

AUGUST 13, 1956 50 cents

AVIATION WEEK

A MCGRAW-HILL
PUBLICATION

Sncase Caravelle



Flight Tests Assay USAF's B-66, Navy's A3D

Are You Interested In WEIGHT REDUCTION?

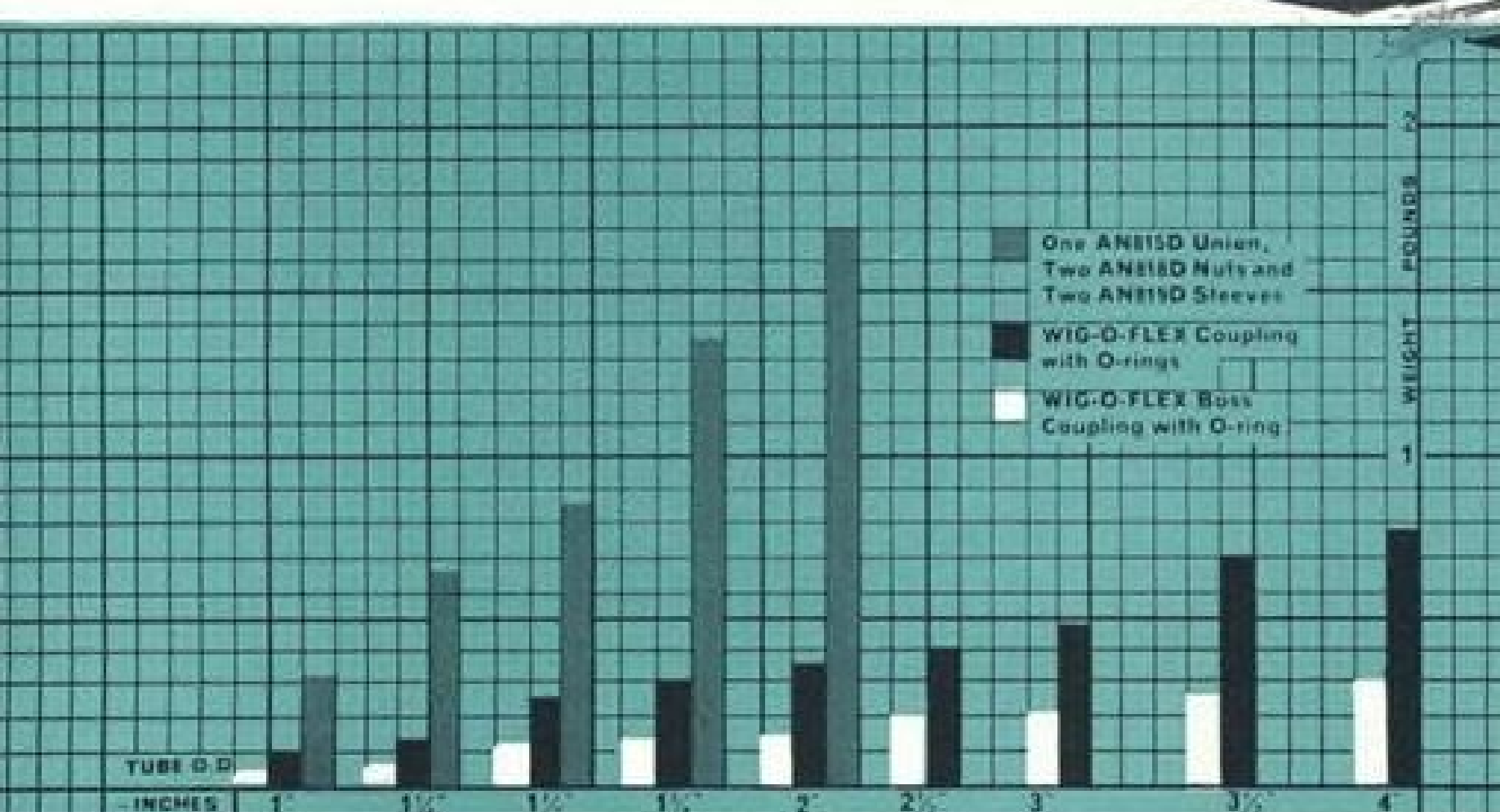
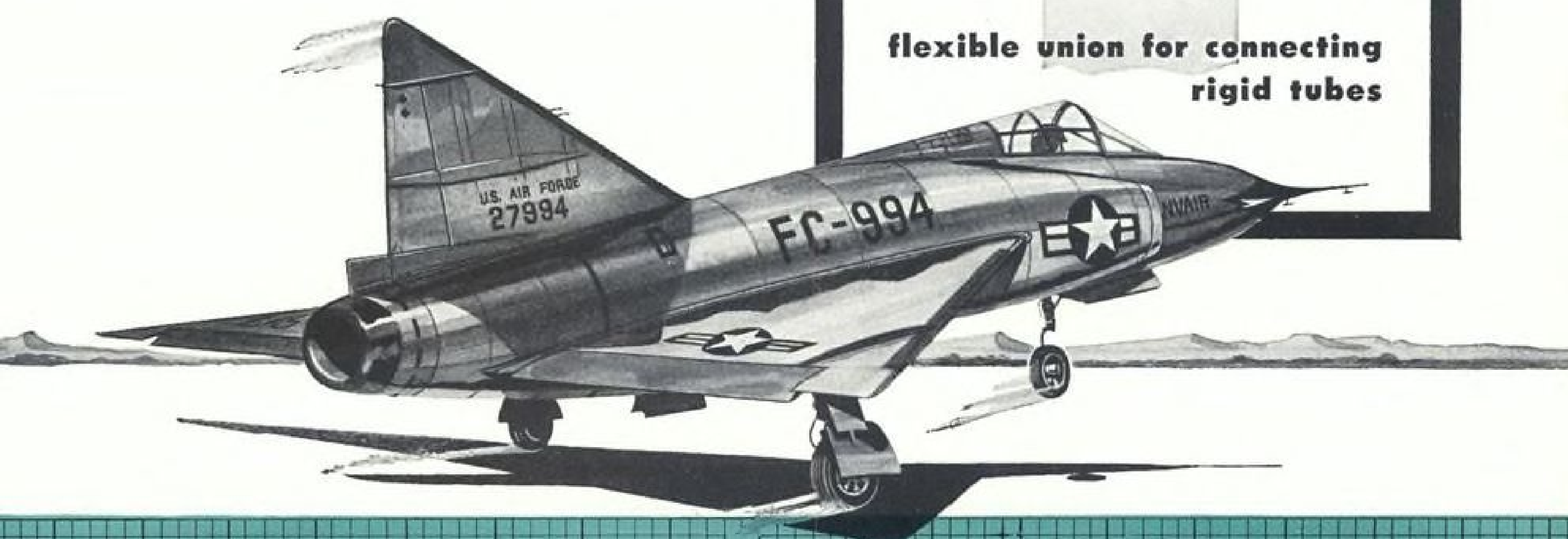
WIGGINS COUPLINGS SAVE 49 POUNDS ON CONVAIR F-102

The new CONVAIR F-102 is 49 pounds lighter because WIG-O-FLEX Couplings replaced standard AN connections and cut hose. We are gratified that engineers at CONVAIR—the company that prides itself on Engineering to the Nth power—chose WIG-O-FLEX Couplings for a plane where weight was a major problem. The WIG-O-FLEX Coupling weighs 1/5 as much as the standard AN connection it can replace. (See weight chart for exact comparisons.)

WIG-O-FLEX COUPLING



flexible union for connecting
rigid tubes



WEIGHT COMPARISON CHART

WIG-O-FLEX COUPLING & AN STANDARD FLARED TUBE CONNECTION

PROVED SUPERIOR FOR FUEL, OIL, AIR

- Withstands more than 1000 psi burst pressure.
- Accommodates 4° tube flexure.
- Installs locally. 80% lighter.
- Temperature range -65°F to +250°F.

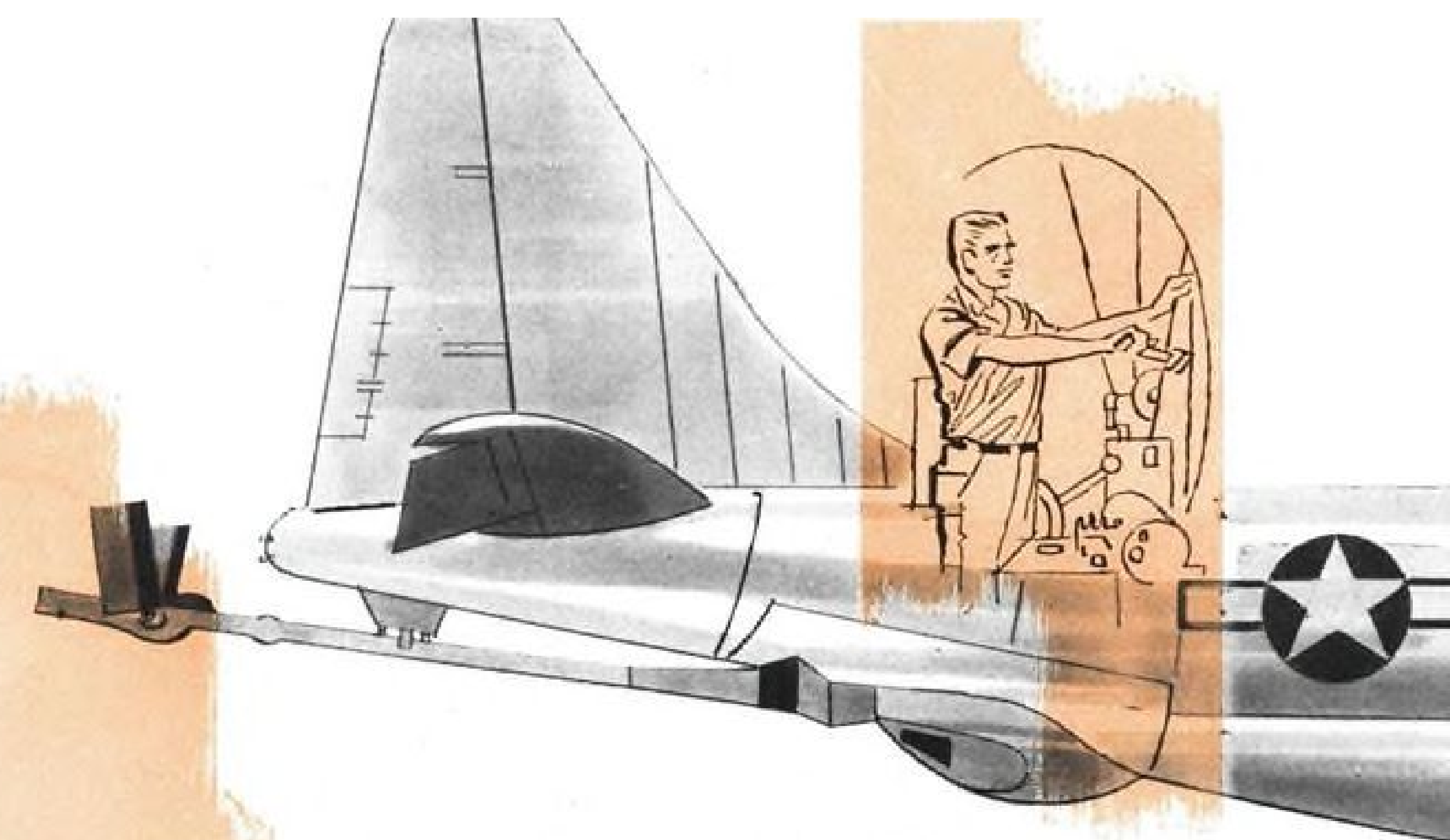
SIZES: 1"-1 1/4"-1 1/2"-1 3/4"-2"-2 1/4"-2 1/2"-2 3/4"-3"-3 1/2"-4"

Wiggins

E. B. WIGGINS OIL TOOL COMPANY, INC.
3424 East Olympic Boulevard, Los Angeles 23, California

WRITE FOR FURTHER INFORMATION

Know-How is the Pay-Off

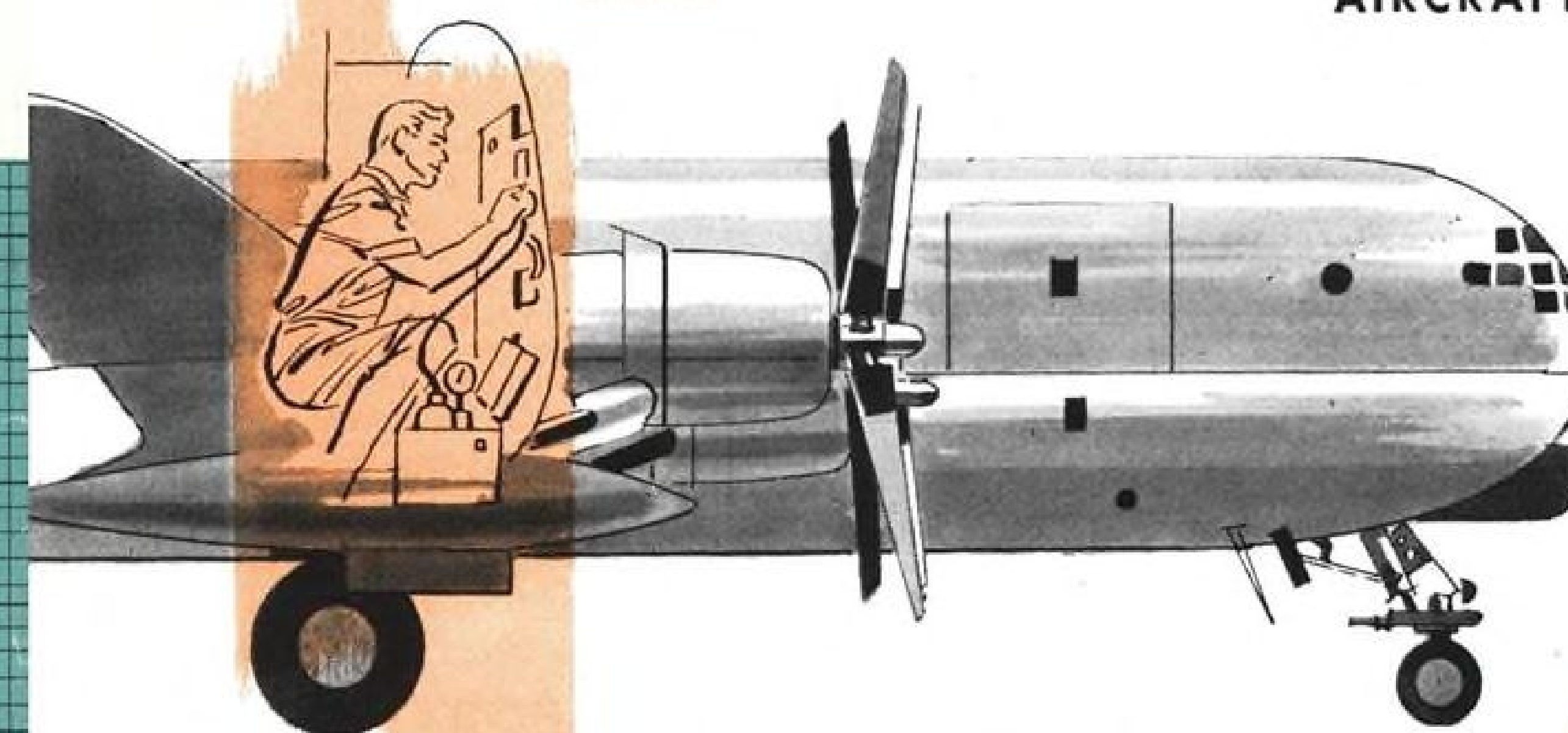


Hayes has been awarded a contract to IRAN recondition KC-97 boom-type tankers, due to Hayes broad experience in aircraft refueling. This contract involves IRAN reconditioning KC-97's for single point refueling.

Hayes has a well designed, efficient Test Station for refueling systems. In addition to the present KC-97 contract, Hayes has performed numerous major projects on refueling tankers, such as the KYB-29T conversion of basic B-29 bombers, and the KB-50 conversion of B-50 basic bombers into three point probe-and-drogue tankers. Over 40% of the KB-50 conversion is completely new in design, requiring more than 8,000 new engineering drawings. Hayes has the know-how in aircraft engineering, aerodynamics, electronics, fabrication and assembly for overhaul-modification of all types of aircraft, under strict cost control. Hayes is the only contractor working on both boom-type and probe-and-drogue tankers.

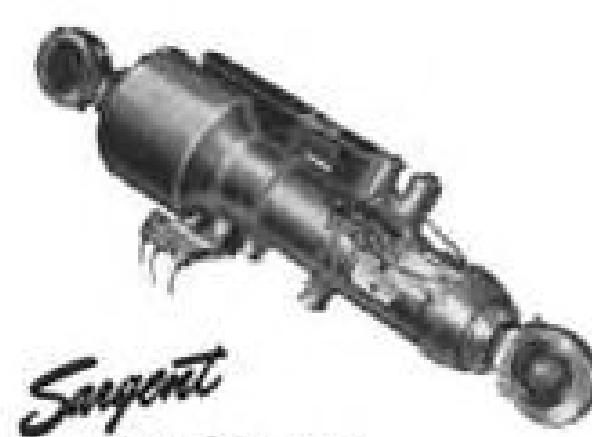
AIRCRAFT ENGINEERS WANTED

With over 6,000 employees, Hayes is a competitive industrial facility for modification and maintenance of aircraft, including guided missile work and engineering design of all types. Opportunities are open for experienced aircraft design engineers, and graduate students in engineering. Write Personnel Department.



ENGINEERS • DESIGNERS • MANUFACTURERS





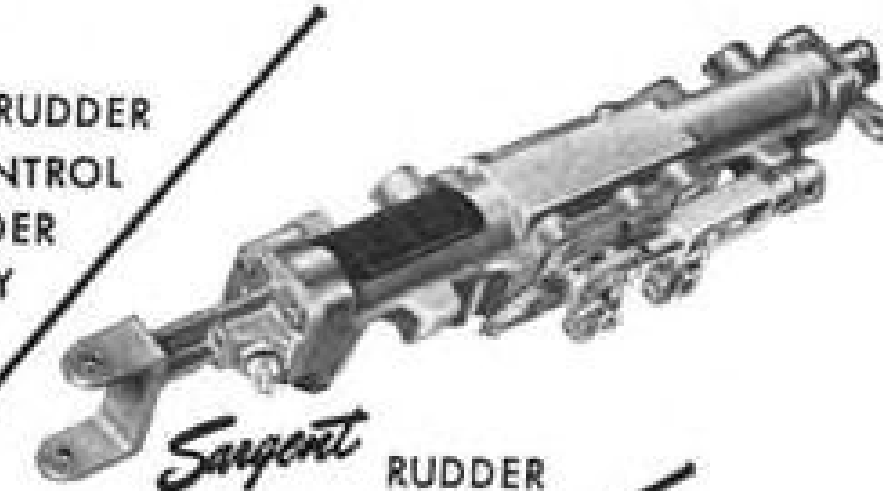
Sargent
2 INBOARD
DROOP CYLINDERS



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Sargent
2 HORIZONTAL TAIL
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CYLINDERS

World's Fastest Navy Fighter 9 Proudly wears Sargent controls

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

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

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

Sargent places its facilities of design and manufacture at your disposal. We invite you to send your specifications for the Sargent proposal of your force control problems.

Standard of Excellence

"GOOD WILL" is the disposition of the pleased customer to return to the place where he has been well treated.

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BUILDS QUALITY THAT BUILDS GOOD WILL

AVIATION CALENDAR

Aug. 15-17—Institute of the Aeronautical Sciences, National Turbine-Powered Air Transportation Meeting, Grant Hotel, San Diego, Calif.

Aug. 20-21—National Telemetering Conference, sponsored by Institute of Radio Engineers, American Institute of Electrical Engineers, Institute of Aeronautical Sciences and Instrument Society of America, Biltmore Hotel, Los Angeles.

Aug. 20-21—Western Quality Control Conference, sponsored by Aircraft Div. of American Society for Quality Control, Hotel Statler, Los Angeles.

Aug. 22-24—Bendix Aviation Corp.'s 1956 International Ignition Conference, Sidney, New York.

Aug. 27-29—Association for Computing Machinery, annual meeting, University of California Westwood Campus, Los Angeles.

Sept. 1-3—1956 National Aircraft Show, Will Rogers Field, Oklahoma City.

Sept. 3-7—Canadian National Air Show, Toronto, Canada.

Sept. 3-9—Society of British Aircraft Constructors' 17th Annual Air Show, Royal Aircraft Establishment, Farnborough, Hampshire, England.

Sept. 9-11—International Northwest Aviation Council, 20th annual convention, Boise, Idaho.

Sept. 10-14—American Society of Mechanical Engineers, Instruments & Regulators Div. Meeting, Detroit, Mich.

Sept. 16-22—American Society for Testing Materials, Second Pacific National Meeting and Apparatus Exhibit, Hotel Statler, Los Angeles.

Sept. 17—International Air Transport Association, 12th annual general meeting, Edinburgh, Scotland.

Sept. 17-21—Eleventh Annual Instrument-Automation Conference & Exhibit, sponsored by the Instrument Society of America, Coliseum, New York, N. Y.

Sept. 17-22—International Congress of Astronautics, sponsored by the International Astronautic Federation, Rome, Italy.

Sept. 23-26—American Society of Mechanical Engineers, Petroleum Conference, Hotel Statler, Dallas, Tex.

Sept. 24-28—1956 Trade Fair of the Atomic Industry, Navy Pier, Chicago.

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Vol. 65, No. 7

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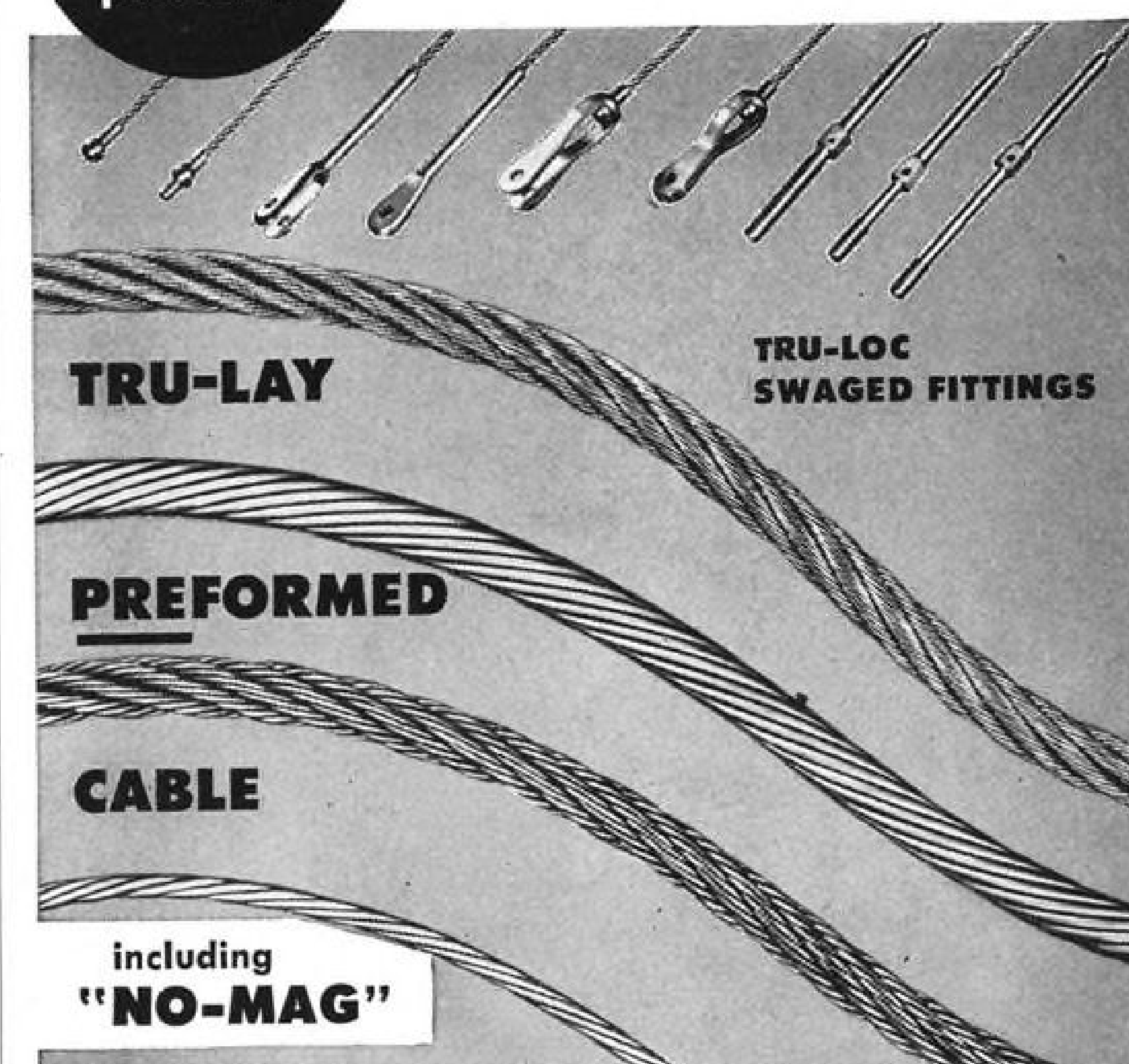
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AVIATION WEEK, August 13, 1956

ACCO
products

TRU-LAY Cables
TRU-LOC Fittings



TRU-LAY

**TRU-LOC
SWAGED FITTINGS**

PREFORMED

CABLE

including
"NO-MAG"

Solving Aircraft Design Problems...

is an old story to ACCO. The originators of preformed cable and swaged terminals for aircraft use, ACCO engineers have now introduced new non-magnetic aircraft cables. The complete line of ACCO cables and fittings now includes...

New "No-Mag" Cable
— ends instrument interference

New "NO-MAG" Aircraft Cables are made from Type 305 stainless steel. Their advantages include:

- Remain non-magnetic even after severe cold working—eliminate instrument interference through cable magnetism.
- Better corrosion-resistance properties than standard stainless steel cables.
- Thermal expansion characteristics are much closer than standard cable to characteristics of aluminum alloys used in aircraft—this simplifies maintaining cable tension under changing temperatures.
- High fatigue and abrasion resistance.

- Preformed construction.
- **TRU-LAY Cable** Provided in all standard stainless and carbon steels in a complete range of sizes and constructions. Because it is preformed it
- Can be cut without seizing.
- Is easier to handle—less tendency to loop or kink.
- Can be installed in less time.
- Is free of tendency to rotate—runs true over sheaves or pulleys—is easier on pulleys.
- Has greatest resistance to bending fatigue—gives longer service.

TRU-LOC Swaged Fittings

- Guaranteed to hold to the rated breaking strength of the cable with which used.
- Eliminate costly, uncertain splicing.
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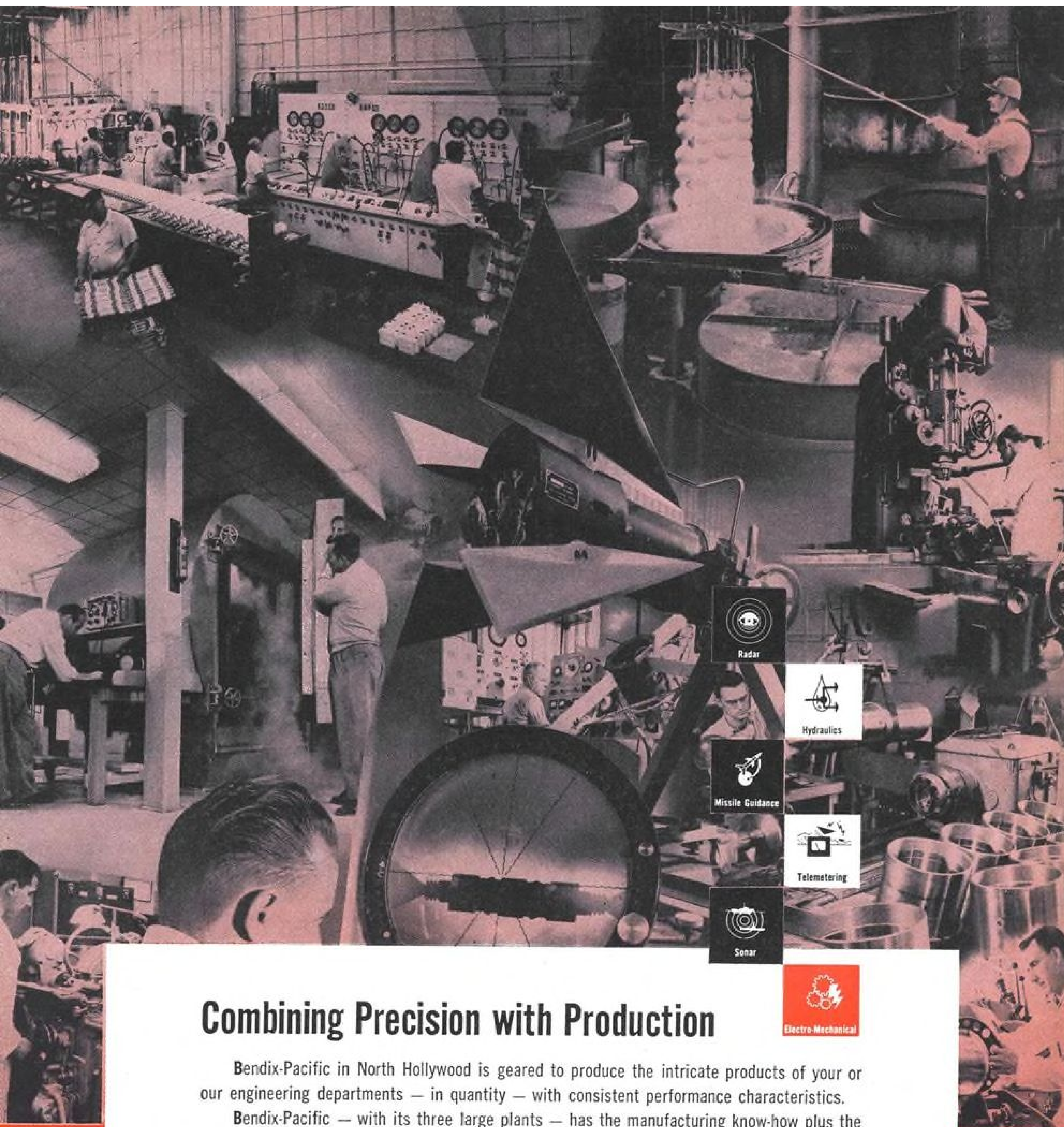
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Cable
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Fittings**



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Bendix-Pacific — with its three large plants — has the manufacturing know-how plus the capacity to meet your quality and performance requirements efficiently and economically, in any quantity desired.

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Did you ever notice that some of Nature's most amiable creatures are those most effectively equipped to deal sorrow to bullies? Now, we at REPUBLIC don't necessarily go all the way with the late Ernest Thompson Seton, who once said the much misunderstood skunk ought to be some sort of national symbol because of its peaceable disposition backed by formidable firepower. But we do think history has shown that in human affairs, too, those who would live without fear must first earn respect.



REPUBLIC AVIATION

FARMINGDALE, LONG ISLAND, N. Y.

Designers and Builders of the Incomparable **THUNDER-CRAFT**

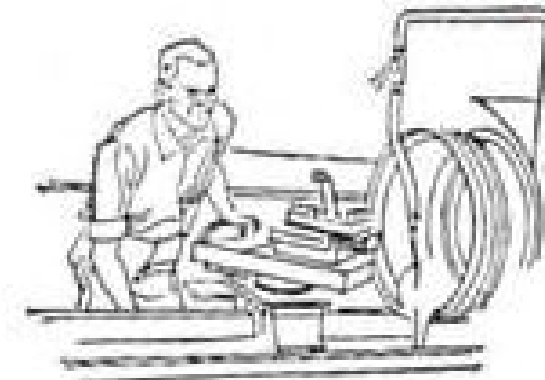
WHAT ARE AMWELD FLASH WELDED RINGS?



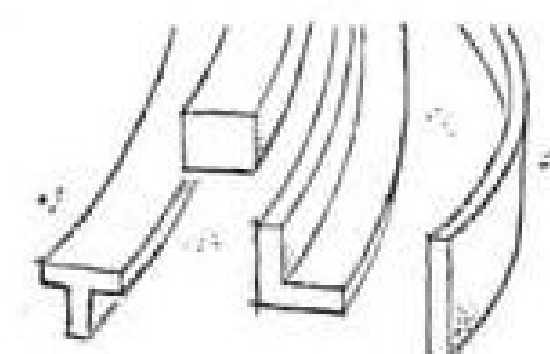
They are rings formed, flash butt-welded, and shaped into the finest quality circular weldments available.



They are rings that offer savings of critical materials. Bar stock formed and flash welded uses considerably less material than rings made by other methods.



They are rings that offer additional manufacturing savings. Since the rings are closer to the desired finished cross section, it is less expensive to machine them to a final dimension. Oh yes, Amweld will machine them for you.



They are rings made by a company with experience in design. We can help you select a mill-rolled or extruded shape that is even closer to the finished ring dimension. This can give you additional savings.



Yes, Amweld flash-welded rings can give you extra profit from savings on material and machining time. Amweld rings can be made of most weldable ferrous or non-ferrous metals in sizes from 4 to 96 inches.



THE AMERICAN WELDING & MFG. CO. • 420 DIETZ ROAD, WARREN, OHIO

All-woman transcontinental air race winners...



FIRST PLACE
Beechcraft Bonanza flown by Frances Bera; Edna Bower, co-pilot. Sponsored by AeroDuct, Incorporated.



SECOND PLACE
Pilot: Alice Roberts
Co-pilot: Iris Critchell
Sponsor: Rheem Mfg. Co.
Plane: Beechcraft Bonanza



THIRD PLACE
Pilot: Marion Craver
Co-pilot: Betty Lambert
Sponsor: Minthorne Music Co.
Plane: Piper Tri-Pacer



FOURTH PLACE
Pilot: Marion Burke
Sponsor: Burke Aviation
Plane: Piper Super Cub



FIFTH PLACE
Pilot: Irene Leverton
Co-pilot: Carol Cooper
Sponsor: Graubart Aviation
Plane: Beechcraft Bonanza

ALL SPARKED BY AC!

The 10th annual Powder Puff Derby is over . . . the gals have gone home . . . and all the records are duly recorded.

Another fact is recorded, too. *Every one of the first five winners flew a plane equipped with AC Spark Plugs!*

Every AC Spark Plug-equipped plane finished the gruelling 2,366-mile race. Four out of six leg prizes were won by gals flying planes with ACs. Of the even dozen additional prizes, AC Spark Plugs were in seven of the winning planes.

That's a record to be proud of. We think that the Powder Puff Derby has proved, once again, the extra reliability you can expect with AC Aircraft Spark Plugs.

Be sure to specify ACs in your plane.

AC SPARK PLUG  THE ELECTRONICS DIVISION OF GENERAL MOTORS

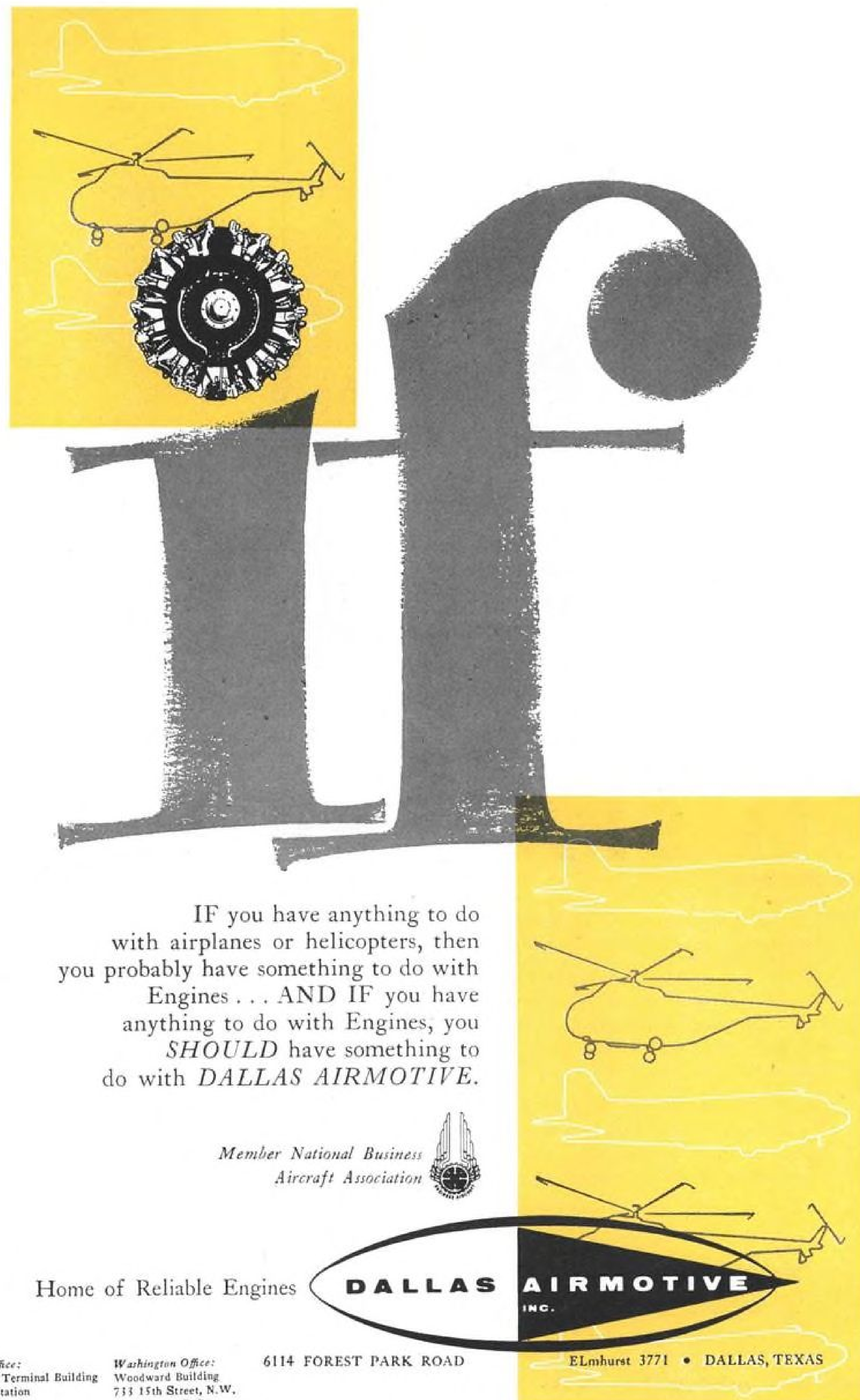


AC short-reach plug shown: S-88. Others: HSR-86; A-88; S-86 R; SR-83 P; HSR-83 P; LA-47; SA-43; A-44.



**AIRCRAFT
SPARK
PLUGS**

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IF you have anything to do with airplanes or helicopters, then you probably have something to do with Engines . . . AND IF you have anything to do with Engines, you *SHOULD* have something to do with *DALLAS AIRMOTIVE*.

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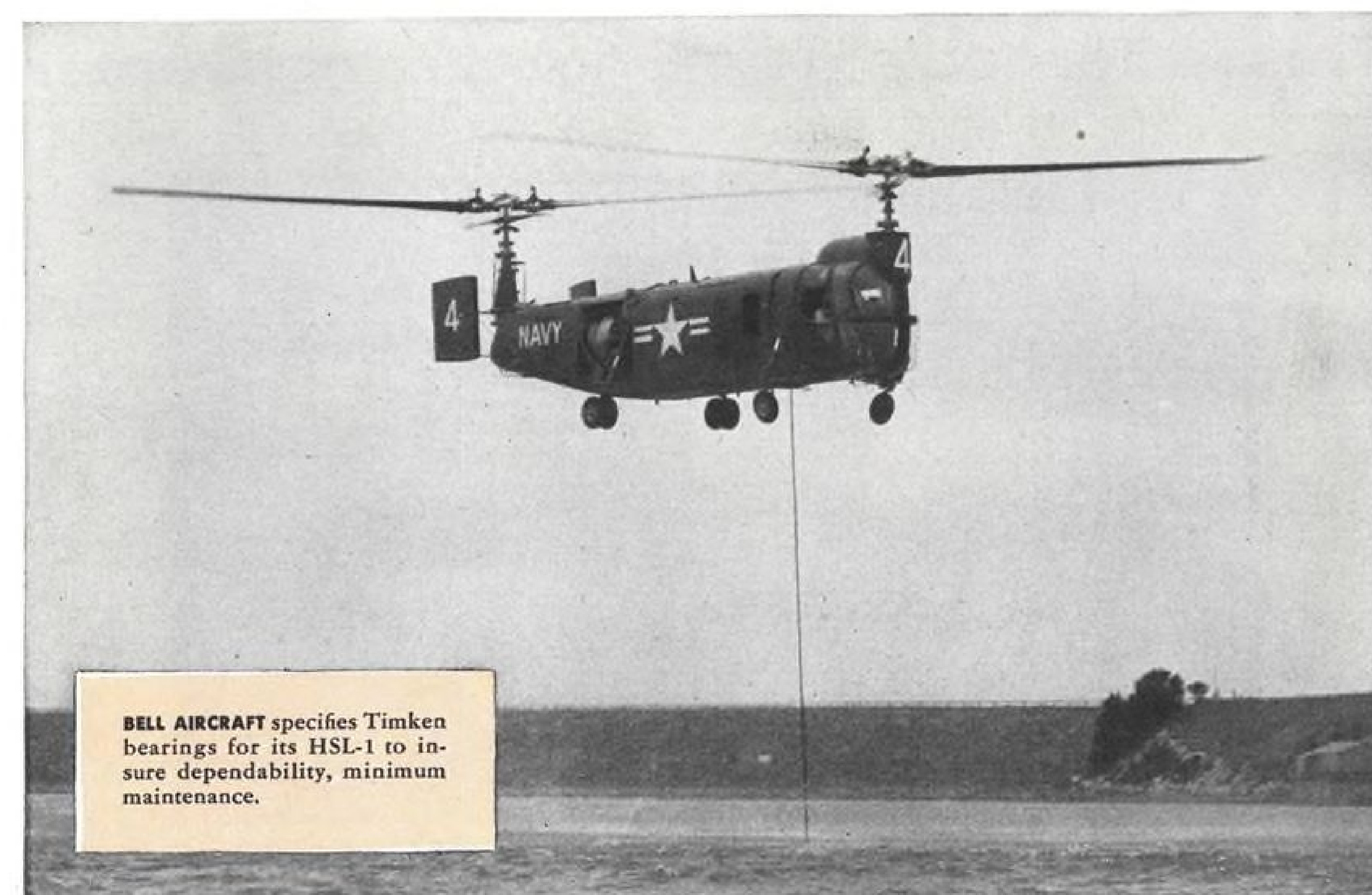
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YOU'RE looking at the Navy's most powerful helicopter, Bell Aircraft's big HSL-1. Advanced rotor design of this new anti-sub 'copter means faster speed, longer range—spells trouble for enemy undersea craft.

Fore and aft transmissions of this twin-rotored watchdog of our sea lanes are mounted on Timken® tapered roller bearings. Timken bearings hold shafts in rigid alignment. Gears mesh accurately, transmit a smooth flow of power with mini-


mum vibration. Fewer transmission and gear box overhauls are required.

The rotor shafts take not only the tremendous radial loads of the whirling blades, but also a thrust load equal to or greater than the weight of the helicopter itself. That's why Timken bearings were selected. Their tapered construction lets them take radial and thrust loads in any combination.

To make sure we get steel good enough for Timken bearings, we make it ourselves. No other bear-

ing maker in the country takes this extra step to insure quality in every bearing.

Whether you build or buy aircraft, make sure the bearings have the trade-mark "Timken". No other bearing can give you so many advantages. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".


 This symbol on a product means its bearings are the best.



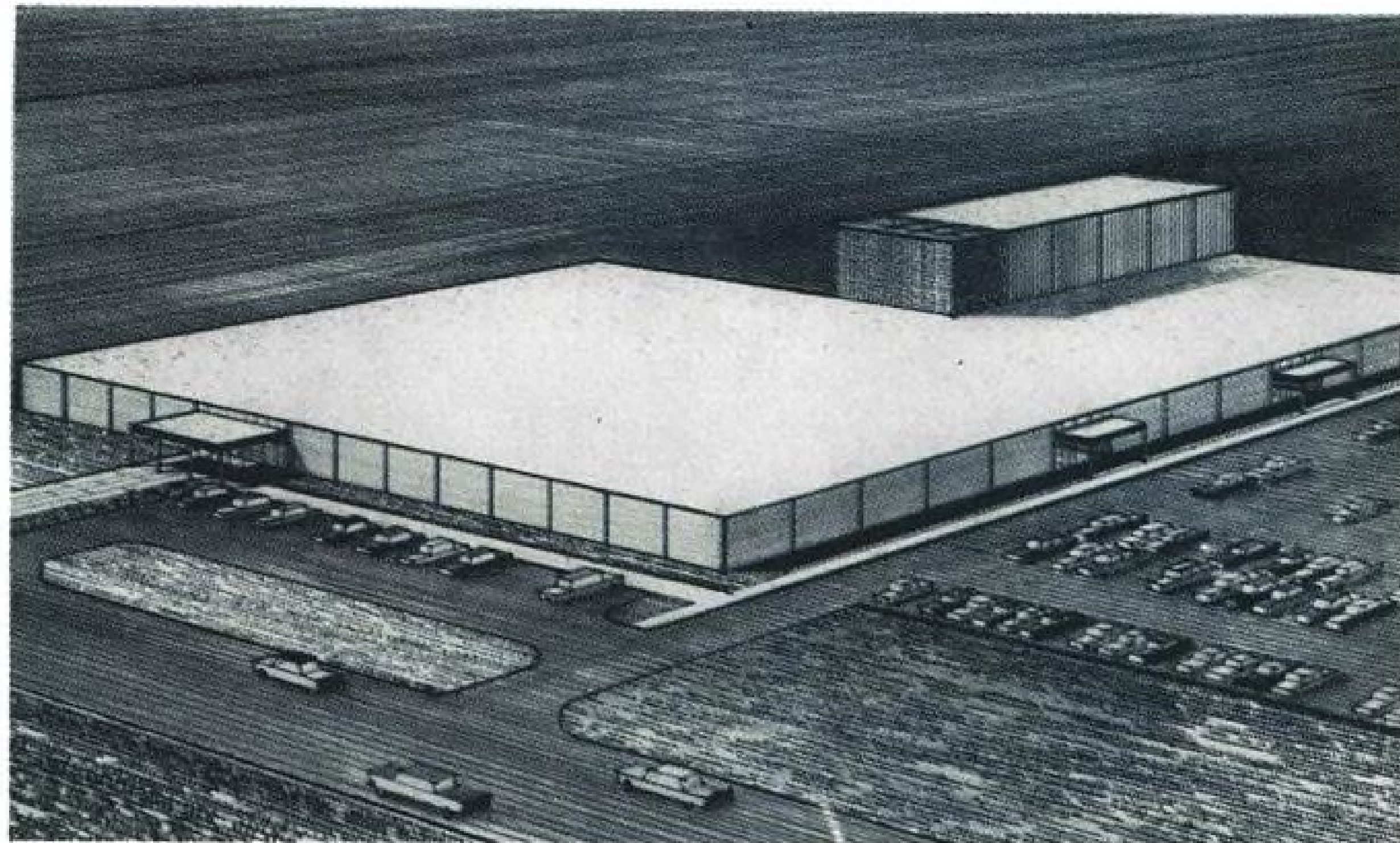
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TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

REVOLUTIONARY BUCYRUS PLANT HELPS HOLD DOWN RISING COSTS

At a new plant in Bucyrus, Ohio, the Timken Company has substantially reduced the cost of tapered roller bearings by: 1) producing these bearings under a new system of extreme mechanization; 2) standardizing on 13 bearing sizes with the widest applications throughout industry. Manufacturers can take advantage of these lower costs by redesigning applications to use these Bucyrus sizes. And as more switch to Bucyrus bearings, production costs can drop still further, meaning even lower costs to you.

NOT JUST A BALL  NOT JUST A ROLLER  THE TIMKEN TAPERED ROLLER  BEARING TAKES RADIAL  AND THRUST  LOADS OR ANY COMBINATION 

This is Temco's new Engineering Center



E. G. Hamilton and George F. Harrell, Architects, Dallas

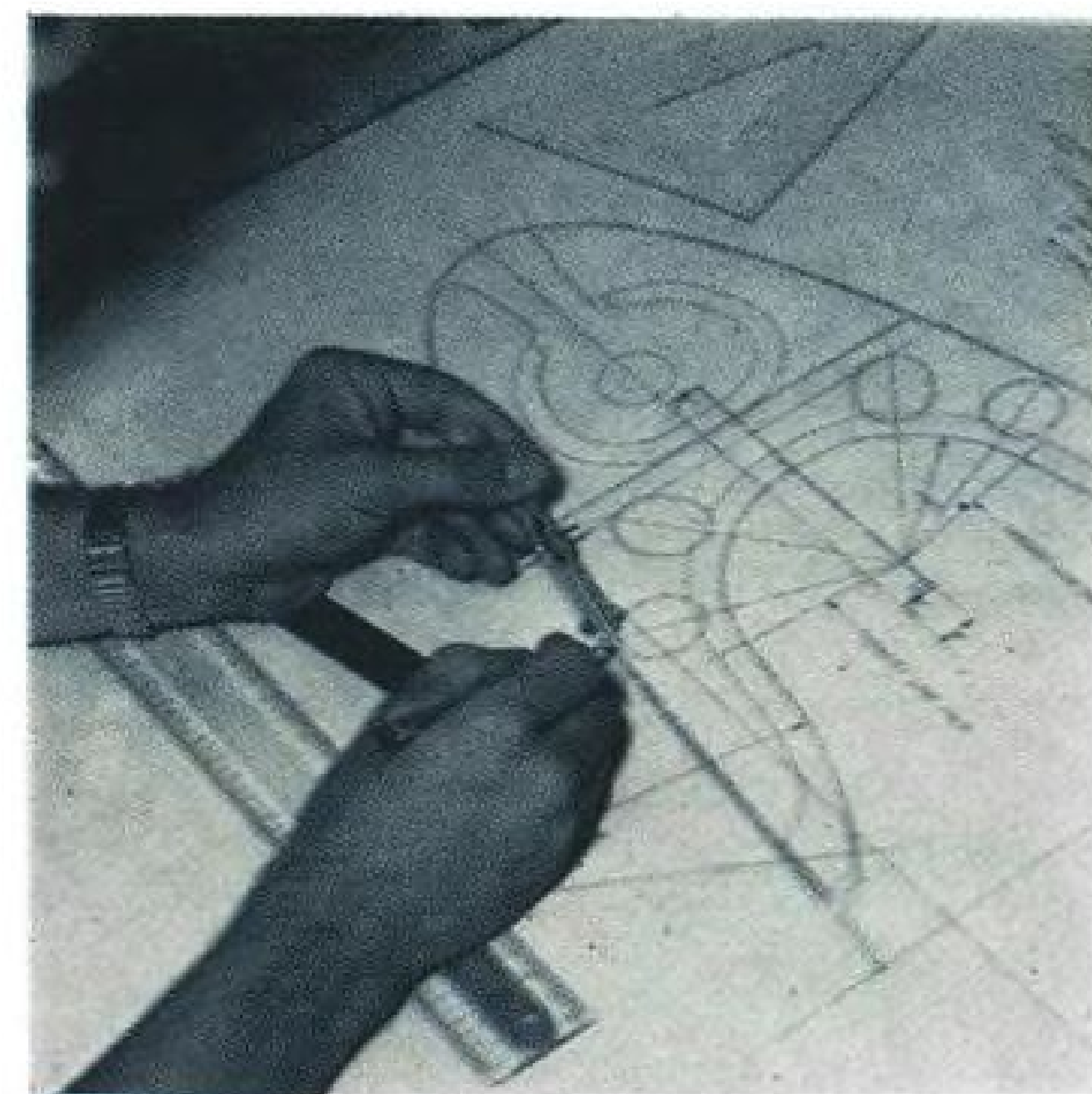
Idea center for new designs in complete aircraft and weapons systems... test-lab for tomorrow's planes and missiles... ultra-modern workshop for a growing force of engineers.

Increasing assignments for development of such Temco projects as the Navy's TT-1 jet primary trainer, plus important subcontracts

in missile and electronics work, have doubled Temco's Engineering Department within the past two years.

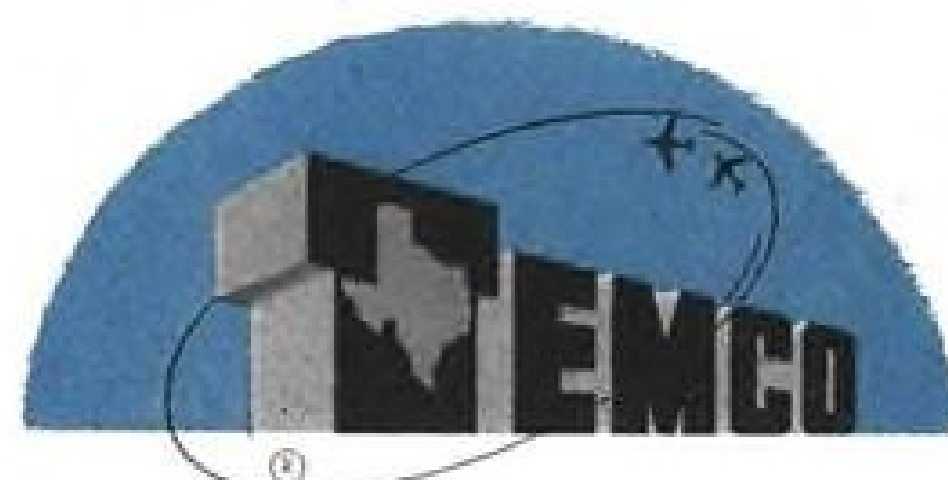
Temco's new million-dollar Engineering Center is designed to permit further expansion at any time. Future programs, already under negotiation, promise yet another doubling in the immediate future.

What is This?



This is a blueprint for tomorrow's air transportation. It's Temco engineering at work on design of components for America's first turbo-prop airliner — the Lockheed Electra.

Temco's proven engineering ability was a deciding factor in earning this important assignment: engineering, tooling and manufacturing ailerons, wing flaps and tips, leading edge assemblies. For the commercial Electra project, Temco is providing the same drawing-board-to-delivery service that is currently at work on fourteen of the nation's top military aircraft.



Engineers: Openings in all phases of aircraft design and development; write to Engineering Personnel, Temco Aircraft Corp., Dallas, Texas

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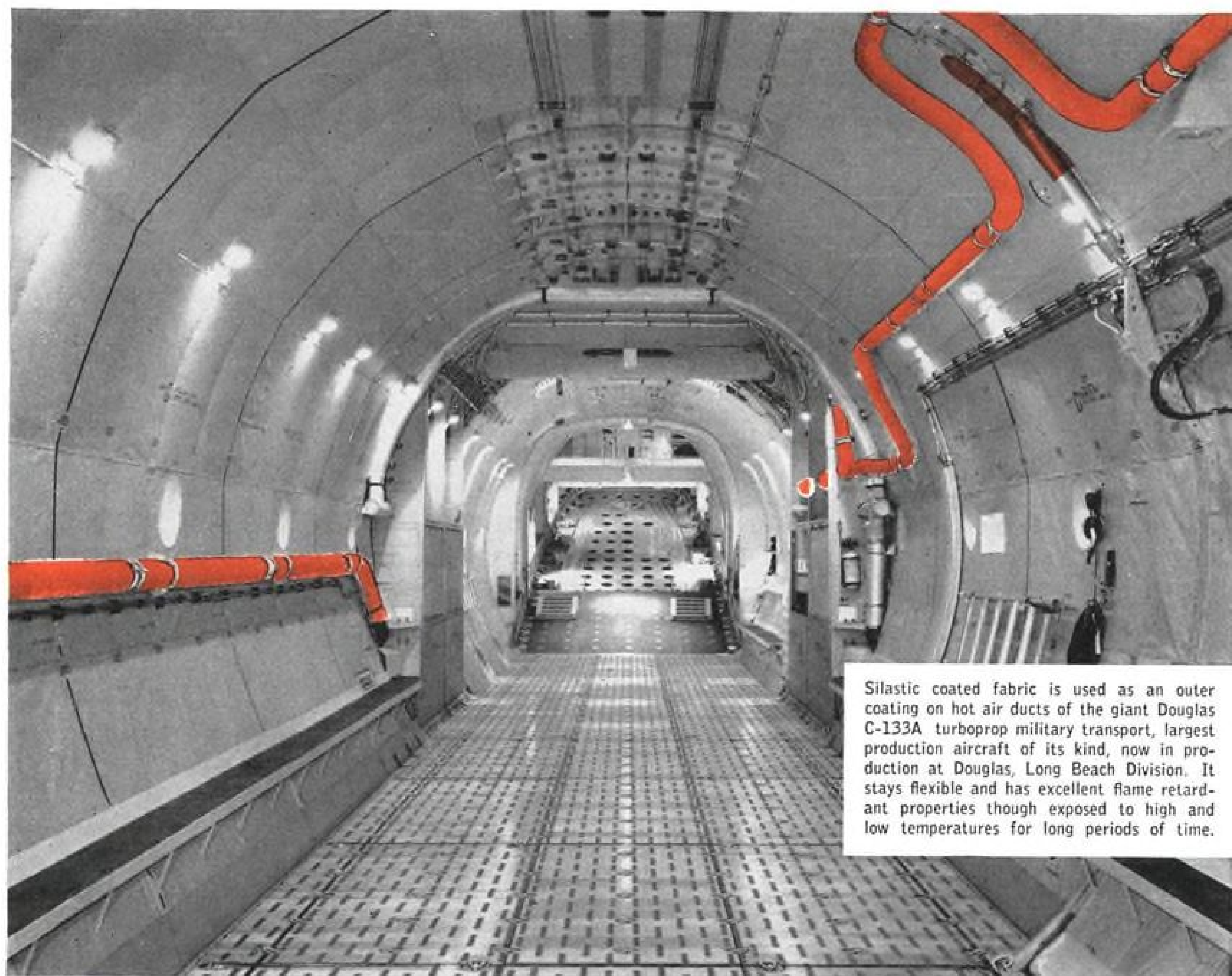
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Silastic coated fabric is used as an outer coating on hot air ducts of the giant Douglas C-133A turboprop military transport, largest production aircraft of its kind, now in production at Douglas, Long Beach Division. It stays flexible and has excellent flame retardant properties though exposed to high and low temperatures for long periods of time.

SILASTIC coated fabrics seal in heat

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Get latest data on Silastic
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Please send me latest data on Silastic

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Fabrics coated with Silastic*, Dow Corning's silicone rubber, are used for ducting, control surface seals, gaskets, and electrical insulating tapes. They give superior resistance to heat, moisture, ozone, certain hot oils and chemicals. Available through leading rubber companies in many combinations of different cloths and compounds to provide the specific properties desired.

Typical Properties of Silastic Coated Fabrics

- | | |
|--|--------------|
| • Temperature range, °F | —130 to 500 |
| • Weather, ozone and corona resistance | Excellent |
| • Abrasion resistance | Fair to Good |
| • Fungus resistance | Excellent |
| • Dielectric strength, volts/mil | 800 to 1200 |
- Flame resistant coated glass fabrics are obtainable by using selected Silastic stocks.

If you consider ALL the properties of a silicone rubber, you'll specify SILASTIC.

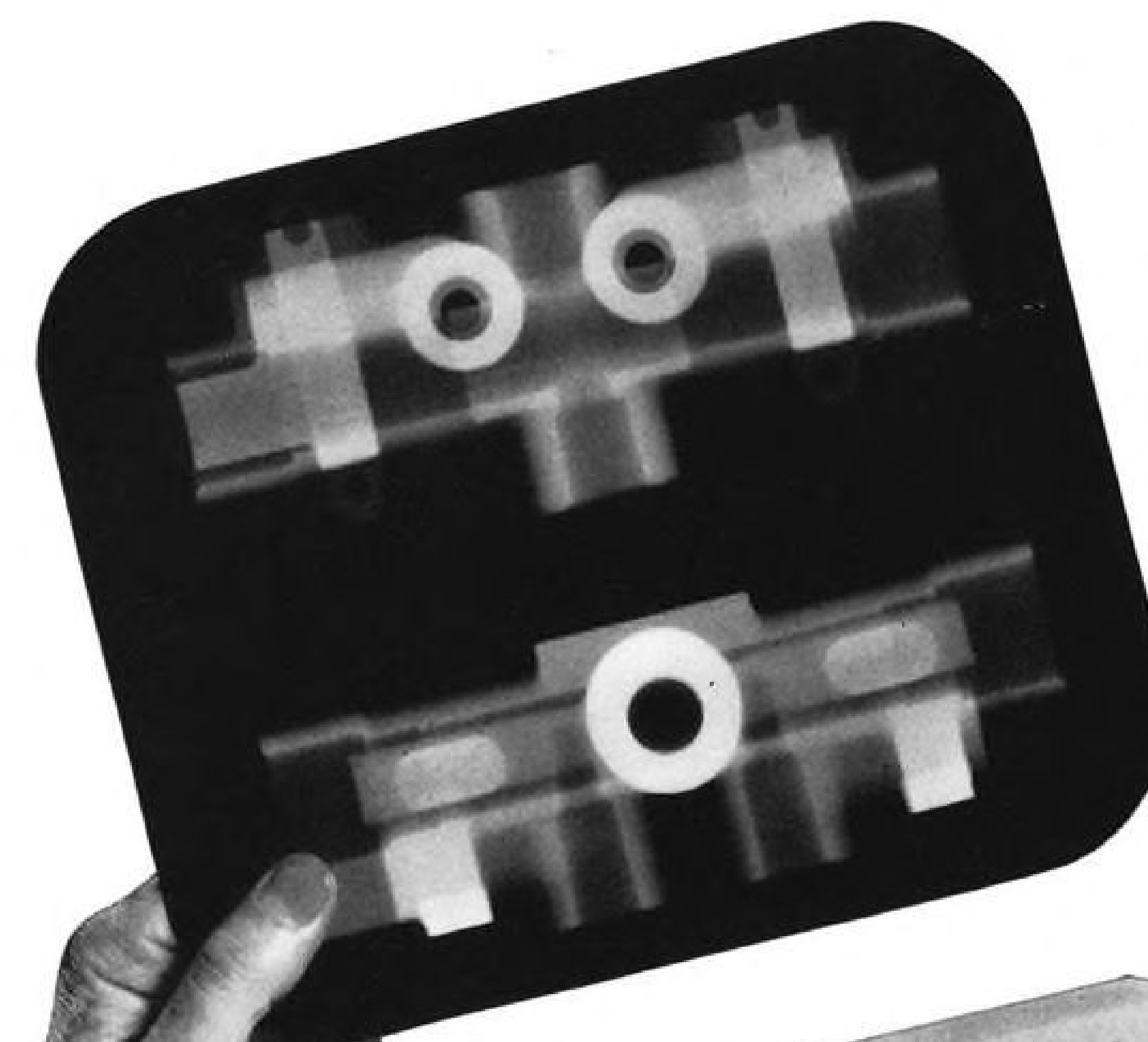
first in silicones

**DOW CORNING
SILICONES**

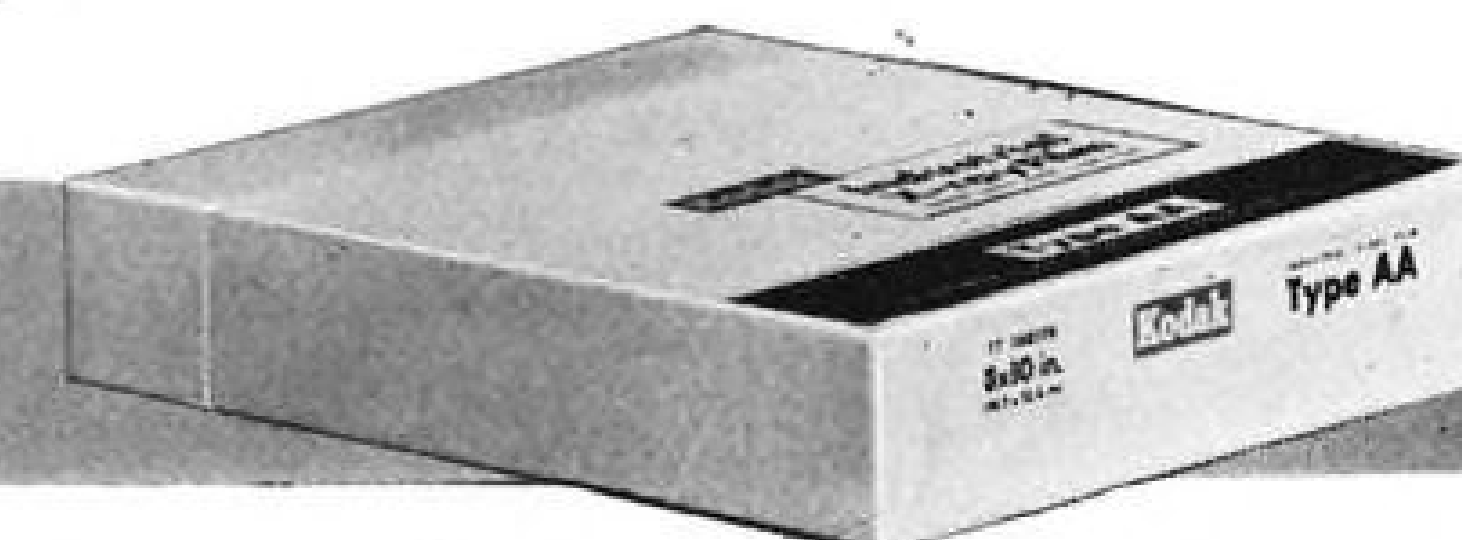
DOW CORNING CORPORATION • MIDLAND, MICHIGAN

New X-ray Film

gives greater detail with usual exposure times



**Kodak
Industrial
X-ray Film,
Type AA**



Read what the new Kodak Industrial X-ray Film, Type AA, will do for you.

- Reduces exposure time—speeds up routine examinations.
- Provides increased radiographic sensitivity through higher densities with established exposure and processing techniques.
- Gives greater subject contrast, more detail and easier readability when established exposure times are used with reduced kilovoltage.
- Shortens processing cycle with existing exposure techniques.
- Reduces the possibility of pressure desensitization under shop conditions of use.

Now your x-ray dealer can supply you with this new x-ray film that gives you greatly increased speed. This gives you the opportunity of using reduced kilovoltage to obtain greater radiographic contrast, and easier readability with established exposure times.

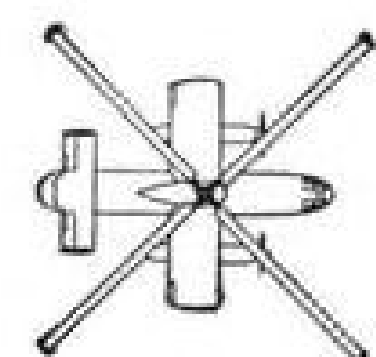
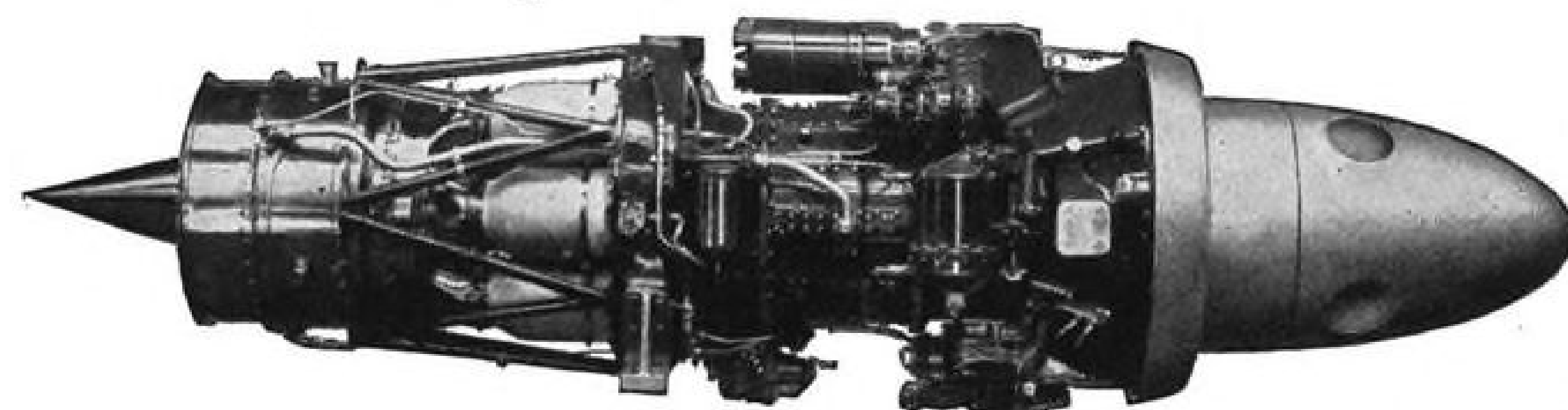
And in addition to ranging up to more than double the speed, this new film retains the fine sensitivity characteristics which have made Kodak Type A the most widely used x-ray film in industry.

Kodak Industrial X-ray Film, Type AA, will save you time. It can produce finer work. Get in touch with your x-ray dealer or Kodak Technical Representative and see how.

EASTMAN KODAK COMPANY
X-ray Division
Rochester 4, N. Y.

Kodak
TRADE MARK

3 engines of increasing importance



ELAND The Convair aircraft converted to Eland engines will be on demonstration flights in Europe during this year. Another aircraft conversion to Elands is the Elizabethan, which will be evaluated on REA routes. Napier Elands fitted with auxiliary compressors for the tip-driven rotor system, will power Fairey's new large transport helicopter, the Rotodyne.

ORYX The Napier Oryx 780-950 gas h.p. turbo-gas-generator provides the hot gas which is ducted to the rotor head for the propulsion of helicopters by jet reaction at the rotor blade tips. This system eliminates all mechanical transmission. The Oryx has been officially Type Tested at 780 and 865 gas h.p.

GAZELLE Gazelle 1260-2000 s.h.p. A rugged new free turbine engine for helicopters—selected for the Royal Navy Westland "Wessex" and the R.A.F. twin-motor Bristol 192. For ease of installation it can be mounted in any position between the vertical and horizontal. Helicopters demand tough, reliable engines—the Gazelle is designed for strenuous duty, long service between overhauls while its outstanding simplicity means economical and speedy maintenance.

Designers and manufacturers of Rocket Engines,
Rocket Motors and Ramjets.

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Collins Radio Company counts on General Electric 5-Star Tubes to help maintain reliability of the WP-101 Airborne Radar system. Thirty-two 5-Star Tubes of five types fill critical sockets in this equipment.

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AUGUST 13, 1956

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VOL. 65, NO. 7

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Congress Leads Sorry Safety Record.. 21

COVER: Sncase Caravelle has entered commercial cargo operations for Air France. This is first of 12 of the twin-engine jet airliners which will begin passenger service around end of next year. As part of Caravelle operational survey, Air France made run from Algiers to Paris using only one jet engine. Flight, at cruising altitude of 20,000 ft., took 3 hr. 3 min. British Rolls-Royce jet Conway by-pass engines are contemplated for future Super-Caravelle. For more on Caravelle, see page 37.

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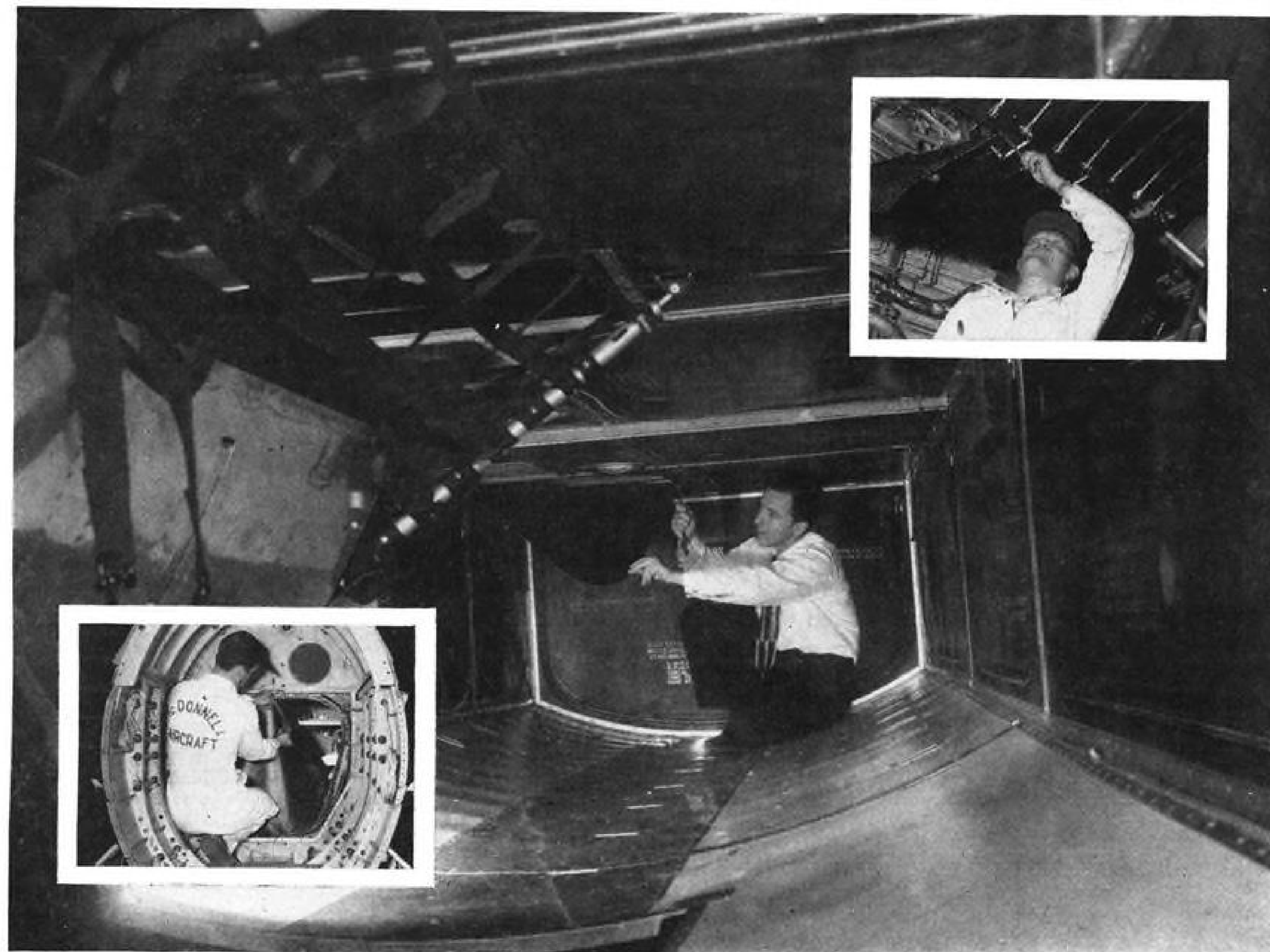
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19

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EDITORIAL

Congress Leaves Sorry Safety Record

Members of the 84th Congress departing from the Capitol to feather their individual political nests in the hinterland left behind a sorry, shameful record on the vital issue of aviation safety. Congress came close to establishing a new Capitol Hill record for the amount of time required by aviation industry executives and government aviation officials in testifying before a wide variety of Senate and House committees concerned with the perplexing problems facing aviation and its federal regulators.

On the military issues, the second session of the 84th Congress vigorously fought for stronger airpower and a faster pace in research and development for aerial weapon systems to insure continued qualitative superiority.

In facing the issues of civil aviation, particularly that of improved safety, the record of Congress was uniformly negative. Even after the tragic collision of a United Air Lines DC-7 and a Trans World Airlines Super Constellation over the Grand Canyon that cost 128 lives, Congress displayed a calloused attitude toward approving any effective steps for better air safety.

\$23 Million Cut

In one of its parting gestures before leaving Washington, the House-Senate conference cut \$23 million from the Civil Aeronautics Administration request for \$68 million for new electronic federal airways equipment so desperately needed to alleviate the air traffic control bottleneck.

Congress made this major slash shortly after members of the House Interstate and Foreign Commerce Committee's Aviation Subcommittee returned from a gay weekend in Las Vegas at the taxpayers expense. Alleged purpose of the tax-financed junket to the gambling casinos of La Vegas was to investigate the Grand Canyon collision. Actually, only three of the nine Congressmen even bothered to go to the Grand Canyon accident scene with CAB Chairman James Durfee.

Las Vegas Weekend

The others barely stirred from the air-conditioned comfort of the gambling casinos. They took time out only for a slap-dash farcical hearing organized primarily for the benefit of television cameras. After this Las Vegas interlude, with the memory of the Grand Canyon crash still fresh, the House and Senate voted unanimously and without debate to make the House-instigated airways slash.

As an added bit of irony, numerous members of the House introduced new legislation to establish a Congressional air safety commission just after they voted to

chop the Fiscal 1957 electronic airways budget. All the Congressional investigations on air safety of the past decade have resulted in headlines for the investigators and nothing for improved air safety.

Another action by the 84th Congress that set back air safety was a \$500,000 cut in the Air Navigation and Development Board's research program. This cut broke the spirit of the ANDB and was instrumental in its speedy disintegration this summer.

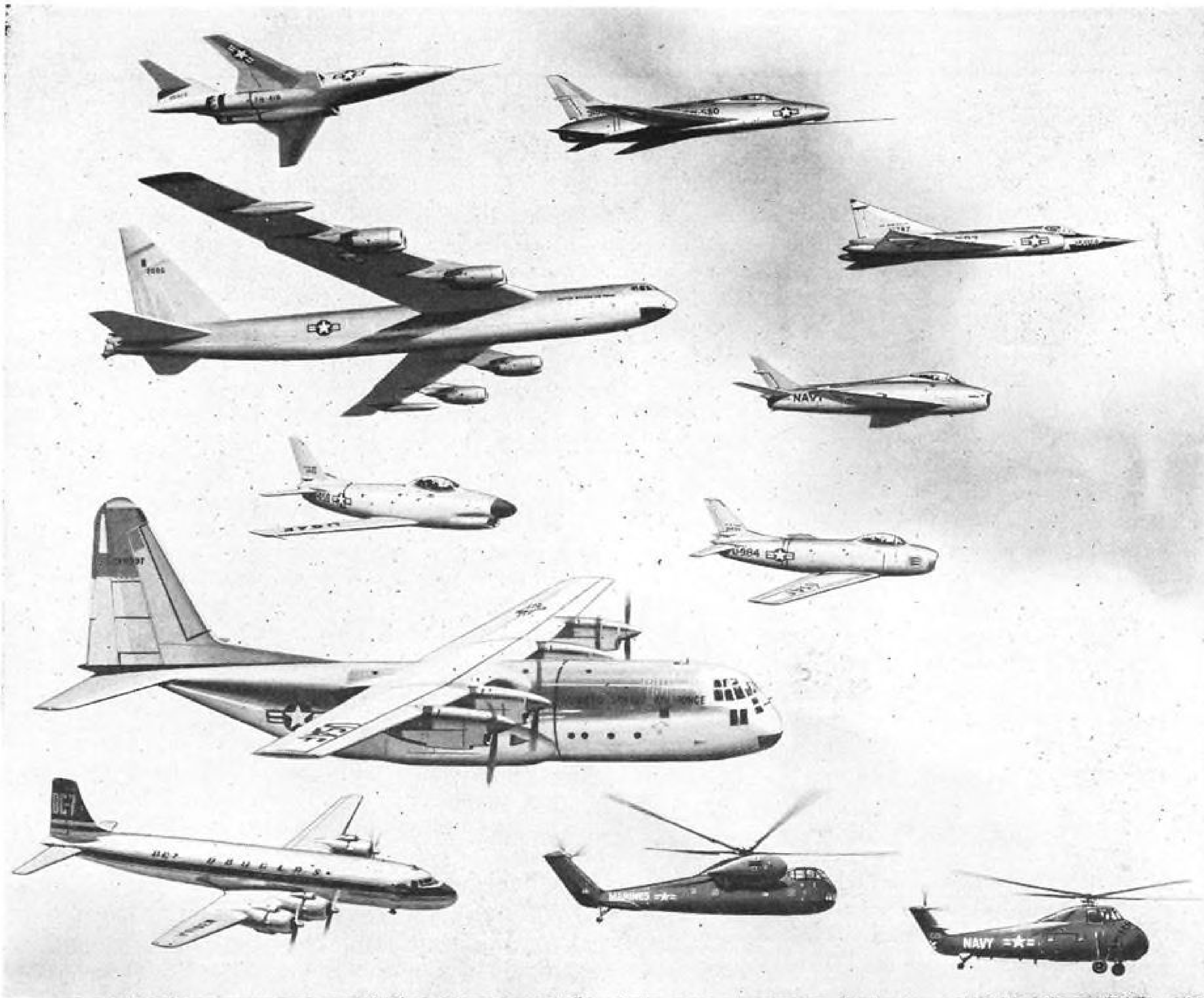
Burke Shelved

The second session of the 84th Congress also added another sad chapter in the already dismal history of the Burke, Va., airport project designed to provide the nation's capital with a modern airport capable of handling jet-age traffic and relieving the dangerous congestion in the National-Bolling-Anacostia air traffic complex. A tiny group of Maryland legislators who want to force Washington air travelers to use the Baltimore Friendship terminal and Virginia congressmen, who just don't want an airport again, blocked the Burke project and referred it back to Congress for further study.

There is absolutely no hope that the airlines serving Washington will ever consent to force their customers to use Baltimore's airport instead of a terminal in the Washington area. Nor is there any hope of operating many jet transports from the current Washington airports with existing traffic density and runway facilities. In postponing action on the Burke airport project, Congress again kicked the traveling public in the teeth and in effect condemned them to increasingly dangerous operations in the Washington area and denied them the opportunity to use jet transport when it is ready.

It has taken a long time for the Eisenhower administration to wake up to the frightening facts of the current air safety situation. After three years of singing an economy song on all projects pertaining to air safety, the Eisenhower administration suddenly was scared into action last fall by the Harding Committee report on the increasing hazards of the air traffic control problem. Since then it has made a belated effort to pump more—but still far from adequate—funds into this sector, appointed Edward P. Curtis as a presidential aviation adviser to organize long-range planning for better air safety and provided vigorous leadership for the Civil Aeronautics Administration. But Congress has still to catch up with the hard facts of the air safety outlook. Only a concerted, sustained effort by all concerned will shake the new Congress out of its traditional apathy toward air safety.

—Robert Hotz



Left to right, from top to bottom: McDonnell F-101; North American F-100; Convair F-102A; Boeing B-52; North American FJ-4, F-86D, and F-86H; Lockheed C-130; Douglas DC-7; Sikorsky S-56 and S-58.

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In the Front Office

Fred H. Rohr, board chairman and chief executive officer, and J. E. Rheim, president and general manager, Rohr Aircraft Corp., Chula Vista, Calif.

Ross Stewart, Houston businessman, a director of Continental Air Lines.

William C. Foster, executive vice president of Olin Mathieson Chemical Corp., elected board chairman, Reaction Motors, Inc., Denville, N. J.

Frank W. Glaser, executive vice president and general manager, Alloy Precision Castings Co., a director of Mercast (Great Britain) Limited, London.

Clifford E. Burt, a director and vice president-controller, and Gifford K. Johnson, vice president-production, Chance Vought Aircraft, Inc., Dallas, Tex. Mr. Burt succeeds Newton V. Turney who has resigned.

Marvin B. Ruffin, vice president-general manager, Summers Gyroscope Co., Santa Monica, Calif. Also: John M. Wright, customer relations director.

Dr. Hermann H. Kurzweg, Associate Technical Director for Aeroballistic Research, U. S. Naval Ordnance Laboratory, White Oak, Silver Spring, Md.

R. H. Rice, general manager, and R. H. Ruud, assistant general manager, Los Angeles Division, North American Aviation, Inc., Los Angeles, Calif. Also: J. S. Smithson, vice president-administration, and N. S. Houston, procedure coordination and organization planning director.

Fred T. Smye, president-general manager, Avro Aircraft Limited, Toronto, Canada. Also: Joseph Turner, vice president-finance; P. H. Williams, comptroller and treasurer; N. E. Kindell, secretary.

Honors and Elections

Donald W. Douglas, board chairman and president, Douglas Aircraft Company, Inc., will receive the seventh annual National Defense Transportation Association's Award as "the person who has made the most outstanding contribution to military transportation in the preceding year."

Harry F. Vickers, president, Sperry Rand Corp., will receive The American Society of Mechanical Engineers' Medal for "distinguished service in engineering and science."

Changes

William B. Main, aircraft service manager-western region, Vickers, Inc., Detroit, Mich.

Cecil Barlow, manufacturing superintendent, and Melvin Schoenberg, planning supervisor, Greer Hydraulics, Inc., Jamaica, N. Y.

Capt. Everard C. Bierer, ground operations representative (Rio de Janeiro), Pan American World Airways.

R. Lynn Eslinger, military contracts manager, LearCal Division, Lear, Inc., Santa Monica, Calif.

W. C. Heath, projects manager, Solar Aircraft Company, San Diego, Calif.

INDUSTRY OBSERVER

► Six avionic firms are now preparing collision warning proposals for the Air Transport Association. They are Collins, Crosley, the Federal Telecommunications Laboratory, Melpar, Radio Corp. of America and the Ramo-Wooldridge Corp. Ramo-Wooldridge originally had asked ATA to underwrite the estimated \$750,000 development cost. All six firms reportedly are now prepared to underwrite their own development programs, asking ATA only for assistance in service test programs.

► General Sound Control, Inc., of Los Angeles, has designed an airborne exhaust silencer for jet engines which functions by smoothing the exhaust stream. Other types generally have depended upon increasing the turbulence of the exhaust. New design is expected to improve aerodynamic performance enough to offset the added weight of the silencer.

► Flight test program of the X-10, test vehicle for the Navaho intercontinental missile, is nearing completion at Patrick AFB, Fla. Flight testing of the vehicle, manufactured by North American Aviation, Inc., and powered by two Westinghouse J40 turbojets, was carried out to study advanced aerodynamic designs, electronic systems and general flight characteristics. The program was begun more than two years ago (AW Feb. 15, 1954, p. 11). Production models of the Navaho will be powered by two Wright ramjets.

► Sncase plans to build the Sikorsky S-58 helicopter under license. Announcement of the program probably will be made by the French Ministry of Defense. Sncaso, however, is expected to give up its option to manufacture the Vertol H-21 (AW March 26, p. 32), with orders continuing to be placed in the U. S.

► Sixteen sets of landing gear legs have been built for the North American G-26M missile. Legs are of conventional cantilever structure and apparently are retractable into the missile body. A tail wheel may also be used. Only one bad landing of a G-26M has been reported. The landing gear was damaged during a hard landing. There was no damage to the airframe.

► Canada plans to spend between \$10 million and \$11 million during the current fiscal year for licensed production of the Sperry Sparrow air-to-air guided missile. The Sparrow will replace the Canadian-designed Velvet Glove (AW Nov. 21, p. 7), which was abandoned after initial production already had begun and \$24 million had been spent on its development.

► New contractors reported by the USAF for work on the strategic missile program include Bell Telephone Laboratories and Remington Rand's Univac Division, both of whom are developing guidance systems, and the American Machine and Foundry Co., which will develop auxiliary propulsion units.

► A. V. Roe's new supersonic, delta wing C-105 fighter has a gross weight of 56,000 lbs. By comparison, the 44-passenger Convair 340 grosses 47,000 lbs.

► Fouga CM 170-M, naval version of the French Magister trainer equipped for carrier operations, including catapult launchings, has made its first flight. The French navy has ordered two prototypes.

► Sikorsky's twin-engine S-56 helicopter is experiencing resonant vibration troubles in the drive shafts between the outrigger-mounted powerplants and the main rotor gear box. One of the shafts recently failed in flight, but the helicopter was landed safely.

► Combustion configuration of the Lycoming T53 permits a very short engine with rapid, simple hot-end inspections. Annular combustor with double 180 degree turn is folded back over the turbines so that unbolted the rear end exposes both the turbines and combustor. The same configuration will be used on the T55 with twice the 825 shp. of the T53.

► Commercial helicopter operators are interested in twin rotor designs because the rotor diameter of the twin-rotor machine is small as compared with the single rotor, and center of gravity movement is much more gencrous.

WASHINGTON ROUNDUP

Nuclear Arsenal Grows

"New principles" being applied at Atomic Energy Commission laboratories in Los Alamos, N. M., and Livermore, Calif., are "rapidly increasing" the family of nuclear weapons.

Without giving any hint as to what the new principles might be, the commission's 20th semi-annual report to Congress said:

- "In order to facilitate early production of the weapons conceived in the Livermore Laboratory, it has become necessary to increase weapons production facilities and to provide ordnance engineering facilities at Livermore, in addition to those currently provided at Albuquerque, N. M., by the Sandia Corp. . . ."

Sandia will contract for the expanded ordnance engineering function, and "the expansion is expected to result in a significant increase in employment," both in the Livermore Laboratory and at the Livermore Branch of Sandia.

- "Construction has begun on an \$18.4 million addition to the weapon production facility at Rocky Flats northwest of Denver, Colo." New construction includes two new process buildings and additions to three existing buildings.

- "Corresponding necessary expansion of other weapon production facilities is planned."

Twining and Single Service

USAF Chief of Staff Nathan F. Twining says he "leans" towards a single military service but not without reservations. The General gave his views on the controversial subject in testimony before the Senate Airpower Investigating Subcommittee.

He said, in part:

"I think it would enable issues to crystallize and be settled promptly when they come up between the services. Sometimes that is a good thing, sometimes it is not.

"I think it would be less expensive than the present organization. However, I still feel that the three services watching each other is a pretty healthy thing, because no one can get really off the beam. With a single service you might get a sort of military dynasty built up that could make a real bad mistake for the United States.

"The single service could be built up and get so strong, through the individual personalities, that they might have an idea about what was best for the United States and do something drastic."

(For other views on the single-service concept, see page 29.)

AFA Riles Wilson

Air Force Assn. awards to Democratic Sen. Stuart Symington and Trevor Gardner, two fiery critics of Defense Department airpower policy, riled sensitive tempers in the Pentagon. Secretary Charles E. Wilson made an effort to keep USAF Secretary Donald A. Quarles from filling his engagement to speak at the association's awards banquet in New Orleans. Choice of Symington as "Aviation's Man of the Year" for his "enlightened inquiries" was offensive to Wilson, but the Gardner citation caused a real blowoff. The resigned assistant secretary of the Air Force, who quit with a

scathing denunciation of the administration's attitude towards research and development, was lauded by AFA for his "courageous leadership." Quarles stood firm in face of pressure, argued that he could not refuse to fill commitment.

In his address, he compared AFA to a college alumni organization that sometimes wants to fire the school president or the football coach.

Tighter Procurement Policy?

Defense Department's lengthy and painful revision of the Armed Services Procurement Regulation on cost allowability probably will be completed within "a month or two." The aircraft industry will watch closely for tightened ASPR on the matter of salaries and bonuses as result of congressional hearing on industry profits. Chairman F. Edward Hebert (D-La.), of the House Armed Services Investigating Subcommittee, said he was "stunned" by the income of some aircraft officials. ASPR, however, applies to all industries with defense contracts.

Security and Absurdity

Disclosure by Gen. Nathan F. Twining, USAF Chief of Staff, that an unnamed pilot had set a speed record produced new security absurdities at the Air Force Assn.'s New Orleans' convention. The fact that the record was set on July 25 at Edwards AFB by Lt. Col. Frank K. Everest in the Bell X-2 at 1,900 mph. had been published in the morning newspapers despite Defense Department security efforts to keep it a secret. Two days later, Col. Everest received AFA's Flight Award for 1956 before a packed double ballroom. Said he: "I think making this unofficial flight I supposedly made in the X-2 would be easier than standing here tonight." Everest, pressed by an army of newsmen covering the convention, kept his lips sealed, refused to discuss his X-2 accomplishment.

His top boss, USAF Secretary Donald A. Quarles, said only: "I agree with General Twining."

SAC Disperses

Strategic Air Command is stepping up its dispersion of bomb units. Beginning late next year, SAC will operate from Dow AFB, Maine; Beale AFB, Calif.; Clinton-Sherman AFB, Okla.; Griffiss AFB, N. Y.; Mather AFB, Calif.; Minot AFB and Grand Forks AFB, N. D.; Columbus AFB, Miss., and three fields in Texas—Bergstrom, Sheppard and Amarillo.

About 1,500 to 2,000 personnel will be moved in with each unit.

Another Soviet Victory

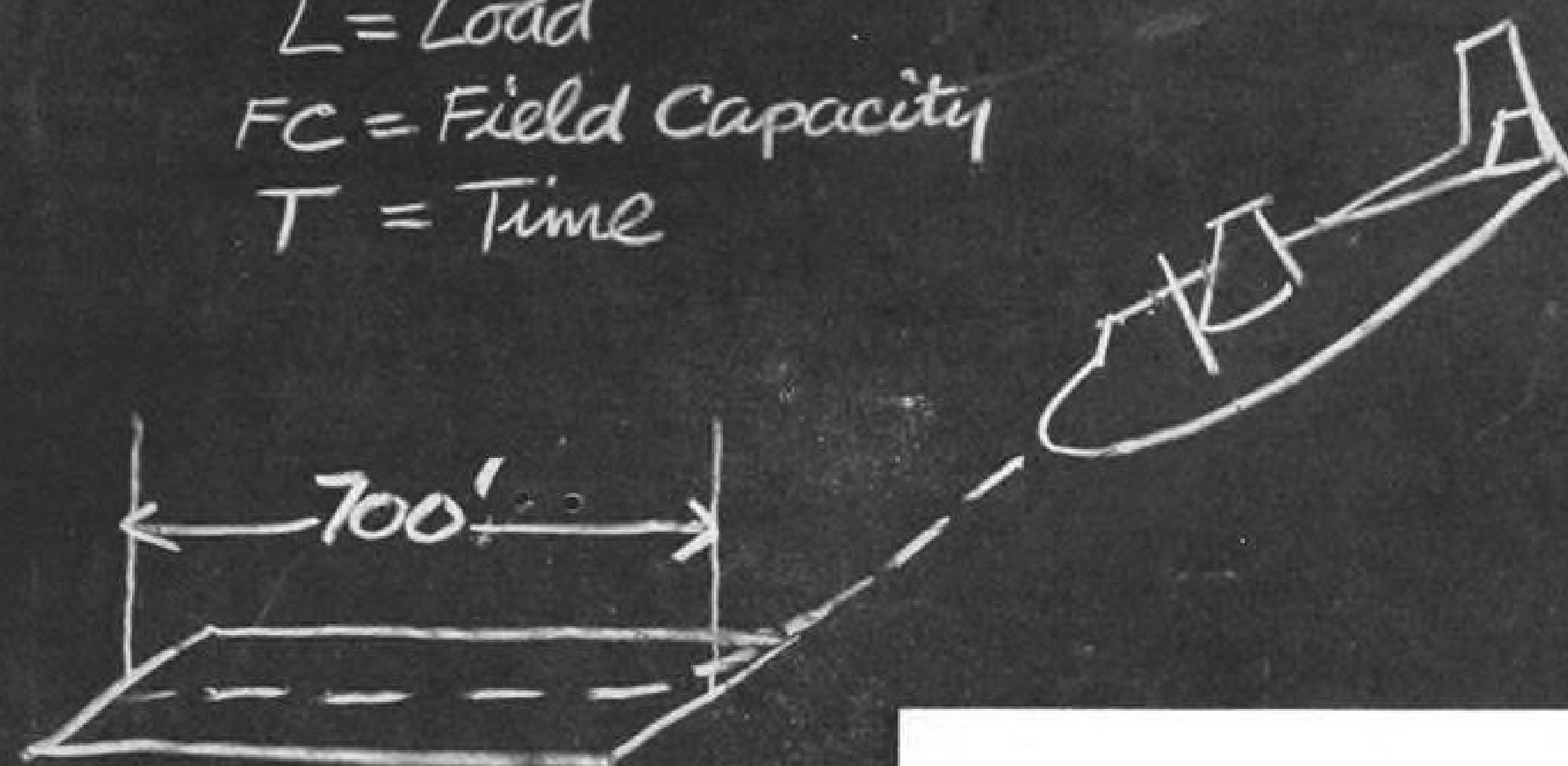
National Science Foundation reports that Russia had more than twice as many 1955 science graduates as the U. S. Science field graduates in the Soviet Union totalled 126,000, of which 59,000 graduates received engineering degrees.

In the U.S., there were 59,000 science graduates, 22,589 of them in engineering.

—Washington staff.

$$\frac{L \times FC}{T} = C-123$$

L = Load
FC = Field Capacity
T = Time



Battle Situation: 10 105mm howitzers, with ammunition and gun crews, plus 10 bulldozers and operators must be delivered to an enemy-surrounded field. **Field conditions:** Ungraded field, sandy and eroded; 1000 ft. at its widest dimension. Assume 15 mph velocity wind. Troops must be ground landed. **Solution:** Load 20 Fairchild C-123

assault transports at supply center 450 miles away; take 3 hours to fly to destination. Land your airplanes 8 seconds apart—allow 700 ft. ground roll for each. **Theorem:** Fairchild C-123 rugged performance and reliability is proved daily in stateside assault and overseas logistical missions.

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Curtiss-Wright Aids Ailing Carmaker

Air Force blocked B-47 retrofit with J65 engine, but accedes on other Studebaker-Packard contracts.

New York—Follow-on orders substantially larger than an existing \$19 million subcontract with the Studebaker-Packard Corp. for J57 engine components and another contract to overhaul J47 engines are in prospect now that Curtiss-Wright Corp. has signed the papers agreeing to bail out the ailing car-maker.

Two factors are clear, however:

- **Retrofitting of B-47** medium jet bombers with J65 engines, (AW June 18, p. 23) which would have been made at the Studebaker-Packard plants, is out. USAF flatly rejected the idea when it was passed along from the Department of Defense.

- **Further contracts** with the Studebaker-Packard and Curtiss-Wright amalgamation must be competitive.

Studebaker-Packard's J57 subcontract is with the Ford Motor Co. Ford's share of the J57 program in the year ending next June will be about \$500 million. Studebaker-Packard has been doing about one-seventh or one-eighth of Ford's work. This ratio is expected to continue if the Air Force is satisfied that Curtiss-Wright's bids are competitive.

USAF probably could have had the J47 work done somewhere else for somewhat less money.

Two considerations outweighed these drawbacks:

- **USAF was concerned** primarily with keeping the Studebaker-Packard complex going and available to the defense effort. The "premium" was not considered out of line for this objective.

- **Politicians in the administration** boggled at the juxtaposition of a Republican peace-and-prosperity election campaign opening at the same time Studebaker-Packard was shutting the front door, letting out 22,000 employees in South Bend, Ind., and Detroit.

Defense Secretary Charles Wilson and Treasury Secretary George Humphrey were mentioned in Washington as those who were active in the Packard-Studebaker maneuver.

Cost: \$1 Billion

When things began to look worrisome for Studebaker-Packard (the corporation lost \$26 million in 1954, \$29 million in 1955), government sources quietly sounded out various large corporations on help for Studebaker-Packard. None offered any.

Then Curtiss-Wright, in the person of Roy T. Hurley, chairman and president of Curtiss-Wright, made the B-47 retrofit proposal as a plan to bail out

Studebaker-Packard. Curtiss-Wright had not been among the corporations originally approached by the government.

Any B-47 retrofit program would cost on the order of \$1 billion. The range of the B-47 would be improved by installation of the J65, but no gain would be possible in speed or altitude.

USAF is wary of any such retrofit program, believing money on this scale would be much better spent for a brand new weapon system. Though flatly rejecting the proposal, which emanated from the top level in the Department of Defense, with an assist from the cabinet, the Air Force did not close the door to doing something to shore up Studebaker-Packard.

Secretary Wilson was asked at his press conference last week whether the government had played any part.

"I think the answer to that would be to say we did," Wilson replied. "We were a little bit like a banker that gets pretty much involved with a concern. There is an old crack, you know, if you owe enough to the banker why you let the banker walk the floor. We had sufficient business involved in Studebaker-Packard that by necessity we had to take some interest in the business."

What about defense contracts for the new combination, he was asked?

"There is no detailed information available on contracts and orders and things like that," he answered. "Our part of it is largely to clarify what our relations were with Studebaker-Packard and what they had been planned to be so that Curtiss-Wright organization could appraise the situation."

"The key to the business actually was to plan on putting the defense business all in a subsidiary so that our business would be taken care of. That was our primary purpose in the whole business."

"If, as a little dividend on the side, it made it possible to avoid a collapse of the Studebaker-Packard company, affecting their employees and 130,000 stockholders, and so forth, that was a dividend on the side as far as we were concerned. Our primary purpose was to soundly look after the Defense Department's business."

Does that involve any new contracts to the new subsidiary, Wilson was asked?

"Nothing that hadn't been planned that way," Wilson said. "In other words, we didn't take any business away from someone else and arbitrarily give it to Studebaker-Packard or a new company just because they might have

thought they needed it."

How much will Curtiss-Wright do for Studebaker-Packard? Hurley said at a display of the Curtiss-Wright Quehanna, Pa., facility, that Curtiss-Wright would place \$200 million worth of business annually in the Studebaker-Packard plants at Utica, Mich., and Chippewa (South Bend) Ind.

Curtiss-Wright is leasing the plants for 12 years for \$25 million. Curtiss-Wright is paying an additional \$10 million for Studebaker-Packard's guided-missile subsidiary, Aerophysics Development Corp., which is developing the Dart surface-to-surface missile for the Army.

None of the \$200 million in business was specified by Hurley. Besides the J47 overhaul, which will be done at Utica, and the J57 work, Studebaker-Packard last week was awarded a \$36-million Army contract to build 5,037 2½-ton trucks at Utica. Studebaker-Packard bid was low by \$1.2 million. Previous J57 component work has been done at Utica, but the plant is not an efficient one for this work, and it will be transferred to South Bend.

Hurley, at Quehanna, extolled commercial business and spoke discouragingly of defense work.

"The day has come to an end," he said, "when you can save a company by defense business."

More Diversification

Though Hurley said Curtiss-Wright was "still in aircraft in a big way" the six months financial report of the company disclosed that 50% of the \$20.4 million net earnings were from commercial business. Curtiss-Wright has sixteen divisions. It makes a rocket engine that powers the Bell X-2, which set a speed record of 1,900 mph. (AW Aug. 6, p. 454). It also makes precision spring clutches, diesel engine governors, textile spindles, and plastic sponges.

Curtiss-Wright's diesel engine component touches on another aspect of the amalgamation that is still vague. That is the participation of the German automotive giant, Daimler-Benz.

Daimler-Benz, makes expensive, high performance cars, and diesel trucks and buses. Its Mercedes-Benz racing cars, utilizing a fuel injection engine, dominated European courses until Mercedes withdrew from racing last year.

Daimler-Benz has shown strong interest in getting back into the aircraft engine field, especially into turbine engines (AW Mar. 12, p. 326). The Curtiss-Wright agreement still being negotiated with Daimler-Benz would make it possible for Daimler-Benz to obtain rights to certain Curtiss-Wright prod-



Navy's Flying Saucer

A true flying saucer is experimental radar early warning installation on Navy WV-2 Super Constellation. It is a new type radome containing radar antenna. Measuring more than 30 ft. across, the discoid radome and supporting shaft are aimed at possible WV-2 follow-on model. New pancake installation is scheduled for taxi-tests at Lockheed Burbank, then radome is to be detached and trucked to Edwards Air Force Base for extensive test program.

ucts for productions in Germany, the "certain products" not specified. In turn, Studebaker-Packard, through Curtiss-Wright, would have access to unspecified German developments in diesel and gasoline engine fields.

Observers at Quehanna were interested to see Hurley driving about with considerable enthusiasm, a Mercedes-Benz 300 SL sports-racing car. Automotive writers there wondered if Hurley's promise of introducing a new philosophy into the automobile business, of operating in selected diversified areas, might mean production of the fuel injection 300 SL which sells for \$7,000 up.

Hurley expressed himself as much more interested in making money than in developing a big sales volume. Studebaker-Packard lost money last year on net sales of \$480 million. In this connection, Hurley stressed the avoidance of overdependence on defense business, for which he blamed a postwar slump at Curtiss-Wright.

Curtiss-Wright, Hurley added, has no intention of simply liquidating Studebaker-Packard, or of milking the corporation for what defense contracts are available. The objective is to build up Studebaker-Packard.

"Curtiss-Wright is bursting at the seams," Hurley said. "The business at the leased plants will come from additional expansion. Curtiss-Wright subcontractors should not expect to lose any business."

Since several other corporations shied away from involvement with Studebaker-Packard, the financial details of the amalgamation assume added importance. On paper, Curtiss-Wright is committed to purchase the Aerophysics Development Corporation, guided-missile subsidiary, and leasing of the plants. (The subsidiary has a \$1.3 million plant under construction at Santa Barbara, Calif.)

It has an option to buy 5 million

unissued shares of Studebaker-Packard common at \$5. The option extends for the first two years of the three-year advisory management agreement under which Curtiss-Wright assumes guidance of the Studebaker-Packard operation.

Hurley said that Curtiss-Wright has every intention of exercising the option when Studebaker-Packard stockholders (there are 130,000) approve the option plan and change in par value of the stock from \$10 to \$1 a share. This possibly would give Curtiss-Wright operating control, though there are a total of 15 million shares, 6,440,445 issued.

As it now stands, Curtiss-Wright would have a total investment of \$60 million—\$25 million for the stock, \$10 million for the guided-missile subsidiary and certain defense inventories, and \$25 million paid now as a lump sum for the leases.

United, Curtiss-Wright Net Profits Hit \$20 Million for First Half

Financial reports of major aircraft manufacturers for the first half of 1956 continue to bear out predictions (AW Mar. 12, p. 194) that this will be a good business year for aviation.

United Aircraft Corp. and Curtiss-Wright Corp. reported net earnings above \$20 million each and Boeing Airplane Co. reported more than \$14 million.

United Earnings

United reported a net income of \$20,556,235 on shipments of \$458,471,149, equivalent to \$4.06 a share on common stocks after dividends on preferred stock. This compares with earnings of \$15,302,738 on total shipments of \$359,109,677 (\$3.02 a

Possibility existed of eventual tax write-offs for Curtiss-Wright on the basis of the Studebaker-Packard losses.

For this Curtiss-Wright is buying a physical plant whose book value was listed with the Securities and Exchange Commission at the end of 1955 as \$140 million, and a net worth of \$87 million.

Studebaker-Packard has borrowed about \$30 million on the basis of a \$45 million line of credit extended by the Chase Manhattan and other banks in 1954. The credit was confirmed when the Curtiss-Wright program was announced.

James J. Nance has resigned as president of Studebaker-Packard, but will remain in an advisory capacity. Harold E. Churchill, vice-president in charge of Studebaker operations, will succeed him. Paul G. Hoffman, former board chairman, has resigned as director.

share) for the first half of last year.

Backlog of contracts, orders and government letters of intent totaled approximately \$2.1 billion on June 30, an increase of \$250 million since last March 31. Non-government deliveries in 1956 should approach \$125 million—approximately two-thirds greater than in 1955, the company said. This does not include any of the J57 or J75 jet engines on order for the Boeing 707 or Douglas DC-8 jet airliners which will begin to be delivered in 1958.

Curtiss-Wright

Curtiss-Wright reported a consolidated net profit after federal income taxes of \$20,452,133 on sales of \$279,147,270, as compared with earnings of

NAA Splits Stock

Los Angeles—North American Aviation, Inc. shareholders last week approved a two-for-one split of its 6 million shares of capital stock. The split becomes effective tomorrow.

The stockholders also approved an employee's stock purchase plan, which became effective immediately.

The actions, taken at a special meeting, marked the first steps in a financing program aimed at providing some \$40 million through an offer of additional shares to shareholders. The money will be used to increase present facilities and to promote new business. The company's current backlog is \$1.2 billion, not including portions of new orders not yet finally committed.

\$15,065,859 on sales of \$250,072,134 in the first half of 1955. Approximately half the 1956 earnings came from commercial business. Curtiss-Wright's backlog now totals \$657,041,000.

Boeing Airplane Co.

Boeing reported net earnings of \$14,488,789 on sales of \$407,334,045 (a return of 3.56%) as compared with a net of \$13,635,550 on \$370,301,711 in sales during the first half of 1955. Net earnings for the first half of 1956 are equivalent to \$2.22 per share on 6,535,969 $\frac{1}{2}$ outstanding shares.

Boeing last month announced a two-for-one stock split and has declared a quarterly dividend of 25 cents a share payable Sept. 10 stockholders of record as of Aug. 20.

Deliveries of B-52 bombers to the USAF, delayed in the first quarter by "non-availability of qualified vendor-furnished equipment," were resumed in the second quarter. Boeing expects to catch up with scheduled deliveries within the next few months. It predicted "somewhat higher" sales and earnings for the last half of the year. Backlog of unfilled orders now totals approximately \$2,607,000,000.

Lear, Inc.

Lear reported net earnings of \$1,017,044 on shipments of \$29,740,200. Earnings were 16% higher than the \$876,366 reported for the first half of 1955. Shipments, which set a record, were \$2.2 million above the figure for the first half of 1955. Earnings represent 44 cents a share on 2,289,472 common shares against 39 cents on 2,247,941 for the similar period in 1955.

New orders booked since the first of the year totalled \$41 million, bringing the backlog to \$62 million (an increase of 35% since mid-1955).

Late in May stockholders approved

an increase in authorized common stock from 3 million to 5 million shares "to place the company in a position to act expeditiously in the event an advantageous opportunity presented itself to increase the company's earning capacity."

President Richard Mock said, however, that Lear "at present . . . has no plans to use stock in the acquisition of or the merger with any other company" nor to issue the stock or offer it for sale.

The Lear report said the company plans a new manufacturing plant at the Grand Rapids, Mich., airport site. Foreign subsidiaries established last March in Switzerland and Germany now are in operation.

Chance Vought Aircraft, Inc.

Chance Vought reported sales for the first six months of 1956 totaled \$51,154,663 with a net income of \$1,457,061, equal to \$1.35 per share of common stock. Sales for the first six months of 1955 totaled \$59,910 and net income was \$1,755,062, equal to \$1.63 per share of common stock.

A backlog of approximately \$267,000,000, primarily for production of the F8U-1 Crusader and the Regulus guided missile, was reported, as against a backlog of \$214,000,000 at the end of 1955.

Sales and earnings for the first half of the year were affected by the phasing out of F7U-3 Cutlass fighter production and by preparations for production of the F8U-3 Cutlass jet fighter and advanced version of the Regulus, the company said.

Temco Aircraft Corp.

Temco reported net sales for the first half of 1956 at \$39,634,337—a 6% gain over the \$37,326,666 registered during the first six months of 1955. Net income was \$1,426,350 after provision for federal income taxes compared with a first half net of \$1,402,990. Stockholders earned first half dividends of 85 cents in 1956 compared with 84 cents in 1955.

Delta, Braniff Northwest Airlines Show Net Gains

Three additional airlines reported profits in financial statements issued recently. Reports from Delta, Braniff and Northwest showed:

• **Delta Air Lines** earned \$4,067,000 net after taxes for the fiscal year ended June 30, the airline reported. Previous year's net was \$2,166,000. Fiscal 1956 net income included a profit on equipment sales of \$1,309,000 after taxes.

Carrying 2,424,644 passengers a record 1,080,267,000 passenger miles—up 13.42% over last year's passenger-mile total—Delta achieved a load factor of 62.55% for the year. The airline car-

ried 28,200,215 lb. of air freight, 13,849,794 lb. of air express and 14,363,596 lb. of mail.

Total operating revenues for the year were \$66,600,000, up from \$59,188,000. Some 125,000 shares of common stock were offered July 11 at \$37.00 each. Delta reported the offering was oversubscribed.

• **Braniff Airways** had net earnings of \$1,006,100 after taxes in the first half of 1956, a 43.5% gain over earnings for the same period last year. Revenues for the first six months were \$25,920,000, compared with \$22,665,900 in the 1955 period.

Capacity increased 14% to 637,130,000 available seat-miles in the first half of the year, and traffic increased 14.4% to 385,101,000 passenger-miles.

Braniff's President Charles E. Beard said that the half year results include the cost of introducing a new Texas-New York service in February. He said the service has developed rapidly and "in addition to meeting its direct expense and absorbing its full share of overhead costs, was operating profitably."

• **Northwest Airlines'** profit for the first six months of 1956 was \$1,223,186 after taxes, and operating revenues totaled \$36,043,574. Revenues in the same period last year were \$32,565,031 and net earnings after taxes were \$188,906.

Northwest's profit in the first six months of 1956 included income of \$1,236,418 from equipment sales and an insurance recovery on a wrecked Boeing Stratocruiser. Operating income after taxes for the 1956 period was \$228,057 compared with \$412,075 in the 1955 first half. The airline said its expenses increased because of expanded service and heavier depreciation.

National Air Show Plans

Oklahoma City—USAF has scheduled 189 aircraft, including the Lockheed F-104 Starfighter, for participation in the 1956 National Aircraft Show to be held at Will Rogers Field here Sept. 1, 2 and 3.

Other Century series fighters scheduled to take part include: North American F-100C, McDonnell F-101 and the Convair F-102. The F-104 will be shown to the public for the first time. Highlight of the USAF demonstration will be a performance by the Thunderbirds, jet precision flying team, in the North American F-100C, Super Sabre.

U. S. Marine Corps plans to display about 40 aircraft types, including jet fighters, helicopters and transports. The Navy show will feature the Blue Angels aerobatic team. Only aircraft announced by the Navy for participation in its exhibit is the Douglas A3D Skywarrior twin-jet bomber.

Air Force Assn. Demands Single Service

By Claude Witze

New Orleans—Adoption of a single military service and immediate reassessment of USAF's 137-wing goal were demanded by the Air Force Assn. at the conclusion of its tenth annual convention here last week.

Charging that the present system, with a separate Army, Navy and Air Force, "too often ties military careers, and therefore military operations, to obsolescent weapons and concepts," the association's 1956 Statement of Policy said such organization "can no longer be tolerated." The statement continued:

"The goal must be one program for utilizing national resources in the national defense. We must have one defense plan. We must have a single military service, one chief of staff, one promotion list."

On the subject of air strength, the Air Force Assn. called on President Eisenhower, Congress and Defense Secretary Charles E. Wilson to "re-assess the existing force goal of the Air Force and the funding designed to support it and either realistically revise the force goal of the Air Force downward or its funding basis upward."

Quarles Indicates Cut

USAF Secretary Donald E. Quarles immediately replied that the administration may well cut the number of wings. He said the administration does not consider 137 wings "a permanent thing" and indicated Fiscal 1958 may see the start of a downward revision. The Secretary emphasized that any such change would be due to the increasing potency of USAF weapons along with the Army's fast-growing ability with tactical missiles for "close support."

The Secretary's indication that the USAF may be forced to surrender at least some of its tactical mission to the Army was made in a statement prior to the convention's awards banquet.

Quarles speculated that USAF manpower demands will be cut in line with administration policy beginning with the Fiscal 1958 defense budget. Despite these cuts, the budget is expected to run substantially higher than the one adopted by the recent Congress with more money being poured into bases, equipment and maintenance.

In his formal address, Quarles argued that a superiority in airplanes does not mean escape from catastrophe in nuclear war. He said it is important only to maintain what he termed a "mission capability" despite changes in the technological and strategic situations. "There comes a time," he added, "in

the course of increasing our airpower when we must make a determination of sufficiency."

Continued reliance upon deterrence to prevent war was accepted by the Secretary, and he insisted that this is true for limited aggression as well as total war. Yet he said that many important elements making up the deterrent power are "intangibles."

Symington Rebuttal

Even before Quarles gave his address, Sen. Stuart Symington (D.-Mo.), first USAF secretary and head of the recent Senate airpower investigation, took issue with the administration viewpoint. He insisted that airpower is not made up of "intangible" factors and bluntly assailed the suggestion of a cutback in the number of USAF wings.

Sen. Symington said Gen. Nathan F. Twining, USAF Chief of Staff, is confident the United States can maintain superiority of airpower "if we continue our planning."

"I am sure he means USAF planning," the Senator declared, "not planning in the Bureau of the Budget."

Air Force Reaction

Secretary Quarles' open defense of proposals to cut the size of the armed forces and the number of USAF manned wings brought immediate and heated criticism from AFA veterans and uniformed officers present at the convention.

This criticism extended to men who

are interested primarily in the research and development effort that is essential to maintenance of qualitative superiority.

Other convention speakers included Gen. Twining, Gen. Otto P. Weyland, chief of the Tactical Air Command; David S. Smith, USAF assistant secretary; James H. Douglas, USAF under-secretary; Edward P. Curtis, special assistant to the President for aviation facilities planning, and Lt. Gen. Charles B. Stone III, chief of the Continental Air Command.

General Tire Orders Fairchild Friendship

Washington—General Tire and Rubber Company last week became the first U. S. Corporation to order an executive version of the Fairchild F-27 twin turboprop aircraft.

The contract for the one airplane brings total sales of the F-27 by Fairchild to 27 with options on an additional 23. Delivery is scheduled early in 1958. The F-27 will be integrated into the fleet of six multi-engined aircraft now operated by General Tire and Rubber Company.

The F-27 has been ordered by five local airlines. Deliveries are scheduled to begin late in 1957. The turboprop transport will be operated by Piedmont Airlines, Mackey Airlines, West Coast Airlines, Frontier Airlines and Bonanza Air Lines.

Symington 'Man of Year'

New Orleans—Sen. Stuart Symington (D.-Mo.), former secretary of the Air Force and stern critic of the Eisenhower administration's airpower policies, was named "Aviation's Man of the Year" for 1956 by the Air Force Assn.

Symington, who received the same honor in 1948, was awarded the H. H. Arnold Trophy at the AFA's tenth annual convention. He was chosen, AFA said, for his "determined and enlightened inquiries into the true status of our national airpower," and his "repeated efforts to achieve armed strength consistent with the dynamic nature of the military requirement."

Others honored at the convention included:

• Television entertainer Arthur Godfrey received the Hoyt S. Vandenberg Memorial Trophy "for distinguished service to airpower in the field of Air Age education."

• Lt. Col. Frank K. Everest, Jr., pilot of the Bell X-2 and chief of flight test at Edwards AFB, Calif., won the flight test award for "advancing the state of the aeronautical art and contributing significantly to the security of the nation."

• Dr. Chalmers W. Sherwin, University of Illinois physics professor and former USAF chief scientist, won the Science Award for "outstanding contributions to the development of a long-range radar system."

• Beirne Lay, Jr., screenwriter, received the Arts and Letters trophy for "dramatic writing on the Air Force mission that is significant for its popular appeal and for a realism born of hard-won experience."

Lay was the author of the scripts for the movies "Strategic Air Command" and "Twelve O'clock High."

Congress Gives Airpower New Strength

Democratic-controlled Congress pushes airpower program but blocks civil air-safety measures.

By Katherine Johnsen

Washington—Constant prodding that forced the Eisenhower administration to put more teeth into its airpower program was the most notable achievement of the Democratic-controlled Congress which recently adjourned.

On the other hand, the second session of the 84th Congress wasted too much time on purposeless civil aviation investigations.

Congressional activities which spurred action in the aviation field included:

Military Airpower

Although the President, in presenting the administration's defense program to Congress in January, emphasized airpower and guided missiles, Senate Democrats promptly challenged the Air Force program as inadequate.

The administration program, the President said in his State of the Union message, was designed to "push the production of the most modern military aircraft." He added that "the development of long-range missiles has been on an accelerated basis for some time."

Dissatisfied, Democratic Sen. Richard Russell of Georgia, chairman of the Armed Services Committee, called on the Air Force to report just how it would use the \$1.5 billion more than proposed by the administration if such a sum were added to the USAF budget. And Democratic Sen. Stuart Symington (Mo.) declared in a floor speech that the President was hiding from the public the "fact" that the U.S. is "behind the Soviet Union in the long-range ballistic missile field, the most important new weapon the world faces today."

In another move, Democratic Sen. Henry Jackson (Wash.) called for a missile "czar" to expedite and coordinate the U.S. missile programs. Finally, a Senate Airpower Investigating Subcommittee, headed by Sen. Symington, was appointed to investigate the administration's airpower program.

The result: the administration declined to submit a proposal for \$1.5 billion additional USAF funds but did volunteer a \$376.5 million USAF increase (including \$248 million for B-52 production), plus \$50 million for possible "emergency" developments in the missile program, \$55 million for Army construction of the Distant Early Warning program and \$65.6 million for Navy DEW construction and conversion of ships to missile capability.

A missile "czar"—Eger V. Murphree, former president of ESSO Research and Engineering Co.—was appointed.

Democratic senators viewed the Administration's proposal as "better late than never" but as still "not enough." Testimony by top Air Force officers before the Symington subcommittee added up to the fact that the administration's increased program remained "too austere." Gen. Curtis LeMay, commander of Strategic Air Command, recommended an additional \$3.8 billion for SAC alone, including \$1.8 billion for aircraft. Lt. Gen. Donald Putt, deputy chief of staff for research and development, called for \$250 to \$300 million additional for research and development.

In another compromise overture, the administration agreed to an increase of \$350 million in USAF procurement funds and \$100 million for research and development. Democrats, with some Republican backing, insisted on \$800 million additional for procurement.

Result of the Democratic prodding: Congress handed the administration a Fiscal 1957 USAF budget providing \$6.8 billion for plane and missile procurement (as compared with the \$5.8 million requested by the President in

January) and \$710 million for research and development (as compared with the \$610 million originally proposed by the President).

Renegotiation

Most consequential result of two congressional investigations into military aircraft procurement and profits was to focus on loose and inequitable practices of Air Force and Navy and the Renegotiation Board.

After a year's study of the 12 major airframe manufacturers, the House Armed Services Investigating Subcommittee said that, in general, it found no excessive profits. It added, however, that profits claimed on some individual contracts "are higher than they ought to be."

The House Appropriations Committee criticized both the Air Force and Navy for delays in setting firm target prices on incentive-type contracts and in firming up letters of intent.

When work has progressed substantially before a contract is signed, the committee protested, the Air Force and Navy are generally obliged to continue it on the contractor's terms.

The committee also complained that, by permitting the use of production funds for research and development, USAF and Navy enable some contrac-



USAF's Flying Nuclear Reactor

World's first aircraft to fly with an operating atomic reactor aboard Convair B-36, now the XB-36H. On flights reactor does not power plane, and low-powered Convair-built reactor is not turned on until over unpopulated area. Aircoops on XB-36H fuselage aft of wing cool reactor when operating. Effects of radiation on instruments, equipment, airframe, flight crew, are checked carefully, and new devices tested. XB-36H's dark blue nose and orange radiation symbol on vertical tail distinguishes airplane from all others. First published information and pictures of the XB-36H appeared in Aviation Week's ARDC issue of August 6, pages 149, 174.

tors "to obtain control of newly developed equipment" and thus gain an advantage towards securing production contracts for the equipment. This committee's investigation is continuing.

The industry, as well as the USAF and Navy, were urged by the House Armed Services Investigating Subcommittee to revise policies on executive compensation charged against government contracts.

The subcommittee chairman, Rep. F. Edward Hebert (D-La.), said he was "stunned" by the executive compensation paid by some of the "smaller" airframe companies and proposed that they "take a good look at themselves or the house will fall down."

The subcommittee also protested the "welter of confusion" in the differing compensation allowance policies of the USAF and Navy and called for the establishment of a uniform schedule.

Renegotiation Passed

Although the renegotiation law was renewed (to Dec. 31, 1958) in the rush to windup the session, there was sharp criticism of it and its administration by the Renegotiation Board. Rep. Hebert termed the law "a hydra-headed monster which everyone seems to be afraid to disown for fear he will be charged with wanting to pay excessive profits."

From the extensive financial data supplied his subcommittee by the 12 airframe companies, Hebert said he fails to understand why the board cleared some and assessed others.

Sen. John Sparkman (D-Ala.), chairman of the Small Business Committee,

called the renegotiation measure "selective taxation without rate from which there is no workable or practical avenue of appeal."

Government Information

After several months study, a House subcommittee headed by Rep. John Moss (D-Calif.) reported that "a paper curtain has slowly, almost imperceptibly descended," blocking the flow of information from the government to the public.

The investigation is continuing. The subcommittee's critical interim report, one unanimously approved by the full Government Operations Committee, singled out the Department of Defense as having "the most restrictive and . . . most confused" public information organization within the government.

Commercial Aviation

Congressional pressure also influenced the administration's attitude on two key commercial aviation matters:

• **Airline Fares.** Under fire from Congress, the Civil Aeronautics Board voted to undertake an investigation of trunk airline fares.

A study by the General Accounting Office for the Senate Commerce Committee had urged the fare investigation. At hearings before the House anti-monopoly subcommittee, Congressmen denounced Board action in 1952 when a proposed investigation was voted down.

• **Bilateral Negotiations.** Civil Aeronautics Board members agreed that representatives of affected airlines should be participants in negotiations of bilateral air agreements with foreign nations after Senate Commerce Committee hearings focused on the lack of industry participation in the negotiation of the U. S.-German bilateral agreement.

Legislation legally requiring industry participation was unanimously approved by the Senate Commerce Committee and the Senate in the closing days of the session.

There was not time enough for the House to act on the measure, but the unanimous, non-political action by the Senate is a strong statement of congressional position.

In addition, the measure would have made CAB decisions on territorial route cases final and restricted the President's authority over international route cases to matters affecting "national defense" and "foreign policy." These restrictions were an outgrowth of the West Coast-Hawaii Case in which the President had initially reversed CAB's decision. Later, under congressional criticism, the President revised his position.

Where Congress Failed

On other measures, Congress was ineffective:

Although several air safety measures (including one which would have banned jet aircraft from airports of cities with a population of over one million) and numerous investigations of the air navigation system were undertaken,

Fiscal 1957 Aviation Appropriations

	(000,000 omitted)			
	Administration Request for F Y 1957	Approved by Congress for F Y 1957	F Y 1956 Appropriation	
Air Force	\$15,666	\$16,460	\$14,740	
(Exclusive of Public Works)				
This includes:				
Aircraft and Related Procurement	6,048	6,848	6,306	
Research and Development	610	710	570	
Naval Aviation	2,546	2,544	1,715	
This includes:				
Aircraft and Related Procurement	1,733	1,733	906	
Civil Aeronautics Administration	305	245	169	
This includes:				
Development of Air Navigation Facilities	108	85	16	
Civil Aeronautics Board	24.7	20.8	56.9	
This includes:				
Administration	4.7	4.6	4.4	
Airline Subsidies	20.	16.2	52.5	
National Advisory Committee for Aeronautics	79.7	75.9	72.7	
This includes:				
Administration	64.7	61.9	60.1	
Construction	15.	14.	12.6	

Congress failed in a final showdown to follow the administration lead on two concrete air safety proposals. They were:

- **Request of \$108 million** to telescope the five-year airways development program into three was cut to \$85 million.
- **Request for \$34 million** to begin construction of an alternative airport to handle the over-saturated traffic at Washington National Airport was refused.

Instead, the Senate Appropriations Committee appointed a subcommittee to study the matter of an alternate Washington airport, which already has been under study for five years.

Independent CAA

Prolonged hearings before the Senate Commerce Aviation Subcommittee, on the resignation under administration pressure of former Civil Aeronautics Administrator Fred B. Lee and the establishment of an independent Civil Aeronautics Administration accomplished nothing but delay in the confirmation of a new CAB member and a new CAA Administrator.

Senator A. S. Mike Monroney (D.-Okla.) attempted to show that Lee was coerced to resign by a "ground minded" Commerce Department and that legislation should be passed separating the CAA from Commerce.

However, so little substantiating evidence was developed at lengthy hearings, that the legislation was not even brought to a vote before the subcommittee.

While Sen. Monroney pursued the project, action on the nomination of G. Joseph Minetti to the CAB and Charles Lowen as CAA administrator, both submitted early in January, were suspended. They were finally confirmed in mid-June.

Monopoly Hunt

An investigation by the House Anti-Monopoly Subcommittee in an effort to find a monopoly situation in air transportation fizzled out. After several months of hearings, the subcommittee has yet to issue a report on its findings. The investigation was largely a one-man show by the subcommittee's chairman, Rep. Emanuel Celler (D.-N. Y.).

At the outset, Celler protested that Pan American World Airways is "absolutely dominating the international scene."

Then he switched to the Air Transport Assn., suggesting that "the close and continuous relationship" between ATA and the CAB might involve "conspiracy." Next, Celler switched to the nonscheduled airlines, proposing that four carriers operated "as a pool" and dominated the Air Coach Transport Assn.

There were two controversial personalities:

- **Defense Secretary Charles Wilson.** Congressional antagonism towards Wilson began early in the session with the complaint of Rep. Clarence Cannon (D.-Mo.), chairman of the House Appropriations Committee, that at executive hearings Wilson "dodged, squirmed and didn't answer."

Criticism continued and reached its peak with the charges on the Senate floor by Sen. Richard Russell (D.-Ga.), chairman of the Armed Services Committee, that Wilson treated senators with "disdain, at times almost with contempt," that the Secretary "dictated without regard to law or the Constitution," that he "sought to intimidate (military) officers" and that "his vanity and arrogance are surpassed only by his lack of understanding of the American system of government and its division of powers."

- **Louis Rothschild,** Under Secretary of Commerce for Transportation. At the opening of the session, Rothschild, who had several bouts with congressional groups, stirred up a political debate by giving advance lists of airports allocated federal aid funds to the Republican Congressional Campaign Committee. Subsequently, Republican Congressmen took credit for projects in their respective districts. Rep. Prince Preston (D.-Ga.) led the Democratic attack by

protesting that Rothschild "clearly demonstrated political contempt for members of Congress of the majority party by the conspiracy to claim credit for a program this administration once undertook to destroy. In other words they deny parenthood but are willing to adopt the child."

Service Rivalry

Service rivalry erupted on Capitol Hill on two issues:

- **Navy testimony** before the Senate Appropriations Committee that carrier air power "significantly augments" the nation's strategic power and that there are "very few" targets out of the reach of the Navy attack bombers brought a prompt challenge from USAF Chief of Staff Gen. Nathan Twining, who told the committee that the Navy's contribution to strategic air capability would be "small" in the initial and critical, phase of a major war.

- **Army Chief of Staff Gen. Maxwell D. Taylor** protested that the USAF program to man bases with the Navy-developed Talos missile invaded the Army's air defense mission. Army at least temporary victor. Congress declined to authorize \$16.4 million for Talos launching installations but authorized an additional \$137 million for various facilities for the Army's Nike missile.

Agencies Hide Information Behind Self-Devised 'Secrecy' Stamps

By Evert Clark

Washington—Government agencies have cited 61 documents, ranging from the Constitution to departmental memoranda, as authorization for keeping information from the public on the grounds of security.

An analysis prepared for the House Information Subcommittee shows that 40 agencies use secrecy classifications which they originated.

President Eisenhower's Executive Order 10501 provides for three classifications—Top Secret, Secret and Confidential—and states specifically that "no other designation shall be used to classify defense information, including military information, as requiring protection in the interests of national defense, except as expressly provided by statute."

The Information Subcommittee, headed by Rep. John E. Moss (D.-Calif.), submitted questionnaires to 60 executive departments and agencies. It has published an analysis of the answers, prepared for the subcommittee by the Legislative Reference Service of

the Library of Congress. The analysis shows that:

What Analysis Shows

- **Of 60 agencies questioned,** only four said all the information they possess is available to the public—the Fine Arts Commission, the Indian Claims Commission, the National Capitol Housing Authority and the Veterans Education Appeals Board.

- **Forty agencies** have originated 30 secrecy labels of their own. Examples: "Not for public inspection," "limited official use" and "for staff use only." The subcommittee and its parent Government Operations Committee noted in an interim report that the "restricted" classification abolished by Executive Order 10501 "has been replaced by many ingenious offspring, all designed to perpetuate concealment."

- **Number of people** in government who have the power to classify information is incalculable. (Trevor Gardner, former assistant secretary of the Air Force for research and development, estimated when he testified before the subcommittee that the number ap-

proaches one million). The Atomic Energy Commission, the analysis shows, has 93 officials authorized to stamp documents Top Secret. The number who can apply lower classifications is even greater.

Thirty of the 60 agencies said they do not restrict information on the grounds of security. The other 30 cited these authorities for their action:

- **The Constitution.**
- **Nineteen federal statutes.**
- **Five Supreme Court decisions.**
- **Five executive orders.**
- **Four Presidential and White House letters and directives.**
- **Two letters and two opinions of the Attorney General.**
- **Twenty-three departmental manuals, memoranda, regulations, orders, etc.**

The subcommittee now plans to resume hearings on government information and secrecy policies late in September to hear Defense Department witnesses whose testimony was postponed by adjournment of Congress.

One day will be devoted to research and development chiefs and one to public information chiefs from Defense and the three services. The secretaries of the three services will be called on the final day and questioned on how they rectify security abuses.

On the basis of what it has heard so far, the subcommittee called Defense's information policies and practices "the most restrictive and . . . most confused" in government.

The subcommittee hopes to have its life renewed in the 85th Congress so it can take testimony from State and Justice Departments and consider legislation to cut down the restrictions on release of government information.

Fiscal '58 Estimates Rejected by Wilson

Washington—Defense Secretary Charles E. Wilson last week rejected estimates of the Army, Navy and Air Force for a fiscal 1958 budget that would total \$48.5 billion, approximately \$12.5 billion above that for the current year.

There was no indication of just how much of the total the USAF requested, but Wilson said he expected the budget to go up and there would be growing emphasis on airpower. He said the Air Force still has not provided a firm program for spending the additional \$800 million provided by Congress for aircraft procurement during fiscal 1957.

The Secretary made it clear that there will be no change in the country's military plans and procurement as a result of the crisis over the Suez Canal.

Obviously placing full confidence in Secretary of State John Foster Dulles to keep the peace while both Britain and France are taking military precautions,

Wilson characterized the Suez affair as a "ripple." Said he:

"And while any of these things are important matters and well worth watching and handling very carefully, our country can't flip up and down with such relatively small things."

Other comments by the Defense Secretary:

Odlum Asks for Better Utilization Of U. S. Scientists, Engineers

New Orleans—Better utilization and recognition of scientists and engineers are essential if the U. S. is to maintain leadership in the technological race with Russia, the Air Force Assn. was warned by Floyd Odlum, president of the Atlas Corporation.

Pointing out that about one-third of the technological talent employed by private industry in this country is working on Defense Department projects, Odlum criticized such multiple efforts as that found in the ballistic missile field, with several projects competing for engineering and scientific skills "as well as for money, facilities and management."

He suggested that such weapons as the intercontinental ballistic missile might be achieved sooner if there were fewer competing projects. He continued:

"Industry might with better management do current tasks with less people. When I hear about 2,000 or more engineers on an airframe task, it impresses me as wastage. Increasingly complex

- **There is no plan** to increase production rate of the Boeing B-52 jet bomber beyond the present scheduled output of 20 a month.

- **Increasing steel prices** probably will cost the Defense Department between \$25 and \$35 million.

- **Atomic weapons alone** are not enough to win all types of wars.

tasks can't be solved by merely increasing numbers.

"With 2,000 engineers on a single project, a disturbing number of them must be wasting their technical skills in administrative and other non-engineering tasks."

Odlum represented industry on a slate of speakers who discussed "Manpower in the Jet Age," at the association's tenth annual convention.

Dr. Alan T. Waterman, director of the National Science Foundation, said future needs of industry for technological talent can best be met by supporting basic research and educational activities in the nation's universities.

James McCormack, Jr., of Massachusetts Institute of Technology and a retired USAF major general, said a major factor in the industry's immediate future is the failure of two-thirds of the top 50% of high school graduates to go to college.

Pratt & Whitney Plans Florida Engine Plant

Pratt & Whitney Aircraft is planning the construction of a \$42-million jet engine design and test center in Palm Beach County, Fla.

Formal announcement of the plans probably will be made shortly after the Florida legislature approves a measure permitting the United Aircraft division to take over a 40,000-acre plot now under the jurisdiction of the State Game and Fresh Water Fish Commission. The legislation, which already has been introduced, is expected to pass without major opposition.

The plant, which will serve as an auxiliary to Pratt & Whitney's main facility in East Hartford, Conn. The Palm Beach site was decided upon primarily because of its remoteness from urban areas. Company officials, who looked over several areas in a number of states before deciding upon Florida, also wanted to find an area that could serve as a drawing card in the recruiting of engineers and technical people needed to man the plant.

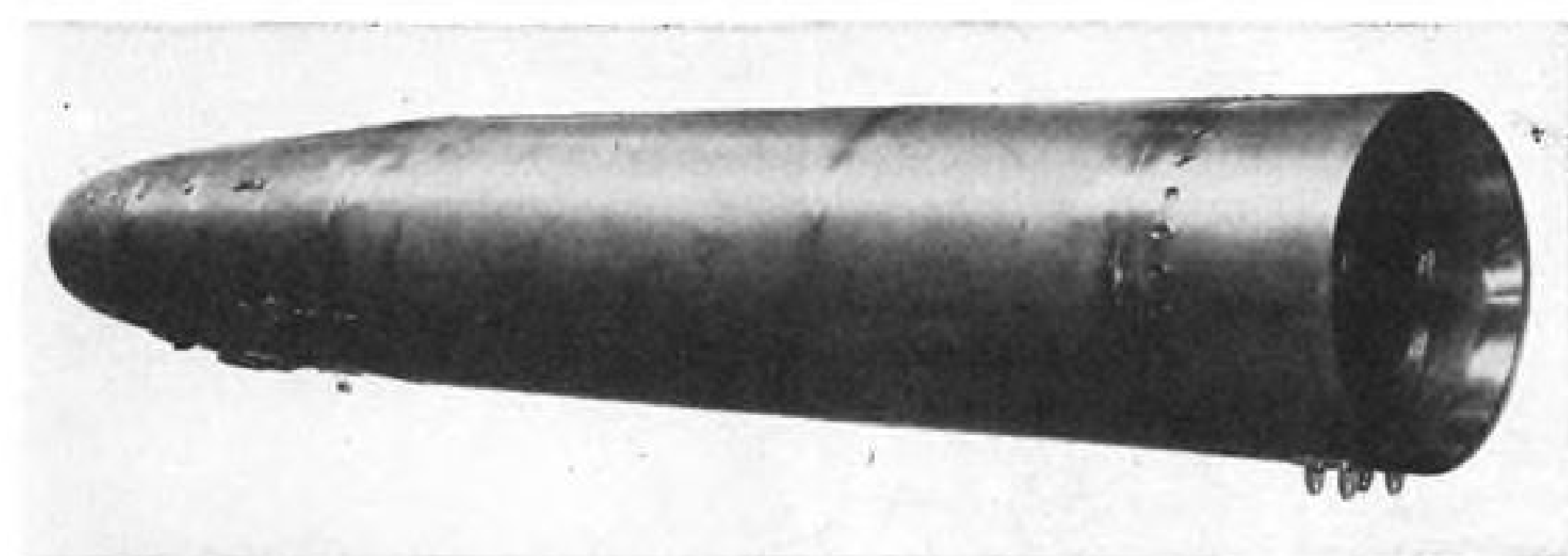
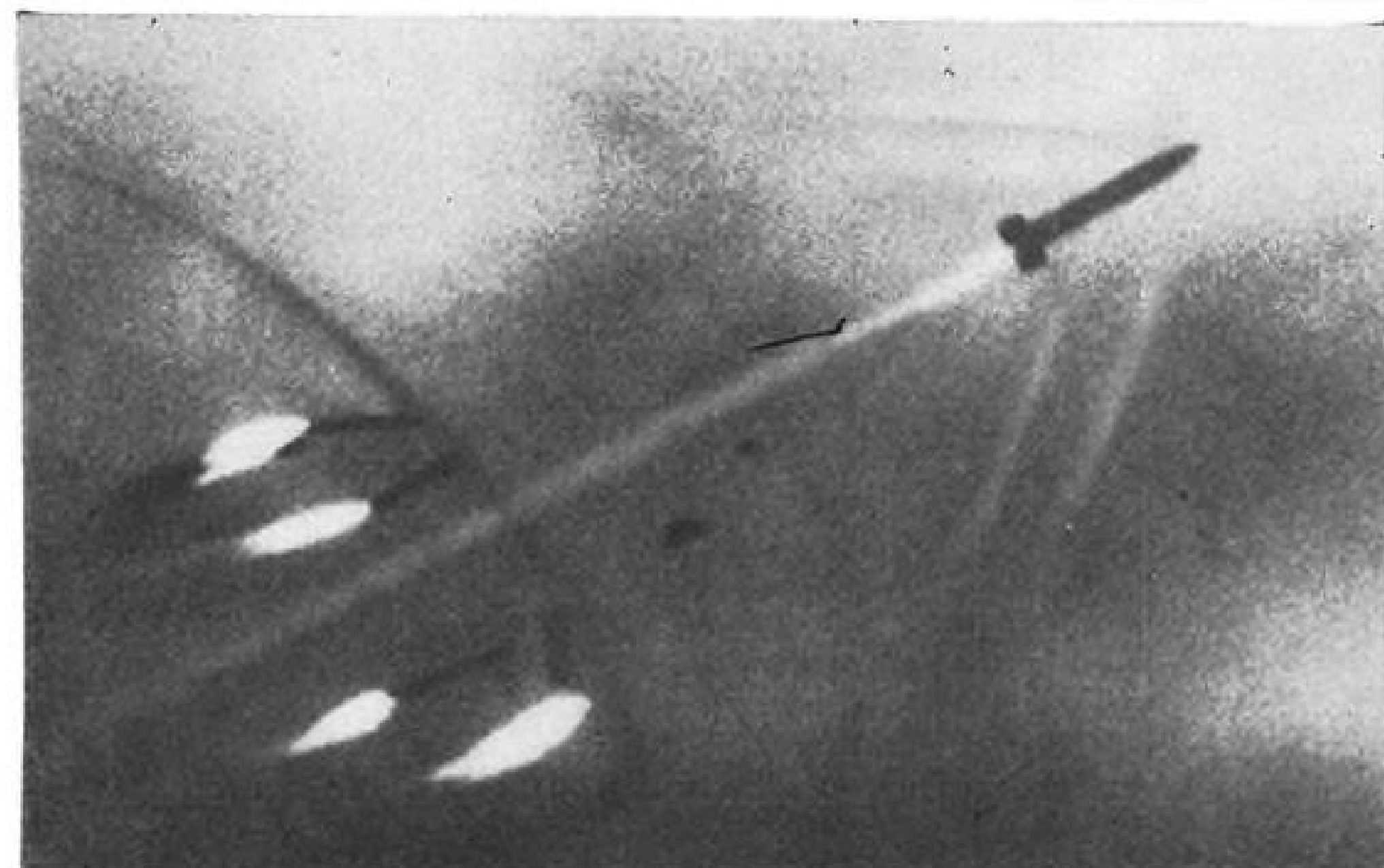
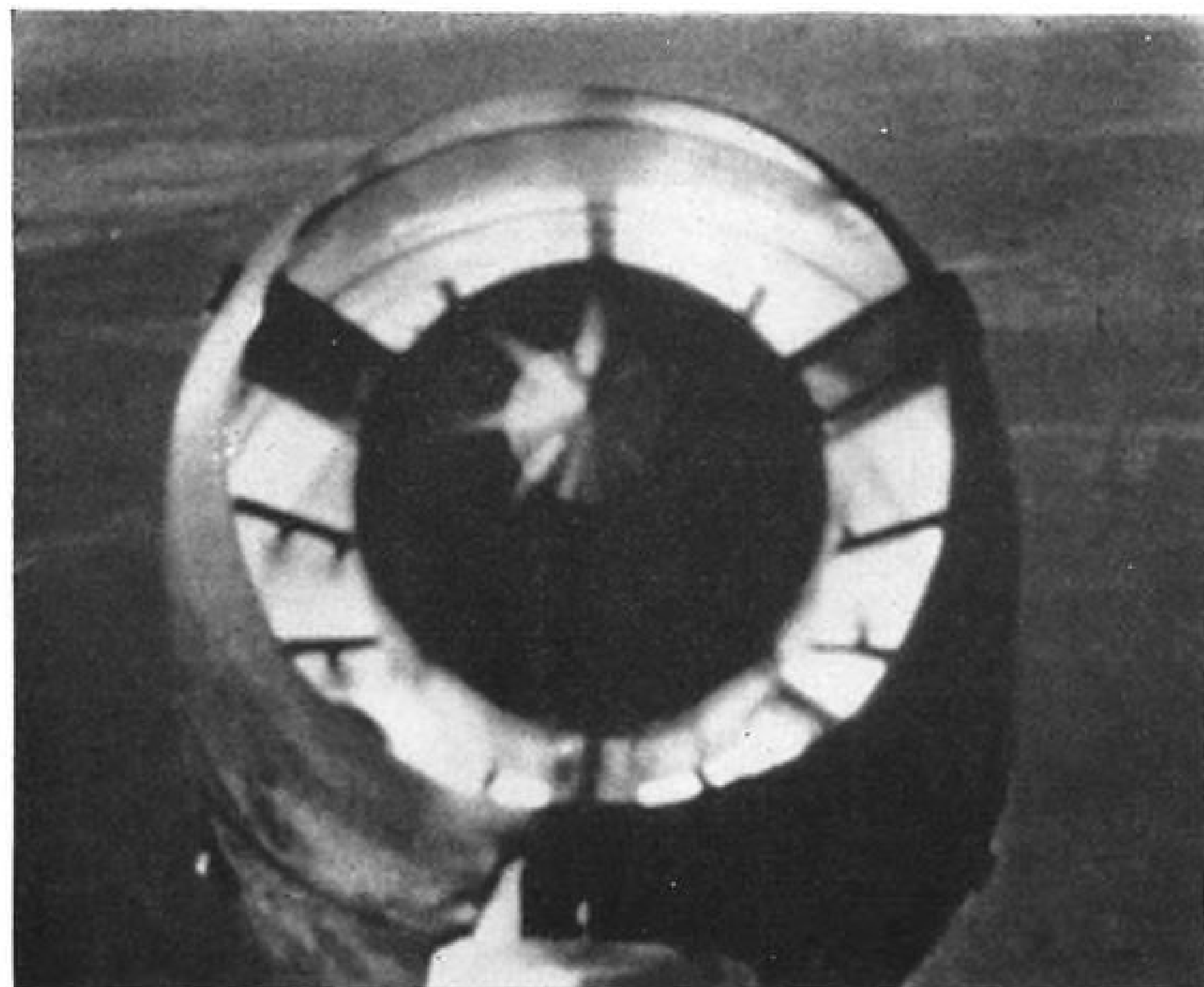
XV-1 Reaches 200 mph.

Baltimore—McDonnell's XV-1 convertiplane has attained speeds of 200 mph. after successfully converting from vertical to horizontal flight.

Last week's announcement by the Air Research and Development Command said the convertiplane made its first successful conversion from vertical to horizontal flight in April, 1955. Pilot for the flight was McDonnell test pilot John Moll. Its recorded speeds in horizontal flights are approximately 40 mph. faster than those attained by conventional helicopters.

The XV-1 is powered in vertical flight by pressure jet engines mounted at the tip of each rotor blade. Pusher-type propellers provide the power for forward flight.

The flight evaluation program was carried out at McDonnell Aircraft Corp.'s St. Louis plant by personnel from the ARDC Flight Test Center. A second XV-1 has been built and is now undergoing evaluation.



Ramjet Drives Missiles

Bristol "Thor" ramjet drives two British missiles reported to be in production by Bristol and English Electric. Starting reliability is claimed to be 100% and Bristol engineers say the fuel system is better than any American system. Thor's shock generating nose cone and radial flame holders are shown by the light of combustion in photo taken by aft facing camera mounted on a test missile (top). A missile powered by Thor is accelerated to starting speed by four booster rockets shown burning out immediately after separation (center). Shock front is visible ahead of boosters and two shocks may be seen on the missile. Envelope of the ramjet (bottom) is characteristically clean and simple. Over 200 Thor-powered test vehicles have flown from the missile ranges at Aberporth, Wales and Woomera, Australia. The missiles have been destroyed in flight because their ranges are great enough to carry them outside the restricted firing area.

Rockets Boost Napier Ramjet Test Vehicle

Technical details of the British Ramjet altitude record holding Napier NRJ 1 (AW Oct. 24, 1955, p. 51; Mar. 26, 1956, p. 53) have been released by the Napier company.

Eight solid propellant rocket motors mounted in pairs on the sides of the vehicle accelerate it to the speed necessary to start the ramjet. Each booster pair is fitted with a large stabilizing fin, the tip chord of which is greater than the root chord. The four large fins are necessary because the center of gravity of the missile is located far aft before the separation of the boosters.

After burn-out of the rockets, the wrap-around booster assembly disengages at the front end and is peeled away from the fuselage by small outward lifting fins.

The four stabilizing fins of the ramjet stage are made of a wooden frame clad with light alloy.

An airfoil-shaped center body divides the front fuselage into two semi-circular diffuser ducts. The center body contains radio receiver, telemetering transmitter, fuel tanks and components of the fuel system.

The NRJ 1 is approximately 20 feet long and 18 inches in diameter. Fuel is kerosene.

Pratt & Whitney to Add Some 3,000 Employees

East Hartford, Conn.—Pratt & Whitney Aircraft will hire approximately 3,000 new employees before the end of the year, mainly to man expanding production of new jet engines.

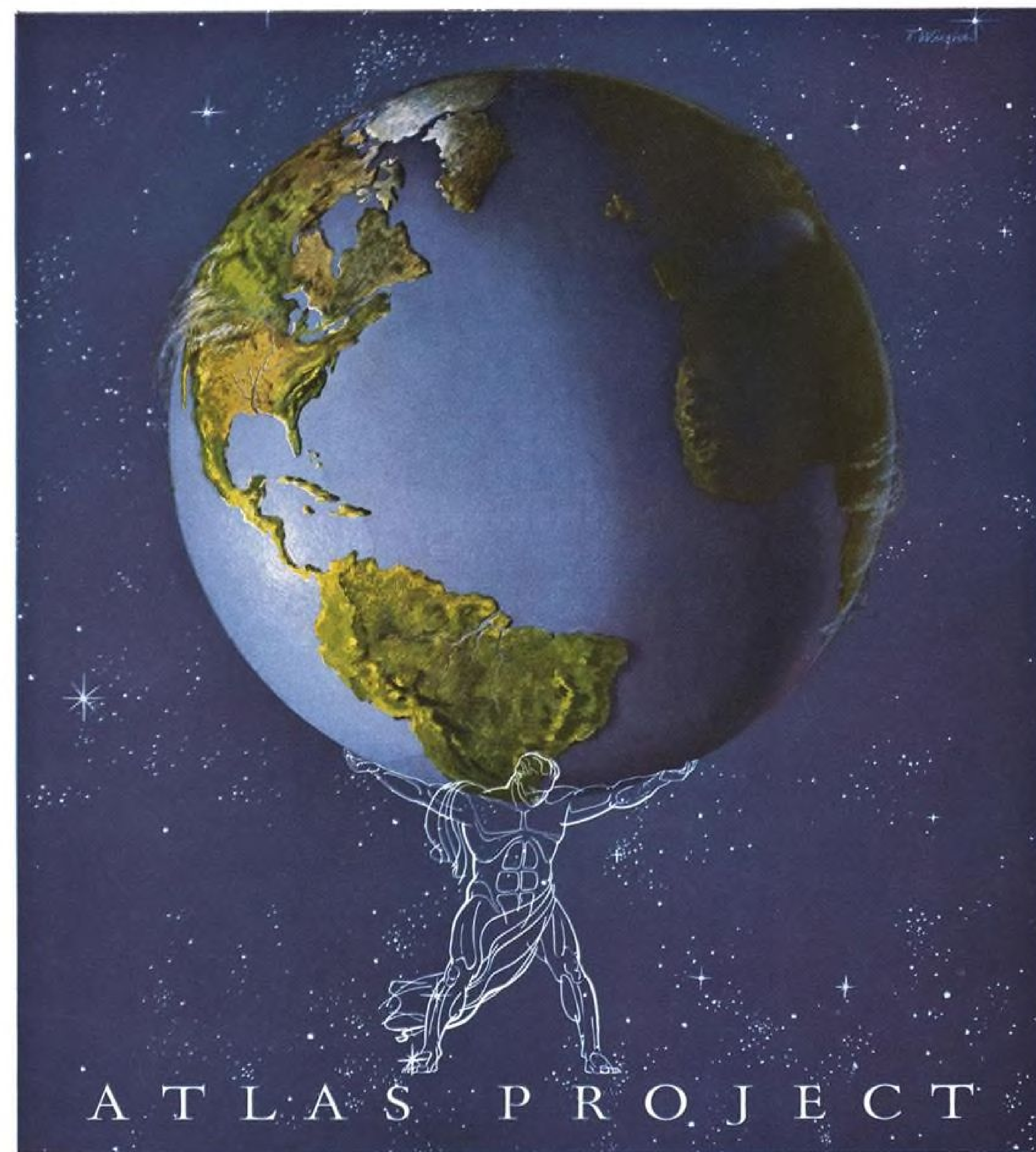
As recruitment schedules are filled, the company expects to begin the new year with 40,000 employees in its various Connecticut facilities.

Wright A. Parkins, general manager of P & W, attributed the new employment to the "outstanding success" of the J57 jet engine and the scheduled future use of the J75.

News Digest

Bristol Britannia G-ANBH returned to England from Entebbe, Uganda where tests were made on modifications of Proteus turboprop engine to prevent combustion flameouts. Results are being analyzed. Preliminary testing began following a "heat soak" of several hours on runway at Khartoum.

Taylorcraft, Inc. purchase of Continental, Inc., Danbury, Conn., is initial



Convair's Atlas...
a key to
ultimate peace!

A TOP PRIORITY PROJECT OF THE U. S. AIR FORCE

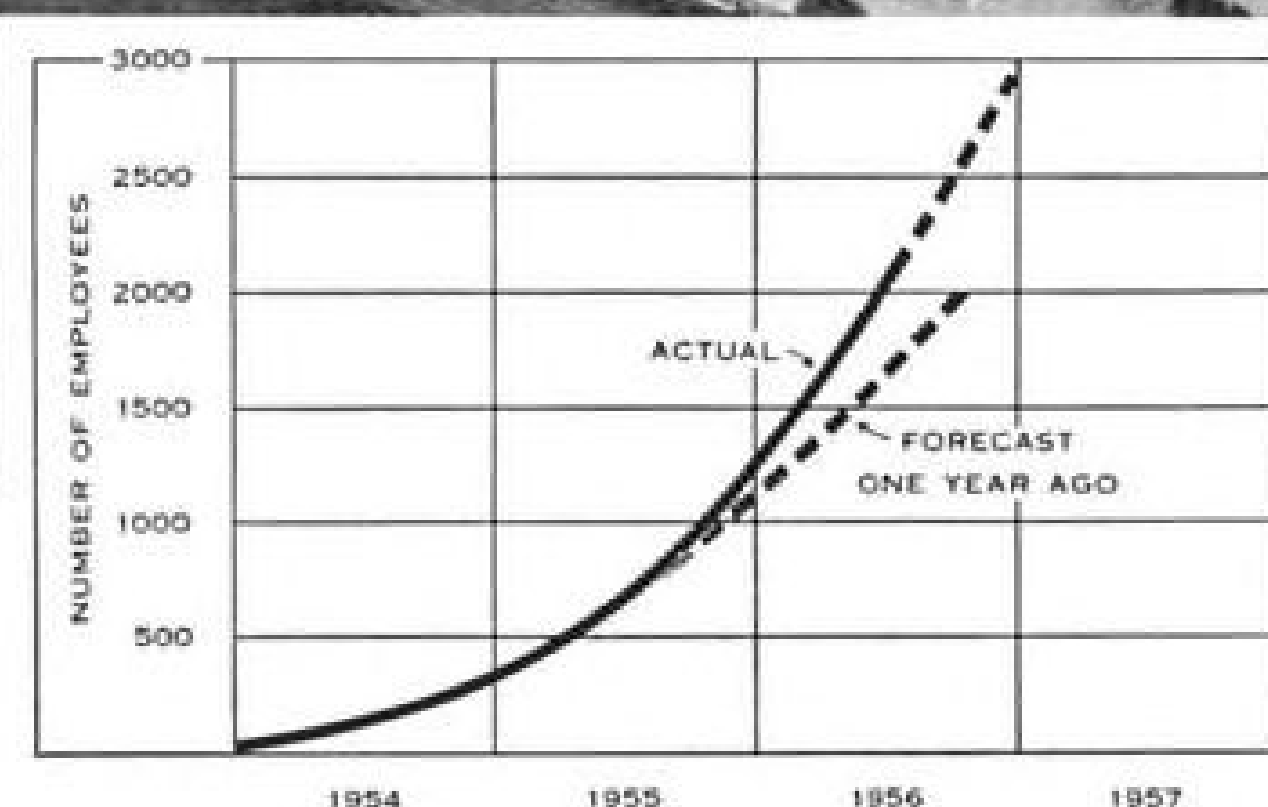
Convair's intercontinental ballistic missile, a vital weapon for our national security, is aptly named Atlas. As a deterrent to war—a force for world peace—it literally can sustain the future freedom of all mankind!

For ten years Convair's Engineering to the Nth Power has led the way in the development of the ICBM. Today, Convair continues its leadership with the largest and most experienced organization in the astronautics field. **CONVAIR-Astronautics** is now building a complete facility in San Diego, California, to produce the Atlas... a key to ultimate peace!

CONVAIR
A DIVISION OF GENERAL DYNAMICS CORPORATION

PROGRESS REPORT

After Thirty-Four Months...



RESEARCH AND DEVELOPMENT PERSONNEL The above curve shows the growth in Ramo-Wooldridge personnel which has taken place since our Progress Report one year ago. A significant aspect of this growth is the increase in our professional staff which today is made up of 135 Ph.D's, 200 M.S's and 265 B.S's or B.A's. Members of the staff average approximately ten years' experience.

FACILITIES Within the past few months, construction has been completed at our Arbor Vitae complex, which now consists of eight modern buildings of 350,000 square feet, four of which are illustrated at the bottom of the page. Nearby is the R-W flight test facility, including hangar, shop, and laboratories, located on a 7-acre plot at International Airport.

To provide additional space for our continuing growth, construction has been started on an entirely new 40-acre Research and Development Center, located three miles from the Arbor Vitae buildings. The photograph above is of a model of the Center, which we believe will be one of the finest research and development facilities in the country. The first three buildings, now under construction, will total 250,000 square feet.

A second major construction program is underway on a manufacturing plant for quantity production of electronic

systems. The initial unit of the plant, located on a 640-acre site in suburban Denver, Colorado, will be completed next spring and will contain approximately 150,000 square feet.

PROJECTS Our current military contracts support a broad range of advanced work in the fields of modern communications, digital computing and data-processing, fire control systems, instrumentation and test equipment. In the guided missile field, Ramo-Wooldridge has technical direction and systems engineering responsibility for the Air Force Intercontinental and Intermediate Range Ballistic Missiles. Our commercial contracts are in the fields of operations research, automation, and data processing. All this development work is strengthened by a supporting program of basic electronic and aeronautical research.

THE FUTURE As we look back on our first three years of corporate history, we find much to be grateful for. A wide variety of technically challenging contracts have come to us from the military services and from business and industry. We have been fortunate in the men and women who have chosen to join us in the adventure of building a company. We are especially happy about the six hundred scientists and engineers who have associated themselves with R-W. Their talents constitute the really essential ingredient of our operations. We plan to keep firmly in mind the fact that the continued success of The Ramo-Wooldridge Corporation depends on our maintaining an organizational pattern, a professional environment, and methods of operating the company that are unusually well suited to the special needs of the professional scientist and engineer.

The Ramo-Wooldridge Corporation

5730 ARBOR VITAE ST. • LOS ANGELES 45, CALIF.



step by Taylorcraft toward production of a combination airplane and automobile. Continental has flown prototypes of CAA certificated "Airphibian," but never has gone into full production. Taylorcraft has no immediate production plans. Purchase was made with Taylorcraft stock.

Additional M-21C Vertol helicopters have been ordered for Army under \$24.5 million contract awarded by USAF.

B. F. Goodrich Co. created a separate organization, B. F. Goodrich Aviation Products, P. W. Perdriau is general manager.

Minister for Civil Aviation for Australia, Athol Townley, said bilateral air transport agreement between Australia and Germany has been reached. When ratified, it will confirm existing Australian airline operations conducted by Qantas Empire Airways to London through Frankfurt. It also will extend reciprocal rights to a German designated airline to operate from Germany to Sydney.

Air-cooled V-4 engine carrying 70 lb. of aluminum in total weight of 200 lb., is visualized as powerplant for airborne military vehicles. Engine, developed by Aluminum Company of America and American Motors, was primarily directed toward automotive field.

Orders of \$23.9 million for electronic bombing systems and gun-bomb-rocket sights went to AC Spark Plug Division of General Motors. The division also is developing an inertial guidance system for an advanced USAF missile.

What company calls largest prefabricated, shielded enclosure ever built has just been erected by Bell Aircraft Corp., Buffalo, for comprehensive electronic testing of guided missiles and small aircraft. Shield measures 40 ft. in length, 35 ft. wide, 18 ft. high.

General Dynamics Corp. will design and build world's largest supersonic wind tunnel, valued at \$2.5 million. Contract, let by U. S. Army Corps of Engineers, is for Air Force's Arnold Engineering Development Center in Tullahoma, Tenn. GD's Boat Division at Groton, Conn., will execute contract with a sister division, Stromberg-Carlson of Rochester, N. Y.

Air Force will send 189 aircraft to participate in 1956 National Aircraft Show at Oklahoma City, Okla., Sept. 1, 2 and 3. Included are Lockheed F-104, Convair F-102, McDonnell F-101, North American F-100C and Boeing B-52.



Caravelle Survey

First SNCASE SE 120 Caravelle delivered to Air France hauls cargo between Paris and Algiers. Air France is conducting an extensive operational survey with the twin-engine jet airliner preparatory to beginning regular passenger service with a fleet of 12 Caravelles late next year or early in 1958. Cargo is loaded through a forward door in fuselage. Passenger entrance is through the hatch to rear bottom. Steps are an integral part of the door. Rolls-Royce RA 29 Avon engines are mounted on either side of the fuselage at rear. Caravelle cruises at 410 knots at an altitude of 39,000 ft. With a payload of 15,000 lb., normal range is 1,620 nautical miles.



AIR TRANSPORT

Eyewitnesses Describe TWA-UAL Crash

CAB hearings produce structural evidence of collision, translation of last United message.

By Craig Lewis

Washington—Public hearings on the Trans World Airlines-United Air Lines accident over Grand Canyon turned up three possible eyewitnesses to the crash and produced definite information that the two transports collided in mid-air.

A high-level Civil Aeronautics panel of inquiry examined three dozen witnesses during the Washington hearings in an effort to find out just how and why the TWA and United transports crashed.

Testimony of the CAB structural investigation group produced evidence that the TWA Super Constellation and United DC-7 collided in flight before they fell into Grand Canyon in the June 30 accident which killed 128 people.

Investigators retrieved wreckage from both planes. Examination showed that the left outer wing of the United DC-7 made contact with the Super Constellation fuselage forward of the tail. It also showed that a DC-7 propeller or propellers made one or more cuts in the Super Constellation fuselage.

Eyewitness Accounts

CAB investigators are still examining material from the accident in an effort to determine the angle at which the two aircraft converged and their positions when they collided.

At the hearing, the CAB called four surprise witnesses. Three of them told the investigators they saw the collision while driving along U.S. Highway 66 near Grand Canyon.

Mr. and Mrs. Eugene J. Siefer said they saw two aircraft appear in a break between two large cloud formations in the Grand Canyon area. They said the aircraft collided, then remained locked together for the few seconds they remained in view. Siefer said the planes were a Constellation and a DC-7.

The Siefers said they were a few miles east of Flagstaff, Ariz., when they saw the aircraft. They reported that the planes appeared between two large, billowy cloud formations, one of which was very dark. Siefer said it appeared that the two planes may have flown around opposite sides of the cloud formation before they met.

In a long day of hearings, the investigating board tried repeatedly to

shake Siefer's story, but he remained convinced that he had seen two aircraft collide over Arizona on June 30.

Two vacationers from West Virginia, Mr. and Mrs. Walter J. England, were on Highway 66 west of Winslow, Ariz., about the same time. Mrs. England said she saw an explosion in the air while watching some heavy cloud formations in the Grand Canyon area.

Puff of Smoke

About noon on June 30, Mrs. England said a cloud formation grew very rapidly over the Grand Canyon. As the cloud grew larger, it grew darker, and Mrs. England said she saw lightning in it.

"And then all at once," she said, "I saw a great puff of smoke appear, and I kept watching, and it spread out just like a parachute was opening up. And, then I began to see something come down out of the sky and smoke following after it, and it came on down until it got behind the clouds, and I couldn't see it anymore."

Mrs. England said the object was an airplane. At the time, she thought it was a jet aircraft. She said she continued to watch the smoke cloud and the falling aircraft "for a good five minutes or maybe more."

Both the Siefers and the Englands told the CAB group that they had failed to realize the significance of what they saw until they learned of the accident later. Neither couple reported what they saw until after their return home because they feared they would be delayed in the West.

Uncontrolled Airspace

Testimony of communications and traffic control personnel involved in the TWA and United flights showed no apparent irregularities in the way the two flights were handled. The flights collided in uncontrolled airspace in an area where the Civil Aeronautics Administration has no responsibility for regulating traffic.

Both flights left Los Angeles under instrument flight plans. They were scheduled to depart 15 minutes apart, but minor mechanical troubles delayed both flights, and they actually departed both flights apart.

When the TWA flight asked to change his altitude from 19,000 ft. to 21,000 ft., the request was denied be-

cause the United flight was at 21,000. TWA got permission to fly 1,000 on top of the clouds. Both flights left the airways—and CAA responsibility—when they crossed an airway approximately at the California border.

CAA officials explained that traffic controller refused to allow the two aircraft to cruise at the same altitude in California because they still had to cross an airway before they moved into uncontrolled space in Arizona.

The CAA witnesses emphasized that air traffic controllers make no attempt to provide an advisory service in uncontrolled airspace. They said the TWA flight was advised of the United flight's altitude as an explanation for refusing the request for 21,000, not as a warning of possible hazards. Under this policy, the United flight wasn't informed of the TWA traffic.

No CAA Advisory

CAA controller Lynn H. McCreary of the Salt Lake City center was responsible for the sector in which the crash occurred, but he pointed out that he was responsible only for the airways in the sector. He said controllers keep track of aircraft flying through uncontrolled space primarily to plot the time and place where they will re-enter the airways system.

McCreary said he knew that both the TWA and United flights were at the same altitude when they last reported and that their courses were plotted to cross. He pointed out, however, that the pilots were on their own and could change their course and altitude at will, and, therefore, CAA does not provide any advisory service in uncontrolled areas.

"Normally," the controller said, "our workload is such that it makes it impossible to provide that type of information . . . with the facilities that we do have."

A fragmentary radio message from the United flight was received at Salt Lake City at the time the two flights were supposed to report over the Painted Desert.

CAA controllers were unable to understand it at first.

'We're Going In'

Careful replaying of the recorded message indicated it was: "Salt Lake from 718—We're going in."

David D. Thomas, director of the CAA Office of Air Traffic Control, was asked what would happen if all air traffic flew under instrument flight



First Britannia, Viscount, Flights

Britannia 301 prototype (top) takes off from Filton Airport for 65-min. maiden flight. Airplane, to be used for certification of new 300-310 series, has 124-ft. fuselage, 10 ft. longer than Britannia 100, plus longer range. Twenty-six 300-310 series are on order. Viscount 802 (below) on 55-min. maiden flight. British European Airways has 24 802s on order; 802 is powered by four Rolls-Royce Dart R. Da. 6s, subsequent Viscount 806s will have R. Da 7 engines.



rules on the federal airways. He said the CAA would accept and handle all the traffic.

But, Thomas added, there would be "penalties in terms of delay, in terms of cancellations and also for those communities which are now receiving service in the now off-airways areas." He said the CAA is now working to relieve the situation, and that the telescoping of the five-year federal airways plan into three is a step toward solving the problem.

Testimony of pilots flying in the general area of the accident indicated that a large cloud formation was building up over the Grand Canyon at the time the collision occurred, and that the top of the formation was near 25,000 ft.

United States Army and Air Force helicopter pilots told the investigating panel of the difficulties they encountered

in reaching the sites of the two wrecks. Helicopter crews made 76 trips into the canyon carrying investigators and removing bodies and pieces of the wreckage. CAB Chairman James R. Durfee expressed the Board's appreciation to the helicopter crews and said "it was an heroic operation."

Beech Delivers Twin Super 18s to Brazil

Beech Aircraft Corporation in September will deliver five Beechcraft Super 18 twin-engined planes to the Brazilian air force. Super 18's will be used for internal communication, and flown often from small, unimproved landing strips.

Beech will convert the planes from executive eight-place capacity to 11-place configuration for the work. Braz-

il's air force presently uses a fleet of Model 18 Beechcrafts, ranking next to the U.S. and Canada.

Beech Flight Tests New Executive Plane

Wichita—Beech Aircraft Corp. last week began flight testing a new four-place executive aircraft which it hopes to place on the market early next year.

Bearing an external resemblance to the six-place Twin-Bonanza and designed to compete with the Cessna 310 (AW July 16, p. 50), the aircraft has been designated the Beech Badger. It will have a cruising speed of 200 mph. and is being put through an accelerated flight-test program.

The Badger, powered by two 180 hp. Lycoming O-360 engines, will sell for between \$35,000 and \$55,000.

Airline Traffic — June 1956

	Revenue Passengers	Revenue Passenger Miles (000)	Load Factor	U. S. Mail	Express	Freight	Total Revenue Ton-Miles	Per Cent Revenue to Available Ton-Miles
DOMESTIC TRUNK								
American.....	743,822	482,035	78.05	1,577,482	747,262	5,610,618	53,900,563	65.12
Braniff.....	156,538	64,926	66.12	225,050	122,875	380,897	6,948,862	58.22
Capital.....	281,362	98,630	66.59	253,720	182,875	289,388	10,163,406	50.02
Continental.....	62,504	23,005	57.06	71,218	27,400	106,832	2,411,910	48.39
Delta.....	208,951	98,416	66.09	314,061	245,017	622,686	10,640,517	60.40
Eastern.....	671,019	321,922	65.02	824,541	402,035	1,179,655	35,057,539	51.05
National.....	105,916	69,511	74.14	229,308	44,513	370,365	7,729,785	71.75
Northeast.....	59,985	12,095	64.03	10,684	16,502	27,714	1,149,602	60.20
Northwest.....	134,938	95,148	73.20	388,828	196,317	660,787	10,570,429	61.52
Trans World.....	398,113	325,037	78.47	955,707	622,816	1,823,805	34,512,587	69.61
United.....	618,875	446,730	77.77	2,121,085	978,781	4,187,669	50,180,125	66.38
Western.....	97,638	49,824	69.45	207,575	71,481	171,779	5,214,650	62.23
INTERNATIONAL								
American.....	11,202	7,699	64.36	11,533	613	299,643	1,098,753	65.96
Braniff.....	2,610	5,785	50.69	16,255	.....	70,488	742,246	54.44
Caribbean Atlantic.....	13,824	1,014	60.04	1,160	.....	2,207	94,647	57.40
Delta.....	4,851	5,855	65.59	6,757	.....	32,633	648,670	51.91
Eastern.....	27,335	34,982	72.10	55,184	.....	88,625	3,862,646	64.31
National.....	8,843	4,476	51.31	8,572	4,684	31,327	501,681	48.08
Northwest.....	11,309	22,489	66.72	859,352	22,887	967,889	4,261,276	73.16
Pan American								
Alaska.....	8,890	9,851	77.35	40,011	.....	401,321	1,459,598	63.35
Atlantic.....	102,921	135,053	64.18	887,754	.....	1,797,502	16,675,405	60.45
Pacific.....	29,597	83,784	79.11	1,078,156	.....	1,161,712	10,875,882	73.81
Latin America.....	414,366	103,414	66.70	351,000	.....	3,108,817	13,217,914	62.68
Panagra.....	11,399	13,146	56.10	50,797	.....	301,603	1,775,277	56.07
Trans World.....	31,132	83,119	70.07	748,769	.....	752,674	10,150,994	71.01
United.....	12,380	30,711	87.22	103,785	.....	61,990	3,307,338	80.57
LOCAL SERVICE								
Allegheny.....	42,425	7,142	47.23	7,047	18,452	6,003	712,823	47.92
Bonanza.....	11,650	2,562	46.51	3,934	2,304	7,304	256,652	44.86
Central.....	9,441	1,746	36.01	4,216	2,199	5,388	178,491	32.22
Frontier.....	16,266	4,258	46.08	17,117	7,664	67,020	498,437	56.62
Lake Central.....	13,133	2,030	43.37	2,111	10,154	.....	195,985	42.20
Mohawk.....	34,639	6,217	60.20	5,426	8,287	10,516	617,619	59.80
North Central.....	55,817	9,467	58.90	18,961	29,292	.....	947,051	52.38
Ozark.....	30,453	4,739	41.35	10,023	16,550	9,143	478,813	42.37
Piedmont.....	40,062	7,669	59.64	14,471	12,334	12,433	.....	59.00
Southern.....	16,395	2,863	47.90	8,362	12,867	.....	295,381	45.61
Southwest.....	27,917	5,359	52.65	8,278	4,773	7,577	530,809	50.84
Trans Texas.....	19,976	4,556	41.16	14,908	9,772	20,227	479,102	37.88
West Coast.....	20,342	3,582	57.80	4,258	2,119	5,431	335,333	54.93
HAWAIIAN								
Hawaiian.....	45,393	6,453	63.13	4,296	.....	115,313	680,990	58.42
Trans Pacific.....	24,685	3,128	55.48	649	.....	11,764	246,508	51.20
CARGO LINES								
Aerovias Sud Americana.....	.....	.....	.....	.....	.....	650,988	650,988	65.85
Flying Tiger.....	6,659	25,784	99.47	37,852	29,893	5,224,913	7,871,104	79.05
Slick.....	4,913	21,332	96.91	92,854	32,928	4,854,860	7,613,935	78.76
Riddle*.....	.....	.....	.....	.....	.....	.....	.....	.....
HELICOPTER								
New York Airways.....	4,373	82	62.60	908	1,399	557	10,492	66.87
Los Angeles Airways*.....	.....	.....	.....	.....	.....	.....	.....	.....
Helicopter Air Service.....	.....	.....	.....	2,755	.....	.....	2,755	44.26
ALASKA								
Alaska Airlines.....	6,361	2,863	39.99	40,577	.....	613,646	980,950	50.72
Alaska Coast.....	5,501	491	59.95	4,061	.....	4,788	58,841	61.33
Byers Airways.....	233	32	37.64	672	.....	957	4,837	77.82
Cordova.....	1,910	269	34.40	3,239	.....	190,831	221,509	56.69
Ellis Air Lines.....	7,018	358	51.43	2,273	.....	3,490	41,999	59.84
Northern Consolidated*.....	.....	.....	.....	.....	.....	.....	.....	.....
Pacific Northern.....	14,258	11,326	64.31	70,683	.....	320,154	1,611,719	68.04
Reeve Aleutian*.....	.....	.....	.....	.....	.....	.....	.....	.....
Wien Alaska.....	4,066	1,753	14.94	45,519	.....	1,371,327	1,595,291	93.27

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



Showcase for Western Transports

Lined up on the ground at Vnukovo airport outside of Moscow (above) are leading western transports. They are (left to right) Douglas C-118 (DC-6B) that brought Gen. Nathan F. Twining and party to Moscow; de Havilland Comet II that carried the Royal Air Force delegation, and a French Bretagne. A Russian built Li-2 that resembles another famed Western transport is at the extreme left, and an Armed Russian sentry is in the foreground. Later the Russians moved a Tu-104 into the foreground, effectively screening the Western air-planes. Czech airline's Il-12B (below) also is parked at Vnukovo. Note B series of Russian-made transport has dorsal fin added, rounded tail.



Argentina Sets Out Policy on Airlines

Buenos Aires—Argentina has decided to continue the unprofitable overseas flights of her state-owned airline, but she leaves the door wide open to any Argentine private company that would like to take over some of these various flights.

This decision was revealed in a decree-law covering the whole field of commercial and civil aviation. In the law the Air Ministry, one of the three military ministries, emerging as sole boss of Argentine aviation.

The law states in part: "The State, through its companies, will continue to operate international air services, but the National Govern-

ment may authorize operations on overseas routes of Argentine private companies, in accordance with rules to be laid down by the Ministry of Aviation."

"Domestic flights will be made only by Argentine companies. The Federal Government may authorize private companies to operate such traffic, without prejudice, however, to the continued development of traffic by the state-owned airline.

Foreign airlines that have long sought authorization to make such domestic flights as the potentially profitable Buenos Aires-Bariloche run, (Bariloche being one of Argentina's major internal tourist attractions, as well as a favored fishing region) were disappointed to note that the door to such authorizations seems definitely closed by the new law.

Scandinavian Airline to Study Northern Lights

Stockholm, Sweden—Northern Lights will be studied and photographed in connection with the 1957-58 Geophysical Year from planes of the Scandinavian Airlines System on the Stockholm-Tokyo Polar route which will open in February 1957.

A special northern lights camera has been designed for the work by W. Stofregen, an engineer at Upsala Ionosphere Observatory. Apparatus makes it possible to photograph automatically the entire heavens every minute during dark hours. Air photographs will eliminate limitation of vision from horizon to horizon experienced at stationary points.



This is a cam characterized potentiometer, one of several in Honeywell's advanced MB-3 Autopilot. By scheduling circuit gains as functions of the basic flight control parameters, these Honeywell-made precision potentiometers help make the aircraft behave at supersonic speeds. The pilot gets the aeronautical equivalent of power steering: he applies the same stick force for a given maneuver, regardless of the aircraft's speed or altitude.

AERONAUTICAL DIVISION, MINNEAPOLIS-HONEYWELL

Future Uncertain for Idlewild Loadair

New York—Future of the \$100,000 Whiting Loadair installation at New York International Airport (AVW Jan. 17, 1955, p. 63), idle now after a year's test operation, is uncertain.

If airlines at the busy airport are to use the mechanical aircraft docking system during the rest of the life of Idlewild's temporary terminal, certain modifications are in order. If no agreement for further use is worked out between the airlines and the Whiting Corporation, the unit will be removed.

Whiting installed the Loadair in December, 1955, specifically for a year's test under a three-way arrangement between Whiting, American Airlines, and the Port of New York Authority. The manufacturer says it got what it wanted in the way of information from the trial, and would not want to continue operating the device without the modifications. The airlines also feel that Loadair needs improvement to offer possibilities for the future.

Industry Interest

The experiment drew considerable interest and pointed up industry awareness that new ground handling methods are needed to keep up with other developments in commercial aviation on the threshold of the jet age. The test in some respects was inconclusive, but it demonstrated one obvious fact: airline passengers appreciate being kept out of the wind and weather.

Some 1,500 flights involving seven

airlines were handled by the Loadair at Idlewild during its operation there, according to the Whiting Corp. Airline officials queried by AVIATION WEEK all agreed that their passengers liked it. From an operational standpoint, there were some reservations.

Loadair consists of an enclosed loading dock and the tracks and machinery which bring an aircraft sideways up against the dock and pull it out again. The aircraft positions itself so that its main landing gear rests on dollies on the main Loadair track, which are moved by cables; the nosewheel rests on a free-wheeling dolly not powered by cables. The installation included several sets of nosewheel tracks to accommodate different types of aircraft.

As the passengers deplane directly from aircraft door to covered dock, their baggage travels by conveyor to a self-claim area at the root of the enclosed walkway leading to the dock.

Airline people spoke of problems with the test Loadair model, including the following:

- **Hand chocking** of the aircraft wheels on the dollies. Chocking was accomplished by moving a lever with muscle power. Whiting plans a hydraulic automatic operation for future models.
- **Fuel spillage** into the trench containing the cables. To eliminate this hazard, Whiting has designed a carbon dioxide purging system for the trench.
- **Snow and ice** in the trench. This was solved in the Idlewild installation by

electrically heating the main gear trench. Nosewheel tracks were cleared by hand.

- **Strain on the nose wheel strut.** Because the nose wheel dolly isn't powered and hence is dragged by the main dollies, some "whipping" of the front strut was reported. Whiting says the front dolly could be powered if necessary, but actually there isn't really that much strain on the strut.

- **Inefficiency of disconnecting** auxiliary power at the dock while the plane is moved out, then connecting power equipment again to start engines. Whiting says this problem could be easily solved by built-in outlets at each end of the track, or by starting engines at the dock.

Latter means would require the improved chocking system for safety.

Valuable Experience

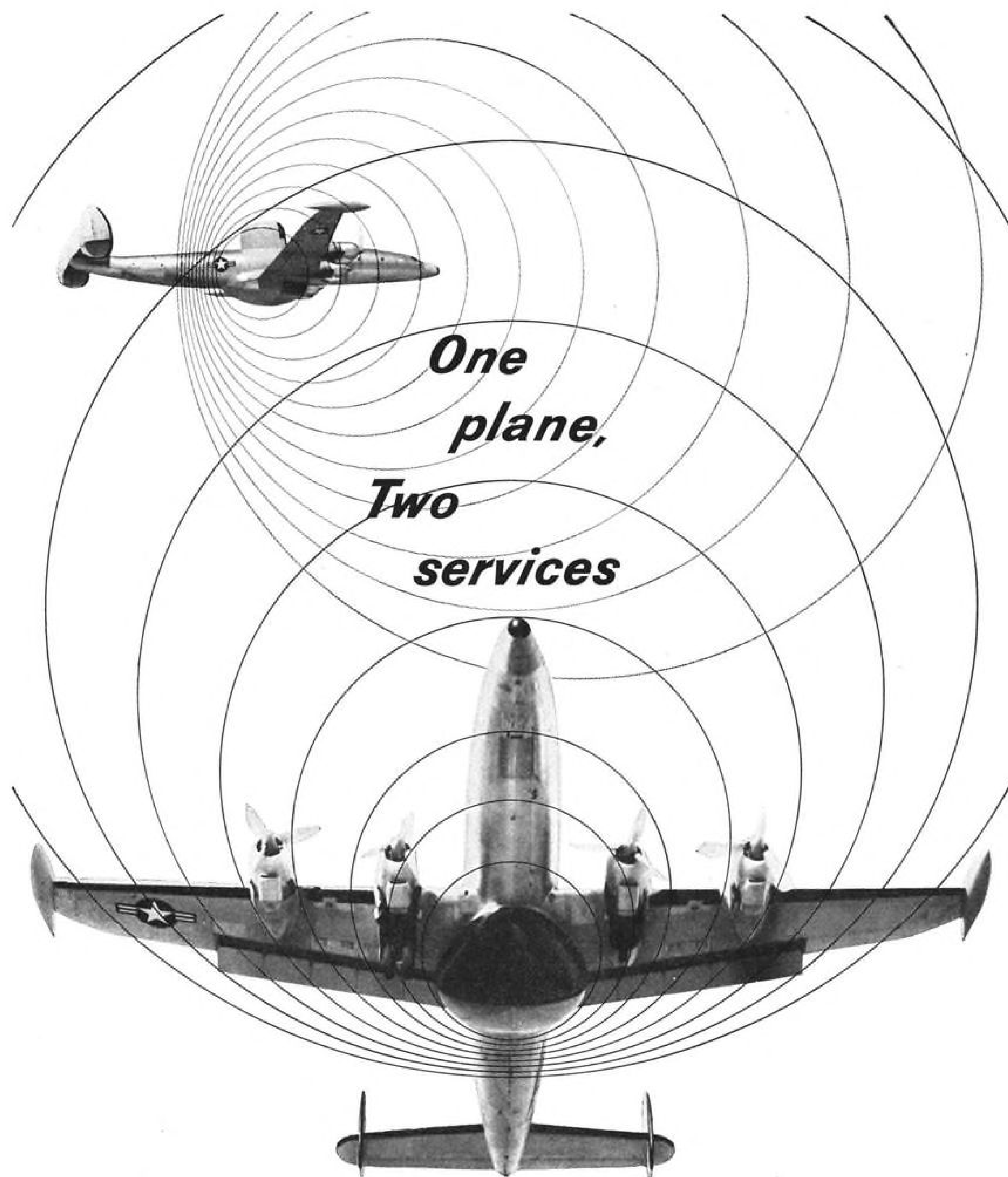
The manufacturer considers the test run as valuable experience and as proof that faults can be corrected. The Idlewild unit suffered some breakdowns, which Whiting says were 70% chargeable to the chock system, 15% to the electrical system, 6% to the drive cable system, 9% to the nose wheel track foundation. All of these flaws except the chocking were corrected by field modification.

Whiting paid for the test installation and its operation, allowing those airlines checked out in its use to operate the Loadair free. American Airlines agreed to the operation in the airline's



New York's Plush S-58C

First commercial S-58C, displayed at LaGuardia Airport by New York Airways, is expected to go into inter-airport service by Labor Day. Carrier will receive two more of the 12-passenger Sikorsky machines within a few weeks, a fourth early next year. Recently certificated by Civil Aeronautics Administration, S-58's will carry passengers in two six-seater compartments. Faster, bigger and plusher than five-passenger S-55's now operated by NYA, S-58Cs will be fitted with amphibious gear for service into Manhattan by early 1957. New Rotorcraft can handle 3,600 lb. of useful load, climb about 1,000 fpm. and are powered by Wright R-1820 engine developing 1,525 hp.



In this perilous age when even *one* thermonuclear weapon can devastate a vast area, the vital role of maintaining our nation's first line of aerial defense has been entrusted to the Lockheed-designed-and-built radar picket plane—the U.S. Air Force's RC-121D and the U.S. Navy's WV-2.

In darkness and fog, in fair weather and foul, these twin sentinels operate around the calendar and the clock, at altitudes up to 25,000 feet and at speeds up to 300 mph. Pressurized and air-

conditioned, they provide 75-degree cabin comfort for a 31-man crew, even when outside temperatures are 60 below zero.

The antenna reflector assembly in the belly radome of these picket planes was developed by Lockheed—enabling them to radar-scan an area of 45,000 nautical square miles from 10,000 ft. altitude.

Only Lockheed produces long-range, AEW planes—a tribute to the all-weather capabilities of the RC-121D/WV-2, and to Lockheed's leadership in the early-warning electronics systems field.

Lockheed

AIRCRAFT CORPORATION, BURBANK, CALIFORNIA Look to Lockheed for Leadership

terminal area, and the Port of New York Authority okayed the experiment and helped in planning it. American, National, Trans World, United, Northwest, Panagra and Air France tried the device to varying extents, Whiting reports.

Baggage handling aspects of the Loadair was watched with interest, but again further modifications are indicated. While in many cases the system worked well and passengers found their bags waiting at the end of a short walk, the claim area in the experimental setup was found too small and delays sometimes ensued.

Four Approaches

Loadair represents one of four approaches to the problem of protecting passengers and their baggage from the elements and other hazards of the ramp. Others: mobile, covered "bridges" to connect the gate position with the aircraft door; overhang of the roof of the terminal itself which covers aircraft parked at the gate positions; special vehicles to transport passengers from terminal to plane (AW June 18, p. 102).

The fixed dock of the Loadair type also could be equipped with integral servicing facilities.

A disadvantage is its relative inflexibility. The unit could handle the DC-4, DC-6, DC-7, Stratocruiser, Constellation series, Convair and Martin.

It could not, for example, handle the Viscount without modification.

Weight No Problem

How would a swept-wing 250,000-pound-plus jet such as the 707 be handled by a Loadair installation? Fine, according to Whiting, if the unit were designed for it. The weight, says the firm, is no serious problem; they've built railroad machinery to handle much heavier equipment.

As to the swept-back wings, Whiting says the 707 and the DC-8 could be brought straight into the dock like conventional aircraft, with the wing fitting snugly between two passenger fingers, and the front and rear aircraft doors meeting the docks at the end of the fingers. Or a swept-wing plane could be brought in canted fashion, with an extra main track for one set of the main wheels. In that case one dock would extend further than the other to accommodate the front aircraft door, according to Whiting's proposal.

The company also foresees additional all-cargo use of the Loadair. A cargo installation has been operated by Avianca at Barranquilla, Colombia, since 1951.

The Whiting Corporation is optimistic about the future of its Loadair. Improved models are in the design stage, the firm says, and negotiations are under way with "several" likely prospects.

AIRLINE OBSERVER

► Hotly-contested New York-Florida Case should be resolved by the Civil Aeronautics Board by mid-September. Quoted price of Northeast Airlines has taken a marked rise with reports that the CAB favors the airline for the lucrative Miami-New York route. Stocks of other leading applicants in the case, Capital, Delta and Pan American, have remained steady.

► Aeroflot's international service closely reflects Kremlin policy changes. A year ago, when Yugoslav dictator Tito was still at odds with Moscow, Aeroflot ran one weekly all-cargo flight to Belgrade. Now, with Tito back in the Communist fold, Aeroflot operates four weekly roundtrips between Moscow and Belgrade. The airline recently published a special timetable featuring Soviet and Yugoslav flags on the cover. Roundtrip fare for the 2,200-mile flight between Moscow and Belgrade is \$295.

► Continental-Capital merger proposals have been shelved because of the present financial strength of both companies. Merger discussions had been fostered by Lehman Brothers, who brought J. H. Carmichael and Robert F. Six, respective heads of Capital and Continental, together on at least two occasions. The Wall Street investment house wanted to see a merger on the grounds that it would solve the financial problems faced periodically by both companies.

► Air Transport Association will make its strongest bid yet to have both the Republicans and Democrats adopt election-year planks endorsing the airline industry. An expanded staff of ATA officials and legislative aids will attend the conventions to push the program. Republicans adopted such a plank in 1944 and 1948; Democrats in 1940 and 1952. Never has the industry received platform support by both parties in a single year.

► Reports that Qantas Empire Airways may buy the Comet IV jet transport are discounted in Australia. Qantas likes the Bristol Britannia but hopes Bristol will come out with an airplane that could compete with Douglas DC-8 and Boeing 707.

► Users of airports in the Washington area are voluntarily obeying a 180 mph. speed limit, although High Density Air Traffic Zone restrictions that previously had enforced such a limit expired on July 31 after a one-year trial (AW July 30, p. 33). Restrictions probably will be re-established permanently within 60 days, when the Civil Aeronautics Board is expected to empower the Civil Aeronautics Administrator to designate Washington and other areas as permanent high density zones. First area outside Washington to receive the restrictions probably will be Chicago.

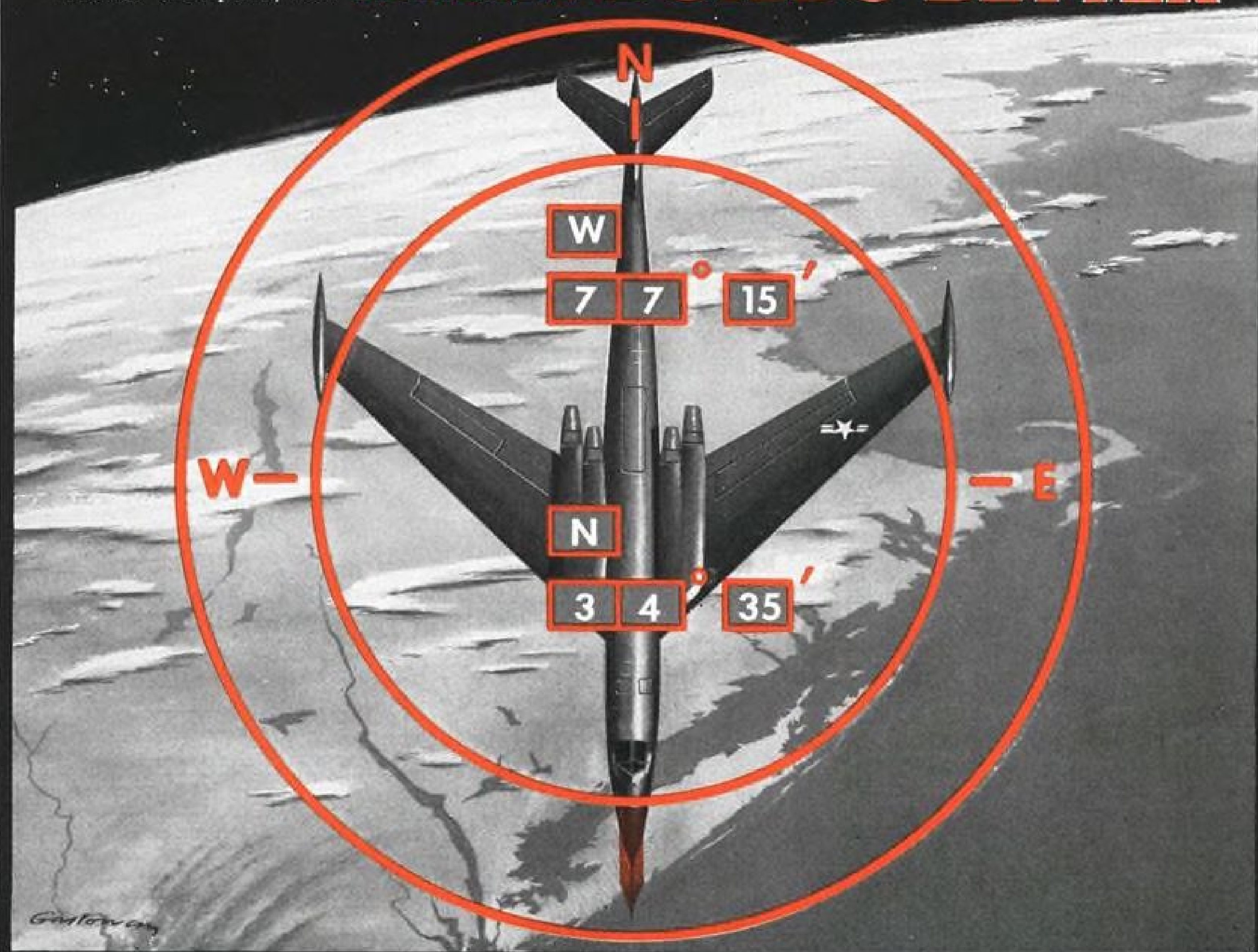
► Detroit may have three downtown heliports if the Civil Aeronautics Board and the Post Office Department approve sites selected by the Detroit Aviation Commission. Ports would be equipped to handle both mail and passengers. Three organizations have submitted applications to the CAB for the Detroit service.

► International Air Transport Association is worried about the lack of tourist facilities in Europe. Accommodations are not keeping pace with the volume of transatlantic passenger traffic to Great Britain and the continent. According to Sir William Hildred, director general of International Air Assn., the American Bar Association, which plans to hold its annual convention in London with 7,000 persons attending, can find beds for only 2,000, although a year's advance notice was given.

► Decline in stewardess applications is apparently behind United Airlines' announcement that employment requirements are being modified. United has increased the maximum acceptable height for applicants from five feet, seven inches to five feet, eight and reduced the age limit from 21 to 20.

► French Union representing air traffic control operators has declined "all responsibility in case of a possible, if not certain, accident" at Paris' Orly Airport. The hazardous situation, according to the union, is created by an understaffed control tower. A spokesman for the French government called the union's claims "greatly exaggerated."

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tude), ground speed, ground mileage, drift angle and ground track in continuous, readable form. No computations are necessary. The equipment is compact and self-contained. No ground facilities are employed—no wind information or aerological data are needed.

This significant contribution to jet navigation is typical of the work which Ryan and the military services are accomplishing in other fields of electronics research such as supersonic missile guidance for the Air Force and helicopter hovering devices for the Navy.

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BEA Carries 12 Million Passengers in Decade

London—British European Airways has carried more than 12 million passengers, earned \$316,400,000 in revenues, and produced 635 million ton-miles of capacity during its first decade of operation, according to the airline. BEA, which says it is the largest airline in Europe and the sixth largest in the world, began operations in August, 1946.

BEA claims to have introduced the world's first scheduled passenger helicopter service in 1950 between Liverpool and Cardiff, Wales. First passenger use of the Vickers Viscount also is claimed by the airline, with first schedules in 1953. BEA since has flown more than 100,000 hours with its Viscounts and carried a million passengers in them, the airline reports.

Shortlines

► **Airlines Clearing House** handled interline business worth \$58,774,927 in June, an increase of 20% over June, 1955.

► **Air Transport Assn.** estimates the scheduled airlines carried their 300th million passenger on July 29.

► **Brazil's airline strike** was settled after it had disrupted air travel for a week. Airline crews asked for a 50% raise in pay, but the Labor Ministry settled the strike on the basis of a sliding scale of increases ranging from 35% to 65% based on 1955 salaries.

► **British Overseas Airways Corp.** will increase its New York-Nassau service from two to five flights a week on Sept. 3. All flights will be tourist class in Vickers Viscount equipment.

► **California Eastern Aviation** reported operating revenues of \$16,601,074 and net earnings after taxes of \$474,809 for the first half of this year. In the first six months of 1955, the company's income was \$11,092,604 and net profit after taxes was \$273,867.

► **Convair** has new orders for 25 Metropolitan 440s. Scandinavian Airlines System has bought five more 440s, bringing its total order to 16, and Swissair has ordered three more Metropolitans for a total of 11. Eastern Air Lines and Delta Air Lines have each ordered three more 440s, and the Air Carrier Service Corp. has ordered two of the aircraft for use in Japan. Finnish and Yugoslavian airlines each ordered one 440. Lufthansa bought two and five

COCKPIT VIEWPOINT

By Capt. R. C. Robson

Boeing 707 Impressive

As the new picture on this column is supposed to show, I am now a jet pilot. At least I'm a few hours and one landing and take-off worth of jet pilot. As one of a group of American Airlines pilots, I recently had the opportunity to fly the Boeing 707. Some members of the group had had considerable experience in jet aircraft, from F-80's to B-47's, and it was interesting to note that their reactions were not a whit less enthusiastic than mine.

Perhaps the highest praise a pilot can give an airplane is that it is an "honest" ship. The 707 feels honest. It is stable about all axis throughout the complete range of speeds. Control response is firm and prompt from hard over aileron at 600 mph. down to slow speed flight.

Stall is Clean

There is ample warning of an unhealthy Mach number—slight wingtip flutter and some aileron nibble, and there is excellent stall warning. Stall speed with full flaps at 150,000 lbs. is 96 knots. The stall is clean and not hard to handle.

Considering the fact that this is a swept wing aircraft which in its airline version will gross upwards of 250,000 lbs. and cruise at 600 mph, the flight characteristics are very impressive. Part of the secret of course, lies in the experience which Boeing gained in building the 47s and 52s. The 707 has profited from its ancestors.

The caliber of this airworthiness was nicely demonstrated as I was approaching for landing. About four miles out on final approach a voice from the rear wanted to know what would happen if all power was chopped off. Boeing test pilot Jim Gannett just shrugged and yanked four throttles closed on me. But the only thing that happened was a gradual decrease in airspeed, no violent change in pitch nor need to re-trim.

Then the voice asked to see a sudden full power application. This was accomplished by simply ramming the throttles forward. Again there was no violent change in attitude. We merely began picking up speed. I learned later that acceleration from idle speed to full thrust takes 4.4 seconds. And it is surprisingly smooth.

Spoilers Used

These shenanigans while I was trying to aim at the runway brought us to the field a bit high but by using 30 deg. of "spoilers" we eased down as nicely as you please. Prior to this we had to use the "spoilers" as speed brakes and were able to establish a rate of descent of 15,000 fpm. in one minute from cruising speed. Flexibility of this type is a real "must" for an airline transport considering the amount of barnstorming that is required to get in and out of some of our airports.

For a large airplane the cockpit of the 707 is quite small, although not cramped by any means, and all controls are easily accessible. In a workshop of this size a little guy like me can feel completely at home and still have excellent visibility. Compactness of this type definitely aids the pilot in doing a smooth job.

Naturally with a plane of this size and weight there will be things like full gross load take-off on hot days and landings on icy runways in bad weather which will prevent monotony from setting in for the pilots. But this could be said for any large airplane and does not detract from the caliber of the Boeing.



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have been sold as corporate aircraft.

► **Copenhagen's Kastrop Airport** handled 451,354 passengers in the first six months of the year, a 27% increase over traffic during the same period last year.

► **General Parcel Delivery** will operate a daily air cargo pickup and delivery service in the Chicago suburban area for American Airlines, Air France, Braniff Airways, Capital Airlines, Delta Air Lines, Eastern Air Lines, Northwest Airlines, Ozark Air Lines, Trans-Canada Airlines, Trans World Airlines and United Air Lines.

► **International Air Transport Assn.** Clearing House handled \$96,628,000 in interline transactions during the first three months of 1956, a 34% increase over the first quarter of 1955.

► **The Sudan** has become the 69th member state of the International Civil Aviation Organization.

► **Meteor Air Transport** flew 2,060,320 ton-miles of air cargo in the second quarter, including 1,084,652 ton-miles under contract with Military Air Transport Assn. Total traffic in the April-June period last year was 646,071 ton-miles.

► **Mohawk Airlines** will move its headquarters from Ithaca, N. Y., to Oneida County Airport, midway between Utica and Rome. Mohawk's planned \$2 million headquarters facility will be financed by an Oneida County bond issue and amortized by the airline over a 25-year period.

► **Ozark Air Lines** carried 26,588 passengers in July, a 23% increase over July, 1955, traffic. The local airline carried 176,703 passengers in the first seven months this year and 130,380 in the same period last year.

► **Poland's national airline** is expected to obtain landing rights at London Airport in the near future.

► **Seaboard and Western Airlines** has increased its transatlantic cargo schedule from five flights to six flights a week.

► **Trans-Canada Airlines** carried 966,135 passengers in the first six months of 1956, an increase of 29% over the 1955 period. TCA traffic on its New York-Canada routes totaled 142,958 passengers in the same 1956 period, a 66% gain over last year.

► **West Coast Airlines'** threatened pilot strike was settled with a new contract that includes wage increases and a pension plan.



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AVIONICS

New Device Automatically Tests Diodes

Auto-Sorter checks semiconductor diodes at rates up to 8,000 per hour, sorts them characteristically.

By Philip J. Klass

The price penalty which avionic equipment manufacturers have long paid to get semiconductor diodes tailored to their specific circuit requirements should be eased greatly by new equipment developed by Pacific Semiconductor, Inc.

The new device, called "Auto-Sorter," automatically tests diodes at rates up to 8,000 units per hour and simultaneously sorts them into as many as eight different types according to individual diode characteristics. To match Auto-Sorter's speed would require 25 human operators using conventional test equipment, according to PSI's Warren Hayes, operations manager.

Widespread Use

Although the semiconductor diode has found widespread use in avionics equipment because of its size and weight advantage over its vacuum tube competitor, an inherent characteristic of semiconductors has put it at a disadvantage relative to tubes.

The manufacturer of vacuum tube diodes can closely control the performance characteristics of the end product by well-known and long-used tube industry techniques. When a tube maker decides to build a batch of 6X4's, he does not find any 6AL5's in the completed lot.

The semiconductor manufacturer has a more difficult lot. He is able to maintain only the grossest sort of control on final diode characteristics by varying semiconductor material characteristics, "cat whisker" material, and the union between the two.

For this reason the semiconductor maker builds a batch of diodes, tests them to see what the "net has brought up," then uses selection to obtain those with similar properties.

One semiconductor manufacturer (not PSI) sums up the situation this way in an application engineering brochure: "Such a selection process yields certain types in greater quantities than others, and the policy has been to price the various (types) in inverse proportion to their abundance. Hence the circuit designer should look carefully at his application and choose the type with the least rigid specifications that can be tolerated. In this way he not only saves money but can be assured a more adequate supply of diodes."

Auto-Sorter Benefits

Auto-Sorter by itself cannot hope to remove the "black magic" that now exists in the semiconductor manufacturing art. Only time and increased knowledge can do this. Nor can Auto-Sorter directly change the yield in a batch of semiconductors. Indirectly, however, the tester should enable a semicon-

ductor manufacturer to obtain sufficient data quickly to make a statistical prediction of yield before all the diodes in the batch have been completed. This will in turn permit the manufacturer to alter certain of its operations and techniques to change diode characteristics in the remainder of the batch.

Equally important, Auto-Sorter will permit effective management of inventory, a problem which long has plagued semiconductor manufacturers, Hayes says.

If an avionic equipment designer needs a diode with very special characteristics, the entire inventory can be quickly and economically searched for such diodes. Previously such a search would have been far too costly and time consuming.

The new device also can be used to match diodes at one or more operating points.

How It Operates

To enable Auto-Sorter to search through an inventory of diodes for one or more characteristic types, it is programmed for the necessary tests and test limits. The diodes then are dumped into and automatically fed from a vibratory Syntron feeder into test position.

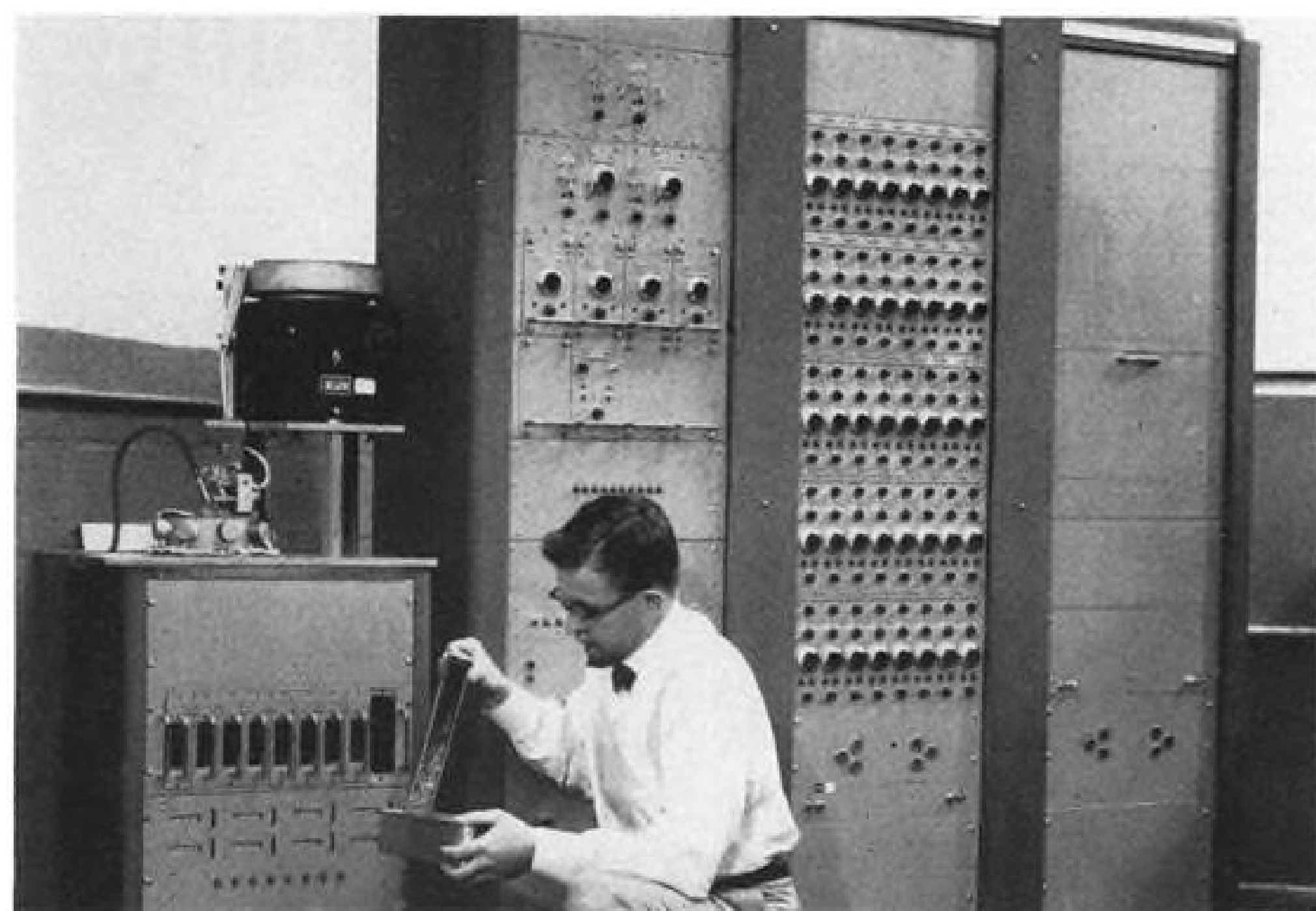
Up to nine different test voltages or currents can be applied to each diode in sequence to measure such things as reverse and forward current, saturation voltage. (Test voltages are checked against a built-in standard cell 60 times a second.)

The measured current or voltage is compared with limits set in previously by the operator, from which Auto-Sorter makes a "yes or no" decision as to whether the diode is within prescribed limits. When all tests are complete, a diode might turn out to be able to meet the specs for several different types.

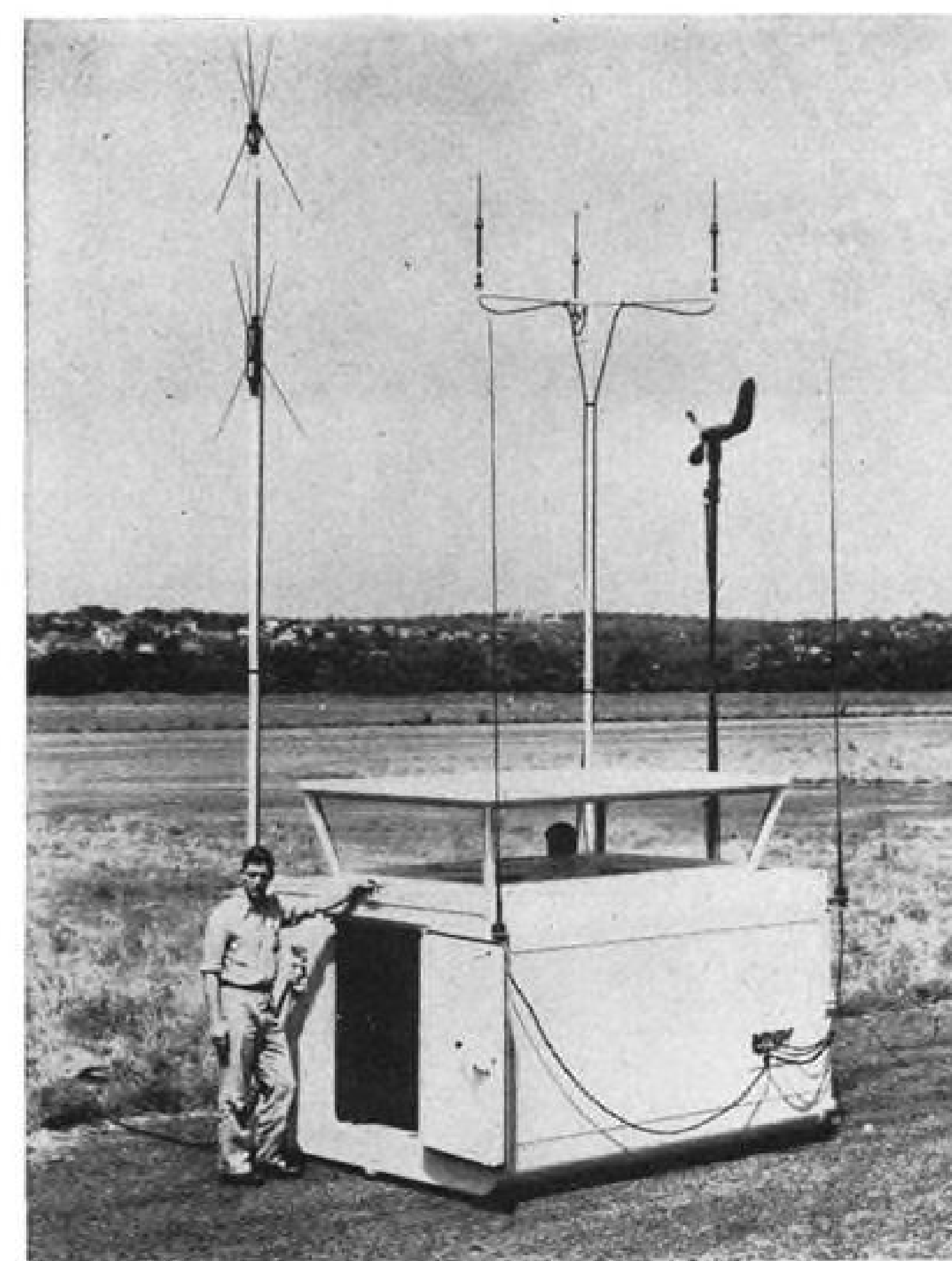
However, certain types may be more urgently needed than others. Auto-Sorter therefore examines the priorities assigned to each type (pre-set by human operator), then automatically drops the diode into a drawer corresponding to the highest priority type whose specs it meets.

Auto-Sorter can make up to 72,000 measurements and 320,000 decisions per hour.

Its measurement accuracy is within 0.2 microamps for currents up to 100 microamps; within 1 microamp for currents up to 1,000 microamps. Hayes says that Auto-Sorter is able to make



NEW AUTO-SORTER makes it economically feasible to search through large inventory of diodes for units with special characteristics. Auto-Sorter does work of 25 human testers.



Flying Control Tower

Lightweight, highly mobile, two man airport control tower can be transported by helicopter to forward air strips and put into operation within 30 minutes. Helicop-Hut manufactured by Craig Systems, Inc., Danvers, Mass., contains all electronic equipment

necessary to operate an airport. Masts, antennas and wind indicator are stored inside unit during transit by Army-H-21 helicopter (right). Special lightweight aluminum and plastic construction produces strength and keeps total weight below 2,500 lb.



decisions with a reliability that far exceeds that of human operators.

PSI's new automatic tester is the result of nearly two years' effort, which included running nearly three million diodes through the machine to check its sorting reliability. The machine is part of PSI's long-range program to automate its semi-conductor manufacturing operations.

It was developed under the supervision of Richard A. Campbell, assistant manager of PSI's engineering department.

Because test and selection are major elements in the cost of manufacturing semi-conductors, PSI expects that lower diode costs ultimately will result from the use of Auto-Sorter. However the immediate gain comes in PSI's improved ability to handle requests for diodes with special characteristics and the assurance of accurate, reliable testing of all diodes.

Because of its potential value to digital computer manufacturers and other large quantity users of semiconductor diodes, PSI has plans to sell Auto-Sorters to industry. The company's address is: 10451 West Jefferson Blvd., Culver City, Calif. The firm is a wholly-owned subsidiary of The Ramo-Wooldridge Corp.



► **Airlines Eye Inertial Guidance**—New sub-committee to investigate self-contained navigation techniques and equipment for possible application to jet airliners has been formed by Airlines Electronic Engineering Committee, Aeronautical Radio, Inc. Preliminary meeting between potential equipment makers and airline people will be held on Aug. 22 in Washington.

► **Beauty & The Beast**—AVIATION WEEK's article on the new Automatic Voice Relay (July 16, p. 89), showing pretty female Volcan operators who may be replaced by the AVR and its magnetic drum, prompts one reader to ask: "This is progress?"

► **Microwave Data Link**—Civil Aeronautics Administration will evaluate new \$440,000 Motorola microwave relay system which will pipe radar data from a military radar network, approximately 400 miles long and 150 miles wide, into CAA's Indianapolis Air Route Traffic Control Center. The system will tie into an existing microwave network originating at the AF

base in Jamestown, Ohio. At later date the system is expected to be expanded to obtain radar data from Bellefontaine, Columbus, and Cincinnati areas.

► **USAF Leases Radio Equipment**—Two way mobile communications equipment used at continental air bases will be leased by Air Force from General Electric, under the largest contract of its type ever awarded, GE says. Previously each base was allowed to purchase mobile radio equipment it needed.

► **Reaching For A Billion**—Electronics industry in metropolitan Los Angeles area appears certain to rack up more than a billion dollars in sales this year, based on last year's total factory billing of \$916,680,000. Survey, conducted by L. A. Chamber of Commerce Electronics Committee, shows 460 firms now operate in the area and employ 72,167 people. Copies of survey results are available from Chamber's Industrial Dept.

► **Tomorrow's Engineers**—To stimulate interest in science and mathematics among high school students, Hughes Aircraft Co. scientists will give lectures to summer school students. Company also will employ a group of science



Double Protection

RADAR **and SINCLAIR**

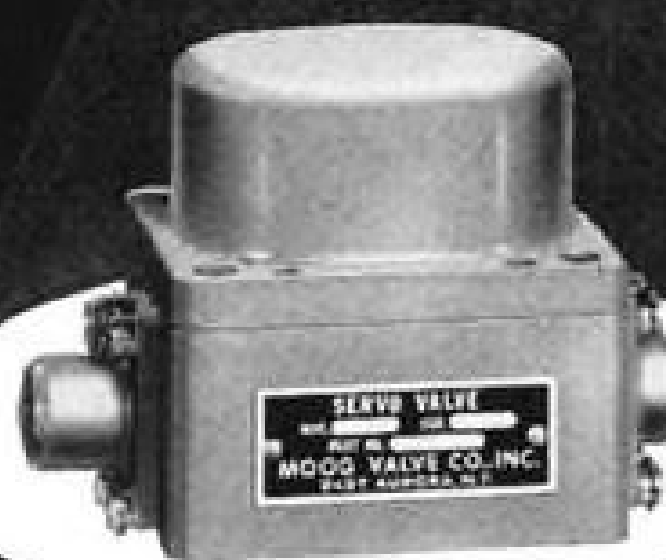
Now...American Airlines famous DC-7 Flagships are equipped with airborne radar. Located in the nose of the plane, it enables the crew to "see" the weather up to 150 miles ahead, and avoid any bad formations, such as thunder squalls. Radar means even smoother flying...a new measure of protection for American Airlines passengers.

For another kind of protection, American Airlines uses Sinclair Aircraft Oil to safeguard the powerful turbo-compound engines of its giant DC-7's. In fact, for over 22 years, American Airlines has relied exclusively on Sinclair for dependable engine lubrication. Today, *45% of the aircraft oils used by major scheduled airlines in the U.S. is supplied by Sinclair* — positive proof of the quality and dependability of Sinclair Oils.

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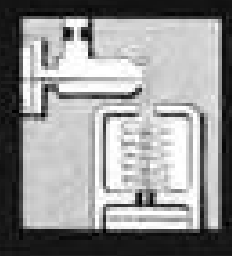
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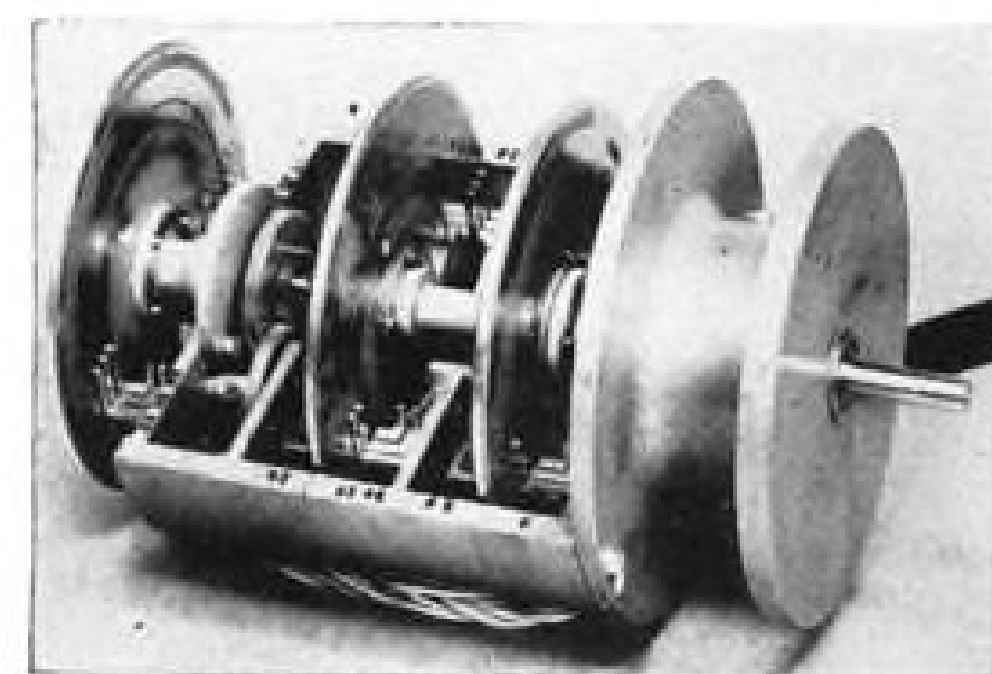
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teachers in its laboratories during the summer to provide latest knowledge and demonstrate practical applications of science subjects.

► **Trig-Digital Converter**—G. M. Gianini Company's Datex Division reports that it is producing analog-to-digital shaft position converters which give directly the sine or cosine of the shaft position in digital form. (This is in response to the item which appeared in the June 11 Filter Center column



pointing out the need for such a device.) The unit encodes the sine function of 0 to 90 degrees in nine bits of Gray code and includes a quadrant marker to facilitate the selection of the proper disc to obtain sine and cosine functions from 0 to 360 degrees. Company's address: 1307 South Myrtle Ave., Monrovia, Calif.

► **Simulator-Computer Handbook**—A basic reference book which covers fundamentals of operation and maintenance of all analog-computer flight simulators has been prepared by Navy's Special Devices Center. The 158-page book, entitled "The principles of Computer Simulation," includes general principles of analog computers as well as brief description of digital computers. The book, identified as PB 121200, is available for \$3.00 from Office Technical Services, U. S. Dept. of Commerce, Washington 25, D. C.

GE Reveals New Airborne Navigator

A new automatic self-contained airborne navigator, weighing only 150 pounds, which makes use of doppler radar and inertial guidance techniques, has been revealed by General Electric's Light Military Electronic Equipment Dept. (LMEED). Developed under Wright Air Development Center sponsorship, several pre-production prototype systems are being fabricated for service test.

The new GE auto-navigator gives the pilot a continuous indication of his present position and the heading and distance to his destination for a great circle course.

The system employs doppler radar to measure ground speed and an "earth

rate directional reference" to obtain airplane/missile heading information. The latter, sometimes called a "north-seeking gyro," is able to establish the direction of true north utilizing the earth's rate and direction of rotation. (For description of the principles of operation of a north-seeking gyro, see AVIATION WEEK, Jan. 16, p. 94).

Hurricanes Will Be Tracked With Radar

U. S. Weather Bureau will construct a nationwide network of radar weather stations for tracking storms and hurricanes, which should prove helpful in guiding aircraft around storm areas.

The Weather Bureau has ordered 39 weather radars from Raytheon Manufacturing Co. similar to the CPS-9 radars which the company developed for military weather surveillance. Contract price is \$3.8 million and delivery is slated to begin early in 1958. Eight of the radars will go to the Navy for installation at bases here and overseas.

By interconnecting the network of radars, each of which has a coverage of about 200,000 sq. mi., Weather Bureau meteorologists will be able to follow storm progress and development.

The Raytheon radars will be capable of operating in any one of three different frequency bands, "X" (9.3 to 9.5 kmc.), "C" (5.6 to 5.65 kmc.) or "S" (2.7 to 2.9 kmc.) and at any one of three different pulse widths (1, 2, or 4 microseconds) to give optimum performance against the particular weather conditions under surveillance.

Expansions, Changes In Avionics Industry

The Ramo-Wooldridge Corp., Los Angeles, has broken ground for its new 140,000 sq. ft. manufacturing facility to be built near Englewood, Col., south of Denver. New facility will be completed in mid-1957.

Other recently announced expansions, mergers, and changes in the avionics industry include:

• **Sperry Rand Corp.** will soon begin construction of a 100,000 sq. ft. facility at a 480 acre site 15 miles north of Phoenix, Ariz., to manufacture flight and engine control systems. New plant will cost around \$2.5 million, should go into operation next spring.

• **Electronic Specialty Co.**, Los Angeles, reports it has sold its instrument manufacturing subsidiary, Electromec, Inc., to Federal Telephone & Radio Co., Clifton, N. J. The sale will enable Electronic Specialty to expand its relay division production facilities, install a



Robot Helicopter

Demonstration of helicopter controlled from ground by Kaman Aircraft Corp. for Defense officials at Ft. Belvoir, Va. Center man on ground, not a pilot, is flying robot. Safety pilot accompanies robot but does not fly it. Equipment shown includes ground control station, TV receiver which gets TV broadcast from small transmitter and camera in robot, and public address system amplifier used by commentator (right).

complete antenna pattern measurement range for its RF systems and components division and install environmental test facilities for its avionics division.

• **Automation Electronics, Inc.**, Burbank, Calif., is name of newly-formed electronic equipment manufacturer headed by Frank G. Jameson. Address: 231 W. Olive St.

• **Cubic Corp.**, San Diego, is moving to new 20,000 sq. ft. facility at 5575 Kearny Villa Road, Kearny Mesa, Calif., near Convair's new Atlas missile plant.

• **Keithley Instruments, Inc.**, Cleveland Ohio, has moved to new facilities at 12415 Euclid Ave. providing a five-year fold increase in plant space.

• **Berkeley Division of Beckman Instruments, Inc.**, Richmond, Calif., has opened a branch facility in Toronto, Canada, at No. 3 Six Points Road, to process all orders originating in Canada,

provide instrument service and stock inventory of Berkeley Instruments. Company reports its Canadian sales have doubled in past year.

• **Airtron, Inc.**, Linden, N. J., maker of microwave components, has opened a new Cambridge division at 317 Vassar St., Cambridge, Mass., to research, develop and produce new ferrite components. Dr. Ernest Wantuch, Airtron vice president, will head new operation.

NEW AVIONIC PRODUCTS

Components & Devices

• **Miniature RF noise filter**, Type AF 1046, reportedly surpasses requirements of MIL-1-11748. Filter is hermetically sealed. Astron Corp., 255 Grant Ave., East Newark, N. J.

• **Molded polystyrene capacitors**, in both round and flat configurations, offer "Q" greater than 2,000, power factor

Change To... PROTO-NUPLA Soft-Face Hammers!

Case Histories Show up to \$10,000 per Year Savings!



PROTO-Nupla hammers bring every possible saving to the soft-face hammer user. One material—Nuplaflex—ranges from "soft as flesh" to "hard as brass." Screw-in tips are quickly interchanged. Nuplaflex tips outlast other soft-face materials as much as 100 to 1.

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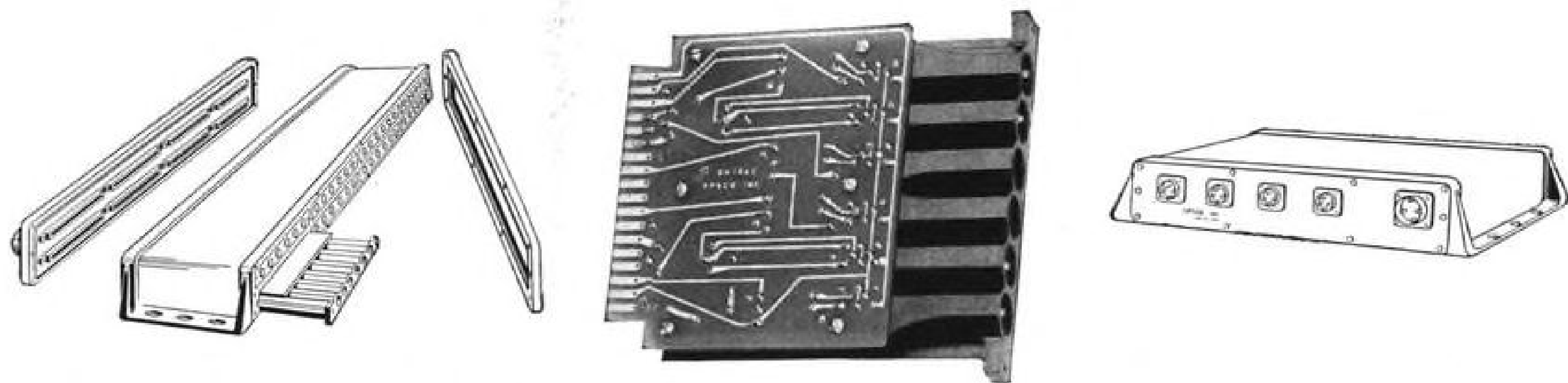
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All meet Federal Specs. • Recover shape when dented or cut • Will not flake • Non-sparking • Will not burn readily • Resistant to grease, oil, gasoline, and common industrial acids • Absorb sting-causing vibration • Safe for workmen's eyes—no flying particles • Reduce worker fatigue • Minimum rebound to permit faster work.

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336 different combinations, including 1½" and 2" shot-loaded impact types designed to reduce rebound. 12 different holders available—two weights for 1", 1½", 2", 2½", and 3" diameter faces.





Epsco's New Airborne Data Conversion System...

Unique MINIDATRAC is subminiaturized voltage-to-digital converter designed for flight test instrumentation and telemetering applications.

Boston, Mass. Epsco, Incorporated has announced that a complete subminiature voltage-to-digital converter weighing only 7 pounds and occupying less than $\frac{1}{2}$ of a cubic foot of space is under development and will soon be available in production quantities.

The Epsco MINIDATRAC is a high speed, highly accurate voltage-to-digital converter, designed and packaged for airborne use under severe environmental conditions. It is a sub-miniaturized version of the Epsco Model B DATRAC which has a proven field accuracy, without adjustments or calibration, of better than 0.1% and a maximum speed of approximately 50,000 data point conversions per second. The MINIDATRAC makes it possible to convert voltages to a digital form at the voltage source, thus assuring maximum accuracy and reliability in subsequent transmission and processing of the data. Further, it is in a form suitable for direct or eventual insertion into a digital computer. The reversible feature of the standard Model B DATRAC converter can be utilized on the ground to convert the digital code back to its original analog form for further analog processing or recording.

Features

Proven Reliability — Standard packaged versions of this equipment have proven field service in excess of 1000 hours of reliable operation.

Long Term Stability — Stability for all conditions of component aging, power source variation, and operational shock and vibration will not affect the encoded value by more than one least significant digit for the life of the equipment.

Simplicity of Operation — Except for a scale factor adjustment, there are no operator adjustments or controls on this equipment.

Versatility of Data Handling Capabilities — The high conversion speed allows for many combinations of data inputs from a single 16.3 kc data input channel to hundreds of lower response data inputs when electronic and/or electro-mechanical multiplexing is utilized. The MINIDATRAC has more data handling capacity than a complete FM/FM and PDM telemetering system combined.

A Technical Paper on this system will be presented at the National Telemetering Conference at the Biltmore Hotel in Los Angeles on August 20 and 21.

Serial and Parallel Outputs — Both a serial pulse train and a parallel pulse output are provided for simultaneous transmittal over a radio or wire link and storage in a recording medium such as a magnetic tape recorder.

Light, compact construction. The MINIDATRAC contains eight sub-chassis assemblies which plug into the main assembly. The main assembly is fabricated in order to attain minimum inside temperature gradients and minimum weight. All access is from a common side which is sealed, thus allowing the unit to be pressurized for use at extremely high altitudes. All connectors appear on the side opposite to the access side.

Operating Characteristics

Conversion time is a maximum of two microseconds per binary digit of code; approximately 50,000 independent data translations can be made per second for a 10-place binary code including sign. Each conversion from voltage-to-digital code is completely independent of the previous conversion. Voltage data may be multiplexed and presented to the converter at any rate compatible with the above conversion speeds.

Trigger or synchronization input: External trigger at any repetitive or random rate from 0 samples per second up to the rates indicated above are possible. Because of the asynchronous feature of the equipment, it may be triggered or slaved from any arbitrary external source. It is also possible to control the rate at which each pulse is fed out. This may be advantageous when recording or transmission link bandwidths are limited.

Full scale voltage range maxi-

Standard Epsco Model B DATRAC Reversible Voltage-to-Digital Converters are available for immediate delivery*. Write for complete engineering data and price quotations.

*Over 100 Epsco high speed analog-to-digital converters have been delivered to over 25 separate commercial and military users throughout the world.



mum is ± 100 volts. Minimum is ± 1 volt. Auxiliary input equipment can be provided for handling input levels down to ± 10 mv. full scale.

Input impedance for full-scale voltage of 1,000 volts — 100,000 Ω ; for full-scale voltage of 100.0 volts — 1 megohm. For any other full-scale voltage, the input impedance available may be proportional to the square root of that voltage.

Output: Provisions are made for the following outputs:

- Serial pulse train (most significant digit first)
 - Output impedance; 500 ohms
 - Pulse Width: 1 microsecond
 - Pulse Amplitude: ± 25 volts
- Parallel semi-static binary valued voltage lines representing code
 - Output impedance: 10,000 ohms
 - Output levels
 - 0 volts representing binary 1
 - 15 volts representing binary 0, or vice-versa

GENERAL CHARACTERISTICS

Size: 2" high x 7" wide x 22" deep.

Weight: approx 7 lbs.

Temperature Range: -55°C to $+70^{\circ}\text{C}$.

Shock and Vibration: The equipment is designed to meet applicable military specifications.

Power Input: 200 watts approximately, 105-125 volts, 55-420 cycles per second, when used with associated power supply.

Accuracy: $\pm 0.1\% \pm \frac{1}{2}$ least significant digit.

Calibration Adjustments: No adjustments are required, other than scale factor adjustment.

Additional technical data is available and your inquiry is invited.

EPSCO, INCORPORATED
588 Commonwealth Ave., Boston 15, Mass.

of 0.05 percent at 1 kc., operate over temperature range of -55 to 85°C with coefficient of minus 100 ppm/Deg. C. Units are available with capacitances of 0.001 to 1 mfd. Condenser Products Co., Division of New Haven Clock & Watch Co., 140 Hamilton St., New Haven, Conn.

• Subminiature blower, Model 1E2CO, for cooling avionic equipment, will fit into a $3\frac{3}{4}$ in. cubic area. Unit operates



McLEAN Model 1E2CO Blower Unit

from 115 v., 60 cps, provides 10 cfm free air delivery at speed of 3,400 rpm. McLean Engineering Laboratories, Princeton, N. J.

• Instant overload protector for instruments, designed to prevent damage such as bent pointers and coil burnouts, can be installed on new or existing instruments without affecting calibration or



accuracy, according to manufacturer. Device protects for overloads as great as 100 times rated meter capacity and reportedly improves meter damping characteristics. Electronic Specialty Co., 5121 San Fernando Road, Los Angeles 39, Calif.

• Solenoid-wound chokes, designed to MIL specs, are available in values ranging from 1.1 to 120 microhenries. Smaller sizes up to 15 mh. use phenolic forms, while larger sizes use powdered iron forms. National Co., 61 Sherman St., Malden 48, Mass.

• Trimmer pot for printed circuit use, called "WeePot," is available with resolutions of 0.3% to better than 0.1%, in resistances of 100 to 40,000 ohms. Unit is rated at one watt at 40°C ,

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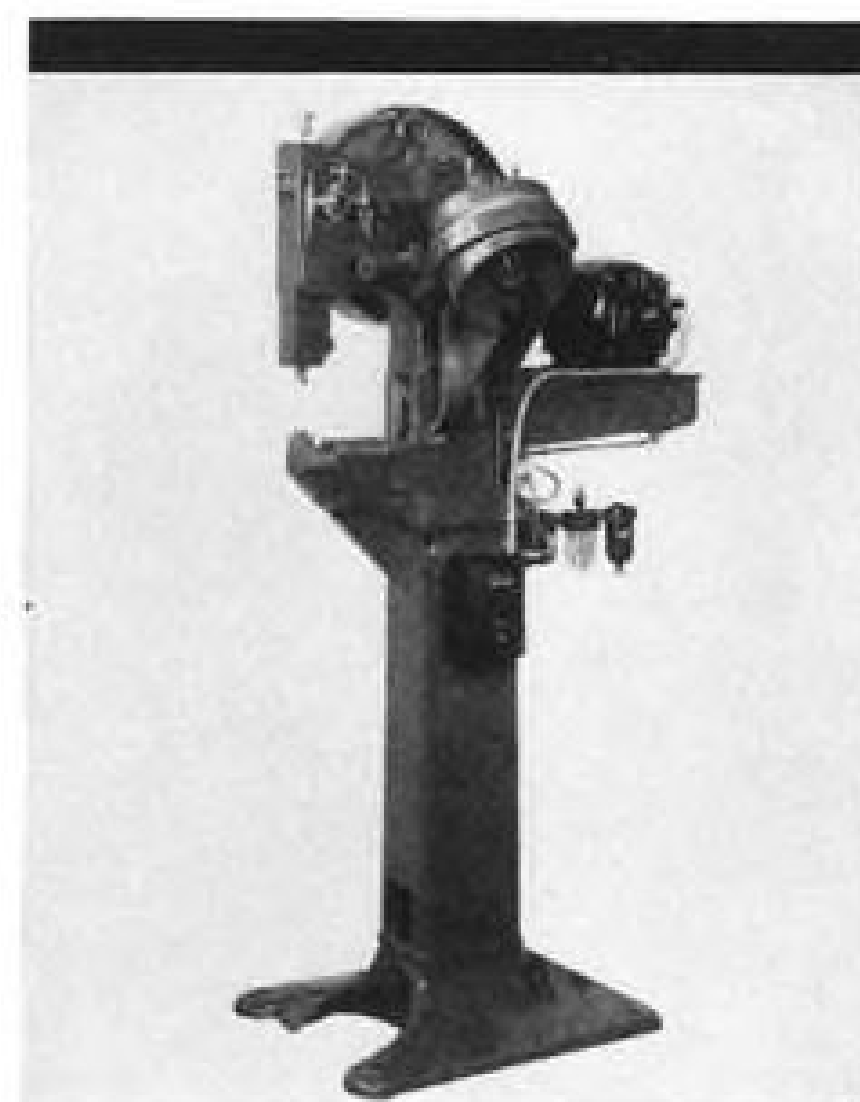
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T-J Clinchers adaptable to a wide range of clinch nut setting problems. Gravity feed model shown here.

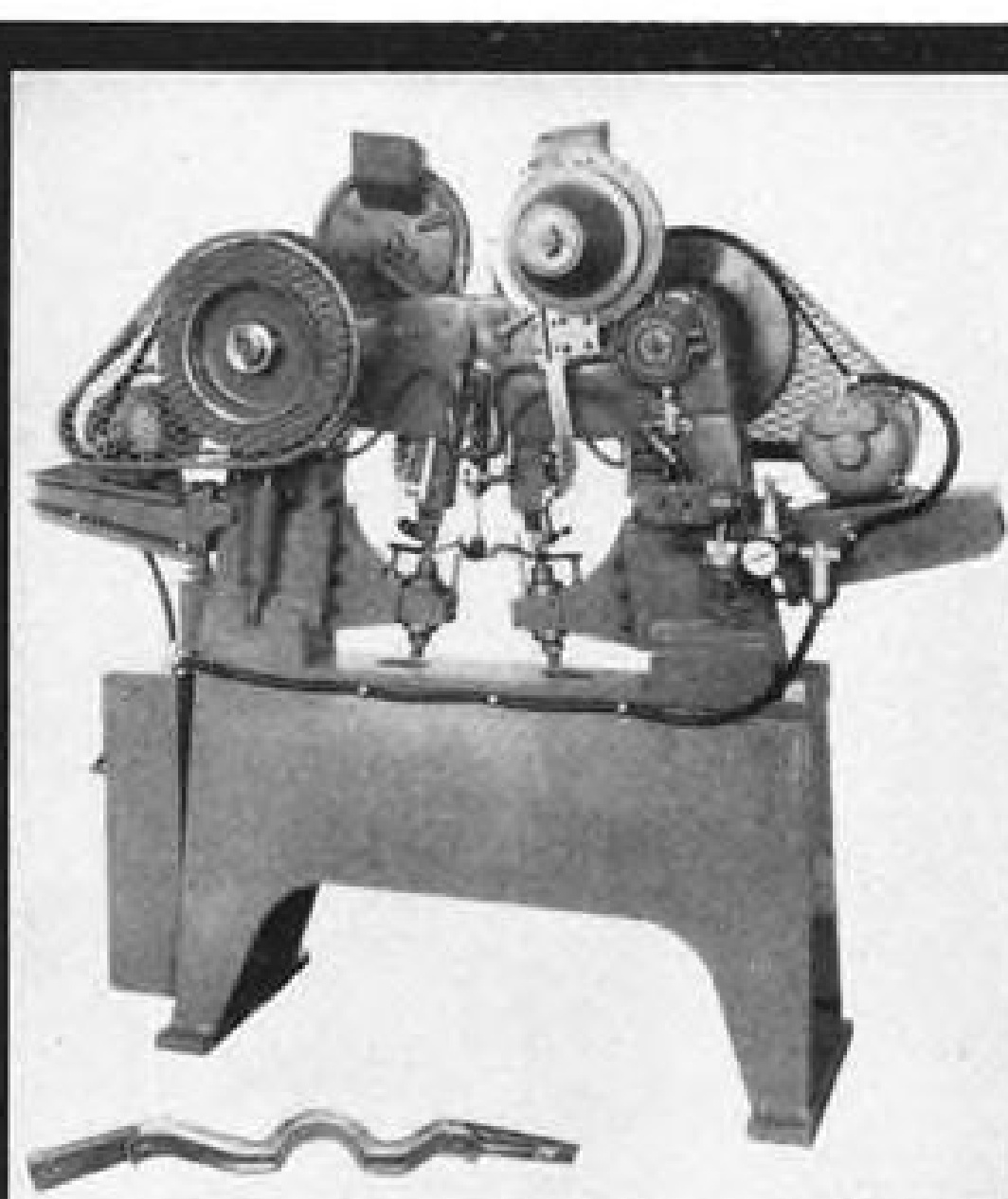
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T-J CLINCHORS set clinch nuts with fully automatic operation, controlled by a single foot pedal. Available in Underfeed and Gravity feed models, throat depths 8" to 36".

T-J RIVITORS automatically feed and set solid rivets with high production. Electrically powered Rivitor sets solid steel rivets up to 7/8" long. Air-powered sets aluminum alloy rivets or steel rivets up to 3/4" long. Throat depths 8" to 36".

Write for Clinchor bulletin 555; Rivitor bulletins 646 and 555.
The Tomkins-Johnson Co., Jackson, Mich.



This T-J Special Dual Rivitor sets two rivets at a time... consists of two 8" throat Model R Rivitors, each with 10" hopper, special oversize anvil post, and special horn. Sample of work shown below machine.

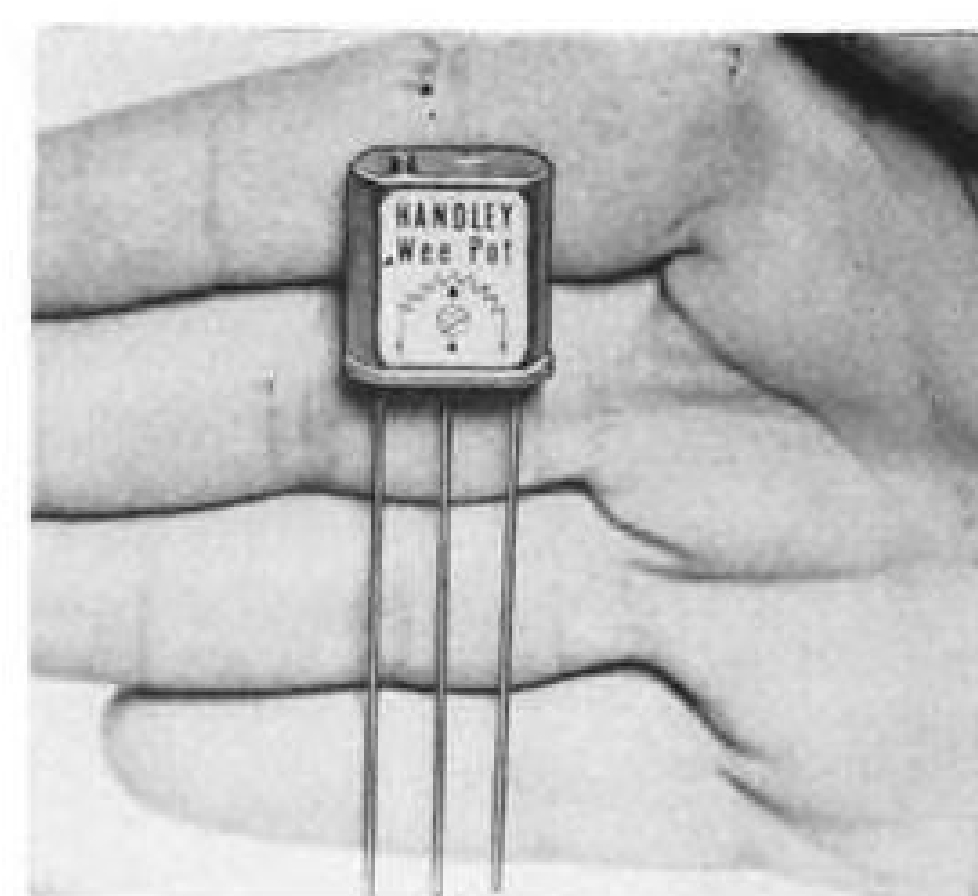
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RIVITORS...AIR AND HYDRAULIC CYLINDERS...CUTTERS...CLINCHORS

39 Years Experience



but can be operated up to 120C. Standard resistance tolerance is 5% and temperature coefficient is 0.002% per degree C. Handley Electronics Inc., 14758 Keswick St., Van Nuys, Calif.

• **Traveling wave tube**, Type 6651/BL850, for S-band use, delivers peak power output of 1 kw. using accelerating



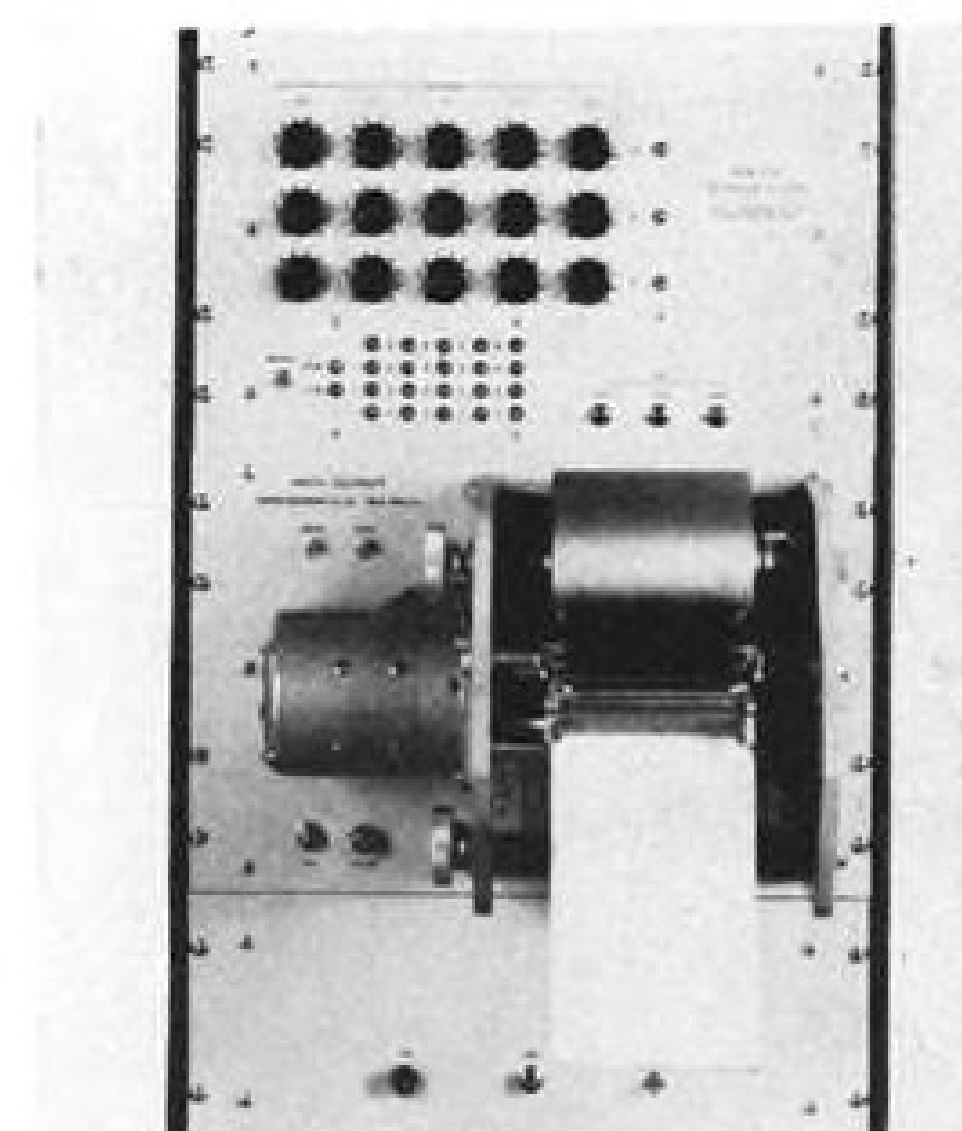
voltage of 5,800. Tube weighs 5 lb., measures 17 x 1 1/2 in. Bomac Laboratories, Inc., Salem Road, Beverly, Mass.

• **Silicon mixer diodes**, four new sensitive point-contact types for L, S, C, and X-band radar, reportedly provide up to 2 db. noise reduction when substituted for 1N23C and 1N21C diodes. Units are available with fixed forward or reversible polarity. Microwave Associates, 22 Cunningham St., Boston 15, Mass.

Instrumentation

• **Airborne d.c. amplifier**, Model 2HMA-2, with isolated input circuit, can be used with airborne thermocouple or strain gage bridge measurements. Amplifier's 5 ms. rise time and flat response to 400 cps. permits it to handle as many as 150 points per second where commutator is used. Application data is available. Doelcam, Div. of Minneapolis-Honeywell, 1400 Soldiers Field Road, Boston 35, Mass.

• **High-speed digital recorder**, Model 3151, provides simple and economical means for simultaneously recording "on"- "off" type phenomena on as many as 45 channels at sampling rates as high as 2,500 per second. Records are made on Teledeltos electro-sensitive chart paper at recording speed of more than



150 in./sec., providing approximately 1/16 in. spacing for the 2 1/2 kc. sampling rate. Chart paper drive mechanism is automatically sequenced to advance chart prior to recording sequence. Potter Instrument Co., Inc., 115 Cutter Mill Road, Great Neck, N. Y.

• **Piezoelectric pressure transducer**, Model LC-33, employs new zirconate sensitive element capable of measuring free-field pressure versus time for sound or shock waves. Unit covers dynamic



range up to 1,000 psi and reportedly is flat within 2 db. from 1 to 80,000 cps. Transducer sensitivity is stable over temperature range of -40C to 100C. Atlantic Research Corp., 901 No. Columbus St., Alexandria, Va.

Microwave Devices

• **Traveling wave tube amplifiers** for X and L-band with broadband noise figure of 10-12 db. Type HA-17 covers frequency range of 1-2 kmc.; Type HA-15 covers band of 8-12 kmc. Both deliver 25-30 db. gain and 5-10 mw. output. Huggins Laboratories, Inc., 711 Hamilton Ave., Menlo Park, Calif.

• **Slotted line**, Model 230, designed for portability, can measure VSWR over frequency range of 500 to 4,000 mc. Device consists of a section of coaxial transmission line of parallel plane type, a pick-up probe and a radio frequency detector. Characteristic impedance is 50 ohms for Model 230, 46 ohms for Model 230B. Device is 18 lb. and its case 9 lb. Marda Corp., Mincola.

MALLORY-SHARON reports on

TITANIUM



World's fastest flies with MALLORY-SHARON titanium

• Performance details on the U.S. Air Force's new Lockheed F-104 are classified. But one thing can be said: all metals—including titanium supplied by Mallory-Sharon—used in this advanced aircraft have met the most stringent requirements.

Mallory-Sharon, one of the leading producers of titanium and titanium alloy mill products, has paced many improvements in the metal which account for its rapid

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AERONAUTICAL ENGINEERING



RB-66S IN FORMATION. Flight by staff member Sweeney was made in production model RB-66B at Douglas' Tucson facility.

Flight Tests Compare Douglas B-66, A3D

By Richard Sweeney

Tucson, Ariz.—B-66 and A3D are closely related airplanes—they evolve from the same basic design and both are manufactured by Douglas Aircraft Co., Inc. The A3D is a high altitude Navy bomber, the B-66 a high and low altitude USAF bomber and reconnaissance plane.

B-66 started as a Korean war effort by USAF to get a tactical all-weather bomber, supposedly an "off the shelf" buy of an A3D with six modifications only. Flight in both aircraft, as well as studies, highlights the differences and similarities.

As delivered to its users in Tactical Air Command squadrons, the B-66 is an airplane which:

- Has excellent low as well as high altitude capability.
- Can carry atomic weapons.
- Has a top quality low altitude bombing system in the K-5 installation.
- Has been through, since its inception, a crash program for Korea, a decelerated development with war's end, then re-acceleration within the Cook-Craigie Plan.
- When delivered to TAC in both the B-66 and RB-66 versions, included all the latest engineering refinements and modifications, practically insuring a tactical use until the IRAN time cycle has been fulfilled.

Highly Maneuverable

During a flight in a production model RB-66B at the Douglas facility here, there was opportunity to check both high and low altitude flight characteristics of the versatile bomber. Principal impression gained was of extreme maneuverability.

Pilot on the flight, primarily a check-out of the ILS approach coupler of the

Minneapolis-Honeywell autopilot, was Robert Pope, assistant flight operations manager at Douglas' Tucson facility. Observer was Robert Almack. Altitudes on the Tucson-El Paso and return flight ranged from above 40,000 ft. to deck level, speeds from maximum to just above stall at low altitude, maximum at high altitude.

In the approach configuration, speed brake, flaps and gear extended, the plane still is highly maneuverable, both at high and low altitudes. With the aerodynamically operated leading edge slats, control through the stall buffet area remains good, and ailerons retain their effectiveness.

Opening bomb bay doors at high speed now results in no trim or control changes out of the ordinary, and buffet has been eliminated after problems were encountered in the flight test program.

Single point high pressure refueling is incorporated. Fuel feeds from wing to fuselage tanks, with engines supplied from rear fuselage tank. Fuel management is accomplished from a control panel on the pilot's right and is automatic with CG limitations. However, the pilot must beware of incorporating the wing tanks into the active system once they have been pumped dry.

When USAF decided on A3D procurement, a projected first flight was set for 25 months from date of contract, predicated on changes being held to:

- Deletion of carrier operation provisions.
- Addition of deicing equipment.
- Ejection seats to be installed.
- Larger radar antenna to be provided.

Between Feb. 15, 1952, when the decision to buy was made, and the engineering release of the design in April, 1953, 112 engineering change proposals had been incorporated. The aircraft,

an RB-66A made its first flight in June, 1954.

The first B model, a B-66B (the first five RBs retained the A modification letter, the remainder were made Bs and the first of the B-66s incorporated the changes, making them B-66Bs) made its first flight in December, 1954, after an engineering release in Aug., 1953.

Engineering Changes

The airplane spanned four years from start of contract to delivery to using TAC squadrons at Hurlbert AFB, Fla., and Shaw AFB, S. C. Total changes from the original A3D concept, all incorporated in the delivered airplanes, exceeded 400.

During its development, some of the

Skywarrior Next

Next week Navy's Douglas A3D Skywarrior will be structurally analyzed by Associate Editor Irving Stone of Aviation Week's West Coast Bureau. Stone, who made an extensive inspection tour through Douglas' El Segundo Division, where the A3D is being produced, will show how Skywarrior is tailored to the minimum size and weight to meet its long-range attack-bomber mission.

Richard Sweeney flew in both RB-66 and A3D while gathering material for the story in this issue. He has flown nearly everything from small single-engine personal planes to jet aircraft, has accumulated some 6,000 hours of flying time, and was a test pilot in the flight test section at Wright Field.

Whereas Sweeney's story in this issue concentrates on flight characteristics of the B-66, A3D, Stone's will have to do with the structural components of the airplane, well illustrated with pictures and cutaway drawings.

major changes, problem areas and fixes on the B-66 included:

- Control system, ailerons and spoilers changed.
- Wing angle of incidence changed from A3D's 4 deg. to 2 deg.
- Engines were changed from the J71-A-9 to the J71-A-11, in the 10,000 lb. thrust class.
- Brakes were changed.
- Slats were changed to correct for pitchup.
- Engine mounting pylons were changed.
- Flutter problems were overcome bomb bay door buffet caused changes.

Buddy System

The airplane is currently programmed for buddy system aerial refueling.

In addition, new JATO bottles of approximately the same thrust as those currently used, but with other characteristics changed (including dropaway paths) are being tested for maximum gross weight and overload takeoffs from tactical airfields.

As of Feb. 1, 1956, with the first RB-66As still part of USAF's test program, more than 570 test hrs. had been flown on the design, in more than 400 flights. Of the original order, 19 were put into the Douglas and USAF test programs.

Trainer-Version Considered

The B-66B, RB-66B and RB-66C are in using squadrons. It is understood that a trainer version with dual controls has been considered, as well as dual placements for observer personnel. The plane normally carries a crew of three—pilot and two observers to handle bombing, navigation and ECM duties.

In an A3D flight similar to that of the B-66 type, the difference between the airplanes was apparent. Pilot for the acceptance flight was Cdr. Charles McBratnie of the Navy BuAer office at Douglas El Segundo Division. In one observer seat, (the A3D also carries a normal crew of three, pilot and two observers), was LCdr. G. P. Milton, also of the El Segundo BuAer office.

In appearance, the differences include wing trailing edges, with the A3D retaining the original straight trailing edge. Wing sweepback of 36 deg. is the same for both planes, but B-66 has extended center section trailing edge.

Mission Difference

The A3D-1 uses the J57-P-6 engine, made by Pratt & Whitney, while the J71 of the B-66 is made by Allison. The A3D-2, latest production model of the Skywarrior, uses the J57-P-10. All engines are in the 10,000 lb. thrust class, go out dry, without afterburner and have variable jet nozzle exhausts.

Prime difference between the planes



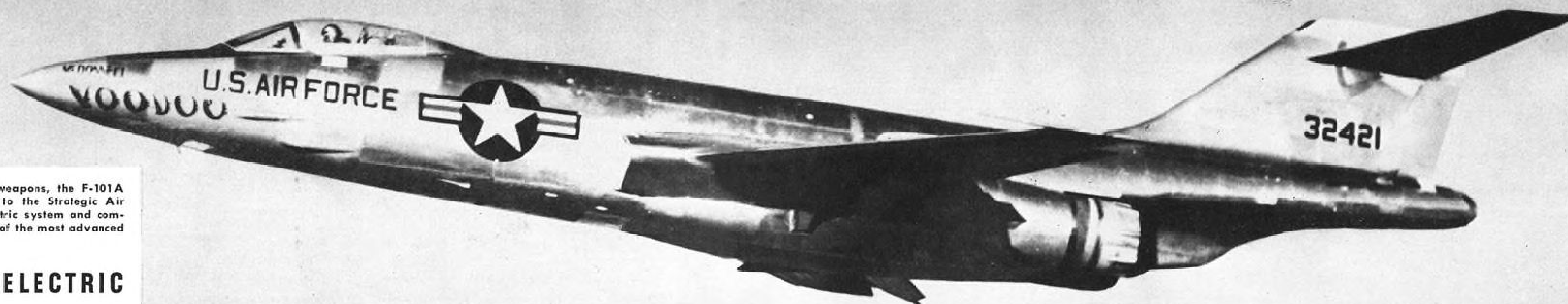
NAVY VERSION, A3D, coming in for landing on USS Forrestal. Wing sweepback of 36 deg. is same for both A3D, B-66, but B-66 has extended center section trailing edge.



A3D ON DECK edge of Forrestal. Primary difference in two planes is in mission: Navy's is for high altitude, USAF's for low-altitude. A3D-1 uses J57-P-6 engine; B-66 uses J71.



ROBERT ALMACK, flight test observer, Douglas Aircraft Co., Tucson Facility; Robert Pope, assistant manager flight operations; Richard Sweeney, Aviation Week associate editor.



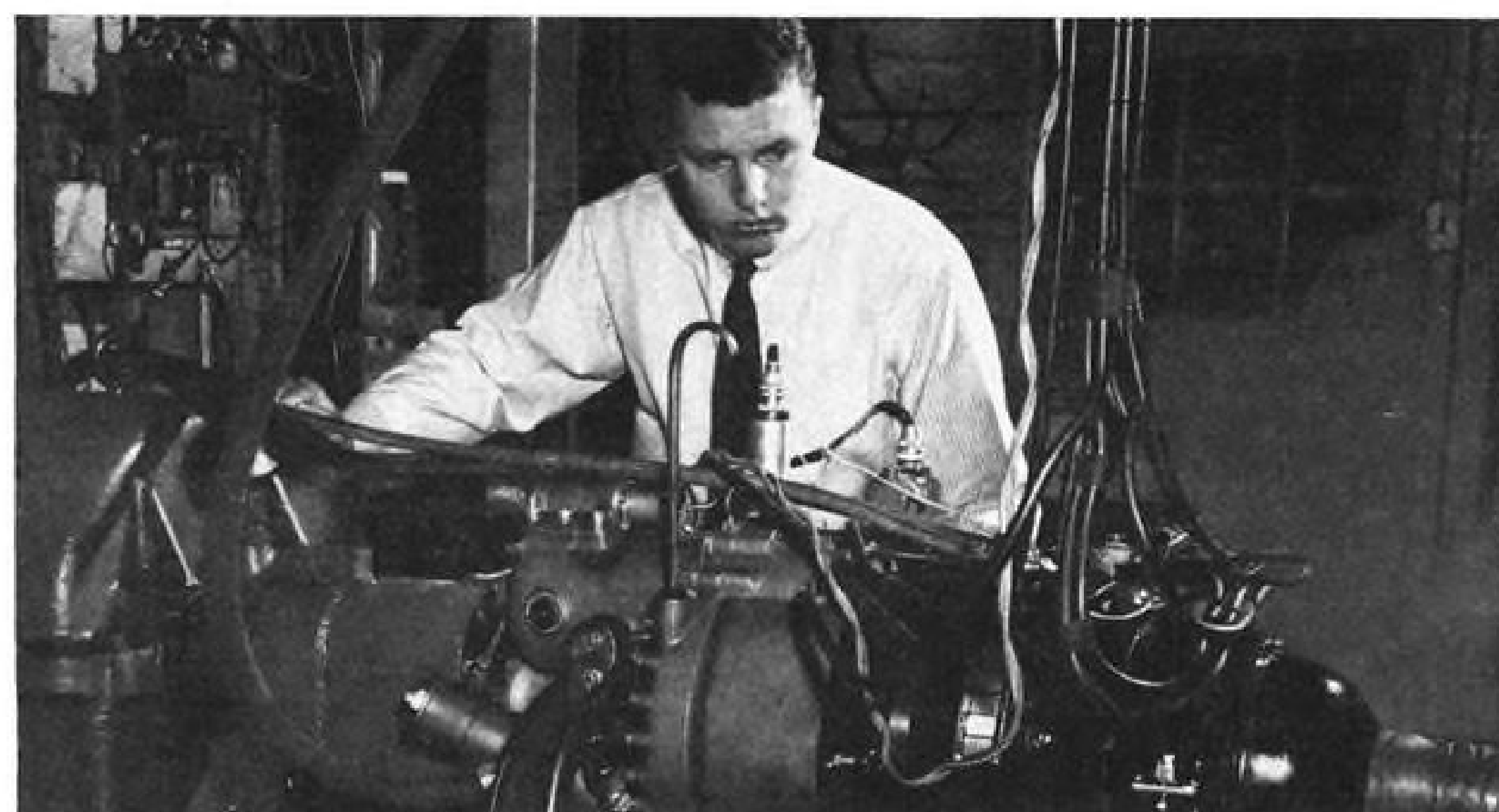
Capable of carrying atomic weapons, the F-101A is scheduled for assignment to the Strategic Air Command. G-E automatic electric system and computing sight help make it one of the most advanced fighters in the air today.

GENERAL  ELECTRIC

How G-E Electric System and Gunsight Help



Main components of system include static voltage regulator and control panel.



Alternator receives test. General Electric tested the complete F-101A electric system prior to first airplane installation.



Typical computing sight operation: pilot makes contact and aligns target in sight.



Pilot keeps enemy aircraft aligned in sight and fires when target is within range.



Hit! Camera guns show that enemy would have been destroyed.

Make F-101A a Potent SAC Fighter-bomber

- G-E power generating system eliminates 10 pilot functions in start-up
- G-E computing sight permits more accurate weapons firing

The Air Force's new supersonic jet fighter, the McDonnell F-101A Voodoo, is being equipped with a G-E computing sight and an automatic electric system which requires no pilot attention.

Designed with emphasis on simplifying the job of the pilot through use of automatic equipment, which includes a paralleling control furnished by another manufacturer, the G-E electric system begins operating as soon as the pilot starts the engine.

SPEEDS TAKE-OFF The control has only two toggle switches, which may remain "on" at all times, even when a fault develops. This eliminates a series of 10 pilot functions, and sharply reduces the time to become airborne.

With a generator that can operate at the high ram-air temperatures of supersonic flight, and a static voltage regulator that has no moving parts except the relays, the G-E system is designed for

long life and reduced maintenance time. The control panel supplies the automatic control of start-up, shutdown, and maximum selective protection against ground fault, over- and under-excitation, and over- and under-voltage.

LIGHTWEIGHT GUNSIGHT HAS HIGH ACCURACY Giving the F-101A high fire-control accuracy for air-to-air gunnery is the G-E designed computing sight. It features lightweight and low maintenance due to its simple design. Automatic inputs assure the sight's accuracy for all modes of operation.

For more information on the General Electric power generating system, write Section 210-97, General Electric Co., Schenectady 5, N. Y. If you are cleared to receive classified material, see your nearest G-E Apparatus Sales representative for advantages of the computing gunsight. General Electric Company, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL  ELECTRIC



RB-66A MADE its first flight in June, 1954. Total changes from original A3D concept exceeded 400, including new control system, ailerons, spoilers and engine.



ENGINE MOUNTING pylons of RB-66A were changed to cleaner configuration, straight leading edge, elimination of overlap on top of wing. Note A3D picture page 61.

is in mission, the Navy having a high altitude aircraft, the Air Force a low-altitude design.

A3D Performance

In the A3D, test flying resulted in modifications which were extended to the B-66 where applicable. Similarly, B-66 tests indicating improvements which could be incorporated on the A3D, resulted in changes in the A3D. Since the A3D preceded the B-66 by some time, the majority of change origi-

nations rests with the Navy plane.

In flight, the A3D performs excellently, an indication of the soundness of the basic aerodynamic configuration on which both planes are based. While the A3D entered buffet at about Mach .85 at slightly more than 41,000 ft., the B-66 buffet range starts a little faster.

Both planes remain stable and without bad characteristics in the high speed buffet zone. In stalls, the A3D also stays controllable and gives ample

buffet warning before complete stall. The plane's maneuverability at high and low altitudes is excellent. In the dirty configuration, the A3D also retains good flight characteristics although its indicated airspeeds are slightly higher on land based approaches.

Escape System

A3D uses a chute escape system, with the crew going out the bottom of the airplane, facing to the rear, a concept Douglas started for subsonic airplanes in its F3D Skyknight fighter. Downward escape can also be accomplished in the ejection seat equipped B-66, although the passage is smaller and more difficult to get through.

Like the B-66, the A3D incorporates tail defensive guns and warning radar as well as atomic capability.

A3D has a greater JATO installation than the B-66, since its maximum effort take-off is from a carrier deck of the modified Essex class (about 800 ft.) at 70,000 lb. gross weight. The plane also can operate from the Franklin Roosevelt class of carrier, as well as from the Forrestal super carriers.

A3D is produced at Douglas El Segundo Division, the B-66 at Long Beach.

Non-Citizen Engineers Used in Unclassified Work

Non-citizen engineers are being used by General Electric Co. on preliminary aircraft powerplant designs. GE's Aircraft Gas Turbine Div., Cincinnati, Ohio, has originated a special systems study project staffed with immigrants from European and Asiatic countries. Until they are cleared for classified work GE is limiting their efforts to powerplants with less important military futures.

Among the group are: Dr. Guenther

Diedrich, Germany (who designed the pulse jets for the V-1 buzz bombs); Jorgen Brunso, Denmark; Werner Offhaus, Germany; Jan Gisslen, Sweden; Tan C. Lu, China; Ed Ternier, Austria; and Dr. Taghi Mirsepasi, Persia.

"We are offering contracts to a limited few on the condition that they apply for citizenship," W. R. Dodge, GE spokesman explained.

New R&D Corporation Organized in Florida

An addition to the guided missile research and development field is the newly organized Dbm Research Corp. that has located in Cocoa Beach, Fla., the nerve center of the Air Force Joint Long Range Guided Missile Test Range.

The primary objective of the new corporation is close coordination of research and development by private industry with the requirements of the Department of Defense.

The new company is particularly concerned with guided missile instrumentation.

Companies with even limited research capabilities will be coordinated in the big R & D projects which formerly could be handled only by larger corporations with a diversity of research capabilities. By utilizing the engineering talent of the smaller companies, close coordination is expected to help relieve the critical shortage of scientists and engineers and expedite the national R & D program.

Dbm is staffed by a group of research consultants who have been active in the field of instrumentation for guided missiles in such fields as propagation of radio waves, radar and beacons, guidance and control equipment, electronic and optionic equipment and systems for the collection of data, problem solving of complex mathematics and information theory solutions.

Lockheed Transfers Nuclear Aircraft Work

Lockheed Aircraft has completed the transfer of all nuclear-powered aircraft preliminary design work to its Georgia division.

The 150 engineers involved in the transfer are the core of the staff which will operate the nuclear aircraft research laboratories to be built in Dawson, County, Ga. for USAF. Announcement that Lockheed will operate the facility was made in April.

Vitro Engineering Corporation of New York will design and construct all buildings, warehouses and access roads on the 10,000 acre site. Types and total number of buildings have

NEW!

GLOBE's 1.675" dia. precision miniature a.c. motor

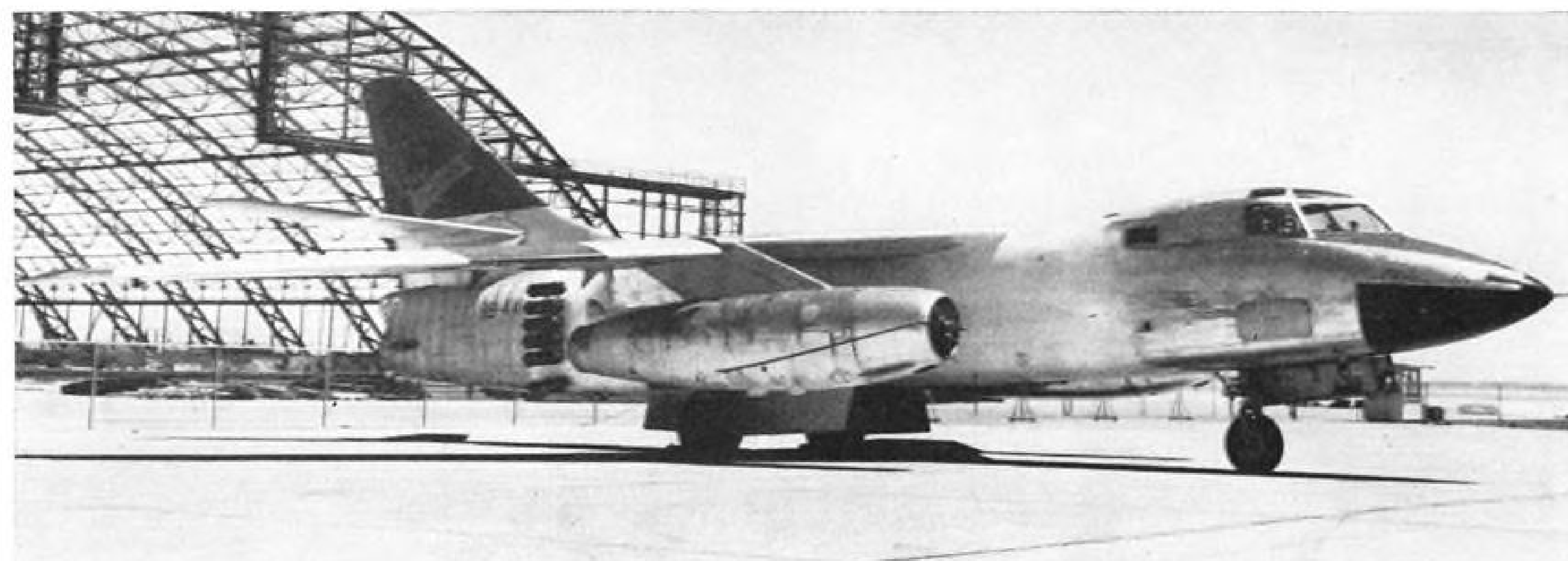
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Globe, the pioneer precision miniature motor manufacturer, now enters the field of larger, yet compact and lightweight a.c. motors for operation at all frequency ranges and speeds. The new motors measure 1.675" dia. x 2 1/4" long, and weigh only 11.5 ozs. Incorporating Globe's latest advancements in hysteresis-synchronous design, they provide absolute synchronous rotation, extremely smooth operation, and high starting and running torque of 1.2 oz. in. For precise timing and control uses, units are available with integral planetary gear heads in a broad selection of even speed reduction ratios and torques up to 5500 oz. in. Induction units with up to 3.0 oz. in. starting and running torque, and variable frequency units are also available in this new frame size. Units are designed to meet military specifications. Write today for bulletin 1170.



NEW JATO BOTTLES are being tested on this RB-66 at Edwards AFB. Strips around tail behind JATO installation are temperature sensitive paint compounds, each with a different melting point. When tests are run, temperatures at various locations can be determined by the melted paint. New JATO bottles were required because the old configurations were skinning the fuselage when dropped. Bottles mounted above are made by Phillips Petroleum Products. Others under test are from Aerojet-General and Allegheny Ballistics Laboratory.

Capital Airlines Says Viscounts Break Even At 56.8% Load Factor

And Company States Turbo-Prop
Aircraft Head for 53% to 55%,
Lower Than Piston Planes

By a WALL STREET JOURNAL Staff Reporter
NEW YORK—The turbo-prop Viscount air-
liner, introduced by Capital Airlines last sum-
mer, is to break-even with a load

← ONE OF MANY
REASONS WHY
CAPITAL AIRLINES
IS BUYING
15 MORE
VISCOUNTS



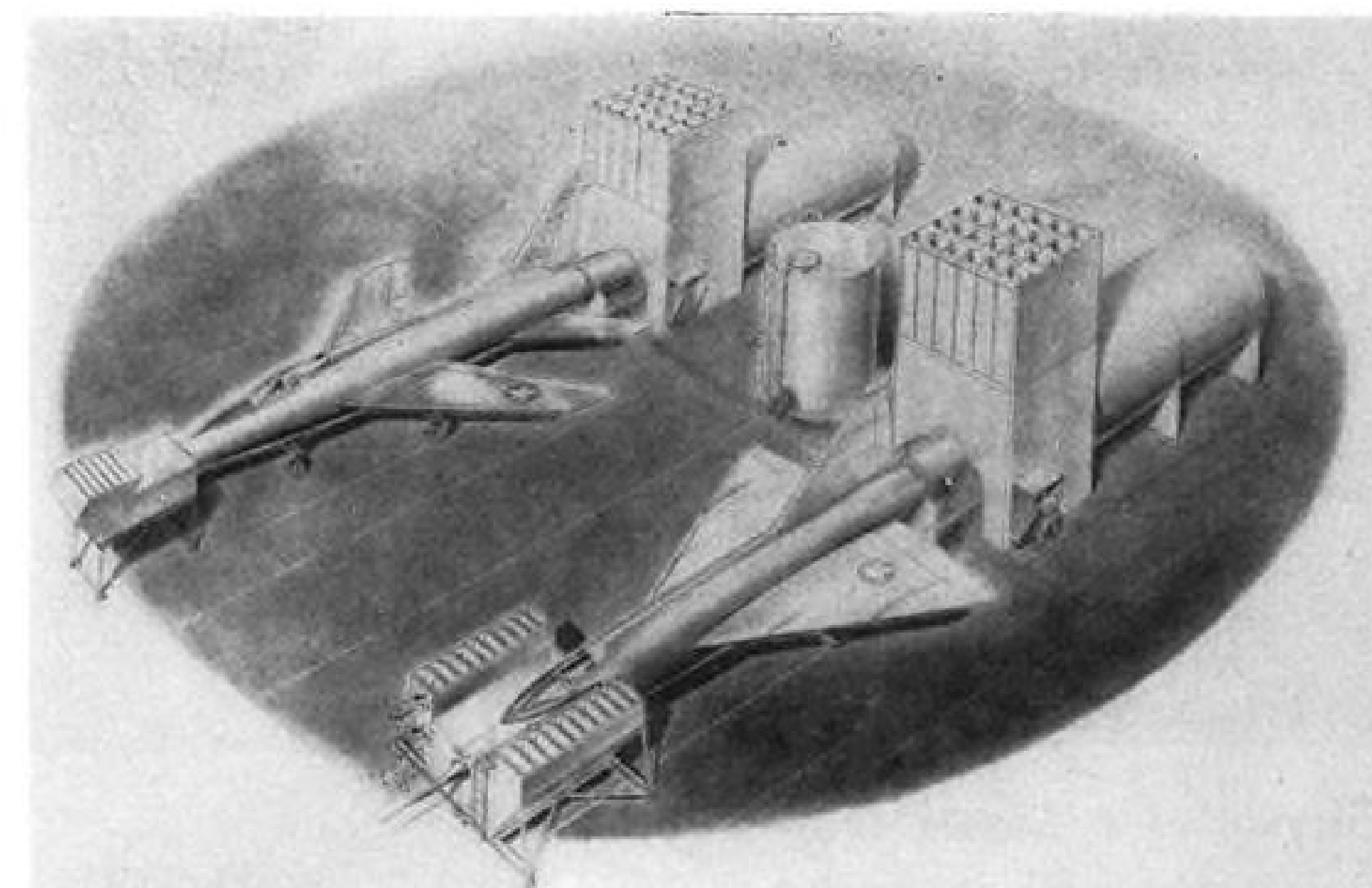
According to J. H. Carmichael, Capital Airlines' President, the Company's decision to add 15 new Viscounts to its fleet is based on the "splendid public acceptance accorded the Viscounts and their outstanding operational performance in scheduled air transportation."

The Viscount, powered by four Rolls-Royce Dart engines for whisper-quiet and vibrationless flight, is the first and still the only turbo-prop aircraft in airline service in the world.

United States Representative: Christopher Clarkson,
10 Rockefeller Plaza, New York 20, New York

turbo-prop
VICKERS VISCOUNT
POWERED BY FOUR ROLLS-ROYCE DART ENGINES

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Jet Noise Suppressors

Jet engine ground-runup noise suppressors to accommodate the North American F-100 and Convair F-102 which will be erected at Norton Air Force Base, San Bernardino, Calif. General Sound Control, Inc., Los Angeles, has designed the units to be prefabricated of all-steel makeup. This will make possible complete demountability for movement to new locations. Exhaust passes through augmentor, perforated diffuser in cylindrical plenum chamber, back through lined bends, and up through company-developed Accoustitubes to atmosphere. Use of water spray will permit afterburner runs. Intake silencers are mounted on casters, roll into position over plane nose. Company is building noise suppressor, based on same principles, for Hughes Aircraft, Culver City, Calif. Unit will accommodate five different aircraft, including twin-engine types.

not been disclosed but one will be a pumping station and one will house a clarifying filter to remove impurities from the water before it is used in the reactors. Two G. E. test reactors are now being built.

New facility is expected to be in operation by the latter part of 1957.

Basic power supply and distribution system will be constructed by Richards and Associates of Carrollton, Ga. Amount of the contract is about \$167,000. Ten miles of asphalt surfaced macadam roads, two steel bridges, culverts and drainage sewers will be built by the MacDougald Construction Co. of Atlanta for approximately \$670,000. Work is to begin immediately.

Training of scientific personnel will be carried on at Lockheed, Marietta and at the General Electric plant at San Jose, Calif.

British Concerned Over Alloy Cracking

London—Strong concern over stress corrosion cracking of aluminum-zinc-magnesium type alloys is expressed by Britain's Air Registration Board in its annual report. (These alloys are similar to the very high-strength U. S. 700 series, also susceptible to stress corrosion.)

The board says that although it is not new the problem is "urgent." "A

number of forgings and extrusions have cracked in an apparently arbitrary fashion, on some occasions before they have even been built into aircraft," it says.

The report adds: "In some cases the design is at fault. In others, manufacturing procedures have left the materials with high internal stress so that stress corrosion cracking has occurred when the parts have been loaded well below the elastic limit."

The board is preparing a handbook which will analyze recent structural failures and defects.

Scientists Form New Aero Consultant Firm

Sixteen scientists, engineers and technicians, mostly from Princeton University's James Forrestal Research Center, have formed a new firm, Aerokinetics, Inc., to provide extensive consulting services to industry in the fields of rockets, guided missiles, jet propulsion and aerodynamics.

Aerojet-General Corp., Olin Mathieson Corp., and Reaction Motors Inc. are reported to be the firm's first customer prospects. These firms are said to be attracted by the Forrestal group's background in ozone rocket fuel.

Familiar names to industry among the 16-man group of founders are: Dr. Martin Summerfield, professor of aero-



ON OUR STAFF

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Skywarrior Slows Down

A deceleration parachute is being fitted to all A3D Skywarriors being produced at Douglas' El Segundo division. Measuring 24 ft. in diameter, the chute will be used for landing on airfields only and will not be used to supplement deck landings of the carrier-based bomber. It will assure safe landings on wet runways, during instrument landings made under GCA conditions, or in emergency landings made with high gross weight. Installation is designed for normal touchdown of 150 knots and emergency speed of 170 knots.

nautical engineering; Dr. John B. Fenn, director of the Navy Squid project; Dr. Luigi Crocco, authority on aerodynamics and combustion; Dr. Sin-I Cheng, gas dynamicist; Dr. Irvin Glassman, expert on jet mixing and monopropellants; Dr. Jerry Grey, combustion and aerodynamics specialist; and J. Preston Layton, chief jet propulsion research engineer at Forrestal and first president of the new firm.

Supersonic Human Factors Studied at Northrop Aircraft

Human factors engineering studies are being conducted at Northrop Aircraft, Inc., Hawthorne, Calif., to determine man's ability to cope with extreme operational demands of supersonic aircraft.

Working on these advanced studies are Northrop's Dr. Gerald F. Rabideau,

psychologist, and Dr. J. Gordon Wells, physiologist. Target will be to determine the practical points in terms of high speed flight at which man's mental and physical abilities must be subordinated to electronic computers and servomechanical systems.

Findings will be fed to Northrop designers assigned to high speed aircraft projects, including development of the company's new supersonic jet trainer.

The study program is being directed by Earl L. Eckerson, head of Northrop's Human Factors Engineering and Equipment Design Section.

Invention of Centripetal Pump for USAF Reported

An Israel Institute of Technology professor reports that he has developed a pump which works by centripetal

rather than centrifugal effect. Marcus Reiner, head of the Institute's Rheological (electrical) Laboratory, says that because the centripetal action increases with decreased air density his pump will have a "revolutionary effect" on high altitude flight.

The pump has been sponsored by a U. S. Air Force contract.

French to Use Republic Ejection Seat in Mystere IV

French Dassault Mystere IV jet fighter will use Republic-designed ejection seat which current is installed in RF-84F Thunderflash photo-recon fighter and the supersonic F-105 fighter-bomber. Seat is first American-designed ejection system to be used in a European jet fighter.

Republic has licensed the Societe Nationale de Constructions Aeronautiques du Sud-Est (SNCASE) to construct the new ejection seat abroad for use in the Mystere IV. SNCASE also is building spare parts under contract to Republic Aviation International, Republic's European subsidiary, for F-84s now in service with NATO.

THRUST & DRAG

Flight in Hollywood Dept.: This quote is from a Warner Bros. release plugging a variety of films with aviation background.

The tight-lipped hero in the flying helmet—the film actor—sometimes lives his part so completely that he too gets the flying bug.

William Holden, long known for his derring-do, was so intrigued with jets in "Towards the Unknown" that he cajoled his way aboard an advanced



Power for the World's Airlines

★

AMERICAN, BRITISH, DUTCH and FRENCH

built airliners,

powered by

ROLLS-ROYCE

GAS TURBINES,

have been ordered

by airlines of the world.

★

*Rolls-Royce gas turbines have already flown 1,000,000 hours
on scheduled airline service*

ROLLS-ROYCE AERO ENGINES LEAD THE WORLD

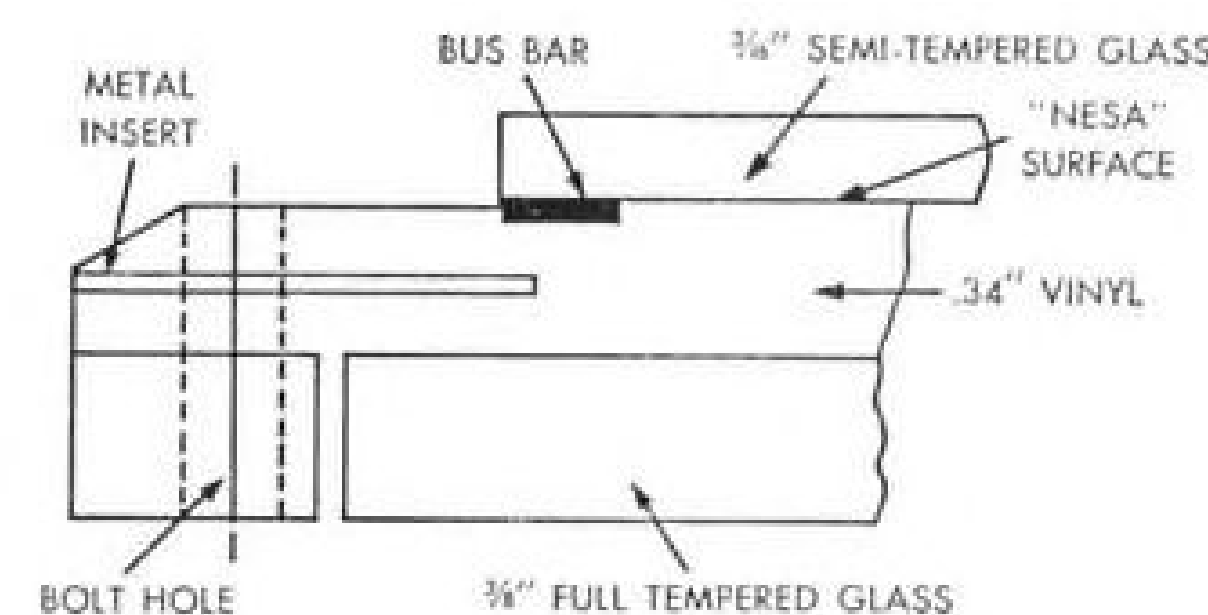
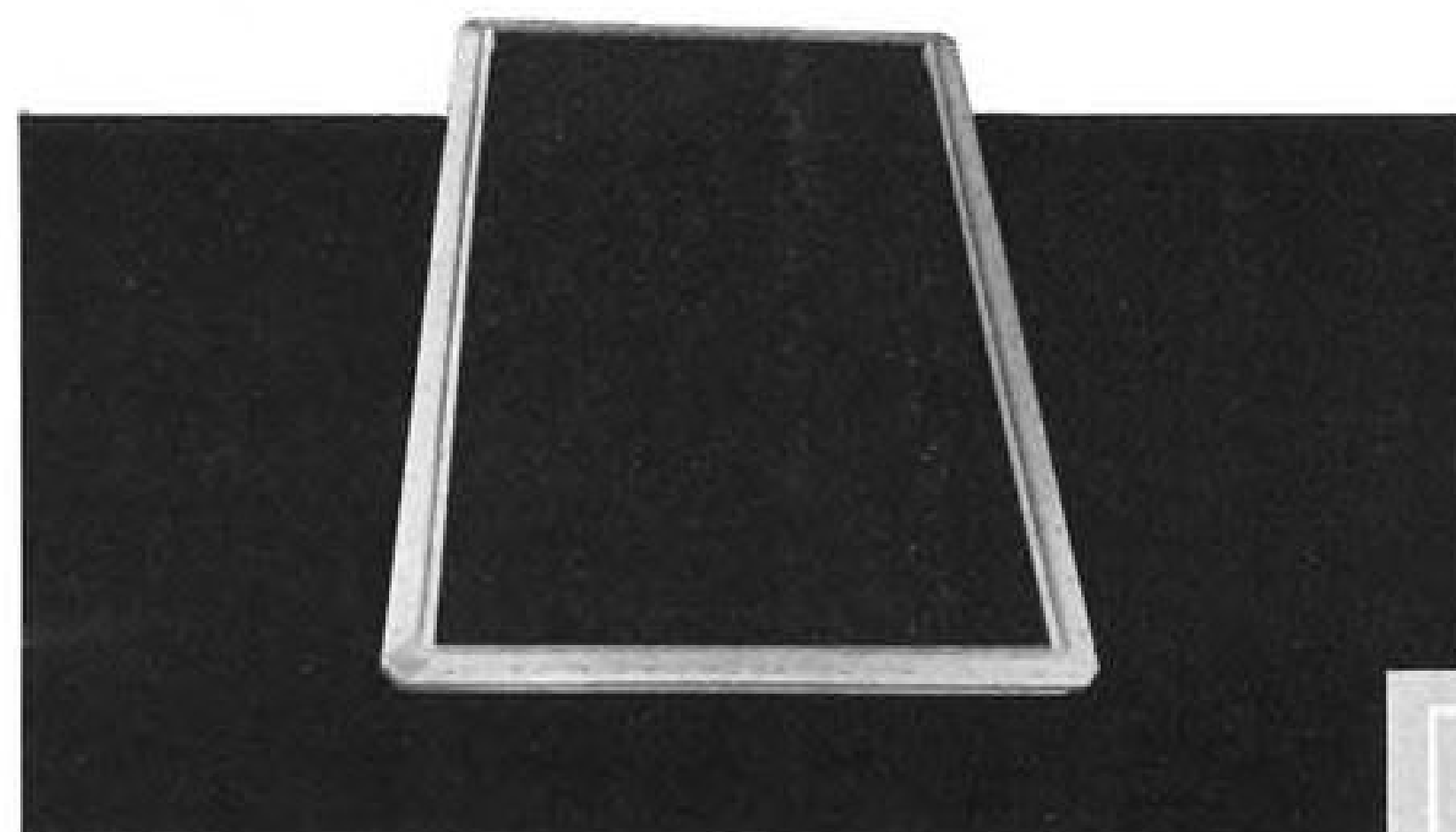


Spaniards Demonstrate Jet Trainer

A European demonstration tour is being made by the Hispano HA-200-R1 Saeta two-place jet trainer designed and built by the Seville company with assistance of Willy Messerschmitt. Powerplants are two 880-lb.-thrust Turbomecas fed by nose intakes and exhausting out of separate tailpipes beneath the trailing edge of each wing. Tests by Austria of trainer have shown it to be superior in economy to DeHavilland Vampire types, and may kill sale of 24 DH-110s and one DH-115 offered to Austria by Sweden.



Good visibility for Boeing B-52 pilots with electrically heated "NESA"® windshields



A report from **THE PITTSBURGH AIRCRAFT GLAZING FILE**

Just about everybody has seen pictures and heard of the 400,000-pound Boeing B-52 long-range heavy bomber.

At extreme altitudes, it will fly more than 6,000 miles without refueling—and on trips like this, the pilot must be prepared for any kind of weather. As far as visibility is concerned, he is prepared with a NESA Flexseal® electrically heated windshield. The 3/4" semi-tempered outer glass ply has the NESA coating on the inside surface to protect against icing and fogging.

Pittsburgh Plate has developed many special

aircraft glasses, and our Technical Representative will be glad to discuss them with you and help solve any of your difficult aircraft glazing problems.

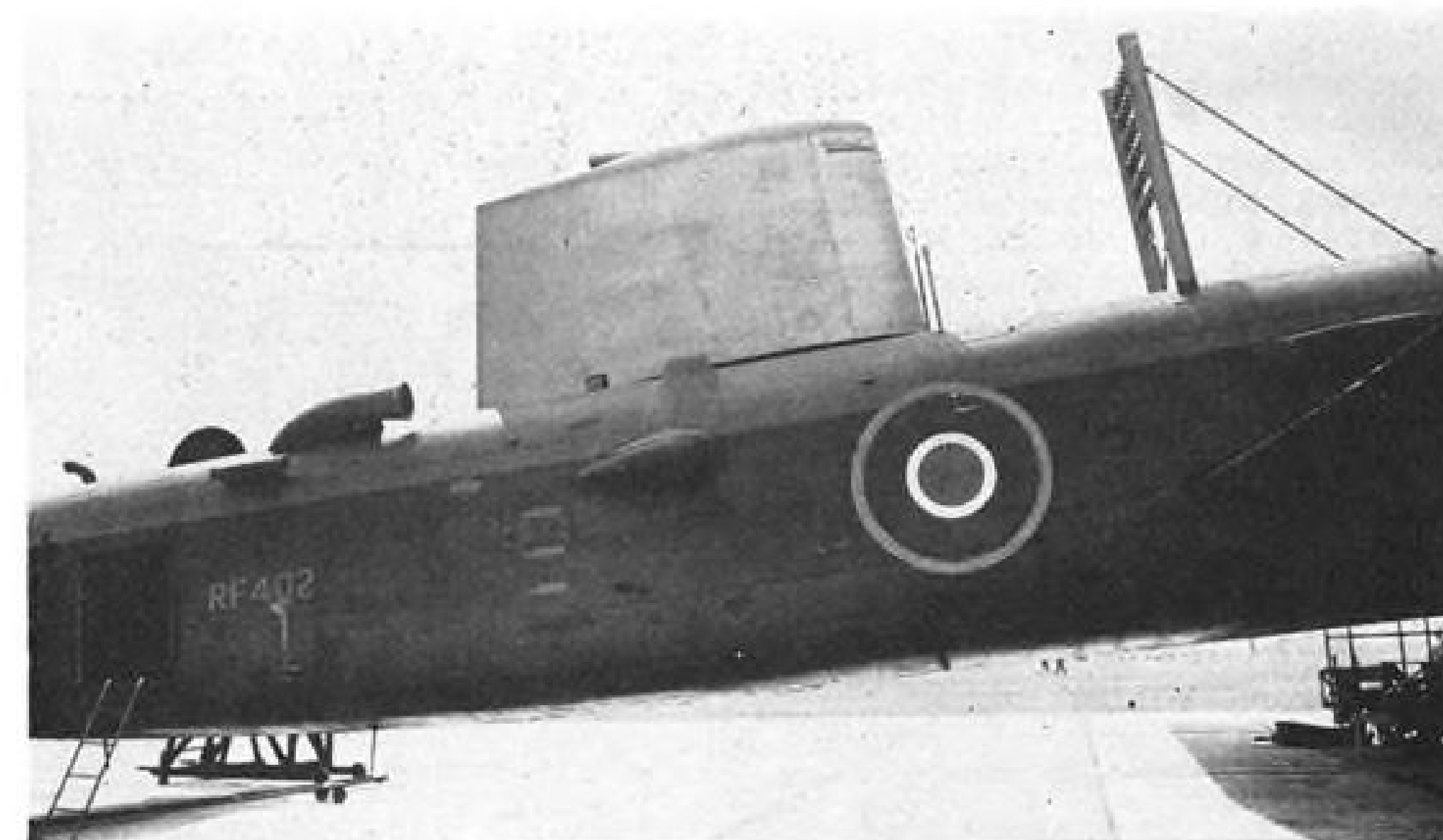
For more information, write to Pittsburgh Plate Glass Company, Room 6356, 632 Fort Duquesne Boulevard, Pittsburgh 22, Pa.



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De-Icing Research

A portion of Britain's Beverly air freighter wing pivoted above the fuselage of a Lincoln bomber provides a flying test tool for D. Napier and Son Ltd. research on the Beverly's hot gas de-icing system. The six rows of nozzles rigged ahead of the test wing section spray aerated water to create the icing atmosphere. Windows are fitted below the test wing to allow photographic observation. Napier's Flight Development Establishment says that the testing will be done at 12,500 ft. altitude at temperatures from -5C to -30C. A flight speed of 155 knots I.A.S. with the wing section at an effective incidence of 5.7 degrees will simulate Beverly cruise and 115 knots and 10.8 degrees will represent climb.

fighter-trainer jet at Edwards Air Force Base in California and became the first actor to break the sound barrier.

And now comes Kieron Moore in "Satellite in the Sky." Moore plays the captain of a rocket ship making man's first trip into outer space.

"I have not purchased a Buck Rogers suit," Moore said, "but the flying bug has bitten me. It was those planes—the Avro Delta and the Folland Midge."

He continued:

"Sitting in them, not knowing what the dials and gadgets are for. Watching them fly. Flying in them. Brother! As soon as the picture was finished, I signed up with a flying school and I'll be soloing soon."

In a Folland Midge, Mr. Moore?

The complexities of contractual relations between customers and the Air Force sometimes defy description. Occasionally they drive some of the parties to distraction, producing bursts of temper or sardonic humor.

In the latter category is this anonymous document which purports to be a management proposal submitted to the Air Force as part of the routine established for getting a contract. It may be easy for you to identify the company, so names have been deleted. You may even work there.

Management Proposal

1. General Experience

A detailed reference to the large number of programs which we have mismanaged would be beyond the scope of this proposal

(see report 789-2, AF Board of Inquiry; see also report of Congressional Investigating Committee, 1209-A). We feel, however, that the experience gained from these miserable failures puts us in a strong competitive position since it is unlikely that these mistakes will be repeated. Our competitors may have a greater number of failures, but we would like to point out that our errors were made on larger and more important projects. Furthermore, we have absolutely no experience in the specialty areas required for this design and will therefore approach the problem without prejudice.

2. Organization

We have reviewed this question carefully and find that we are unable to determine the precise instant of time at which the customer desires to see the organizational structure, and are therefore at a loss as to how to present it. We have investigated the use of high speed movie cameras and magnetic recorders as means for presenting a changing organization, but feel that these do not meet the requirements. We therefore request that the customer specify the moment desired. We suggest a time during the interval from 0200 to 0700 on a Sunday would be best as experience has shown that the rate of change is at a minimum during this period.

We have found on recent proposals that our key personnel received offers from one of our competitors a few days after the submission of a list of personnel. Since there seems to be evidence of a security leak in the customer's organization, we request that a need-to-know be established before this information is supplied.

3. Technical Approach

Our plan for this project is to hire engineers from the companies which lose the competition. Our technical approach will

Engineers



SQUEEZE

**a bigger future
for yourself**

"Water squeezers" and other energy absorption devices are just part of the variegated engineering and development picture at All American. You find too a wide range of other projects, including the famous Hydro-Lift landing gear, tow-target reels and air-sea rescue devices, in-flight remanning and refueling systems and literally dozens of others — stimulating and challenging programs for *Aero and Mechanical Engineers*.

What's in it for you? A really outstanding opportunity to develop with a young, dynamic organization, anxious to help you put your own ideas to work, and able to provide a fertile ground for your career growth.

Drop a line today, in confidence, of course, to Ray Janney, Chief Engineer.



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therefore be determined by these people and can be obtained from our competitors' proposals. We do have a few guiding principles. We have found that on a project of this nature, about 12-18 months are required to catch up with the art. This time is spent in visiting other companies, universities, and test sites and in reading classified reports and Aviation Week. This period is followed by a 6 month study phase. At the end of this time it is usually desirable to start traveling again because of the extremely rapid changes that take place in the State-Of-The-Art.

4. Schedule

In order to improve the appearance of our proposal the art department has made up

a 7-color schedule using stereoscopic plexi-glass overlays. The dates in this schedule represent a weighted average between the estimates of the Research and Sales divisions (they are the Sales division figures). In any event, company practice is to terminate a project when the personnel are needed on a new and more profitable contract.

5. Subcontracts

It is a firm company policy to never let a dollar get out of the house.

6. Cost Information

Engineering—we do not plan to spend much here. We have found that engineers make changes, and this reduces profits.

Facilities—this is a large item. We view



Dearest Vicki:

You don't know it, but dangling near the windshield of my plane is a tiny shoe you wore as a baby, to remind me I'm the daddy of a gorgeous little girl—and to soothe my eyes after seeing my own big flat dogs beneath the panel.

You've grown up but, thank gosh, all your

expansion has been in the right places, and your tootsies still are neat and trim. Men prefer ladies with small, shapely feet, especially when displayed by an auburn-haired, brown-eyed Someone who's 18, 5'4", and 114 lbs.

Southwest Airmotive—my favorite service station—is 25 years old but, unlike you, it has NEVER stopped growing. Now, SAC has:

1. Opened a Mid-West Division in Kansas City, Kans., to distribute and service the products of the Eclipse Pioneer, Red Bank, Pioneer Central, Utica, and Pacific divisions of the Bendix Aviation Corp., and of the AC Spark Plug Division of GM, the Aeroquip Corp., and B. F. Goodrich Co.;
2. Opened a Rocky Mountain Division at Denver, Colo., as distributor for the Bendix Products and Bendix Pacific divisions, AC, Goodrich, and Aeroquip, and
3. Moved ahead with plans for its new \$2,000,000 service and parts distribution facility at Love Field, Dallas.

Yesmam, faith in the future is identified by Major Investments in the past and present. This always has been the case with Southwest Airmotive. Come to think of it, this also is true in the case of me and my Queen Victoria. I consider the faith of both of us—me and SAC—extremely well placed!

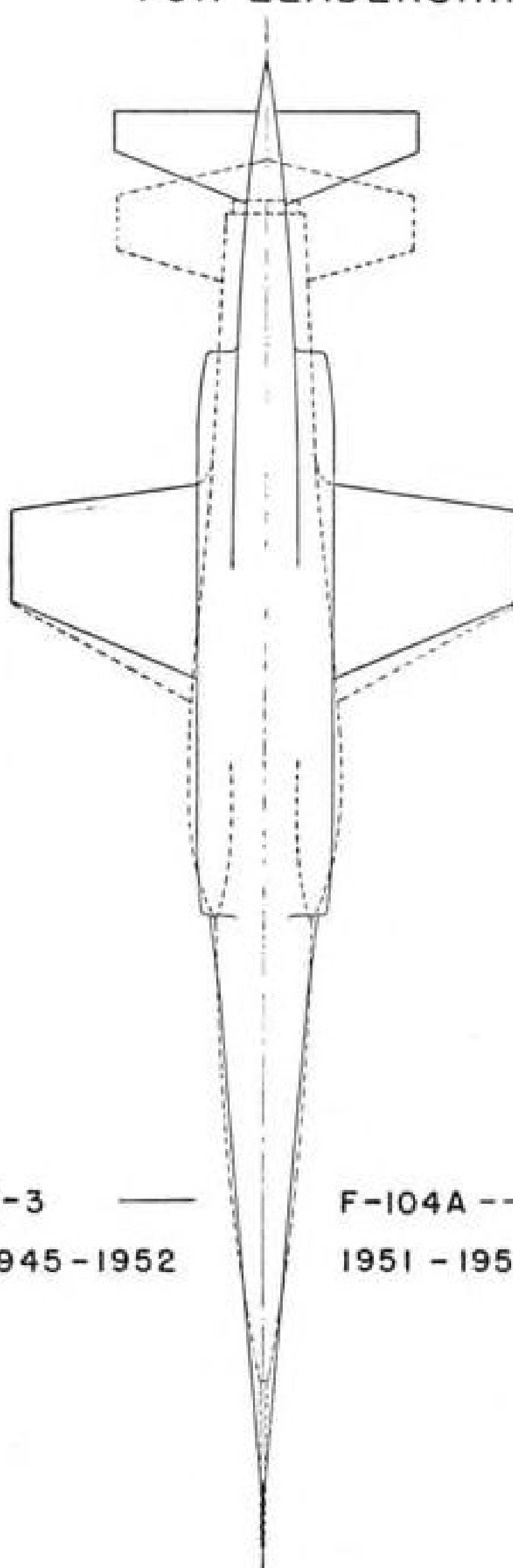
Love,

Daddy

SOUTHWEST AIRMOTIVE CO. • LOVE FIELD • DALLAS, TEXAS



LOOK TO DOUGLAS FOR LEADERSHIP



this contract as an excellent opportunity to build up our plant.

Testing—no charge has been put in since we do not plan to test. In the past test programs have shown up faults and caused cancellation of contracts years before the mistakes would have been discovered in the field.

Entertainment—this item was inadvertently omitted from the request for proposal; we have added it.

7. Contract Forms and Profits

An exhaustive study will be made during the first 6 months of the contract to consider these factors. All of the modern techniques of operational analysis, game theory, and high speed computing will be applied to the problem of profit optimization.

Key points in this study will be legal loopholes, tax dodges, and evasively written clauses. It is expected that several nationally known consultants will be retained for this work due to the overriding importance of the problem.

8. Physical Resources

An excellent survey of our physical facilities is contained in the Receiver's Re-

port prepared during our most recent bankruptcy proceedings. A copy of that report is appended.

9. Additional Facilities Required

It is our belief that an important project such as this should not be carried out in our shabby plant. We plan to use government furnished facilities exclusively. We would like to point out that several directors of the company have excellent property which they would be willing to sell to the government for the erection of these facilities.

PRODUCTION BRIEFING

Warehouse for titanium aircraft stock has been opened by Titanium Metals Corporation of America. Address: 6465 Corvette St., Los Angeles, Calif.

Spar milling machine, most powerful ever produced, has been completed by the Farnham Div., Wiesner-Rapp Co., Inc., Buffalo, N. Y. First of 30 similar machine in a \$6 million Air Force



contract, the Farnham machine is said to be able to remove 150 lbs. of aluminum per minute with .001 in. accuracy from parts up to 3 ft. wide and 60 ft. long.

Danly Machine Specialties, Inc., Chicago, machine speeding Pratt and Whitney Co. jet engine production by actually stabbing vanes into shroud. This direct assembly method has



stepped up completed shroud production from five to 30 units per day. Method eliminates tolerance worries as each vane now becomes its own punch and gauge, says P. & W. who developed the original design concept.

Hamilton Standard Division of United Aircraft reports that three years of operating nickel-plated propellers on C-119s, P5Ms and UF-1s have shown that the nickel plate definitely increases the propeller's ability to withstand runway rocks and salt spray.

William Brand & Co., Inc., Willimantic, Conn., announces a 33,000 sq.

ft. \$300,000 addition to their North Windham plant. Part of this expansion is due to the increased demand for the company's high temperature teflon and silicone rubber-coated wiring.

Predictions from the National Screw Machine Products Assn. (NSMPA): annual sales of screw machine products will rise from present \$485 million to \$700 million in 1965, current death rate of small companies will result in fewer bigger firms, and more complete automation will take place. The NSMPA says that while a man could set himself up in business for \$5,000

Royal AMPHIBIAN NEWS



Notes on America's outstanding utility amphibian for business flying and charter service operation

ROYAL GULL IN NEW DAILY AIR-TAXI SERVICE TO LAKE TAHOE



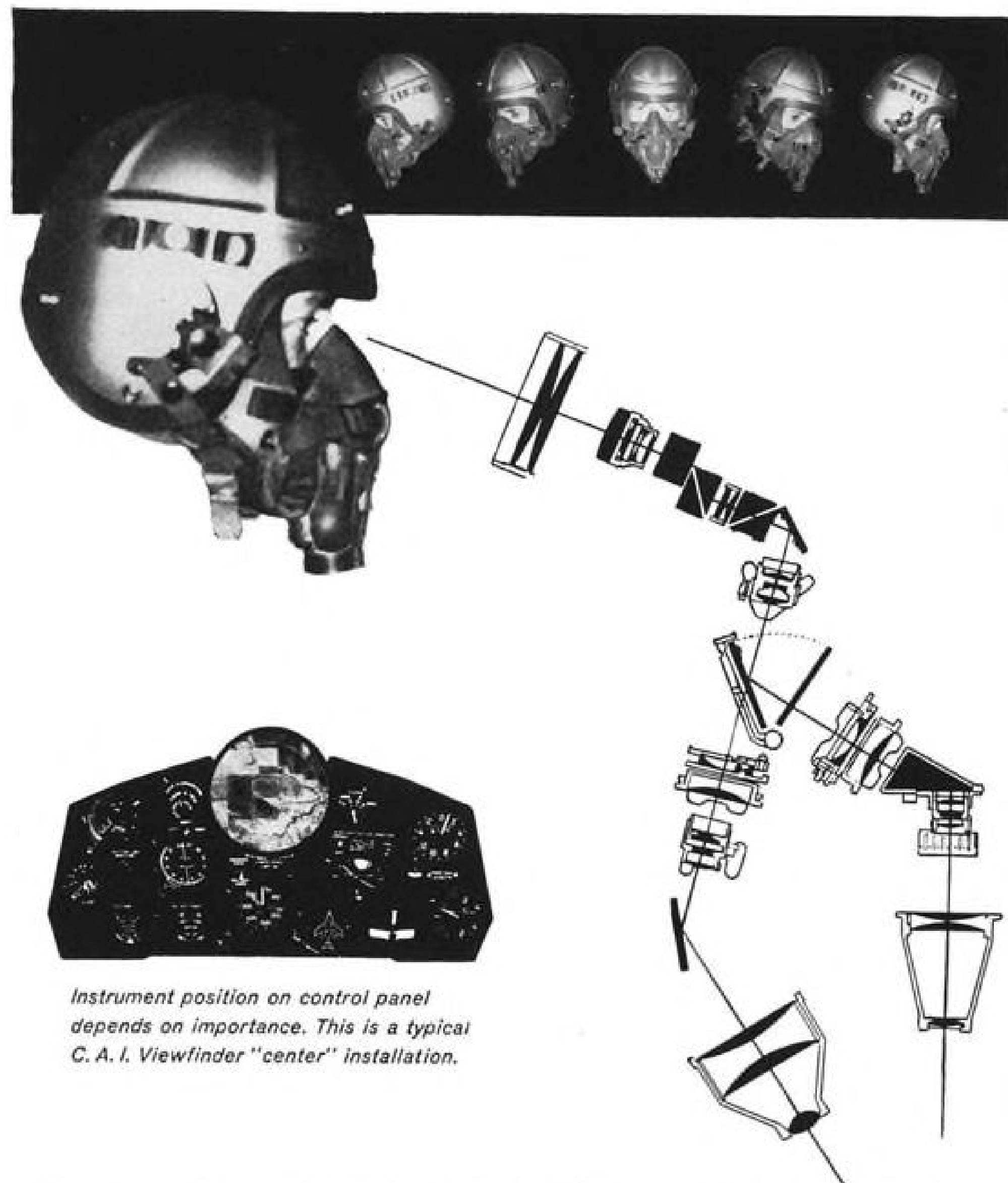
Across the bay from San Francisco in Sausalito, Commodore Air Service makes its home base. Everyday . . . only 60 minutes after pilot Bob Law takes off on his scheduled daily round trip, he lands his luxuriously appointed Royal Gull on beautiful Lake Tahoe, 6000 ft. above sea level. An hour later, grossed out again at 6000 lbs., he's winging his way home. The five passenger Gull is ideally suited for such water-to-water commuter service. Its amphibian design with 270° visibility feature, however, adds a great measure of versatility, convenience and safety for land or water based operations.

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5 HEADS for the Reconnaissance Pilot?



Instrument position on control panel depends on importance. This is a typical C. A. I. Viewfinder "center" installation.

How else to line up on target, fly the aircraft over the target, pinpoint the camera coverage, watch the flight instruments and monitor the camera controls—simultaneously!

Chicago Aerial's answer: utilize ground area as another flight instrument. The Periscopic Viewfinder permits the pilot to see through the airplane, and makes visible the ground area below and ahead—the area most vital to photo-navigation. With its selective wide angle and narrow angle views, the Viewfinder gathers this light, directs the ray bundles through narrow enclosures, and sends all the light to the pilot's eyes. With CAI's Viewfinder the brilliant, distortionless image preserves the natural color and fine detail of the ground below... so valuable for navigation and target detection and recognition.

Long or short eye relief... magnification or minification—these and other parameters are tailored to particular aircraft requirements. From research through manufacture, the Viewfinder is exclusively C.A.I.—only one of a long list of accomplishments.

Look to CAI for research, engineering, and manufacturing of airborne optical systems.

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If you are interested in the unique C.A.I. story, we suggest you write for our 24-page brochure, "Advancing Horizons."

CHICAGO AERIAL INDUSTRIES

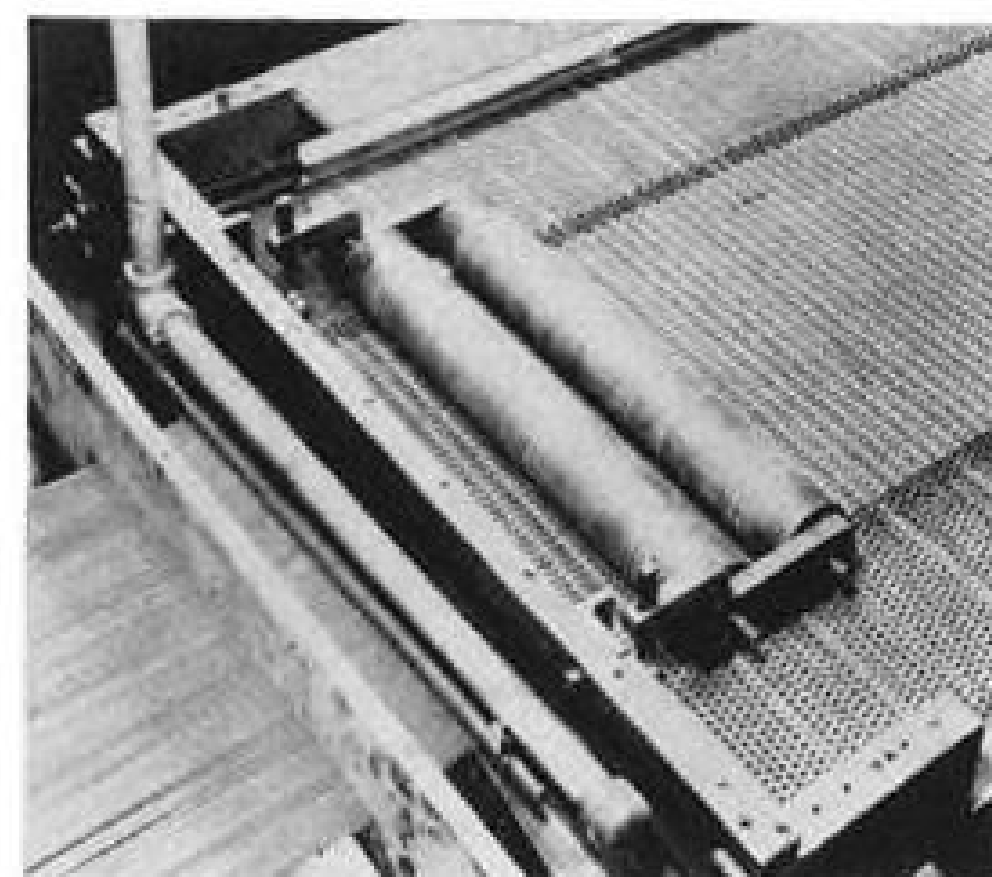
1980 Hawthorne Avenue, Melrose Park, Illinois
Chicago Office: 332 South Michigan Avenue, Chicago 4, Illinois

during World War II, today it takes \$125,000 and the returns are lower. A \$1 million-a-year company nets only \$70,000 after taxes. The NSMPA, which says that they represent more than 280 producers whose output comprises more than 65% of the national total, is located in Cleveland, Ohio.

Lockheed Aircraft Corp. is adding a 68,000 sq. ft. to its Bakersfield sub-assembly plant, Bakersfield, Calif., to handle subassemblies on their turbo-prop Electra airliner.

An industry panel on use of steel castings in aircraft has recommended that the government spend up to \$1,250,000 annually "for several years" to coordinate industry attempt to produce reliable steel precision castings with ultimate strengths of 180,000-200,000 psi. Their report, PB 121148, Precision Steel Castings for Aircraft Use, may be ordered through OTS, U. S. Dept. of Commerce, Washington 25, D. C. for \$1.75.

Narmco Metlbond Co.'s "Multi-wave" machine continuously fabricates aircraft sandwich core. Individual strips are being fed in from the left and oriented and bonded into a honeycomb in the device to the right. The Costa Mesa, Calif., firm says its ma-



chine can automatically produce a 36 in. wide core paper of aluminum, stainless steel, re-inforced fiberglass, inconel, titanium or paper at the rate of one ft. per min. Present pilot production facilities are being augmented by two production machines.

The Automatic Controls Division Clary Corp., San Gabriel, Calif., made \$1.3 million worth of deliveries in the first six months of the year. The division is producing control and guidance mechanisms for North American, Convair, Firestone, Aero-jet General, Wright Aeronautical and Cal. Tech's Jet Propulsion Laboratory.

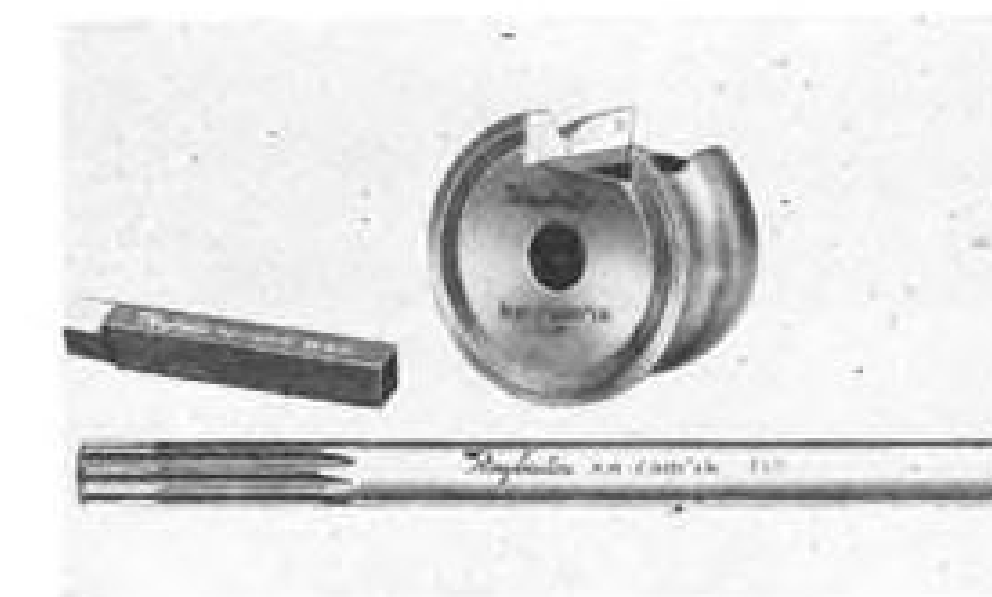
Thermo Materials, Inc., Menlo Park, Cal., has been organized to manufacture and distribute high temperature

ceramic, Cermet and ferrite items. Company research will aim at producing high temperature components for rockets, guided missiles, jet engines, nuclear engines and electronic equipment. Emo D. Porro has left Stanford Research Institute to become general manager.

Southwest Research Institute, San Antonio, Texas, has two building projects underway which are helping to expand San Antonio's "Science City" area.

One is Pratt & Whitney's \$600,000 radiation effects study lab which will contain two cells capable of handling up to 10,000 curies of cobalt 60 and the other is Army Ordinance's three-quarter million dollar research laboratory.

The Raybestos Div., Raybestos-Manhattan, Inc., Bridgeport, Conn., has developed a ceramic cutting tool which is bonded to a steel base. The product,



called Keramik, is said to outlast other tools 20 to one. National distribution of Keramik tools will be handled by L. C. Chappel & Co., Fairfield, Conn.

Walmet Corp., Madison Heights, Detroit, Michigan, has been formed to custom-manufacture cemented carbides for metal cutting blanks.

Aluminum Co. of America's Lafayette, Ind., works will install a twin to the world's largest extrusion press. Alcoa will privately finance the \$9 million, 14,000-ton press which will be able to produce structural shapes such as wing spars and rotor blades up to 110 ft. long and 2,500 lbs. weight. Alcoa says that the existence of this facility along with its twin, owned by the Air Force but also located in the Lafayette works, will encourage designers to design for the weight reduction permitted by large one piece extrusions.

General Electric's machinability computer is being used to determine proper speeds and feeds in the Chicago Plant of Scully-Jones & Co. GE Carboloy Dept. computer is a portable device into which the machining variables are dialed and out of which is read the best manner of handling the machining job so that more uniformity results in the methods of individual machinists.

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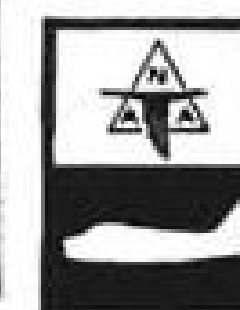
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EQUIPMENT



RADIOGRAPHIC SERVICE being performed (left) at Idlewild Airport by Burgoyne X-ray and Metal Testing Laboratories, Inc., of a wing. Radiographer positions film inside wing. Andrex X-ray New Cassel, L. I., on Constellation belonging to major airline. equipment (right) in typical set-up for X-raying wing spar.



Portable X-Ray Boon to Aircraft Industry

By George L. Christian

New York—Portable X-ray equipment for non-destructive inspection of aircraft and their components is proving an essential and money-saving tool in the airline industry. Airframe manufacturers are turning to portable X-ray machines for specialized uses such as inspection of complex-contour air ducts, 360 deg. inspection of guided missile fuel vessels, and other close area structures.

(This article is not concerned with large, industrial-type X-ray machines which have long been used in aircraft and other industries for such jobs as inspecting forgings, castings and weldments on a selective or mass production basis.)

At least ten U.S. and five foreign airlines, as well as several airframe companies on both sides of the Atlantic, are using portable X-ray equipment for non-destructive inspection. One airline said that in the first month it X-rayed incoming new propeller blades two were found to be cracked.

Another carrier told Aviation Week X-ray inspection was instrumental in having the Civil Aeronautics Administration increase the major overhaul period of its fleet of four-engine air-

craft from 1,600 to 2,000 hours, resulting in large maintenance economies.

Increasing interest in X-raying techniques among airlines is underlined by the fact that, in the last six months, airline representatives have gathered at two symposiums—one here and one abroad—to exchange information and establish criteria concerning the use of X-ray on modern aircraft. The U.S. meeting was sponsored by the Air Transport Assn. at Highland Park, Ill. and was held in cooperation with General Electric's X-ray department. It was attended by 40 airline representatives and GE technicians. The European conference, sponsored by Carl Drenck X-ray Laboratories in Copenhagen, Denmark, was attended by 30 technicians from airline, airframe manufacturing and X-ray industries representing eight countries.

Portable X-ray Equipment

Portable X-ray equipment firms and suppliers in the U.S. are:

- **Andrex.** Three sizes of equipment are available through Holger Andreasen, Inc., San Francisco, sole American distributors for the Danish-made sets. Airlines using Andrex are: Pan American World Airways (Pacific-Alaska and Latin American divisions), Braniff Air-

ways, Delta Air Lines, National Airlines, and Eastern Air Lines.

- **Norelco.** Three sizes are available from North American Phillips Co., Inc., Mount Vernon, N. Y. These sets are made at the company's plant at Eindoven, Holland. Airlines using the equipment are: United Air Lines, American Airlines, Capital Airlines and Trans World Airlines.

- **General Electric.** One size is available through GE's X-ray Department, Milwaukee, Wis. (G.E. makes a second model too large to be called truly portable.) Northeast Orient Airlines has purchased one of each size.

- **Baltograph.** Four sizes are being put on the market and distributed by Westinghouse's Industrial Products X-ray Sales Department. (A fifth miniaturized set, the Baltospot, also is available.) The machines are made by the Balteau Electric Corp., Stamford, Conn. Only the transformers used in the equipment are imported from the company's headquarters in Liege, Belgium. No machines have been sold to date, but demonstrations have been made for Pan American at New York International Airport and for Delta at their headquarters at Atlanta, Ga.

- **Fedrex.** Four sizes are available through the sole U.S. distributor,

Machinery and Welder Corp., Chicago. No sets have been sold in this country to date. Maker is Carl Drenck Electro-Technical Laboratories, Copenhagen, Denmark. The equipment is used by airlines in Europe.

All of the above equipment can be carried by one or two men. Some of the smaller units are compact enough to fit into awkward and inaccessible parts of an airplane. The sets are made up of X-ray heads, remote control units and connecting cable.

Quicker, Cheaper, Better

All X-ray users report that the equipment saves time and gets planes out of overhaul and into the air quicker, cuts inspection man hours and therefore expense, and improves the quality of inspection. In some cases, X-ray performs inspections which would be virtually impossible to accomplish visually.

The use of X-ray allows inspectors to locate incipient and potentially dangerous structural defects, such as cracks, breakage or corrosion which might otherwise never have been detected.

Example is KLM Royal Dutch Airlines' experience while experimenting with X-raying thermal anti-icing ducting in a DC-6's stabilizer leading edge. Here is what the carrier reports: "Two shots of the duct showed finely defined cracks. . . . A third radiograph revealed that a Y-section had completely broken loose and had travelled outboard about five feet. These three radiographs were actually made to detect cracks in five hot air duct brackets and the above-mentioned defects were found by chance. The cracks in the duct, for instance, would never have been detected visually because of being wrapped in insulation. These experimental shots helped to convince us that X-rays really can do something in inspection."

An English firm, Vickers-Armstrongs (Aircraft) Ltd., had this experience X-raying the wing structure on a large, high speed military aircraft which was damaged when a landing gear collapsed while taxiing: "The position and condition of the fire warning capillary tubes were adequately displayed and it was found that the fuel system pipe end attached by silver solder was not of the quality normally expected. The partial absence of a capillary film of solder within the nipple shirt could clearly be seen.

"It was found that the radiographs could be used as a very effective quality control over riveting, displaced heads and poorly filled holes being clearly displayed. In addition, the presence of chromated sealing compounds produced very distinctive images.

"Odd rivets, popped rivet nails, locking wires, taper pins, and bolts and

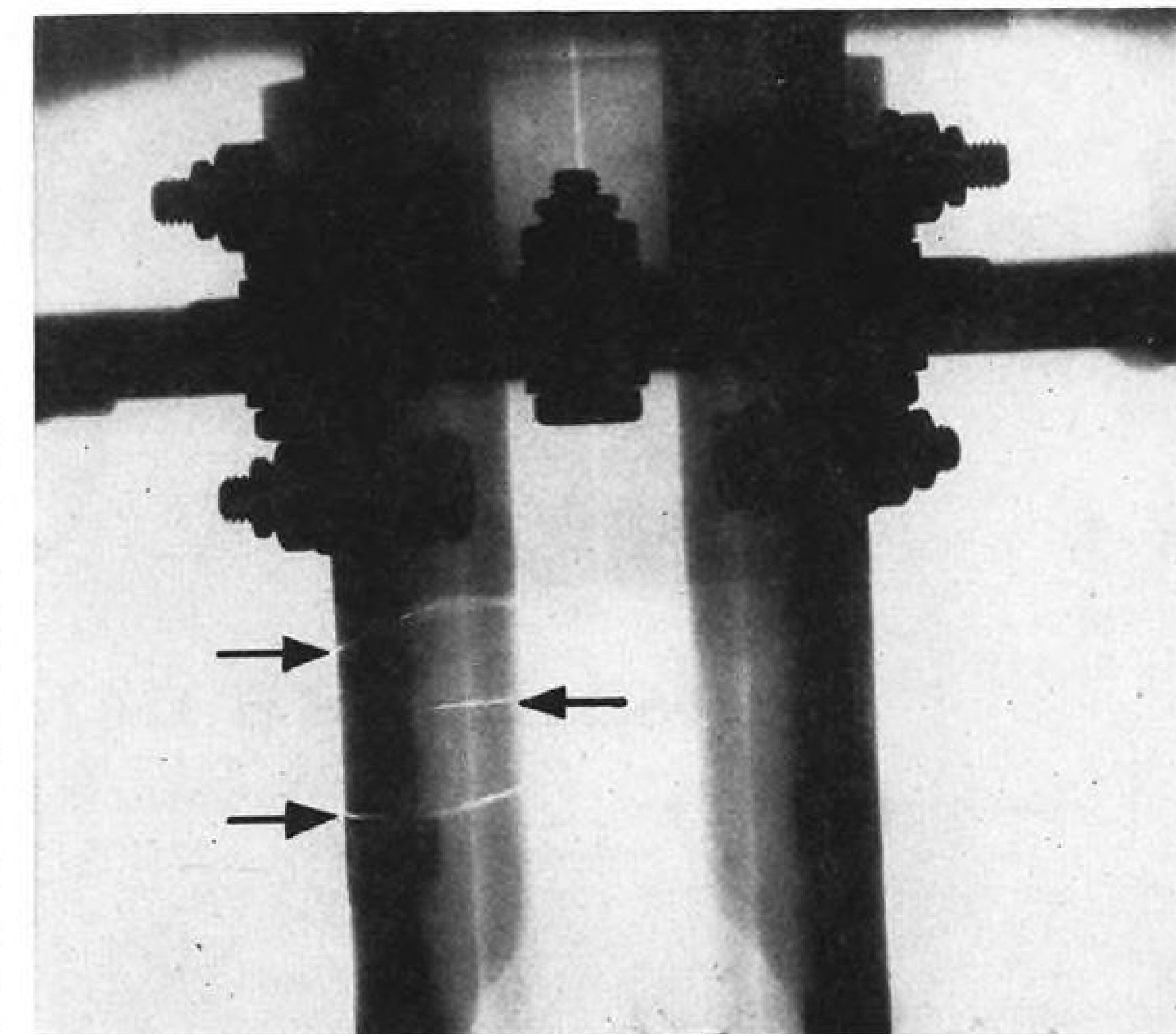
nuts which had been left within the structure on assembly were shown to have migrated, due to vibration and maneuvering, into certain areas. The possible consequence of this need not be elaborated."

Savings possible by the use of X-ray can be seen from a statement by Pan American World Airways. The airline saves 46,500 man hours at its Miami Overhaul Base by using portable X-ray equipment to inspect emergency exit hinges, propeller plane areas on DC-6Bs

and under wing skin of B-377s and L-049s.

PAA reports that "greatly increased efficiency has resulted from the use of X-ray on overhaul." MOB has effected an annual savings of 42,500 man hours on DC-6B prop plane area inspection, 2,000 man hours on inspection of the lower wing skin at the main gear of B-377s on a one-time, fleet-wide basis, and another 2,000 man hours on L-049 lower wing skin inspection.

"Even further use of X-ray equip-



CRACK IN main stringer of DC-6B is shown in X-ray. Slight white line between two other horizontal white lines is actual crack. Photo was taken during inspection of Clipper at Pan American World Airways' Miami Overhaul Base. Camera was placed on top of wing and negative at bottom for photo.

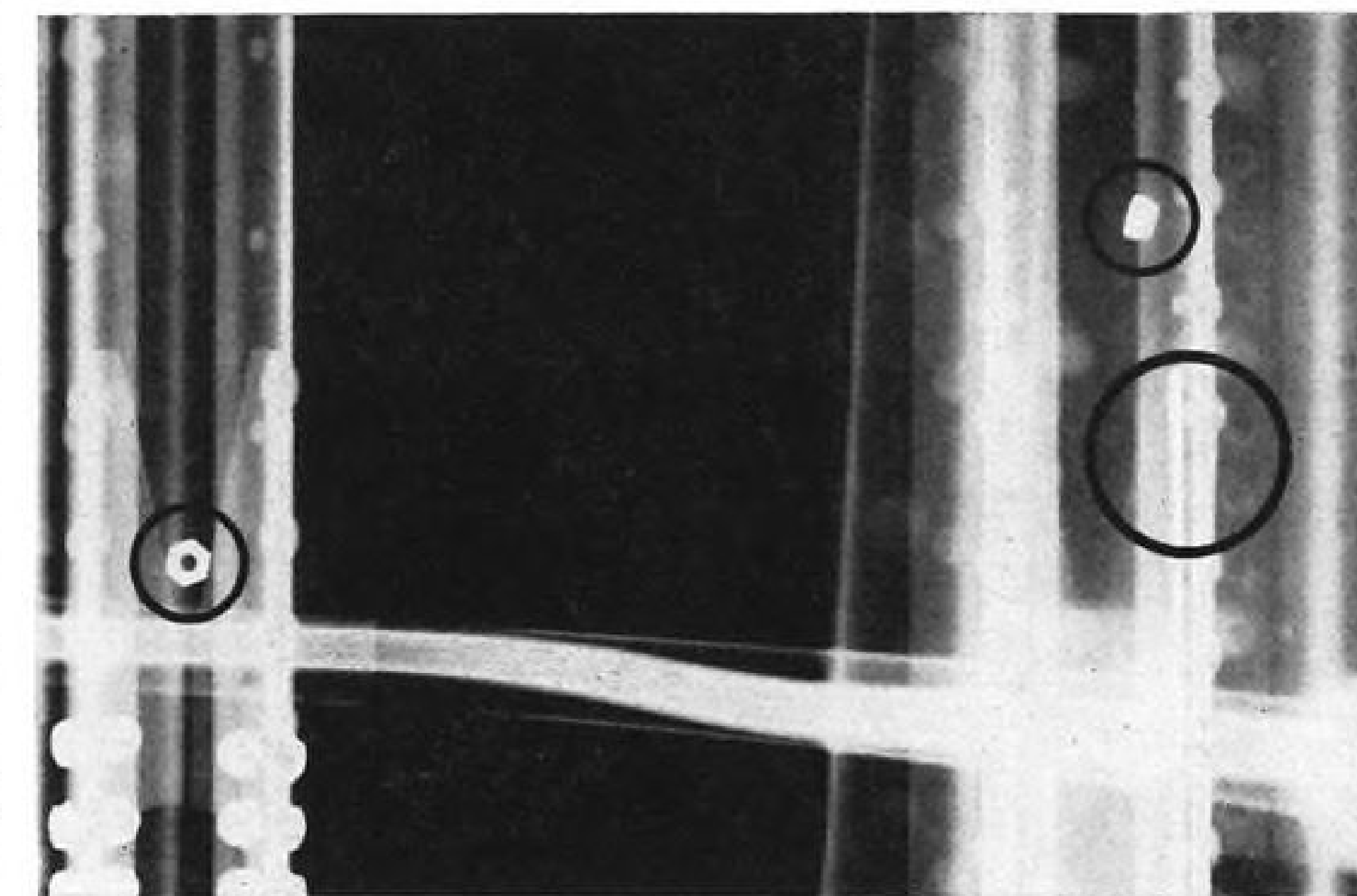
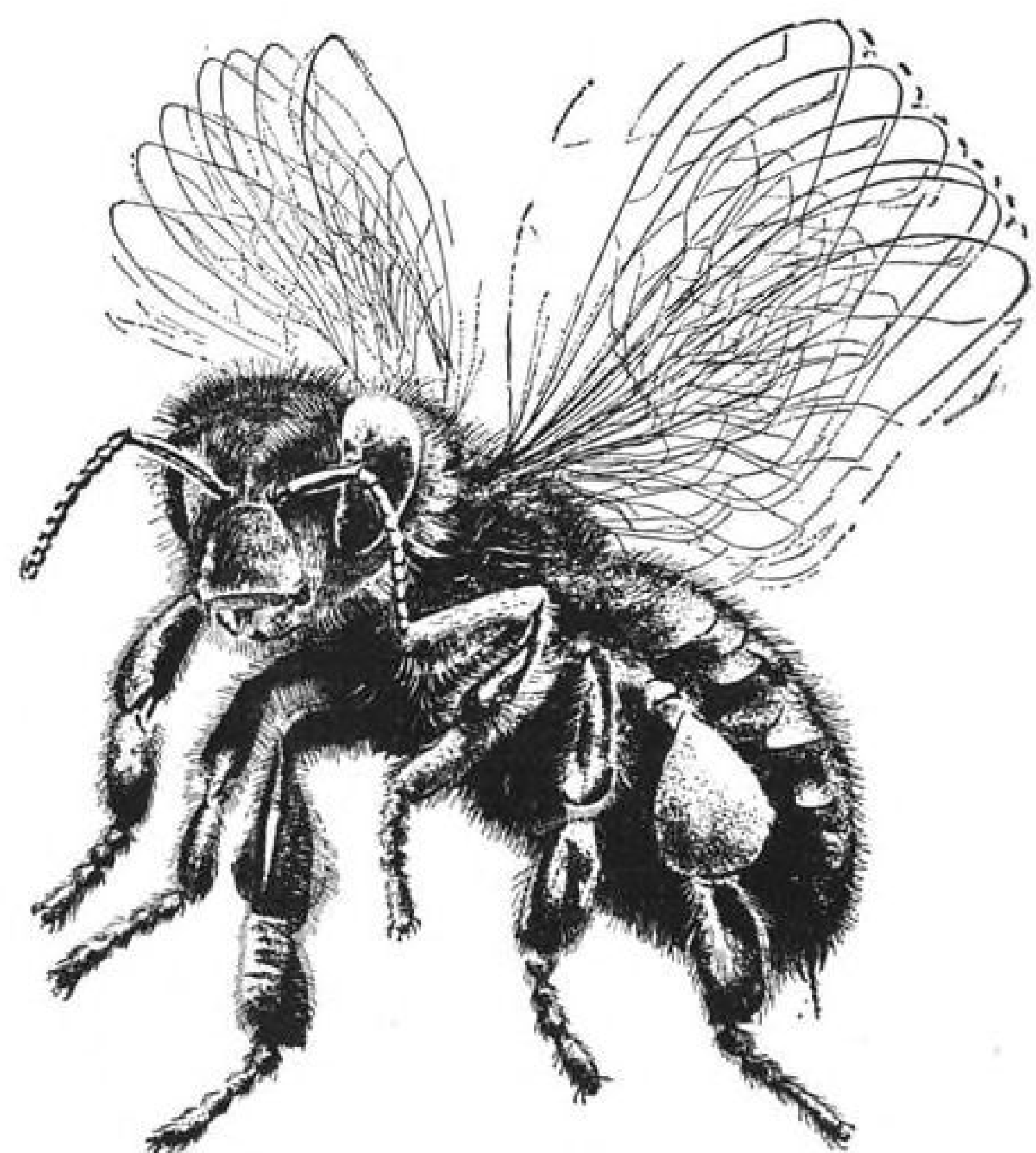


PHOTO TAKEN by Delta Air Lines shows unriveted wing doubler plate (large circle) and two errant nuts (smaller circles).



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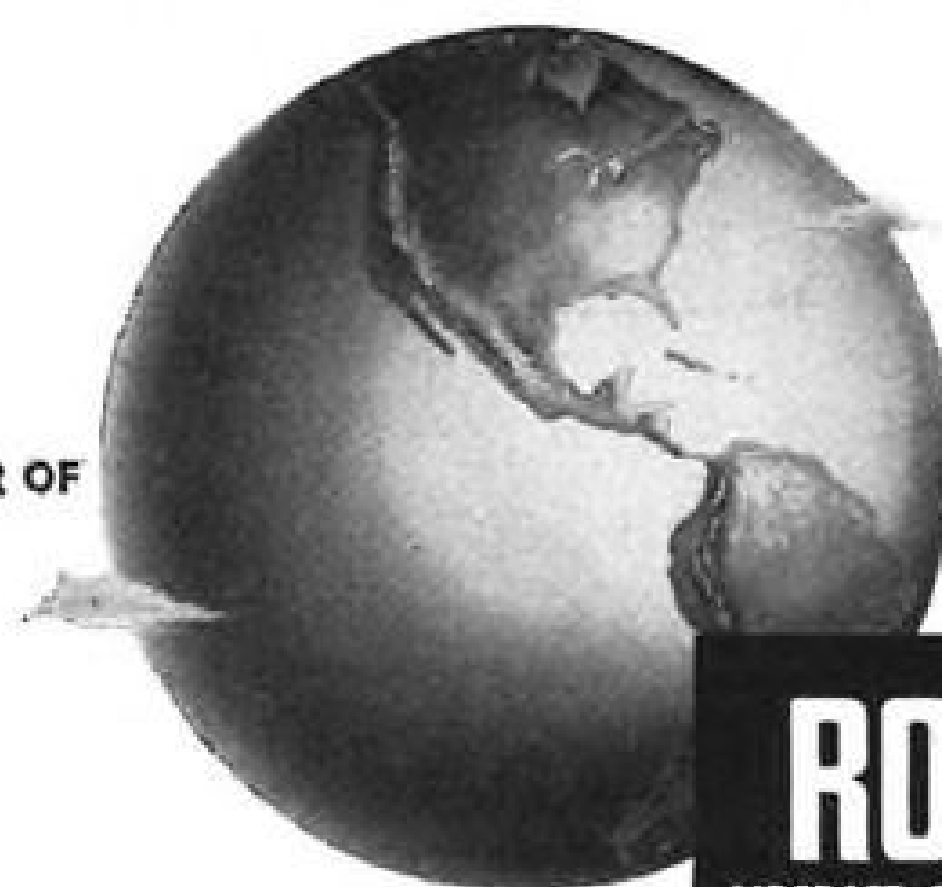
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J. L. HobeI, Industrial Relations Manager, Rohr Aircraft Corporation, Chula Vista, California, Dept. 29

WORLD'S LARGEST PRODUCER OF



READY-TO-INSTALL POW-R-PAX FOR AIRPLANES

ROHR
AIRCRAFT CORPORATION

ment is planned with the installation of MOB's own X-ray unit," the company said. "In addition to greater use on aircraft structure, certain units, such as oil tanks and B-377 nose gear cylinder assemblies will be checked by X-ray."

Image Intensifier

Norelco technicians believe that airlines can reduce substantially the time and cost of X-ray inspection by using an image intensifier. The fluoroscopic device can be moved along an aircraft's structure, allowing a technician to conduct a continuous, visual inspection of a large area instead of having to record a small section on film and waiting for it to be developed before being able to determine the integrity of the structure.

Fluoroscopic inspection saves time because of the continuous and rapid manner in which inspection can be accomplished. (A gage of the inspection speed possible with the intensifier was demonstrated by a manufacturer who was able to inspect $\frac{1}{2}$ in. welded steel pipe at a rate of 2 inches per second.)

Over and above the savings due to faster inspection and resultant reduction in man hours is an appreciable economy in film used and dark room time. With the intensifier, pictures need only be taken of areas where defects show up; all clean structure goes unphotographed. Also, possible interpretation errors due to improper exposure, or film development, are reduced.

A Norelco spokesman estimated that an intensifier could slice X-ray inspection cost about 65%. A shot that now costs about \$3 could be made with an intensifier for about \$1. The \$4,000 price of the unit would not take long to amortize since wing inspection alone of a DC-6-size plane requires about 60 exposures.

Clear Image

The intensifier's image is one thousand times brighter than images appearing on standard fluoroscopic screens, which allows the device to be used in average daylight. It produces a very clear image which makes it easy for an inspector to detect a structural flaw. By using a closed circuit television system, inspection can be accomplished remotely and all possible danger of radiation effects are eliminated.

A Norelco intensifier weighs 125 lb. and measures approximately 15x9x9 in. Several companies make similar devices.

A survey of several airlines and airframe manufacturers which use portable X-ray equipment for non-destructive inspection produced these comments:

• **United**—"We use our Norelco X-ray machine primarily for 'extraordinary' structural inspection of aircraft during overhaul. Primarily because of the X-ray equipment, the CAA and CAB extended the flying time between major

overhauls on the DC-6 and DC-6B from 1,600 to 2,000 hours."

The equipment is used primarily for wing spar inspection.

"Other components inspected by X-ray include:

"Fuel injection lines to determine whether the silver soldered joints are intact. (This single type of inspection resulted in a \$52,000 saving in one year.)

"Electrical plugs to determine their integrity without having to cut them.

"Welding inspection to determine the quality of the welding shop's work.

"A one-time X-ray inspection of the interior tail assemblies of our fleet of DC-4 and -6 aircraft took approximately 270 man hours and cost \$3,000 per plane. Without the X-ray equipment, it would have been necessary to remove the rudder, inspect the interior, re-install the rudder, and test-fly the plane at an estimated cost of 1,440 man hours and \$15,000. Saving was 1,170 man hours and \$12,000 per plane.

"In July, our fleet of 55 Convairs will undergo the same extraordinary inspection given to the DC-6-type aircraft."

• **American**—"We use X-ray equipment to inspect the following areas of our DC-6-type aircraft:

"Center section lower stringers through the fuselage in the bell crank and box beam compartment without removing stringer pressure shields at the junction with the fuselage.

"Fuselage frames and stringers in the propeller plane area without removing interior sidewall panels.

"Center section wingspar tangs for examination of skin attachment without having to remove the skin."

AA cites these examples of economy through use of X-ray in equipment:

"X-ray of the upper and lower front center spar caps, station 60 right and left of the center section without removing numbers 1 and 3 alternate fuel cells. Estimated savings is 80 man hours per plane.

"X-ray of station 122 and 175 right and left hand lower center section skin for cracks on DC-6Bs for a saving of about 80 man hours per plane.

"X-ray in the box beam and bell crank compartment without having to disassemble the area or remove the EC-801 sealant saves about 55 man hours.

"Use of X-ray inspection will grow. But its principal use will be as a checking device to pin-point defects revealed by other inspection methods, or in



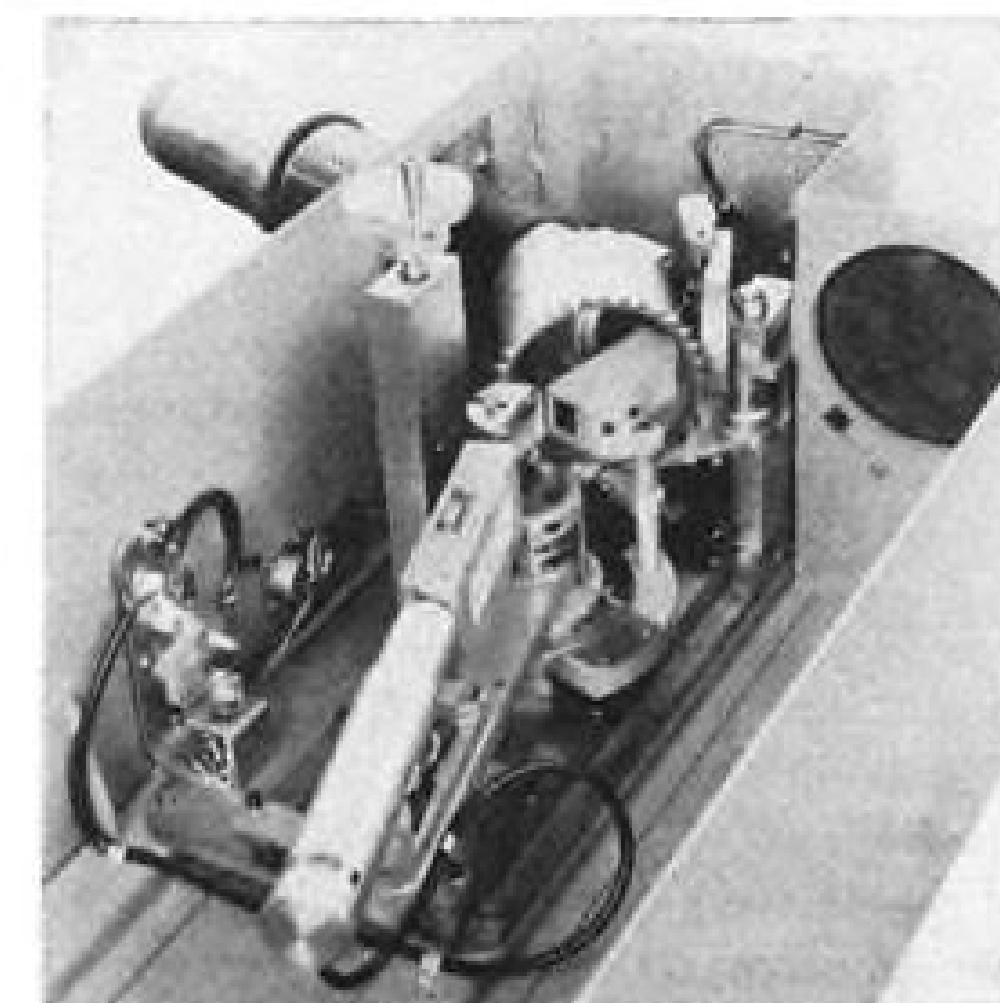
BALTOSPOT X-ray unit complete is easily carried to job by one man.



NOVELCO's MG 160-D wide field X-ray unit (left) and control (right).



FEDREX 160, 120 tubeheads with control.



X-RAY BEARING analyzer made by Norelco.

some cases to confirm or deny defects whose existence was indicated—but not conclusively—by prior examination.”

• **TWA**—“We use our Norelco X-ray machine to check the lower wing skin on Constellation aircraft from the front to the rear spar between wing station 191 to 205 and from station 131 to 145. One aim is to detect skin cracks which might be hidden under wing spar caps.

“While we have no specific cost figures, it is obvious to us that X-ray inspection results in a very considerable saving.

“Although we have no immediate plans to expand the use of X-ray inspection at this time, this technique will undoubtedly be used in wider applications in the future, particularly in the inspection of heavy engine parts.”

• **Delta**—“Among the most useful applications of X-ray inspection to an airframe is checking the condition of wing stringers in fuel cells without removing the access doors and destroying the fuel-tight seal.

“Other areas inspected by X-ray include: a number of places adjacent to fuselage doors, stringers and circumferentials in the propeller plane area, and heater ducts and ribs in the horizontal stabilizer. We also inspect ribs in the rudder of DC-7s to avoid removing the fabric.

“We have had several cases of cracks discovered by X-ray which could not be found visually. An example is an enclosed area doubler plate which had several rivets missing completely.

“Examples of man hour savings are: X-ray inspection of wing stringers at 1,500 hour intervals is accomplished in 16 man hours instead of the 138 previously required. Also, not having to remove fuel cells eliminates the possibility of damaging them.

“X-ray inspection of the propeller plane area can be accomplished in about 2 man hours instead of the 44 man hours previously needed to remove and reinstall lavatory equipment and inner lining.

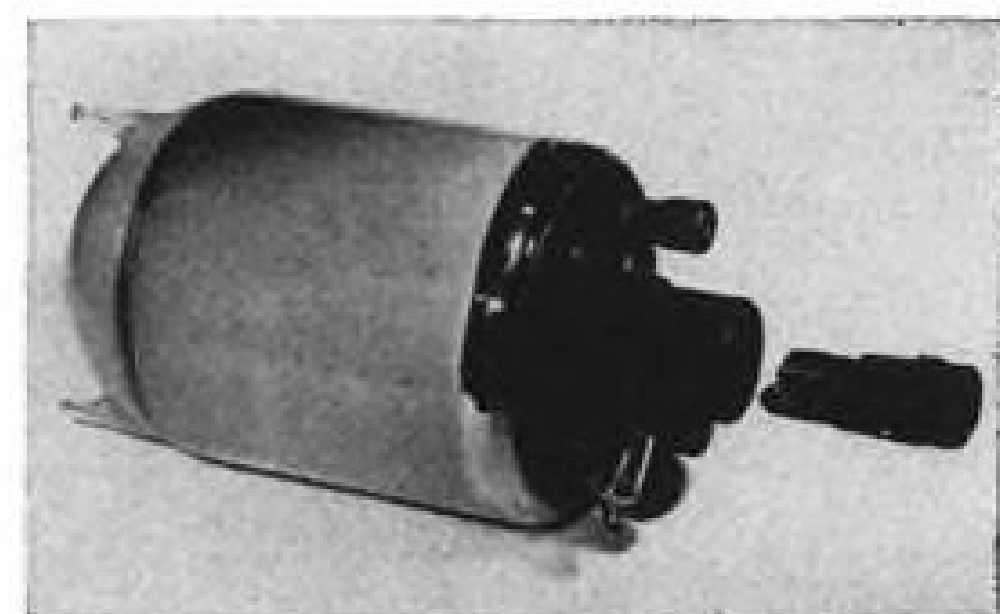


DIAGRAM (right) of image intensifier pictured at left. R—Fluoroscopic screen on which X-rays are received after passing through object to be examined O, and glass wall of tube. D—Support of fluoroscopic screen and photocathode. K. Fluorescent radiations produced in R release electrons from the photocathode K. Electronic image is reproduced on a reduced scale by electric field between K and perforated anode A, on viewing screen F1. This image is observed through a simple microscope, M. W is a conductive layer on the inside of the tube.

“We believe that X-ray inspection will become a ‘must’ with new aircraft. Example is the new type of stringer used on the DC-7 whose cap is riveted in place. X-raying is the only way of detecting cracks. New designs seem to have an increasing number of inclosed areas which make visual inspection impossible.”

• **Northwest**—“Our X-ray work has developed so rapidly as to become a vital factor in our entire inspection program, and we are considering setting up a separate X-ray inspection program for even greater use in routine inspections.

“Here is a summary of the various uses to which we have put our GE X-ray machines in one year:

“Inspection of internal surfaces of landing gear pistons for corrosion and metal failure.

“Inspection of propeller blades for flaws and to determine the condition of internal wiring.

“Check oil coolers for metal contamination (here X-ray cut the cost from \$40 to \$5 and extends the oil coolers’ life because they do not have to be disassembled so often).

“Inspect spot weld for corrosion.

“Check the condition of welds.

“Inspect an inaccessible structural component for evidence of incipient failure.”

• **National**—“Inspection of DC-6-type aircraft fuselage in the propeller plane area used to involve ripping out the entire toilet, fuselage lining and half the flooring—a 300 man hour job. X-ray inspection does a more accurate job than visual inspection in 5 man hours.

“The wing root area of the same aircraft is next to impossible to inspect visually and several hundred man hours are required to tear into the area. X-ray does it in 3 to 4 man hours.

“NAL will probably make a permanent X-ray installation to inspect overhauled engine parts.”

• **Braniff**—The carrier does very much the same type of X-ray inspection as the other airlines. Examples are: lower stringers in center section between sta-

tions 67 and 421, and between front and center spars (DC-6); lower skin and stringer inspection from station 125 to station 200 (049 Constellation); and check main landing gear side braces, which otherwise would have to be removed and magnafluxed (C-46).

Braniff cites this typical man hour saving attributable to the use of X-ray (the example refers to the DC-6 wing center section inspection just mentioned):

For visual inspection:
Open and Close Inspection Plates
(4 men at 6 hours each)

24 man hours
Inspection (2 Inspectors at 8 hours each)16 man hours

TOTAL40 man hours

For X-Ray Inspection:

X-Ray of the Area... 8 man hours

Film Development... 2 man hours

Film Interpretation . 4 man hours

TOTAL14 man hours

Savings attributable to X-ray: 26 man hours.

Here is a sampling of airframe makers’ opinions of X-ray inspection:

• **Douglas**—The use of X-ray inspection is growing on two fronts at DAC. The company is continually expanding the use of X-ray inspection on its production line, and it is underwriting the device as a useful tool in the inspection of the hundreds of Douglas airliners in service throughout the world.

In the factory, Douglas spokesmen believe that the next big advance in X-ray techniques will be the introduction of Lumicon (made by Bendix freeze) or similar image intensifying devices used with closed circuit television. Among the many advantages of such a system is the possibility of observing the internal functioning of components in actual operation.

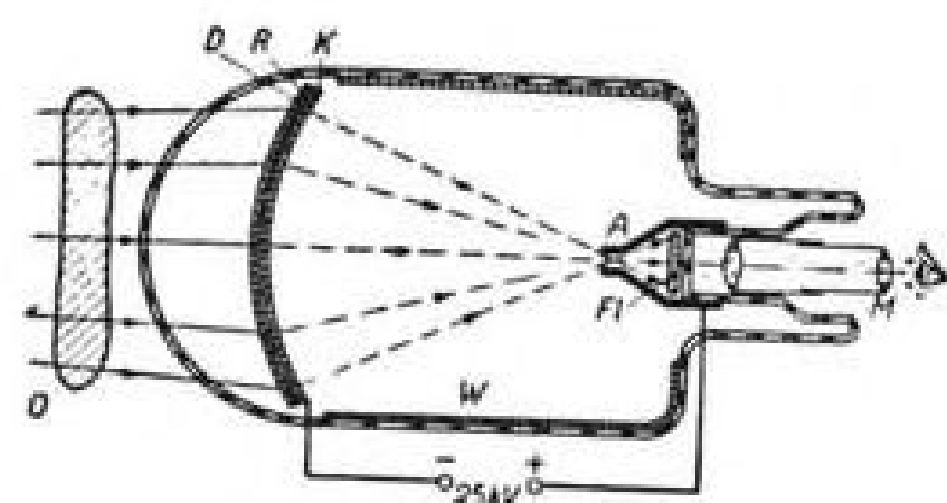
On the commercial transport side, Douglas inspection research personnel, headed by W. C. Hitt, have been developing techniques for taking and interpreting X-ray photos of aircraft structures for the purpose of inspection without disassembly.

The research team has not yet arrived at a standardized procedure to be used with aircraft in service.

However, Douglas personnel have developed inspection criteria with laboratory specimens and now want to check these with service aircraft to enable them to prepare an X-ray inspection manual. Data for the manual are currently being compiled. So a team of Douglas Service Department men are now in the field working with airlines to accumulate the data, using techniques developed in company’s lab.

Douglas has approached all airlines using its equipment, asking them to cooperate.

• **Boeing**—The company recently evalu-



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RADAR SYSTEMS

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ated a Norelco Mfg. 150 X-ray machine as applied to inspection of certain components of its Bomarc guided missile. Here is a summary of the evaluation:

The rod anode may be placed inside a pressure vessel component, allowing radiographic inspection of the entire girth weld in a single exposure. This decreases exposure setup time 80% since a single, continuous strip of 70 mm. film may be wrapped around the outside of the vessel. Also, quantity of film used is cut 50% over the previously used method which involved taking eight separate exposures of a girth weld from outside the assembly with the film on the inside.

Another application of the X-ray machine is to survey non-structural castings for foundry control. By suspending the tube vertically, so the cone of radiation will be along a horizontal plane, many castings may be placed in a circle around the anode and inspected simultaneously. A considerable time saving can result.

In a further test, the rod anode was placed inside a nine inch diameter aluminum casting and the film wrapped around the outside. Results were radiographs acceptable for foundry control yet exposure time was reduced 75% and quantity of film used was cut in half.

The report concludes that, on

Bomarc fuel vessels alone, savings per missile amount to \$44.10 and 4,676 square inches of X-ray film, which costs about \$18.

• **Lockheed**—LAC thinks that X-ray inspection is most useful to look for fatigue failures in highly stressed areas of high-time aircraft.

Example of cost saving at Lockheed: formerly, it cost \$5,000 to remove a Constellation's wing and inspect it. Using X-ray equipment, the job cost but \$1,500.

Lockheed technicians anticipate greater use of X-ray equipment and techniques.

Expansion of X-ray inspections into military operations is indicated by a special X-ray inspection course recently conducted by GE for the USAF at Hill Air Force Base, Ogden, Utah. Representatives from every Air Materiel Area, except San Bernadino, were present to take the two weeks course.

Here are summaries of the two airline X-ray symposiums held in Copenhagen, under the auspices of the Carl Drenck X-ray Laboratories and in Highland Park, Ill., under the sponsorship of ATA and GE.

Copenhagen Meeting:

• **Inspection Equipment Co., London.** It is in day-to-day routine inspection that radiology makes its most important contribution to reducing the cost of keeping airplanes flying.

An essential requirement is a centralized "information agency" to act as a clearing house for all matters pertaining to X-ray inspection of aircraft.

The process of accumulating techniques is . . . the most expensive part of radiography. In Europe, inspection of aircraft in service is now at this stage. In America, a number of airlines have already reduced at least part of their radiography to routine procedures.

Douglas and Lockheed have been of considerable help.

X-ray inspection already has made a contribution to the reduction of maintenance costs—but it could make a much more serious contribution.

• **Scandinavian Airlines.** The company stated that its experience was limited. In its first experimental shots on DC-4 and -6 structure, the carrier encountered three problems. The airline stated:

"How can one obtain a radiograph of even density when the area being X-rayed varies considerably in thickness?

"How can you be sure that all the cracks will be shown on the radiographs?

"How can all false indications be eliminated?

"These problems have to be solved to make radiography of aircraft structure 100% reliable," the airline said.

• **Kodak Ltd., London** for best definition, the size of the source of radiation should be as small as possible; the dis-



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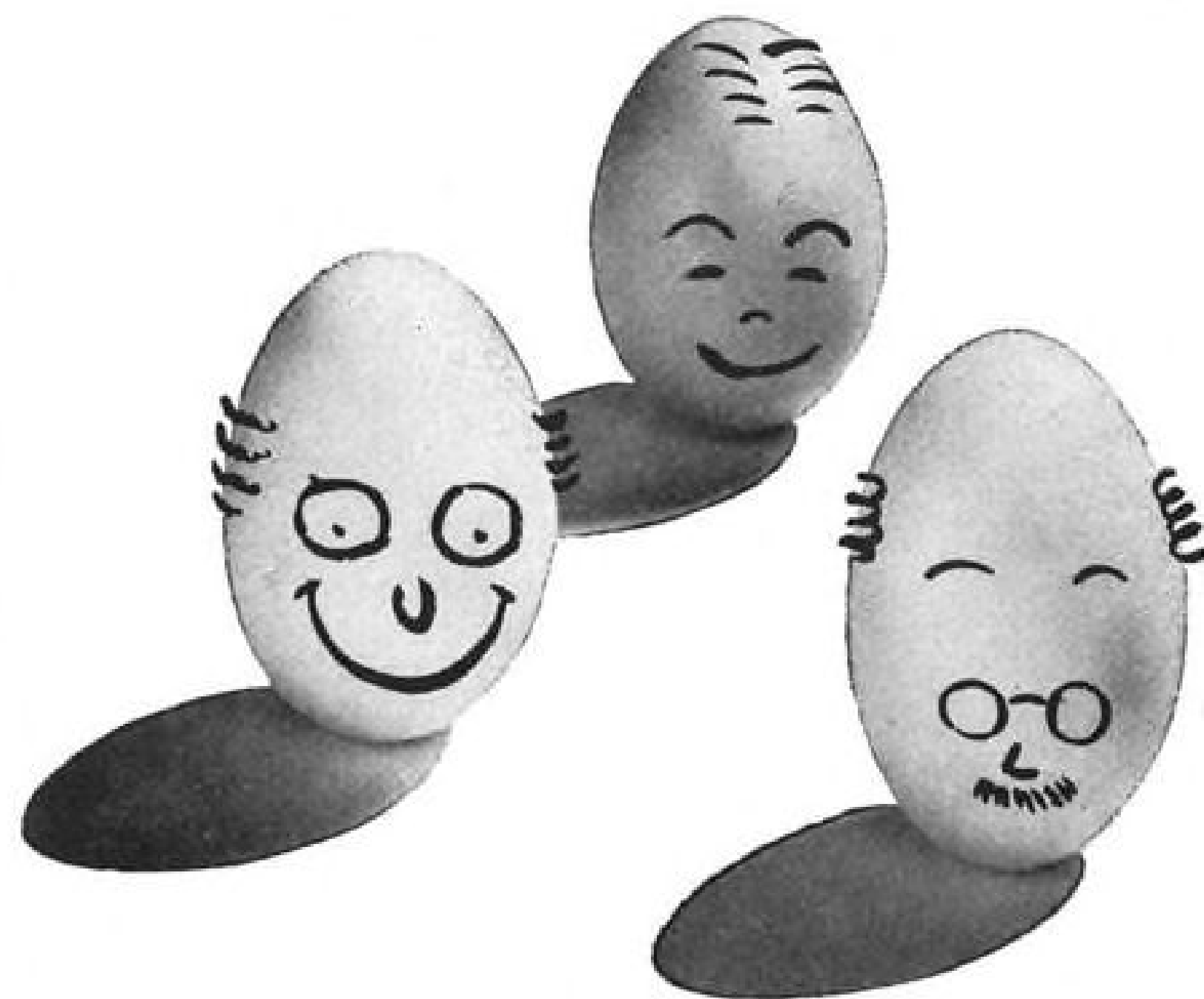
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tance between the object and the film should be as small as possible; and the distance between the source and object should be as great as possible.

Image contrast depends on the film used and on the quality of the radiation.

The Kodak representative warned, "in reading an X-ray film, it must be realized that images may arise from (1) surface marks on the job such as innocent scratches in the paint; (2) bona fide internal defects such as cracks; (3) faults in storing, handling, exposing, processing, or drying the film. If any doubt exists about the image, the shot should be repeated.

"When establishing the significance of the information provided by radiography, it is desirable to note the limitations of the method.

"No useful information is obtainable at all if radiation fails to penetrate the structure. And the absence of the image of a crack on the film must not be taken as evidence that no cracks are present. Cracks will be revealed only if the direction of the X-rays approximately coincides with the plane of the crack.

"Fortunately, cracks rarely follow the same plane so there is a fair possibility of detecting them."

Other representatives made comments which, generally, reflected the opinions expressed by American carriers.

• General Electric. Dr. E. Dale Trout, consulting radiation physicist for GE X-Ray, warned, "The biggest mistake a company can make is to buy an X-ray machine by the pound. Light weight may be easy to handle, but may also indicate a lack of adequate protection from radiation.

"Another mistake is to depend on a conventional Geiger counter to measure radiation.

"A third mistake is failing to consider the 'wave dependence' of the instrument used for measurement. It should be calibrated to read in milliroentgens-per-hour at the wave length with which you are X-raying.

"The best and cheapest protection from radiation is distance."

Dr. Trout warned the symposium of "the urgent need to establish consistent standards for radiation protection in the use of industrial X-ray." He added:

"Unfortunately, industrial users have never established a set of standards for what the permissible leakage of X-rays may be in the vicinity of the machine.

"There is also a lack of understanding as to the behavior of radiation, the inverse square law, the distribution of X-rays around the exit port and behind the machine, and the many other factors which must be considered before one can say that an installation is safe or unsafe."

He urged that a uniform set of

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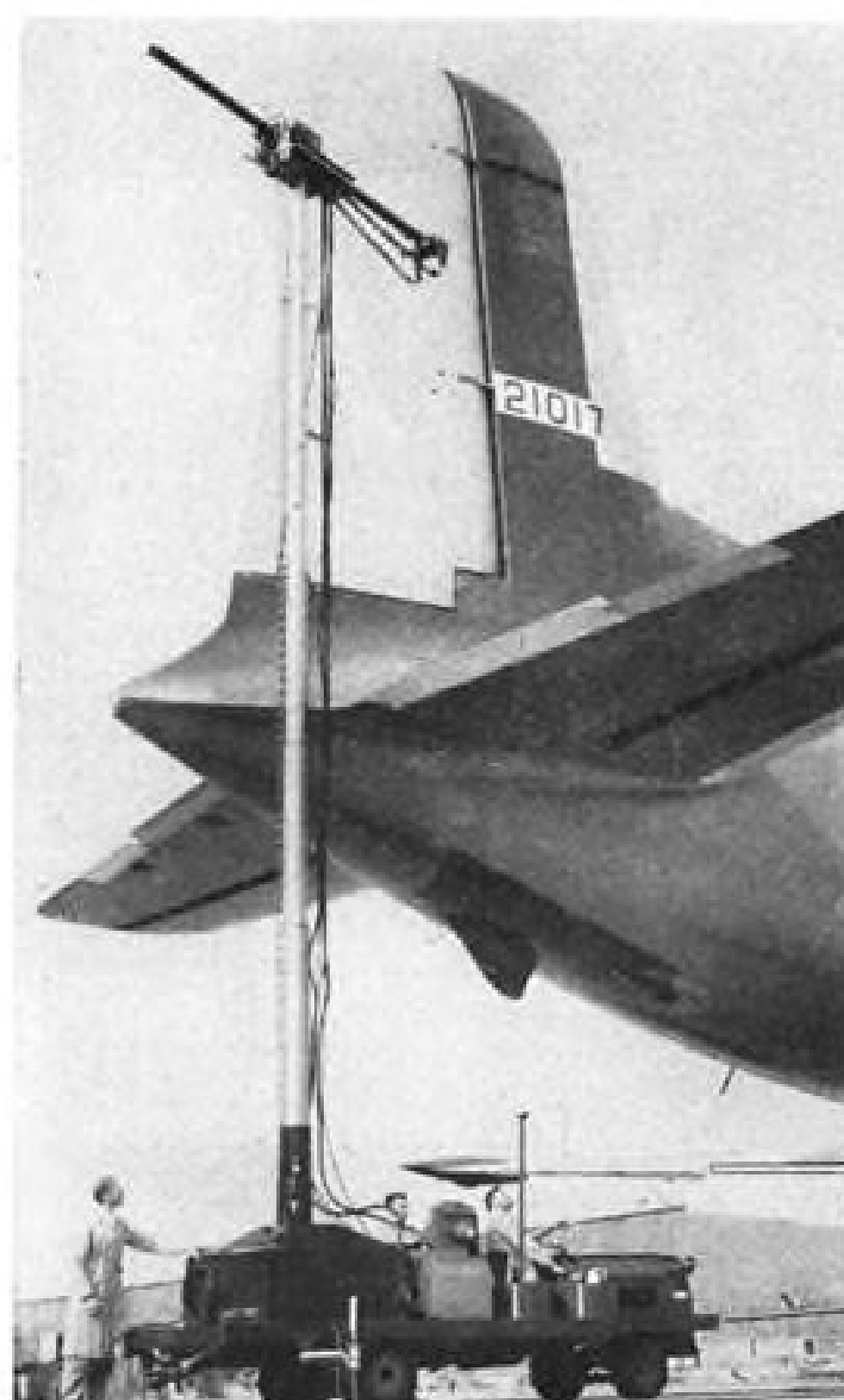
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Tall X-Ray Rig

Douglas designed this mobile X-ray unit to perform non-destructive inspection on its B-66 and C-133 aircraft (although here it is shown beside the tail of a C-124).

The mobile X-ray unit will be used for production inspection. On each B (or RB) -66, 178 closed area X-ray shots are made.

With the new rig, three men in six hours can do the work which formerly required five or six men up to 12 hours to accomplish.

The truck mounts a hydraulically-operated telescoping mast which carries a 160 kv. portable X-ray machine. Operated from a control panel on the truck, the mast can be raised to a maximum height of 40 ft. The adjustable boom atop the mast extends ten feet and can be rotated 360 deg. to give complete accessibility to any section of the airplane.

standards be established for all manufacturers to follow.

• Northwest Orient Airlines. Dr. J. J. (Doc) Harrington, superintendent of service engineering, presented many case histories in which the use of X-ray prevented disaster, reduced overhaul time, and minimized ground time.

He told the meeting that "while most X-ray work is now done at our central overhaul base, in the future 75% will probably be done at line stations to which we will pass on the know-how we are now accumulating.

"While we are only in the early stages of X-ray use, we already foresee extensive use of this method and expect to save many man hours in the future."

The services of the many G-E X-ray specialists throughout the U.S. and Canada were offered to the airlines to help them get the most out of their X-ray equipment.

As a result of the meeting, a steering committee is being organized by Allan W. Dallas, ATA's director of the Engineering Division to accomplish the aims:

- Gather, sift and disseminate information on the use of X-ray in the airline industry;
- Serve as a mutual exchange point for information among the airlines;
- Sponsor future periods meeting on the same subject.

Dallas said that "both public safety and profitable airline operation require that we give greater emphasis than ever before to the use of X-ray and other non-destructive testing methods . . . with the advent of portable X-ray equipment, airlines can effectively use the machines in hitherto inaccessible areas without disassembling aircraft structures."

OFF THE LINE

A \$200,000 contract for 4-million new-type, one-piece life-jacket inflation cylinders has been awarded to Worcester Pressed Steel Co. by the Navy. The cylinders, which are 1 1/4 in. in dia. and 4 1/4 in. long, are deep-drawn from a flat blank.

New dust binder which can hold down dust effectively at air fields and other open areas has been put on the market by Golden Bear Oil Co. The company reports the product is used at Edwards Air Force Base, Calif. The manufacturer says the binder is less expensive than frequent waterings, is not harmful to newly seeded areas and does not sterilize the soil. Address: Chemical Div., Golden Bear Oil Co., P.O. Box #446, Oildale, Calif.

A price increase of 7 1/2% became effective Aug. 1 on all General Electric fractional hp., d.c. motors and generating equipment and on two lines of fractional hp. a.c. motors.

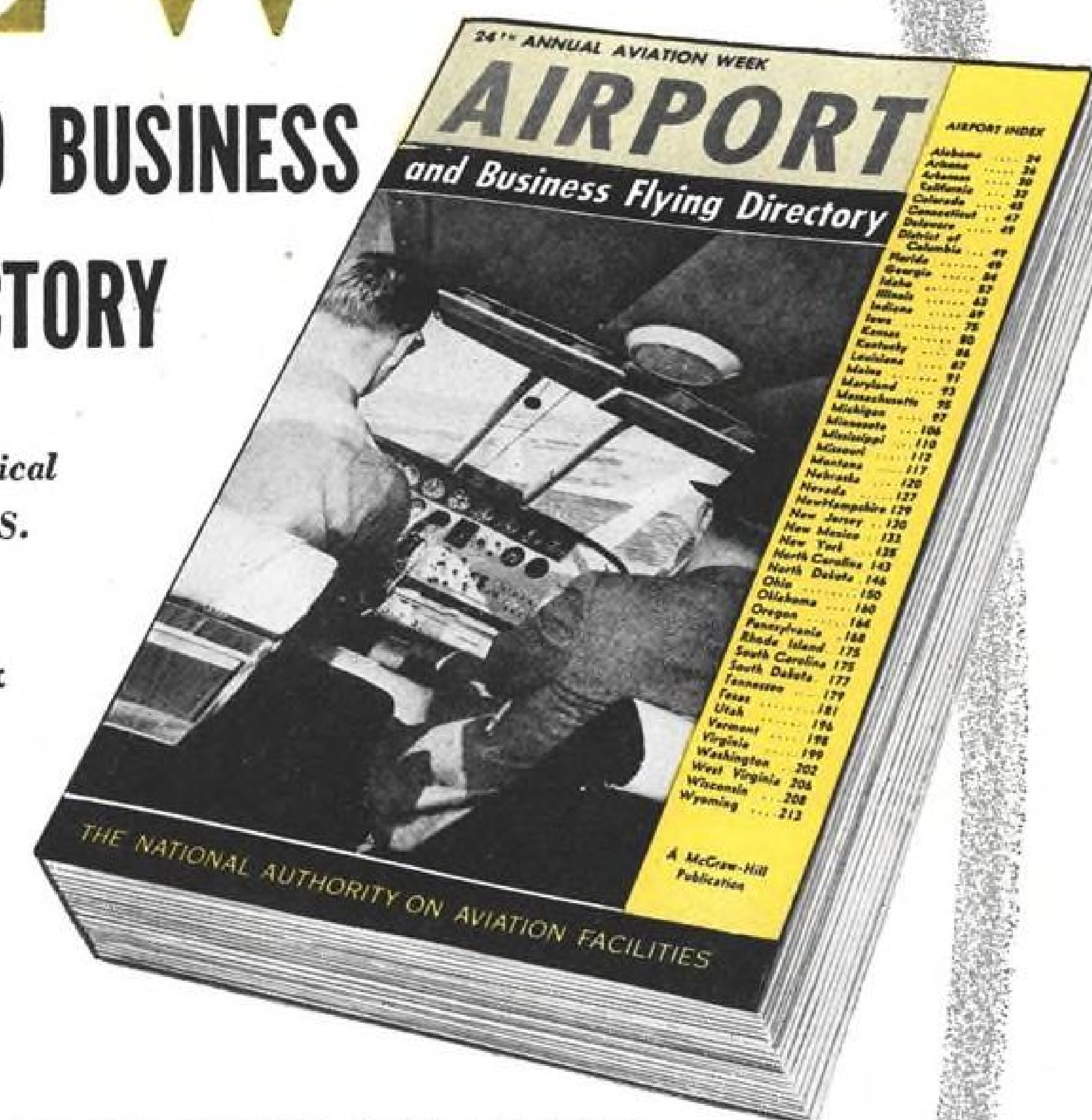
A new, high energy missile and aircraft chemical fuel will be produced for the Air Force by Olin Mathieson Chemical Corp. in a \$36-million plant to be erected at the Lake Ontario Ordnance Works, Model City, N. Y. A second, smaller plant will be built in the same location (just north of Niagara Falls) to produce the same fuel for the Navy. The new facilities will be operated by the corporation's recently formed Aviation division.

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USAF Contracts

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

DAYTON AIR FORCE DEPOT, Gentile Air Force Station, Dayton 10, Ohio.

The Garrett Corporation, (AirResearch Mfg. Co. Div.), 9951 Sepulveda Blvd., Los Angeles 45, Cal., repair, overhaul and modify controls, thermostatic (PR GE-688336), 1660 ea., \$167,717.

R. & H. Instrument Co., Inc., 3479 W. Vickery Blvd., Fort Worth, Tex., testers-jet engine thermocouple contr. P/N 112-G-12, 30 ea., testers-jet engine thermocouple contr. P/N 112-G-25T6, 30 ea., testers-sub-assembly jet engine contr. P/N L12G5, 63 ea., testers-jet engine thermocouple contr. P/N 112G8, 13 ea., testers-jet engine thermocouple contr. P/N 112C4TL, 50 ea., probe assembly temp. contr. P/N 372, 48 ea., modification kit, contractor's P/N 120, 48 ea., heater probe-contractor's P/N 376, 100 ea., handbook data in a/w table VI, testers-jet engine thermocouple contr. P/N 112G-4T1T7, 10 ea., handbook data, van dyke reproducibles of contractor's commercial dwgs. and 6 sets of non-reproducible cys., (RFP 33-604-56-2306), \$537,708.

Televiso Corp., 1415 Golf Rd., Des Plaines, Ill., turntable-instrument testing, type MA-1 in a/w MIL Spec. MIL-T-9026 (USAF) dtd. 2 June, 53 and amdt. no. 1 dtd. 9 June 54, 99 ea., engrg. data, maintenance data, (RFP 33-604-56-2161), \$42,938.

Sylvania Electric Products, Inc., 1740 Broadway, New York 19, N. Y., tube-electron, receiving pentode JAN type 28DTW in a/w spec. MIL-E-1C dtd. 3 Oct. 55, suppl. 1A dtd. 26 Oct. 55 and individual spec. sheet MIL-E-1/74 dtd. 5 Feb. 53, 30,000 ea., (PR 633615), \$130,500.

Eitel-McCullough, Inc., 798 San Mateo Ave., San Bruno, Cal., tube-electron transmitting tetrode JAN type 4X150A in a/w spec. MIL-E-1B dtd. 2 May 52, amdt. no. 3 dtd. 12 Nov. 53, suppl. no. 1Z dtd. 23 Aug. 55 and individual spec. sheet MIL-E-1/160B dtd. 17 Dec. 54, 8,000 ea., (IFB 33-604-56-211), \$159,920.

Eitel-McCullough, Inc., 798 San Mateo Ave., San Bruno, Cal., tube-electron transmitting triode type JAN 2C39A a/w spec. MIL-E-1B dtd. 2 May 52, madt. no. 3 thereto dtd. 12 Nov. 53, suppl. no. 1Z dtd. 23 Aug. 55 and individual spec. sheet MIL-E-1/546A dtd. 13 Aug. 54, 28,000 ea., (IFB 33-604-56-212), \$331,520.

Broadway Maintenance Corp., 22-09 Bridge Plaza North, Long Island City 1, N. Y., rectifier assy-metallic selenium Broadway Maintenance Corp., 00042, 50 ea., (RFP 33-604-56-2812), \$46,850.

Leach Corp., Leach Relay Co., Div., 5915 Avalon Blvd., Los Angeles 3, Cal., relay assembly, Leach Relay 9043, 500 ea., (RFP 33-604-56-2476), \$74,350.

The Narda Mfg. Corp., 160 Herricks Rd., Mineola, N. Y., impedance measuring test set AN/USM-14 in a/w spec. MIL-L-4929 (USAF) dtd. 30 Nov. 54, 94 ea., maintenance handbook data, engrg. data, (IFB 33-604-56-153), \$38,590.

Scintilla Div., Bendix Aviation Corp., Sherman Ave., Sidney, N. Y., switch-assy, 1 push-pull, 1 rotary R and 1 rotary L switch, scintilla P/N 10-29055-1, 1,000 ea., (RFP 33-604-56-3346), \$38,960.

Technology Instrument Corp., 531 Main St., Acton, Mass., resistors variable linear prec. WW, various quantities, 9 items, (RFP 33-604-56-2276), \$41,035.

Electrical Specialties Co., 729 Washington St., Dayton 7, Ohio, resistors-variable composition, var. quantities, 20 items, \$25,063, (RFP 33-604-56-2212).

Projects Unlimited, Inc., 1926 E. Sieben-thaler Ave., Dayton 4, Ohio, mockup flight director system (mockup zero reader system) Sperry model 1000025, 31 ea., engineering data, basic handbook data, (RFP 33-604-57-2725), \$43,263.

Herbach & Rademan, Inc., 1204 Arch St., Philadelphia 7, Pa., capacitor-variable air fairchild P/Dwg EA24AB1 Bendix P/Dwg N219042, 1,600 ea., capacitor metallized paper tube P/N TK-4003, 600 ea., capacitor-fixed paper national no. G4300, 700 ea., capacitor-fixed paper 1,600 VDCW national no. 164GL16, 700 ea., (RFP 33-604-56-2424), \$32,148.

Bird Electronic Corp., 1800 E. 38th St., Cleveland 14, Ohio, wattmeter-triple scale for use with continuous wave amplitude modulation Bird Electronic Corp., model 67, 30 ea., watt-meter, portable RF type, Bird Electronic model 43, 201 ea., data for items 1 and 2 (RFP 33-604-56-2622), \$32,432.

Cutler-Hammer, Inc., 410 W. First St., Dayton 2, Ohio, relay-solenoid P/N AN3353-2 a/w ANA std. AN3353 dtd. 15 Nov. 55 and MIL spec. MIL-R-6106B (ASG) dtd. 20 Sept. 55 and sup. 1A dtd. 20 Sept. 55, 3185 ea., relay-solenoid, P/N AN3381-2 a/w AFNA std. AN 3381 dtd. 5 July 55 and MIL spec. MIL-R-6106B (ASG) sup. 1A dtd. 20 Sept. 55, 2,000 ea., relay-solenoid, P/N AN 3352-1 a/w ANA std. AN3352 dtd. 25 May 55 and mil spec MIL-R-6106B (ASG) sup. 1A dtd. 20 Sept. 55, 2,000 ea., relay-solenoid, P/N AN3391-2B a/w AFNA std. AN3391 dtd. 7 Aug. 53 and mil. spec. MIL-R-6106B (ASG) dtd. 20 Sept. 55 and sup. 1A dtd. 20 Sept. 55, 2,500 ea., relay-solenoid, P/N AN3381-1 a/w AFNA std. AN3381 dtd. 5 July 55 and mil. spec. MIL-R-6106B (ASG) sup. 1A dtd. 20 Sept. 55, 7,430 ea., (IFB 33-604-57-109), \$252,290.

Piqua Engrg. Co., Inc., South and College Sts., Piqua, Ohio, relay-solenoid nonpile up type piqua eng. P/N A132, 2842 ea., (IFB 33-604-56-109), \$27,993.

U. S. Relay Co., 1744 Albion St., Los Angeles 31, Cal., relay-solenoid P/N AN3370 dtd. 22 June 55 and mil. spec. MIL-R-6106B (ASG) sup. 1A dtd. 20 Sept. 55, 700 ea., relay-solenoid, P/N AN3371-1 a/w AFNA std. AN3371 dtd. 5 July 55 and mil. spec. MIL-R-6106B (ASG) sup. 1A dtd. 20 Sept. 55, 4,000 ea., relay, armature P/N AN3306-1 a/w AFNA std. AN3306 dtd. 17 Nov. 54 and mil. spec. MIL-R-6106B (ASG) sup. 1A dtd. 20 Sept. 55, 36 ea., (IFB 33-604-56-109), \$67,340.

MEMPHIS AIR FORCE DEPOT, Mallory Air Force Station, 3300 Jackson Ave., Memphis 2, Tenn.

Continental Motors Corporation, 205 Market St., Muskegon, Mich., spare parts, Contract No. AF 40(604)6474, 10290 ea., \$160,733.

Norma-Hoffman Bearings Corporation, Hamilton Ave., Stamford, Conn., bearings, RFP 40-604-57-181, 16000 ea., \$198,400.

SKF Industries Inc., Front Street at Erie Ave., Philadelphia, Pa., bearings, RFP 40-604-56-181, 25,000 ea., \$43,875.

SKF Industries, Inc., Front Street at Erie Ave., Philadelphia, Pa., bearings, RFP 40-604-57-182, 20000 ea., \$35,100.

General Motors Corporation, New Departure Division, Bristol, Conn., bearings, RFP 40-604-57-182, 19800 ea., \$189,030.

TOPEKA AIR FORCE STATION, Topeka, Kan.

Carbide & Carbon Chemicals Co., Division of Union Carbide & Carbon Corp., 30 East 42nd St., New York, N. Y., alcohol, 130000 gal., \$32,500.

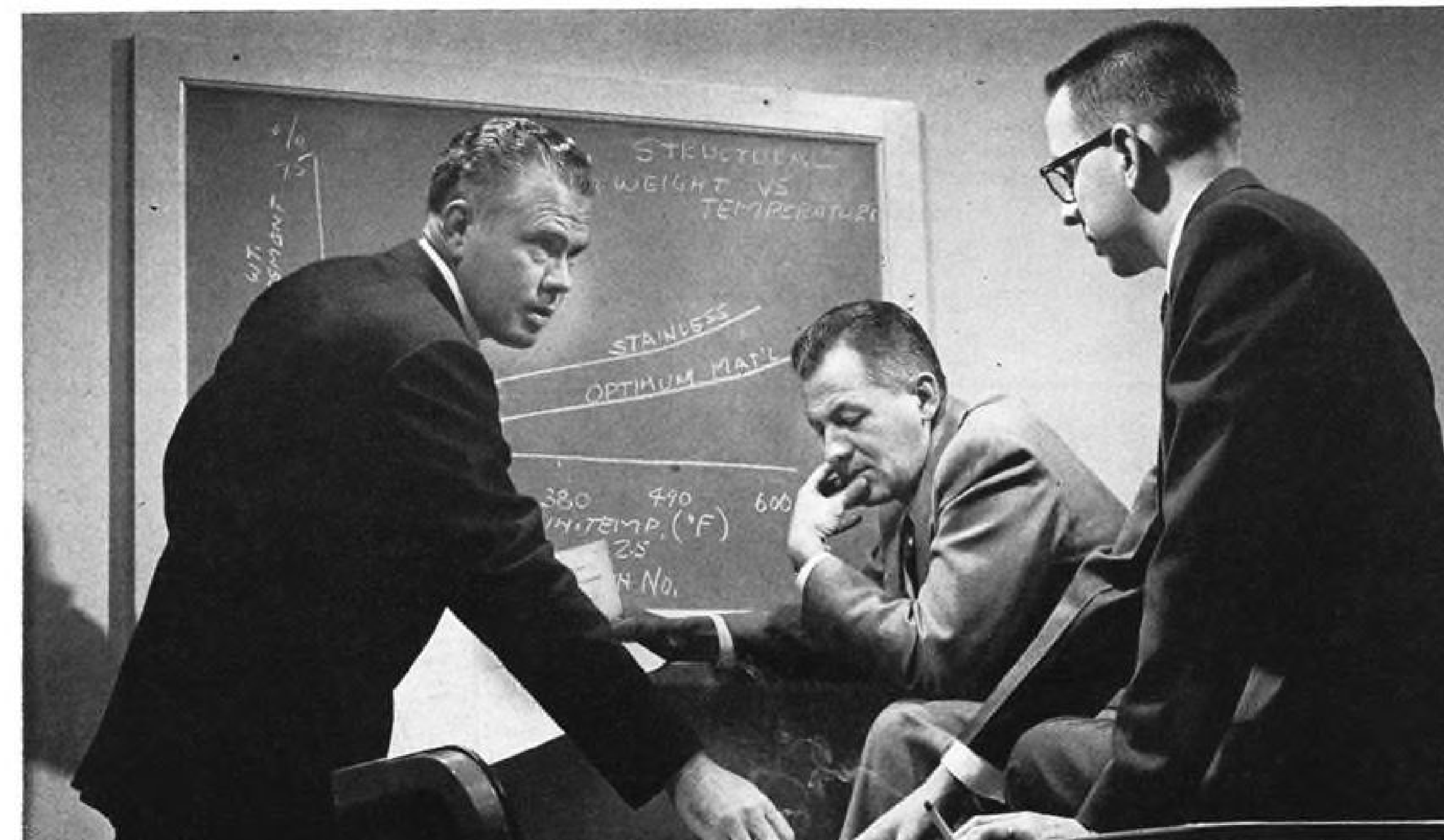
Pyrene-C-O-Two Corp., U. S. Highway No. 1, Newark, N. J., charges, fire extinguisher, 483505 gal., \$47,2914.

United States Rubber Co., 1 Market Street, Passaic, N. J., synthetic cement, 40308 ea., \$25,394.

Metal Hose and Tubing Co., P. O. Box 151, Dover, N. J., rubber hose assembly, 1500 ea., \$132,000.

Geo. Rinner Construction Co. Inc., 4th and North Lane Street, Topeka, Kans., construct instrument landing approach system, job, \$97,196.

EXT AIR FORCE BASE, Colorado Springs, Unistrut Products Company, 1015 West Washington Blvd., Chicago 7, Ill., rack, storage, pallet type 2.75 rockets, 3920 ea (IFB 05-603-56-44), \$458,091.



to weight engineers

who seek preliminary design assignments

A. C. Robinson (left), weight group engineer in charge of research and development, discusses new solutions to problems involving effect of aerodynamic heating on structural weight with L. T. Maynard (center), Structures Division administrator, and Weight Engineer W. L. Weber.

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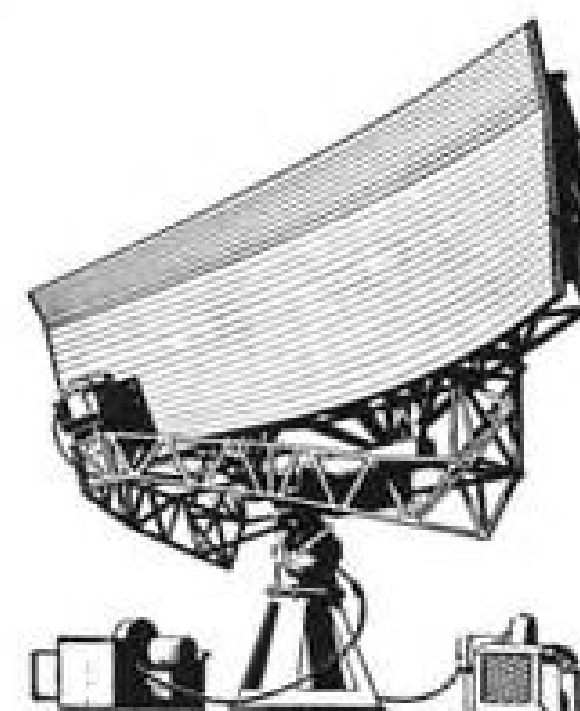
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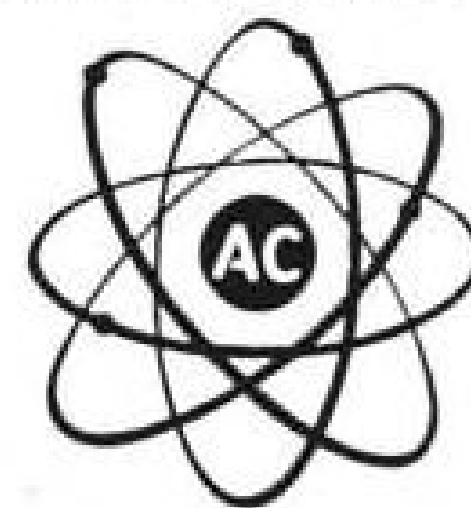
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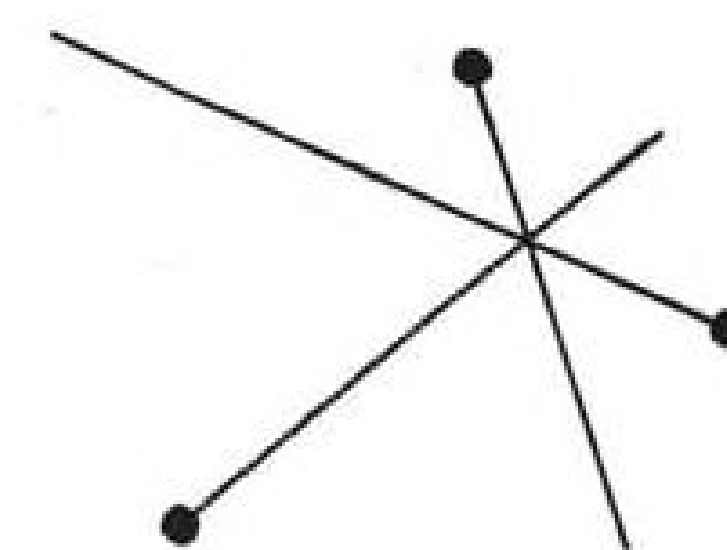
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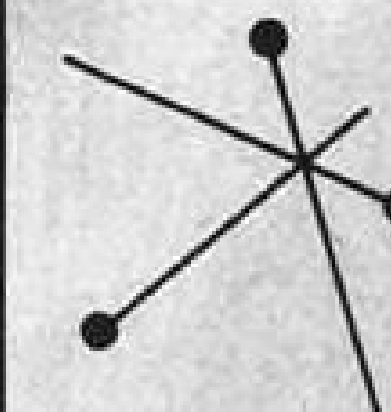


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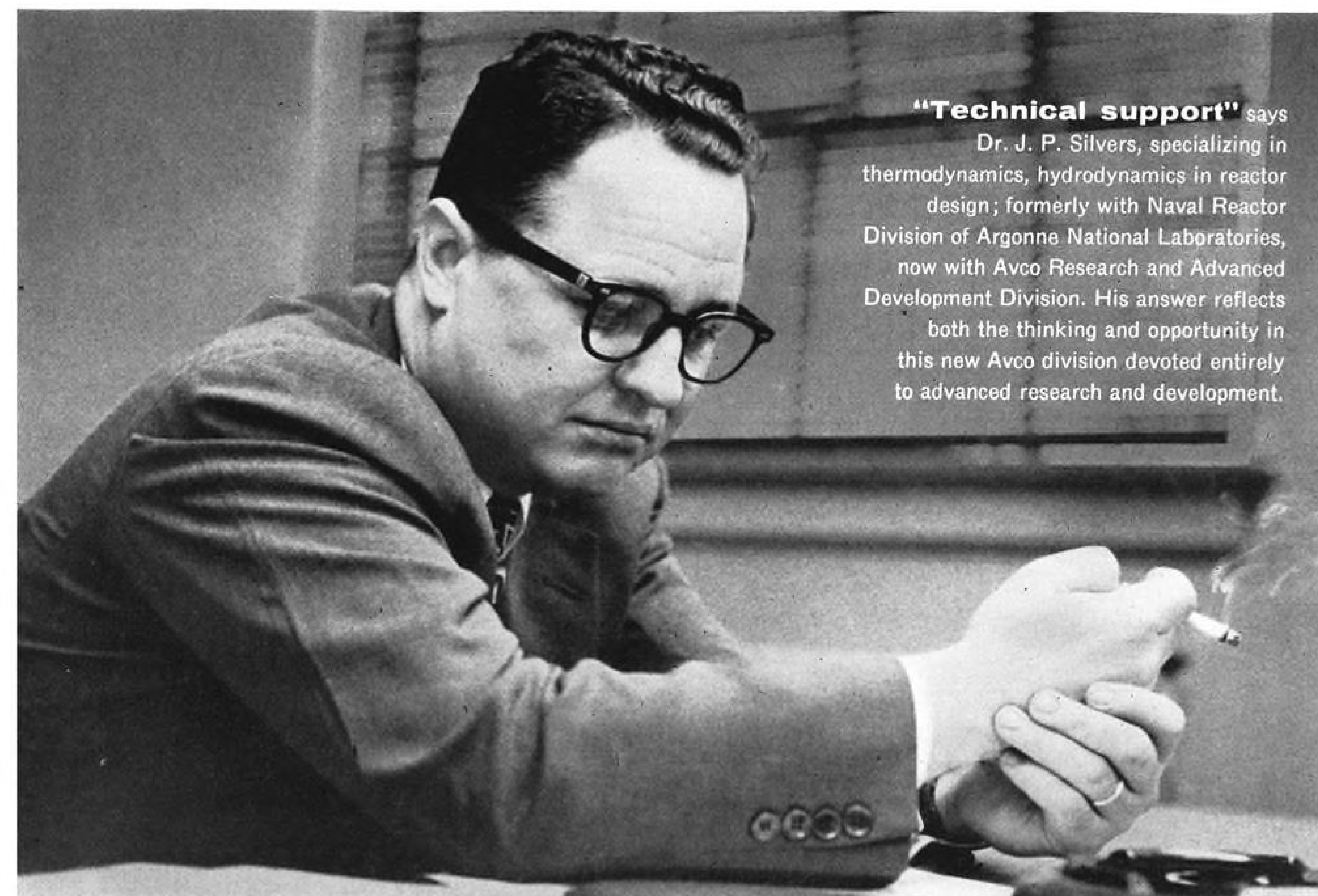
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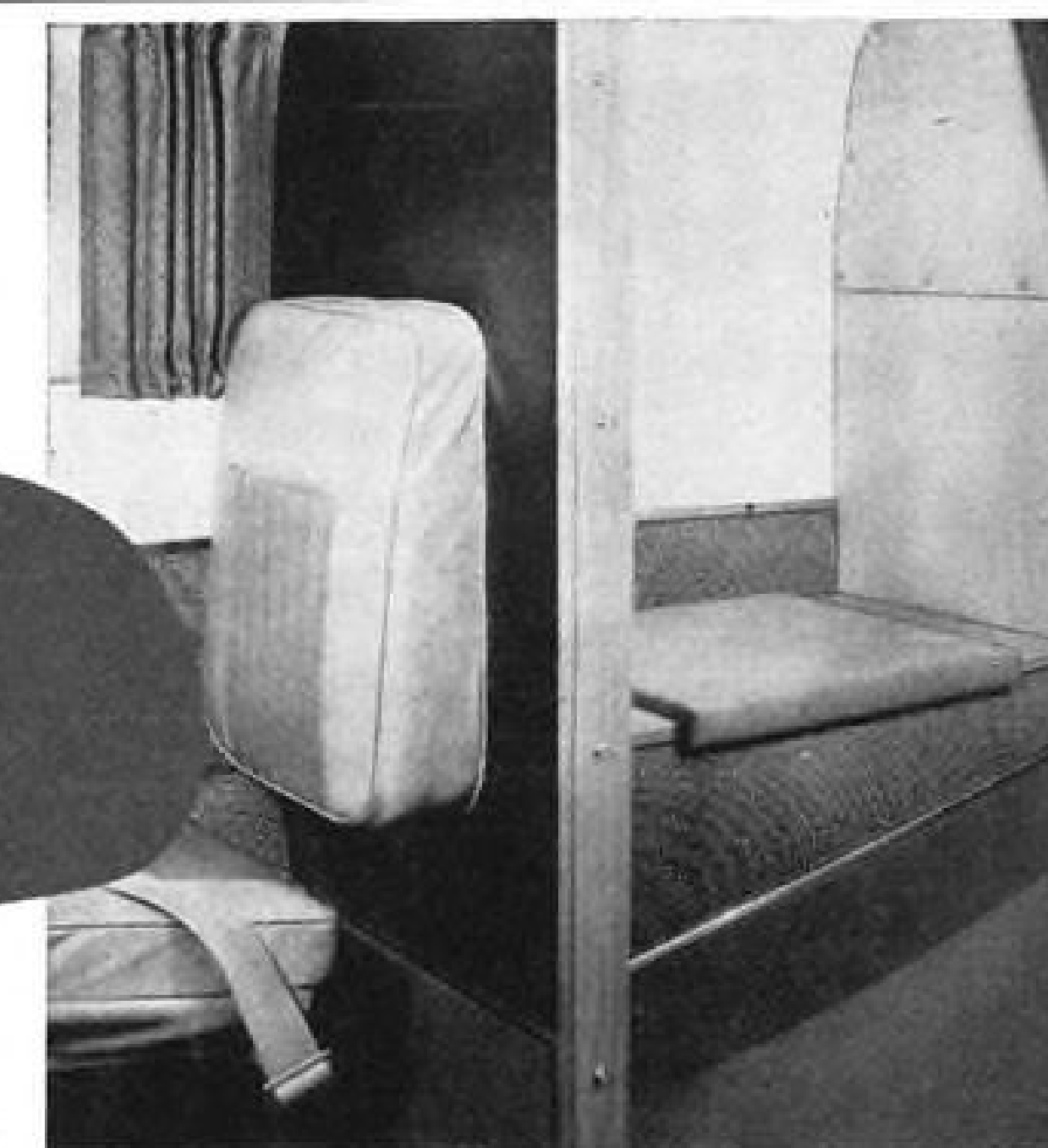
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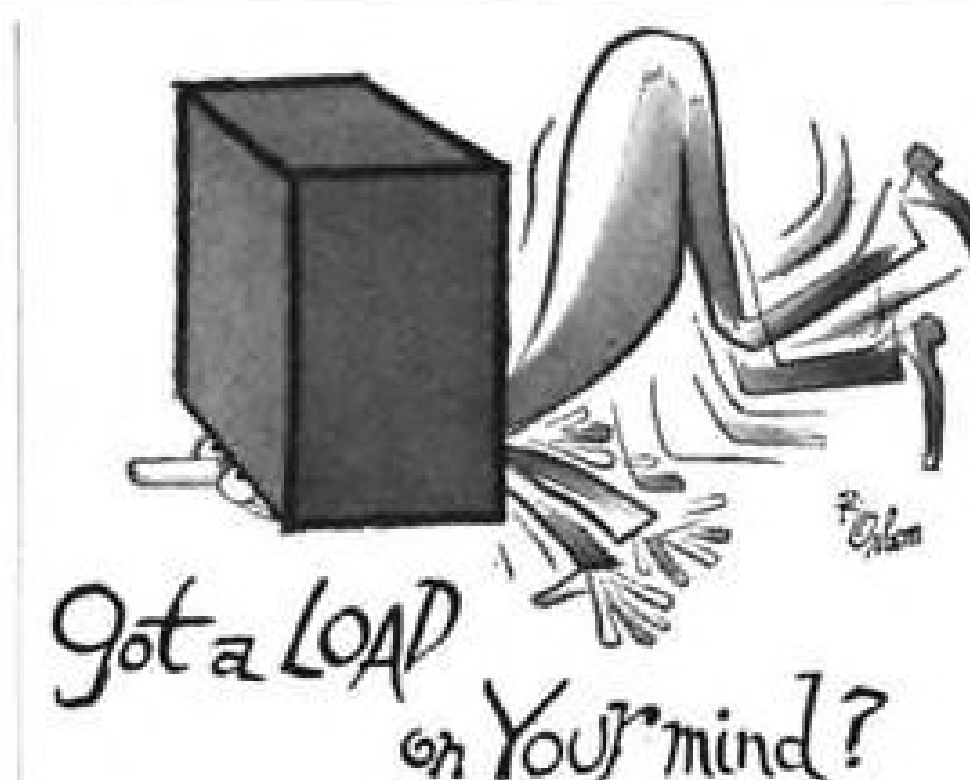
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LETTERS

Airlines Apathetic?

I would like to congratulate you on your excellent editorial, "We Are All To Blame" (AW July 16, p. 21), and on the article by L. L. Doty, "Mass Airways Traffic Jam Snarls East" (AW July 16, p. 26).

Enclosed is a copy of a letter I have sent to the Chairman of CAB protesting the unilateral ATA passenger penalty plan. The publication of this letter, or its use by you as the basis for an editorial, would be appreciated. I feel that the apathetic attitude of the airlines toward meeting schedules should be given wide publicity. For example, on Monday, 16 July 1956, at Chicago Midway Airport, TWA listed eleven flights delayed from fifteen minutes to six and one-half hours, and on 17 July, they listed six flights as being delayed. A seventh flight, posted as on time, was delayed some forty minutes due to the fact that operations were unable to find the hostess. This same flight was additionally delayed by operations in not taking immediate action to correct a rough engine reported by the incoming pilot. Work on the engine was not started until some ten minutes after scheduled departure, although, the airplane had been on the ground for approximately one hour.

I am fully cognizant of the many legitimate reasons for delay such as weather, poor airway traffic control, and the times major mechanical difficulties occur. However, I feel that the majority of the delays on airlines are occasioned by extremely poor operations. It would seem reasonable to expect that, should the airlines be a party to no-show penalties, that the traveling public would soon find a vastly improved airline operation.

WILLIAM J. CUSHING
Dayton, Ohio

Cockpit Visibility

It seems that one important aspect of the collision problem is not receiving proper attention; the cockpit visibility afforded the pilot and crew. Everyone is speaking in horrified tones of the impossibility of "see and be seen" because of closing speeds (head-on) of 1,200 mph, when all the airline vs. airline collisions to date, to my knowledge, have occurred between aircraft flying nearly parallel courses with closing speeds of less than 100 mph.

One of the major factors in each accident was the fact that the cockpit visibility did not permit either crew to see the other aircraft until too late. Furthermore, the poor visibility encourages bad habits of not looking. Airline cockpits could have as much visibility as a fighter aircraft if the CAA, CAB and ALPA demanded it of the aircraft industry. The flight engineer, facing the rear, could have a view of the upward rear portion of the sky and would be able to see overtaking aircraft approaching from above and behind.

More rigid traffic control, while certainly helpful, is not the complete answer since I have had near collisions due to errors made

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

by control personnel in assignment of altitudes and directions. Radar aids, both ground and airborne, are fine when they work and are not cluttered by rain, ice, chaff, and obtain adequate return from the aircraft and its beacon, but 360° coverage around an aircraft is going to compromise performance considerably with the antennas and amount of power required.

Certainly every aid we can get should be thoroughly evaluated and utilized but the simple, direct aids should not be overlooked or discarded without considerable deliberation. Quadrantal separation can reduce the enroute VFR problem to closing speeds which are within the "see and be seen" capability of the human eye. New terminal traffic patterns outlining climb corridors and letdown corridors for VFR can reduce most terminal VFR flying to a safe "see and be seen" level—particularly where radio communication and radar surveillance are also utilized to spot those not aware of the proper patterns.

Military fighter aircraft are the only aircraft today, other than a few helicopters, which have anything approaching adequate cockpit visibility and many of them are marginal. Military traffic can be heavy upon occasion and the number of mid-air collisions involving fighter aircraft (not in formation) would doubtless be greater if their visibility was as restricted as other types.

I have had some experience flying light planes, transports, bombers, and fighters over a period of 18 years and today feel trapped, blind and apprehensive, flying in aircraft with less than 180° hemispherical visibility; it's like driving a panel truck with no rear window, no mirrors, and no way to signal in six-lane traffic during rush hours—How do you turn off, change lanes, pass, or know who's passing you? Today, the demand should be made for the visibility required of future aircraft. It is not yet too late to modify the coming string of jet airliners and new commercial aircraft.

CLYDE L. WADE
Major, USAF

Engineers: Loving Care

I did not see the letter from "Bitter Engineer 1" (AW June 4, p. 122), but having read the letter from B. E. 2 (AW July 2, p. 106), I had the definite feeling that here was a man, probably of inconspicuous ability, who has either not been given an offer by an aircraft company or who has not been given a raise.

I am a technical employment recruiter for a major aircraft company and I am sure that we have the same general employment policies as do most large reputable organizations. The writer of the letter in

the July 2 issue mentions that the A/C industry does not have the interests of the engineer at heart. I do not believe that there is another industry where the personal interests of the engineer are as assiduously catered to as in the aircraft industry. The average young engineer out of college only a year or two is courted with loving care.

The engineer is moved from one end of the country to the other at practically no cost to himself. In many cases his employment emoluments include a per diem allowance while looking for a home, free housing assistance, practically free advanced educational opportunities, free sick leave, personal time off, overtime (which is not available to salaried personnel in most other industries), and many other benefits. I think most engineers will agree that the aircraft industry probably takes the engineers' personal interest to heart to an extent never dreamed of 15 years ago.

It is quite possible that the writer of that letter is so naive that he does not realize the aircraft industry is not the only one doing business with the U. S. Government. Maybe he does not realize that the aircraft industry sub-contracts out a large part of its government work to so-called civilian industry. Maybe this engineer does not realize, either, that the programs which the aircraft industry is carrying out at the request of the government are for the most part crash programs where speed is essential. It is very difficult to economize heavily when one is engaged in a crash program.

Surely this engineer is not so short-sighted that he fails to realize the missile program he criticizes is merely a forerunner of the greatest transportation advance in hundreds of years, the ground work for interplanetary exploration and travel.

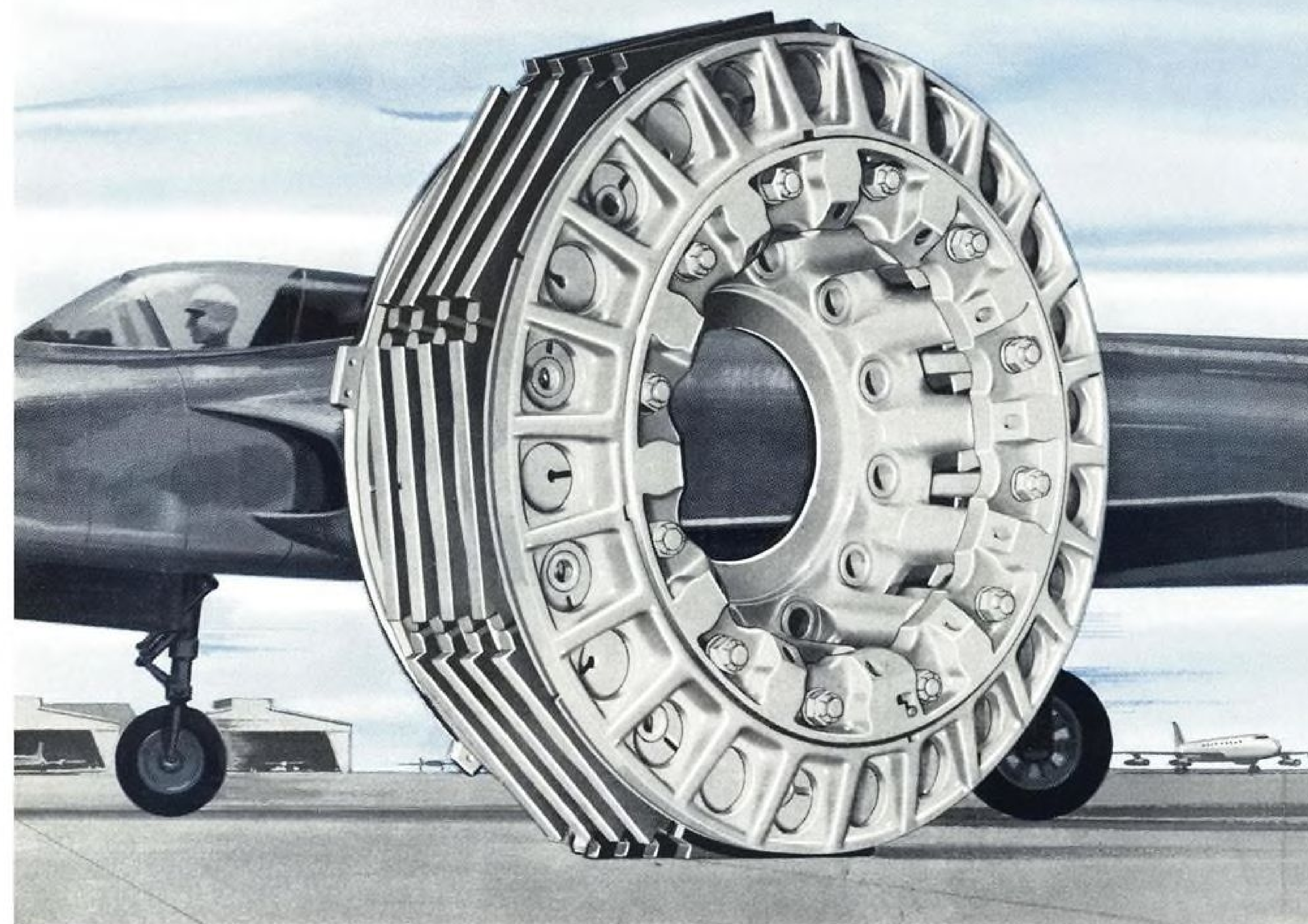
I feel that the matter of security for the engineer is not a pressing one. This is a situation similar to one which we see in all industries. The engineer who is mediocre and who should never have become a technical man in the beginning probably will be let out when his company retrenches. This situation is not unique to the aircraft industry. What is unique, however, is the necessity forced on the industry by the demands of our troubled times to employ marginal engineers of questionable ability who, were it not for crash programs, would probably not find suitable employment anywhere. We are not perfect in the aircraft industry and we have our employment problems, but we feel that we handle them as well as anybody and that we treat the individual engineer with more kid in our gloves than any other industry.

Possibly the writer of the B. E. 2 letter should resign from his untenable and unwanted position in the aircraft industry and seek employment in the automobile industry, where he can achieve the security he so desires. He sounds very much like a man who barely got into his job by the skin of his teeth and is unwilling to admit that his inability to get anywhere is due to his obvious mediocrity.

DAVID POTTER
Denver, Colo.

AVIATION WEEK, August 13, 1956

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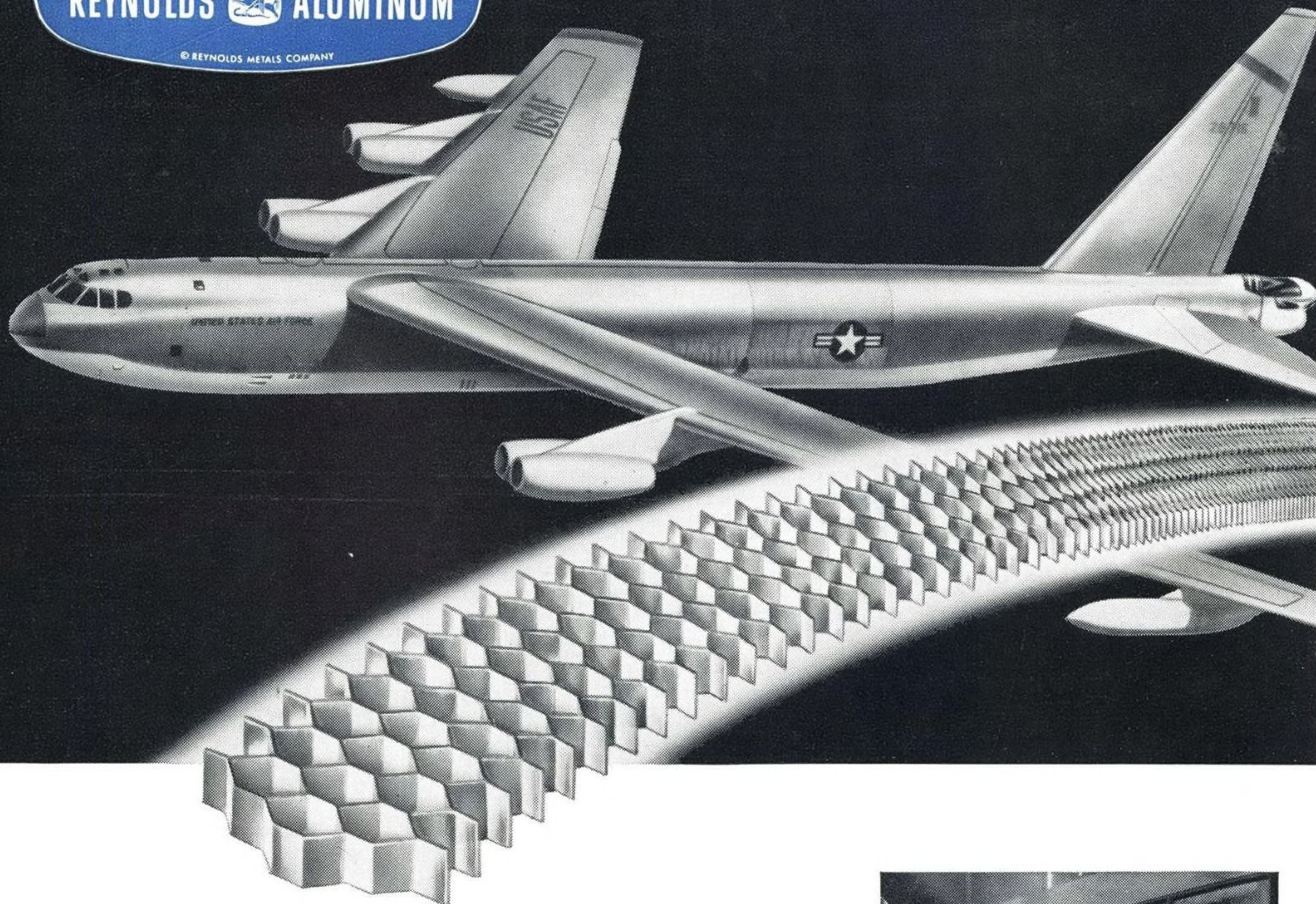


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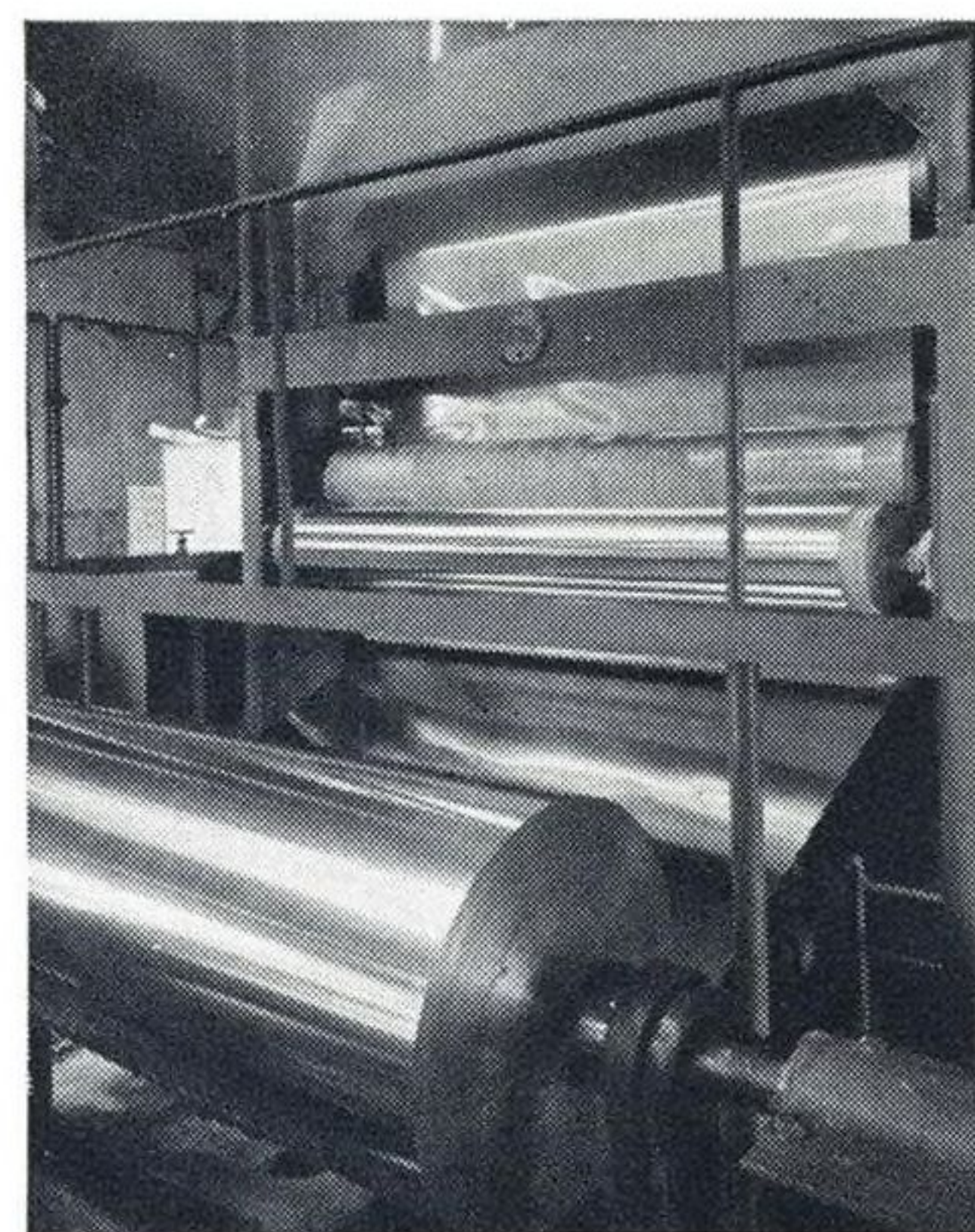
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