
Sud-Est Aviation
Paris, France

(Mr. Jakimiuk is correct.—Ed.)

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. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Polar Quadradar

YOUR COVER PICTURE JAN. 21 ISSUE AVIATION WEEK OF GLOBEMASTER AT McMURDO SOUND ANTARCTICA ALSO CLEARLY SHOWS OUR QUADRADAR IN OPERATION ALONGSIDE RUNWAY. THIS IS ONE OF THE TWO QUADRADARS USED EXCLUSIVELY BY NAVY OPERATION DEEPFREEZE AT ITS SOUTHERNMOST ARCTIC AIR BASES. WE ALL SOUTHERN CALIFORNIA REBELS SURELY APPRECIATE FRONT PAGE PICTURE IN YOUR DAMFINE DAMYANKEE MAGAZINE OF OUAH LATEST GCA RADAR EQUIPMENT OPERATED BY SOME MIGHTY FINE NAVY CREWS FOR OVER A YEAR IN THE DEEP SOUTH.

DAVE CALLAHAN
GILFILLAN BROS., INC.
LOS ANGELES, CALIF.

"Dither" Clarified

Your summary of the Pilot Analog results (AW Dec. 31, pp. 62-64) is notably concise and accurate. However, an error that appeared in a paper of mine* was repeated in the Goodyear block diagram, p. 63: the block labelled "dead zone" was actually a viscous damper.

Because of the error, discerning readers may have been misled into suspecting that the interesting 1.4 cps. "dither" oscillation was simply control resonance. As project engineer on the work described, I can testify that it was not. Furthermore, similar oscillations have been observed during "tight tracking" phases of certain flight tests.

R. J. MEAD
McDonnell Aircraft Corp.
St. Louis, Mo.

* *"Development of a Pilot Analog for the Single-Degree-of-Freedom Case," R. J. Mead and N. D. Diamantides in Aeronautical Electronics Digest, 1955, a compendium of papers presented at the National Conference on Aeronautical Electronics (Dayton Section, I.R.E.), Dayton, Ohio, May 9-11, 1955.*

Report to Britain

The bit of venom, captioned Rockets Red Glare (p. 138, AVIATION WEEK Jan. 7) is disgusting, mainly because it typifies the hatred of the not-so-great Britain for everything American except dollars. I wonder how many thousands of American GIs (the "sweepings of Europe" according to Limey Thomas) would be alive today if we'd have really been "on the fence."

Why must Americans continue to be robbed of their necessities (schools, roads, medical research, etc.), through continued and ever increasing "victory tax" rates in order to support such scum.

If, after 17 years of American "aid," Britain can now build commercial transport aircraft and sell them over here, maybe she can *now* build her own military aircraft, rather than depend on further gifts from Uncle Sam. Britain's "Lagging Aircraft Production" is a multi-billion dollar joke--on American taxpayers. What country wouldn't "lag" if by so doing it is made periodic gifts of the finest aircraft in the world—no charge (except to American taxpayers).

DAN FOLEY
Fairmont, West Va.

Future Aircraft

Twice in the past year the Defense Department has canceled its intereceptor weapons systems—the LRI (Long Range Interceptor) and the API (Advanced Piloted Interceptor). The only available defense weapons systems that could possibly replace these piloted interceptors are long range interceptor missiles like the Boeing Bomarc. This is an example of a missile replacing a specialized aircraft. Another example of this is the ICBM and the cruise missiles like the Navaho and Snark which are replacing the intercontinental atom bomber.

The trend toward missiles replacing the one mission type aircraft will continue in the interceptor and nuclear bombardment categories. Obviously the trend for airplane designers will be toward versatility or the multi-mission aircraft.

In the long range interceptor and intercontinental bomber categories the U. S. needs an interceptor-bomber. This type of aircraft would be both a flying anti-aircraft base and a flying missile launcher. The interceptor-bomber should be equipped with long range search radar and should carry a supply of long range air-to-air interceptor missiles for defense against the ICBM, the Bison, the Bear, and future Russian supersonic intercontinental bombers. The bomber version would replace the interceptor missiles with air-to-ground bombardment missiles. For added versatility this type of aircraft should have intercontinental range with provisions to replace the interceptor missiles and bombardment missiles with atomic, thermo-nuclear, and conventional bombs or with supply pods of anti-tank weapons and other items.

LEROY F. IVERSON
Manhattan Beach, Calif.

for Navy's new A3D Skywarrior...

Flight Control System—by Sperry

Fast, long-range jet attack bombers like the new 600/700-mph Douglas Skywarrior require super-precise flight control systems to match their flashing speed and power. And the need for precision control becomes even more critical when they're designed, like the A3D, to carry many types of the Navy's carrier-based weapons.

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Beyond such special requirements Sperry's S-5 system meets all standards of accuracy and reliability required during bombing runs and the long hours of flight back to its tiny landing field afloat.

R. P. SNODGRASS, Director-Flight Research of our Aeronautical Equipment Division. Serving aviation as engineer, analyst and test pilot, he directs Sperry's fleet of aircraft, evaluating new equipment and low-weather flying techniques.

The S-5 Flight Control System is only one of many Sperry systems designed especially for the job to be done. Other Sperry systems are in use today on many of the world's leading airlines, on hundreds of business planes and on thousands of military aircraft.

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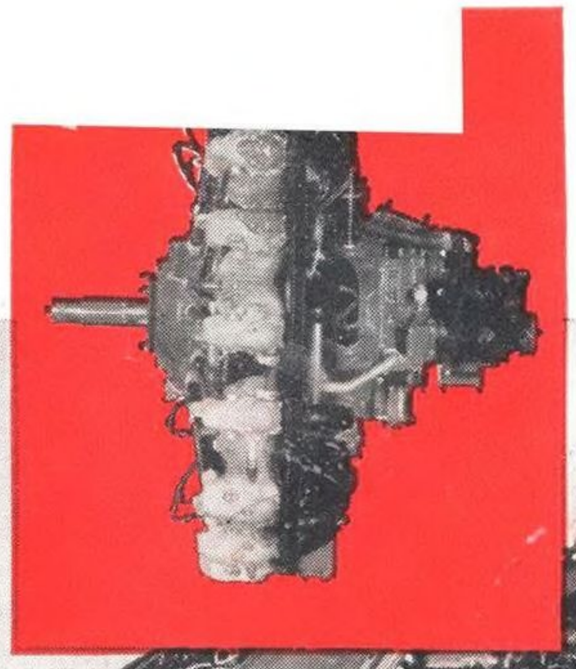
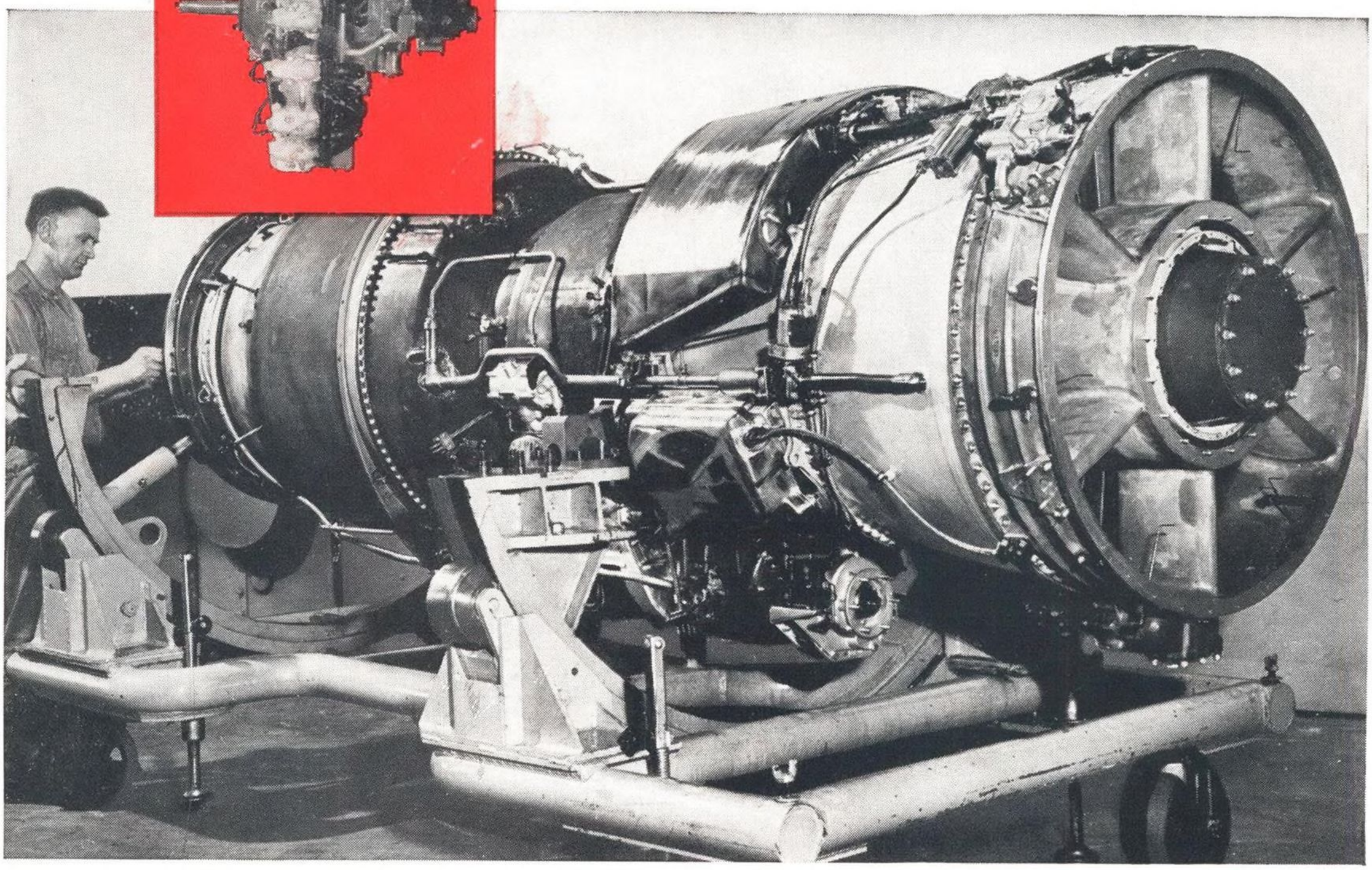


from Wasp Junior to J-57



More than 25 years of engine development and the fasteners are still by ESNA

These two engines . . . built by Pratt & Whitney Aircraft over twenty-five years apart . . . dramatically reflect the evolution of aircraft power plants. Back in the early '30's engines rated at several hundred horsepower pulled air frames at speeds under 200 mph. Today the mighty J-57 develops over 10,000 pounds of thrust and rockets America's fighters through the skies at speeds faster than sound. Both of these power plants embody the finest design and high precision production skills of their era; and both engines use Elastic Stop® nuts for important fastenings.

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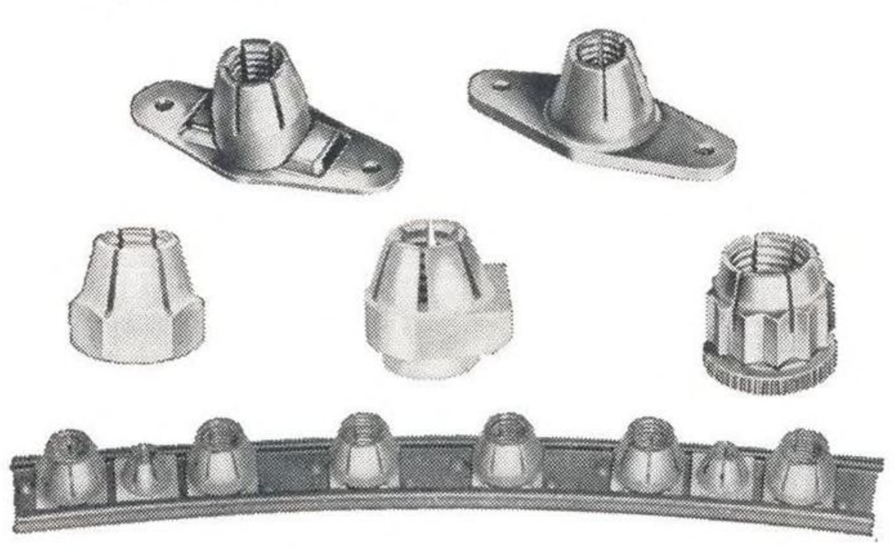

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