FEBRUARY 6, 1956 50 Cents

AVIATION WEEK

A McGRAW-HILL PUBLICATION

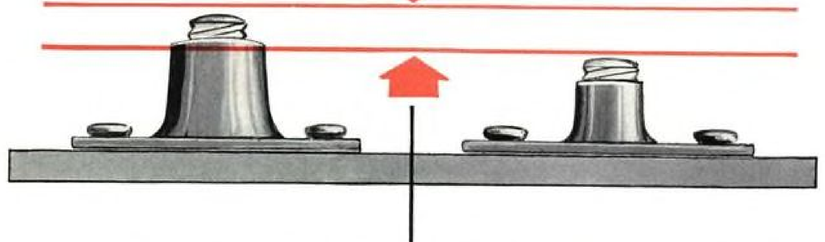


Britain's Air Dilemma: Too Little and Too Late

Flying Boom or Probe-Drogue Refuels McDonnell's F-101A

what does lowest height mean in a nut?

SPACE SAVINGS!
WEIGHT SAVINGS!



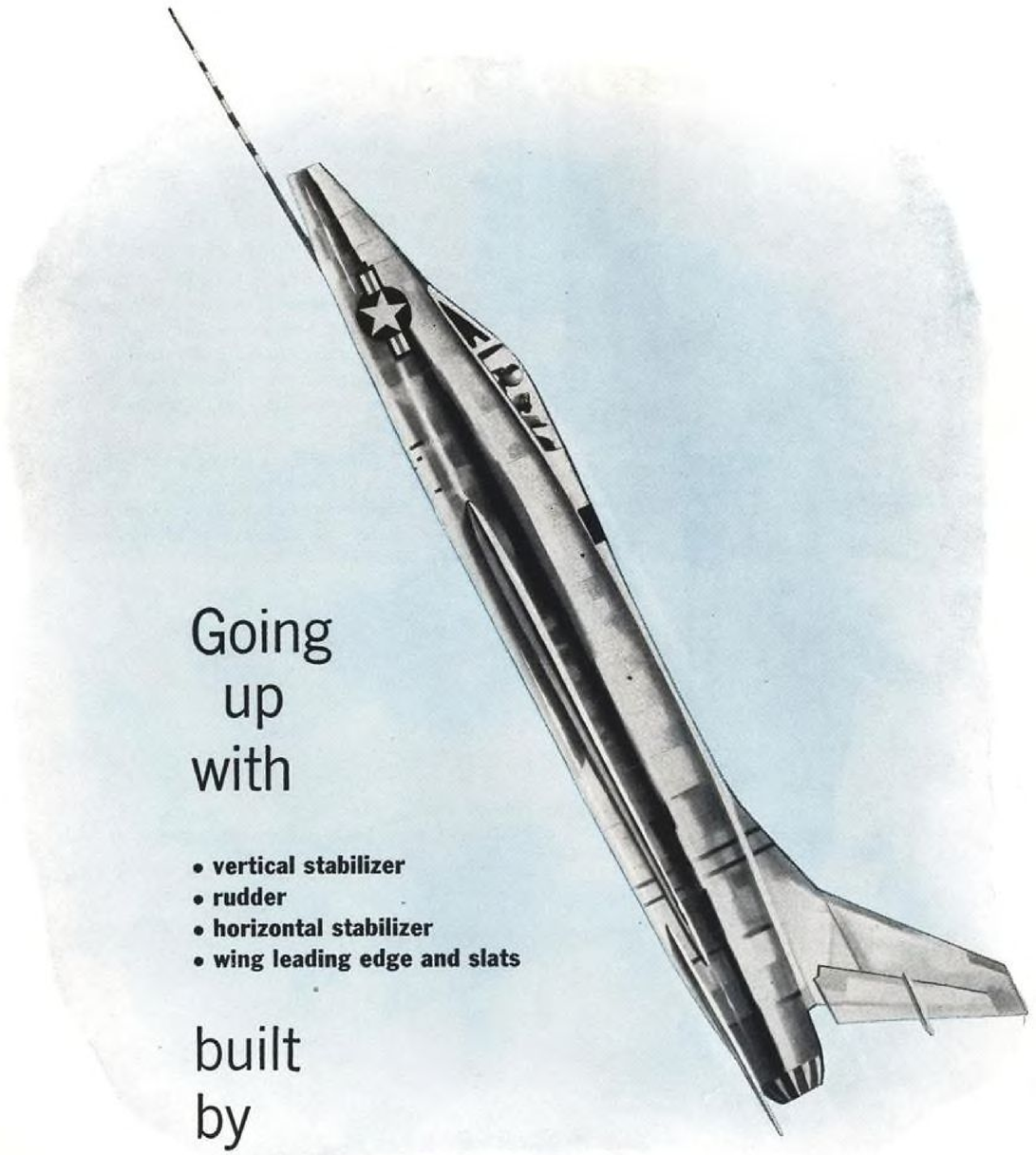
OLD STYLE
Regular Height Tension Nut (AN366)

KAYLOCK
TRADE MARK
all-metal self-locking nuts
Shear-nut height with tensile nut strength

As the lowest (height), smallest, lightest and strongest of all self-locking nuts — Kaylock's versatility will meet *all* of your structural fastener requirements.

Kaylock nuts are precision product produced in full conformance with Air Force-Navy specifications AN-N-5 and AN-N-10. For more information, write for our catalog.

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GOODYEAR AIRCRAFT

North American Aviation sets exacting standards for its high performance F-100 Super Sabre. Goodyear Aircraft Corporation, at its Akron plants, has contributed its metal-working skills to deliver quality assemblies, *on time,* on specs, and at the right price. Another demonstration of the versatility and quality-performance of Goodyear Aircraft Corporation. Plants in Akron, Ohio, and Litchfield Park, Arizona.

Twin-jet raider
is Navy's largest carrier-based bomber



A positive step in neutralizing an enemy sea force is to wreck or immobilize home ports and outlying bases. This strategy, to be successful, has always demanded a huge force.

Now the Navy has a new weapon, a versatile jet bomber—the Douglas A3D Skywarrior—a fast, high-altitude raider with a nuclear wallop that could smash harbor installations, submarine pens or coast line defenses in a single blow.

Skywarrior is not only the largest carrier-based bomber, but is faster than many fighters, and designed to handle a wide variety of missions.

Defense Is Everybody's Business

Development of the A3D shows how Douglas works with the Navy on its long-range preparedness program. But without men and women to fly and service them, the Navy's airplanes are useless. If you agree that defense is everybody's business, give a thought to a career with the U. S. Navy.

Depend on *DOUGLAS* First in Aviation

AVIATION CALENDAR

Feb. 16-17—Transistor Circuits Conference, University of Pennsylvania, Philadelphia. Sponsored by Institute of Radio Engineers, American Institute of Electrical Engineers and Univ. of Pa.

Feb. 22-24—Fifth annual Ohio-Indiana Agricultural Aviation Conference, Ohio Union, Ohio State University Campus.

Mar. 6-8—Fourth Annual Air Line Pilot Association, Air Safety Forum, Shoreland Hotel, Chicago.

Mar. 14-16—1956 Aviation Div. Conference of the American Society of Mechanical Engineers, Beverly-Hilton Hotel, Los Angeles, Calif.

Mar. 19-21—Society of Automotive Engineers, national production meeting and forum, Hotel Statler, Cleveland, Ohio.

Mar. 19-22—Institute of Radio Engineers, national convention, Waldorf-Astoria Hotel & Kingsbridge Armory, New York.

Apr. 9-12—Society of Automotive Engineers, national aeronautic meeting, aeronautic production forum and aircraft engineering display, Hotel Statler, New York, N. Y.

Apr. 10-11—Symposium for Management on Application of Analog Computers, sponsored by Midwest Research Institute, University of Kansas City, Kansas City, Mo.

Apr. 18-19—First Annual National Industrial Research Conference, sponsored by Armour Research Foundation, Hotel Sherman, Chicago.

Apr. 19-20—Second Annual Meeting of the Science Section of the Environment Equipment Institute, Sheraton Hotel, Chicago.

Apr. 22-26—American Association of Airport Executives, 29th annual convention, Hotel Carter, Cleveland, Ohio.

May 2—Society of Aeronautical Weight Engineers, 14th annual conference, Fort Worth, Tex.

May 2-5—Twelfth Annual National Forum of the American Helicopter Society, Sheraton-Park Hotel, Wash., D. C.

May 3-4—Sixth Annual Institute of Aeronautical Sciences West Coast Student Conference, Los Angeles.

May 7—Ninth Technical Conference of the International Air Transport Association, San Remo, Italy.

AVIATION WEEK • FEBRUARY 6, 1956

Vol. 64, No. 6

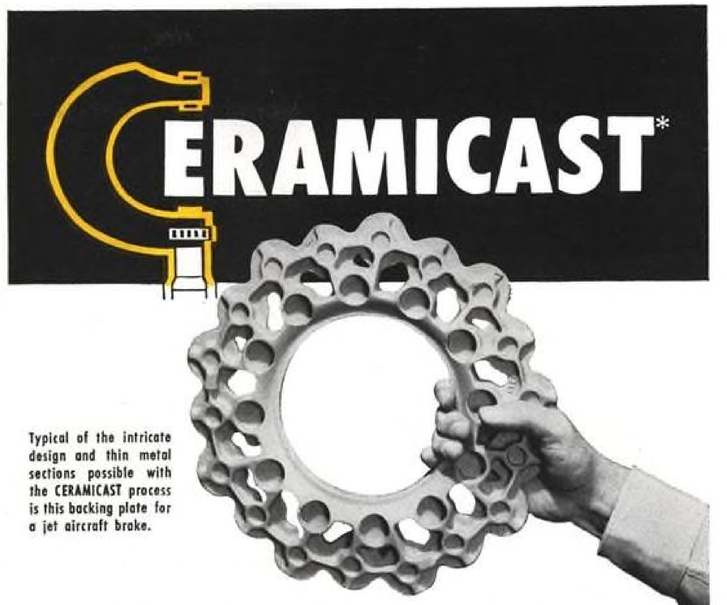
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Typical of the intricate design and thin metal sections possible with the CERAMICAST process is this backing plate for a jet aircraft brake.

Lebanon's new casting process for . . .

CLOSE TOLERANCE STEEL CASTINGS AT LOW COST

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- **TOLERANCES as close as** ±.003″ to .005″ per inch.
- **INTRICATE SHAPES:** Ideal for castings of complex design.
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*produced under licensing agreement with Shaw Processes, Ltd., London, England.

CIRCLE L®

LEBANON STEEL FOUNDRY

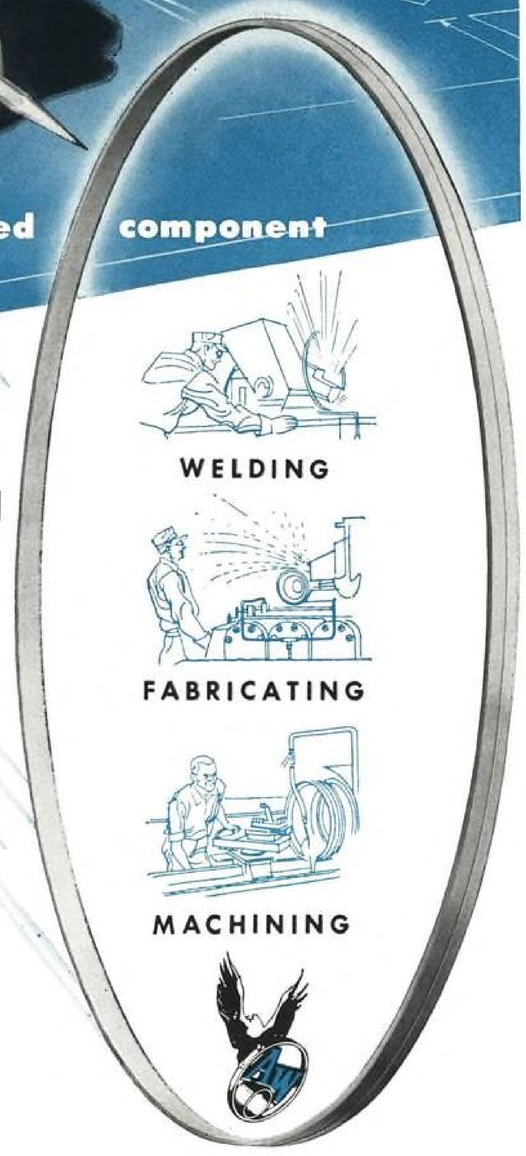
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The next time design requires a circular weldment, or you think fabrication of a complicated weldment might be the best solution, give us a call. Our Industrial Products Division stands ready to assist manufacturers with problems involving fusion or resistance welding of all types of metals. In addition, we are actually a complete manufacturing plant with the "know-how," the manpower, and the facilities to handle the operations required to produce finished welded components of complex design or assembly. Send today for our new 24-page catalog describing American Welding facilities that are available. Let us demonstrate what American Welding can do for you.



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...for jet engines



...for turboprop engines

- *accurate within ½ of 1% of operating speed settings*
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- *exceeds all requirements of Mil-E-5009A*

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Now, you can automatically control ignition at set engine speeds . . . control fuel flow . . . operate hydraulic bleeder valves . . . actuate afterburners . . . or any of a dozen other operations important to the functioning of a gas turbine engine.

But, the amazing part is this: *This new AC Speed Sensing Control is so carefully engineered, and so precisely built, that it will "repeat" within a tolerance of less than ½ of 1%.*

What's more, this small-size, lightweight control will operate switches at as many as four different predetermined speeds. It is designed to withstand high engine vibration, is ignition-proof, will hold calibration and operate without attention for periods exceeding engine overhauls.

AC can design a Speed Sensing Control to fit the specific requirements of any aircraft or industrial application in the gas turbine field. If you have a speed sensing problem, write direct to AC in Milwaukee. Your inquiry will receive a prompt reply.

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GM GENERAL MOTORS

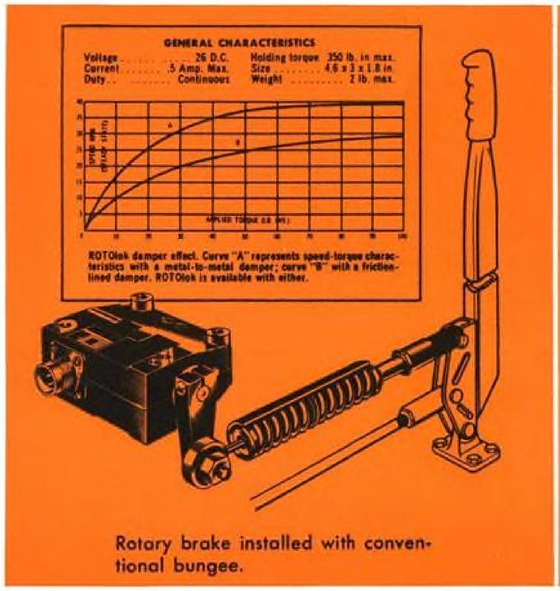
AC SPARK PLUG THE ELECTRONICS DIVISION OF GENERAL MOTORS • FLINT, MICHIGAN • MILWAUKEE, WISCONSIN

THE INFORMATION ON THIS PAGE IS TYPICAL OF THE DATA YOU WILL FIND IN THE NEW AIRBORNE CATALOG

BUNGEE CONTROL SYSTEMS

R-460-Rotary
(variable anchor)

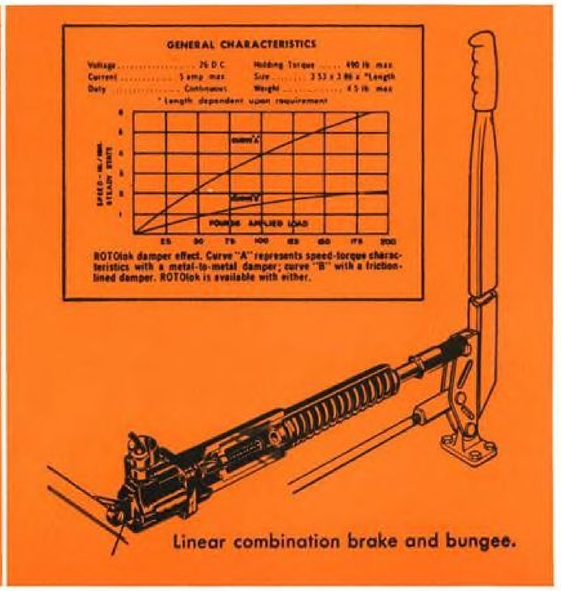
350 in. lb. max. brake holding capacity.



Rotary brake installed with conventional bungee.

R-590-Linear
(variable link)

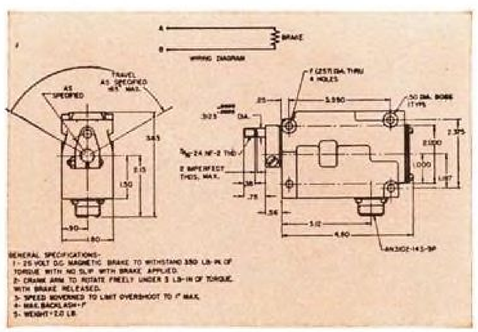
480 lb. max. brake holding capacity.



Linear combination brake and bungee.

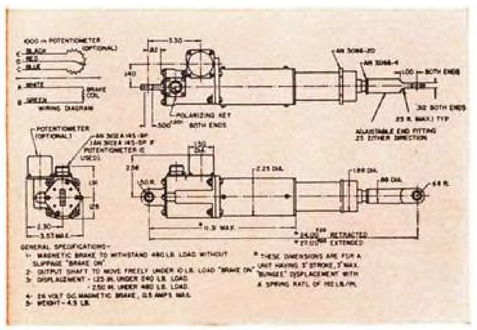
These units are available in other configurations to meet specific torque and steady state speed requirements.

MAGNETIC BRAKE. First designed for control applications in rotary wing aircraft, it has now been applied successfully to fixed wing aircraft. This unit, employed as a variable anchor or link, is most commonly used to cancel out a stick force or for bungee zeroing. In use, the brake is normally on and is energized to release, allowing connected load to "free wheel." These units are available in either rotary or linear configuration and with or without bungee spring.



Special design features are available to meet specific customer requirements:

- Damping—for "dead beat" to eliminate stick kick
- Wide range of torque or force holding
- Specified values of breakout (friction torque or force)
- Specified values of back lash or end play



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but A-MP® found the solution for aluminum wire termination

No galvanic action . . . oxidation is inhibited . . . full rated conductivity is assured . . . by using A-MP's all aluminum Termalum Terminals. The distinguishing features are the cartridge, containing abrasive inhibitor compound, and the specially-designed symmetrical "C" crimp. Under pressure of the crimp the compound abrades oxide from the wire and prevents it from reforming. The cartridge is closed with a removable plastic plug that is color-coded for wire size identification. The entire terminal is tin-plated by a special process to assure high conductivity and corrosion resistance.

TERMALUM

Trade mark

terminals and connectors

Copalum* Terminals and Connectors have the same features as Termalum except that the body-tongue is made of copper. With this design, smaller tongues are permissible. Precautions usually taken with aluminum terminals when connecting to copper busses can be eliminated. Termalum and Copalum Terminals and Connectors exceed all military specifications.

A-MP Termalum and Copalum Terminals are applied with A-MP Dyna-Crimp* Power Tools and Hand- or Foot-operated Hydraulic Tools. Dyna-Crimp Tooling is available for bench mounting or with a portable cart.

Write for additional information on these products.



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*Trade mark

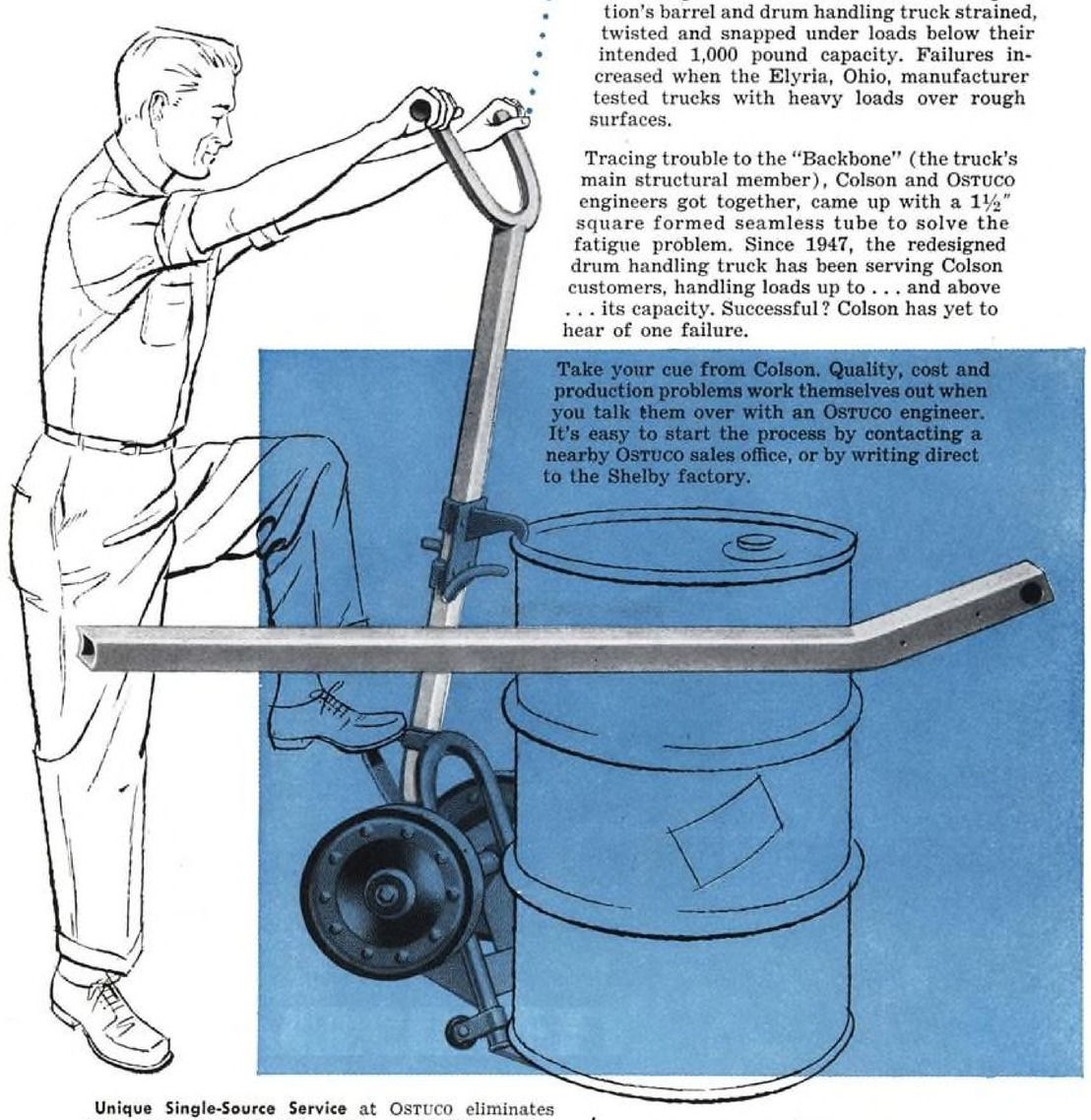
Colson cures barrel-truck fatigue with

STRONGER BACKBONE FROM OSTUCO

First experimental models of Colson Corporation's barrel and drum handling truck strained, twisted and snapped under loads below their intended 1,000 pound capacity. Failures increased when the Elyria, Ohio, manufacturer tested trucks with heavy loads over rough surfaces.

Tracing trouble to the "Backbone" (the truck's main structural member), Colson and OSTUCO engineers got together, came up with a 1½" square formed seamless tube to solve the fatigue problem. Since 1947, the redesigned drum handling truck has been serving Colson customers, handling loads up to . . . and above . . . its capacity. Successful? Colson has yet to hear of one failure.

Take your cue from Colson. Quality, cost and production problems work themselves out when you talk them over with an OSTUCO engineer. It's easy to start the process by contacting a nearby OSTUCO sales office, or by writing direct to the Shelby factory.



Unique Single-Source Service at OSTUCO eliminates interplant shipment and error . . . another reason why your product can be improved when components are made from

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SEAMLESS AND ELECTRIC WELDED STEEL TUBING
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ENGINEERS. . .

It might be an old cliché, but wise engineers agree that it is easier to succeed with a successful company—a company which provides the machinery by which you can advance in the profession.

The achievements of the McDonnell engineering team speak for themselves—the Air Force F-101 Voodoo, the Army XV-1 Convertiplane, and the Navy F3H-2 Demon.

M.A.C. is equally interested in developing outstanding engineers as well as superior air weapons. In addition to stimulating and provocative work assignments, advanced in-plant engineering courses are available, as well as supplementary training at two local universities.

Positions of technical leadership exist in virtually all fields of airplane, helicopter and missile engineering.

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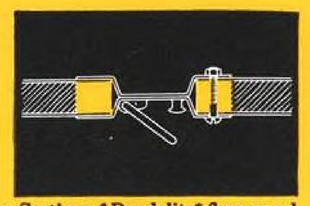
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MACareers are Successful Careers!

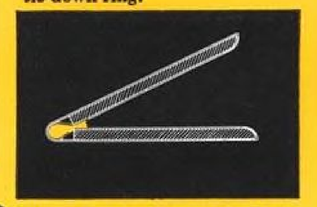
McDONNELL *Aircraft Corporation*

How many riveting and welding operations can you eliminate with

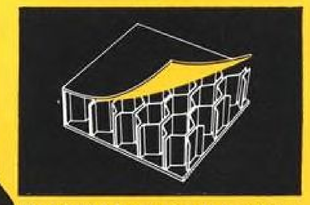
SOLVENT-FREE



Section of Bondolite* floor panel (*T. M. Goodyear Aircraft Corporation) with inserted cargo tie-down ring.



Wing flap section made from Bondolite. Bend is reinforced with Epon Adhesive VI.



Bondolite honeycomb construction. Epon Adhesive VI bonds aluminum skin to central aluminum honeycomb.

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New Epon adhesives are being specified to replace expensive riveting and welding in an ever-increasing variety of aircraft applications. Because they contain no solvents, Epon adhesives permit immediate assembly of metal-to-metal bonded parts. Contact pressure alone is all that is required to form sound bonds. Surfaces before bonding need not be machine-finished and glue lines need not be uniform. Air-relief drilling is never needed.

For your specific needs, three standard formulations are:

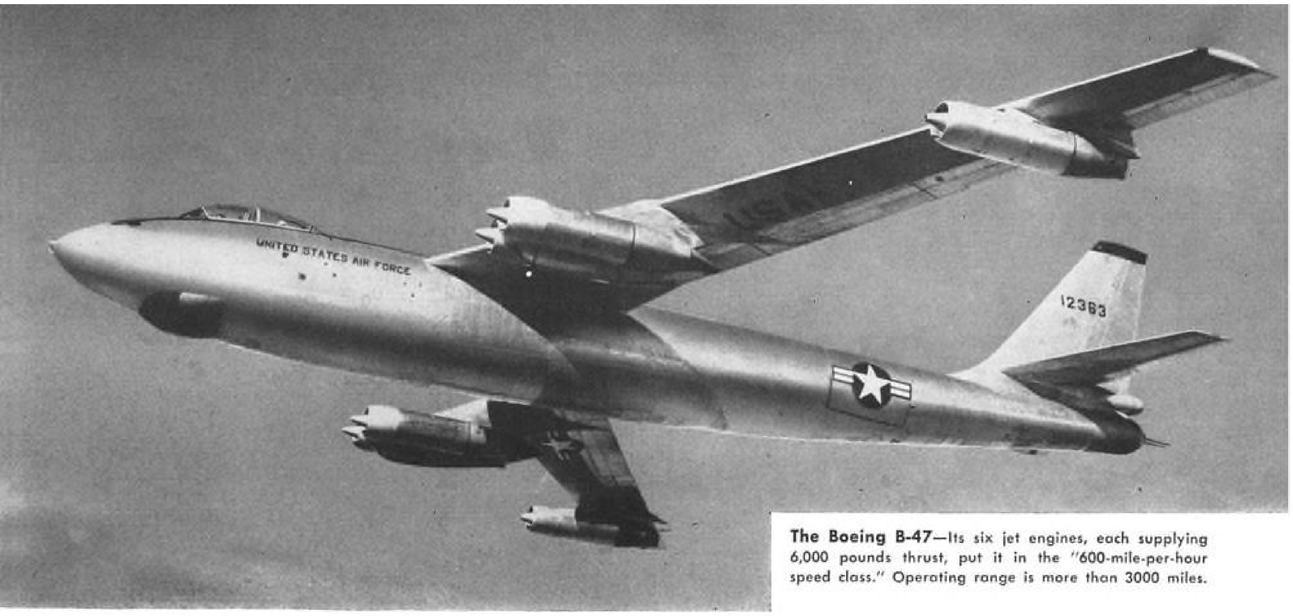
- **EPON ADHESIVE VI: General purpose, high-strength adhesive. Cures at room temperature or slightly above.**
- **EPON ADHESIVE VIII: High strength, capable of withstanding moderately high service temperatures. Cures in 90 minutes at 200°F.**
- **EPON ADHESIVE 422: A special formulation in tape form for service at temperatures up to 500°F.**

Epon adhesives have been used successfully in bonding metal, plastics, rubber and wood for helicopter rotor blades, honeycomb wing sections, jet fuel tanks, radar antennae, structural joints and floor panels. Can Epon adhesives solve an assembly problem for you? Write us about your problem and we'll send full technical information and samples.

(Epon resins are the epoxy polymers made exclusively by Shell Chemical Corporation)

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The Boeing B-47—Its six jet engines, each supplying 6,000 pounds thrust, put it in the "600-mile-per-hour speed class." Operating range is more than 3000 miles.

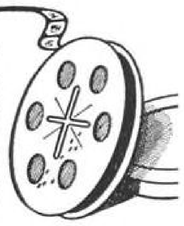
Cold drawn Shelby Seamless Tubes provide *high strength, low weight* outrigger struts for B-47 Stratojet



The landing gear of the 100-ton B-47 Stratojet consists of dual main wheels in tandem with single outriggers attached to the inboard engine pods. The outer cylinder of each of the outrigger struts is fabricated from cold drawn USS Shelby Mechanical Tubing.

Shelby Seamless is extremely strong and shock absorbent in proportion to its weight. Thus, it is ideal for incorporation into landing gears, engine mounts, longerons, wing spars, fuselage struts, and tail assemblies. Moreover, with Shelby Seamless Tubing, *the basic shape* for myriad aircraft parts is already made—and each section of tubing is as sound as the solid steel forging from which it is pierced. Thoroughly uniform and dimensionally accurate, Shelby Seamless Tubing is easy to bend, shape, machine and weld.

Shelby Seamless is produced to exacting aircraft standards, in a wide range of diameters, wall thicknesses and steel analyses. For further information or for help in applying Shelby Seamless Mechanical Tubing to your design specifications, write to National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.



"WALLS WITHOUT WELDS," the vivid story of the manufacture of National Seamless Pipe and Tubes is available free of charge for showing to industrial groups, clubs, school groups, etc. This educational sound film in brilliant technicolor contains some of the most dramatic steel mill operations ever recorded. Write for information.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
(Tubing Specialties)

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS **SHELBY SEAMLESS MECHANICAL TUBING**

WALLS WITHOUT WELDS

UNITED STATES STEEL



Another advancement by

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New 19 Inch Hydroform makes...

large prototype and pre-production parts

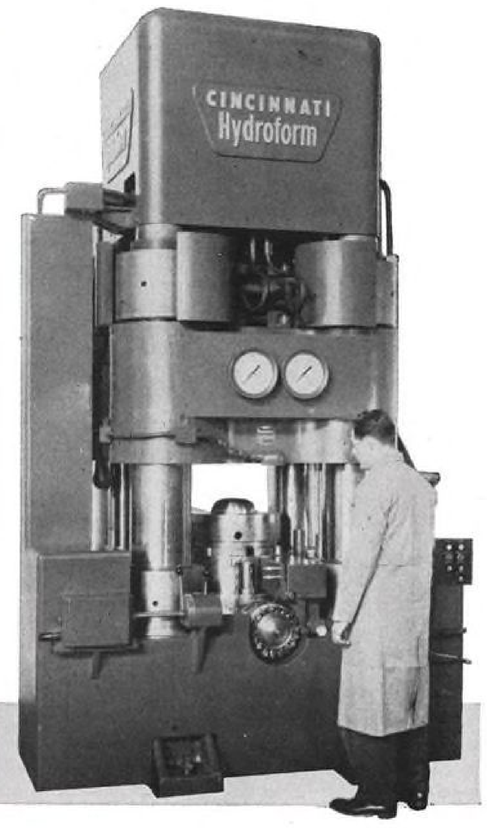
...now available by economical Hydroforming

The new 19" Hydroform is an important addition to Kaupp facilities. This new machine makes it possible to produce larger parts than heretofore possible on the 12" Hydroform previously installed. With both machines now in operation, a vast new field is open for design and development engineers who require prototype components. Your inquiries are invited.

HYDROFORMING BY KAUPP SAVES TIME AND REDUCES TOOL COSTS —

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- **Simple tooling**
- **Fast set-up**
- **Improved quality**

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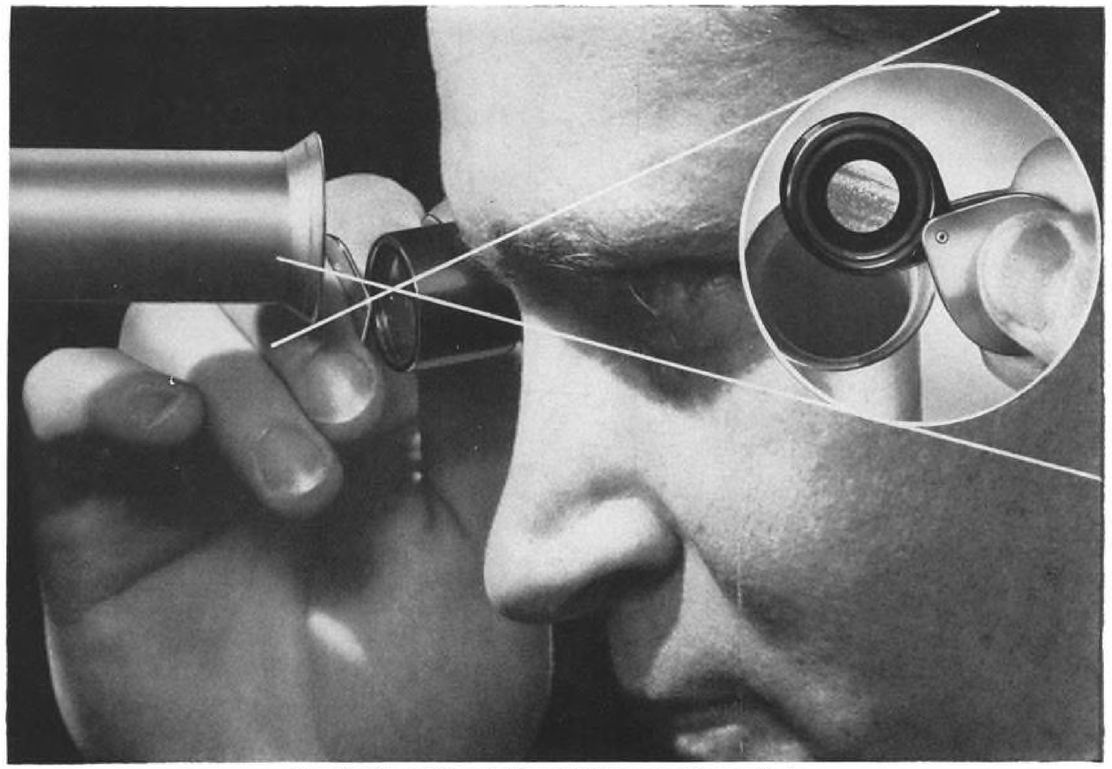


NEW 19 INCH HYDROFORMING—WORK CAPACITY:

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Examining flares in Superior Aircraft Tubing under 10x magnification.

Why "Superior" Stainless Hydraulic Tubing Gives You Above-Specification Quality

Here are some of the steps Superior takes to make certain first that its tubing meets specifications; second that it will save you time and money by eliminating rejects; third that you will get above-specification quality for long trouble-free life.

Even before material is released for production, a microanalysis is made to check grain size and intergranular precipitation. A chemical analysis is made, wall runout is checked. Samples are pickled and checked for carburization. A boroscopic examination is made of interior surfaces.

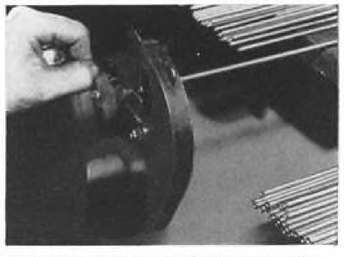
During production, the intermediate annealing heat treating operations are 100% automatically controlled. Cleanliness of aircraft quality hydraulic tubing is most important. Therefore a test is made to check for metallic chips and other foreign particles by running a white cloth through the ID of the finished tubing.

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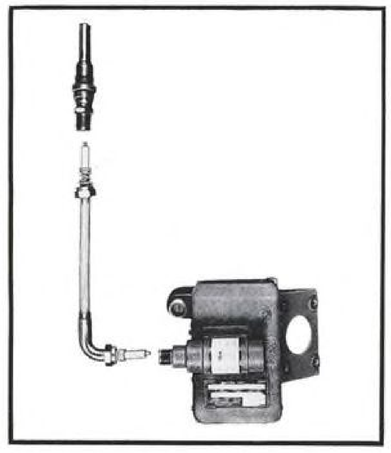
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Washington 4, D. C.—National Press Bldg., Phones: NAtional 8-3414, REpublic 7-6630
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COVER: During a recent flight, McDonnell's F-101A Voodoo refueled twice in the air—once using the flying boom system and once the probe and drogue method. It was the first refueling test for the Voodoo. Other views of the refueling trials, including a probe and drogue hook up, are on p. 30-31.

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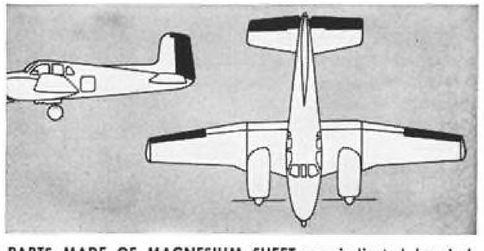
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EDITORIAL

The Harding Report—A Good Job

President Eisenhower is now looking for a man of sufficient experience and stature to conduct the study of long-range civil aviation needs recommended by Budget Bureau's Aviation Facilities Study Group headed by William Barclay Harding. The President has endorsed the group's recommendation and pledged himself to see that the study is made and a long-range program organized to meet the needs of civil aviation's rapid development.

This decision by President Eisenhower will get virtually unanimous support from both military and civil aviation groups. The only criticism we have heard on the subject is some grumbling that this top level administration interest in civil aviation is about three years late and perhaps too late to do any real good.

We believe that if properly executed and adequately supported by both the executive and legislative branches of the Government this study and its resultant program can be of great help in solving the already acute problems of civil aviation's growth.

Many Policy Studies

The idea of a national aviation policy study is not new. Since the days of the Morrow Board in the mid-twenties, presidentially appointed groups have been surveying the growth problems of both military and civil aviation in an effort to develop a national policy aimed at achieving and maintaining American superiority in the air. Although some of these efforts have resulted in significant Government aid to aviation it is evident from the record that present American superiority in the air is primarily the result of the technical skill and management skill of private individuals and organizations rather than of a federal master plan.

A good look at the present plight of British military and civil aviation is a good example of how a government master plan can retard rather than speed aviation development by throttling individual skill, initiative and imagination in a maze of bureaucratic red tape.

However, the Harding group has done an excellent job in outlining the principle areas in which the future problems of civil aviation will be found and some of the basic flaws in the present governmental organizations aimed at handling them.

Basic Assumptions

The basic assumptions which the Harding group used as a foundation for their exploration of civil aviation's next 20 years are interesting. They include:

- **No global war,** continued international tension and local incidents involving armed conflict.
- **The North American** continent will be vulnerable to enemy air attack.
- **U. S. population** will increase to about 210-220 million.
- **Gross national product** will rise to about $715-740 billion in terms of 1955 dollars.
- **Defense expenditures** will be maintained at about the $30-40 billion level.

Future Factors

The Harding group noted four principle factors that will characterize future civil aircraft design and performance:

1. Commercial aircraft operating speeds will increase from 300 to 1,000 mph. during the next 20 years.

2. Maximum operating altitudes of civil aircraft will rise from about 25,000 ft. today to over 40,000 ft., putting jet airliners into the same airspace that is now exclusively the province of military aircraft.

3. Civil aircraft will show greatly increased productivity. New jet transports will have the same annual transatlantic carrying capacity as a large luxury ocean liner.

4. Trend toward lower operating costs will continue with a 30% reduction in passenger seat-mile costs and an 80% reduction in cargo ton-mile costs likely by 1975.

The most important contribution of the Harding group was made in its analysis and recommendations on the joint military-civil air traffic control problem. Although the Harding group wielded no official authority it is no secret in Washington that its work on air traffic control was instrumental in changing both the attitude of the Eisenhower Administration and the leadership of the Civil Aeronautics Administration. The intense interest of the President and the Commerce Department in the air traffic control problem can be traced directly to the forceful presentation of the Harding group. The section of its report on air traffic control should be carefully studied by all segments of civil aviation as it is likely to serve as the take-off point for most future discussion of the problem and plans of action aimed at solving it.

Everybody in aviation owes the Harding group—Chairman Harding, George P. Baker, Fred M. Glass, N. E. Halaby, Harold R. Harris, Jerome Lederer, T. F. Walkowicz and J. Gordon Bennett—a vote of thanks for a job well done.

—Robert Hotz



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WHO'S WHERE

In the Front Office

Dr. Frederick L. Hovde, chairman, U. S. Army Scientific Advisory Panel, succeeding **Dr. James R. Killian Jr.,** president of Massachusetts Institute of Technology. Dr. Hovde, president of Purdue University, has been a panel member since 1954.

Dr. Arthur R. Kantrowitz, vice president, Avco Manufacturing Corp. and director of Avco Research Laboratory, on leave of absence as professor of aeronautical engineering and engineering physics, Cornell University.

Maj. Gen. Lucas V. Beau, (USAF, ret.), vice president-foreign operations, Consolidated Diesel Electric Corp., Stamford, Conn., former head of the Civil Air Patrol.

Maj. Gen. Leslie E. Simon, (USA, Ret.), member of the planning board and director, Gruen Precision Laboratories, Inc., Cincinnati, Ohio, former director of research for Carborundum Co. and chief of research and development, Army Ordnance.

Maj. Gen. Gerald J. Higgins, (USA, ret.), a director of Piasecki Aircraft, Corp., Philadelphia, Pa., formerly Chief, Military Assistance Advisory Group in Japan.

Honors and Elections

Dr. William F. Ballhaus, chief engineer, Northrop Aircraft, Inc., Hawthorne, Calif., elected head of committee on aircraft construction, National Advisory Committee for Aeronautics, for 1956. Other Northrop appointments to NACA: **George N. Mangurian,** chief of structures, to sub-committee on aircraft structures; **R. B. Davidson,** assistant chief of structures, to sub-committee on aircraft loads and **R. B. Katkov,** chief of fluid dynamics to sub-committee on aerodynamic stability and control.

Resigned

James W. Mariner, former vice president-sales, Northwest Orient Airlines. He has not disclosed his future plans and no successor has yet been named. Mariner joined NWA in 1947 as director-cargo sales.

Changes

J. J. Dysart, assistant project engineer, DC-8 jet transport, Douglas Aircraft Co., Santa Monica, Calif. **F. N. Fleming,** project engineer, and **H. W. Melon,** assistant project engineer, DC-8 series. **H. W. Cleveland,** manufacturing control manager, Tulsa Division, Douglas Aircraft Co. and **H. V. Montgomery,** planning general supervisor.

H. D. Cameron, manager, domestic lines, Canadian Pacific Airlines; **J. G. Twist,** assistant general manager, operations and **V. H. Perry,** assistant to the vice president.

John F. Barrett, general traffic manager and **J. Robert Carter,** assistant general manager, Riddle Airlines.

Richard M. Somers, engineering director, Kansas City Division, Bendix Aviation Corp.

Emmet E. Baker, Jr., manager, Electronics Division, Chamberlain Aviation, Inc., Akron, Ohio.

INDUSTRY OBSERVER

► Douglas Aircraft is developing the Ding Dong air-to-air missile with an atomic warhead. Initial tests of Ding Dong warhead were made last spring at Atomic Energy Commission's Nevada test site. The experimental nuclear warhead, dropped from a B-36, was detonated at 30,000 ft.

► Convair has modified one R3Y Tradewind flying boat with four aerial refueling pods equipped with the probe-and-drogue system. This R3Y can refuel four jet fighters at a time.

► North American Aviation and Aerojet are prime and secondary sources, respectively, on the giant first-stage rocket powerplants for the Convair and Martin intercontinental ballistic missile projects. Both firms are working on rocket powerplants of well over one million pounds thrust. USAF is attempting to maintain a security clamp on the tests of these giant engines, but the complaints about extraordinary noise from residents near North American's Santa Susana test site and Aerojet's facility near Sacramento make it obvious when intercontinental missile motors are being fired.

► First Lockheed F-104A production model rolled off the Burbank line in early January and is now at Palmdale for final instrumentation before delivery to USAF Flight Test Center at Edwards AFB.

► North American Aviation has a project for an anti-missile missile to intercept and destroy ballistic-type missiles before they reach their targets. North American's missile projects cover the widest range of any company in the missile business.

► Navy is trying to break the USAF transcontinental record of 3 hr. 46 min. set by Col. Robert Scott in a Republic F-84F. First attempt by a Navy crew flying a Douglas A3D bomber, powered by two Pratt & Whitney J57 turbojets, failed. More attempts will be made on A3D delivery flights from the Douglas El Segundo plant to Norfolk, Va.

► Success of recent rough water landing tests with the Convair Sea Dart using a single hydro-ski have revived Navy interest in this development. Single ski design plus a new oleo has reduced the severe vibration of the double ski. Fresh-water spray system, installed on the Sea Dart, washes corrosive salt water off turbojet compressor blades after taxiing in sea water. Salt water corrosion on compressor blades even after short taxi runs reduced maximum thrust available for takeoff.

► Installation of the British Decca navigation system in the New York area is planned by the U. S. Army for an evaluation of its use as an helicopter navigation aid. Project is sponsored by the Air Navigation Development Board.

► Trans World Airlines position near the tail end of any turbojet or turboprop delivery line—well behind its competitors—is due to Howard Hughes' indecision. All TWA equipment purchases must be personally approved by Hughes. In most cases he personally negotiates the deal. During the recent flurry of jet transport purchases by TWA competitors, top officials of the airline were unable to see Hughes to press for a decision.

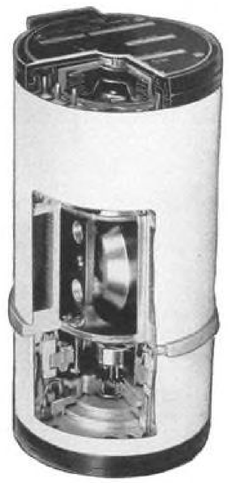
► Martin's second P6M SeaMaster is scheduled for first flight in April.

► Lockheed and USAF will begin cargo drop tests of the C-130 late this month.

► Radioplane Inc., Northrop subsidiary, has the Crossbow missile project.

► Lockheed's first production T2V-1, Navy jet trainer featuring boundary layer control, is now being flight tested.

► Designation of the Ryan delta-wing vertical riser experimental aircraft is X-13. The plane has been flying at Edwards AFB using a special landing gear for near-horizontal landing and takeoff attitudes, similar to the arrangement used by Lockheed during its flight test with the XFV-1. Powerplant of the plane is a Rolls-Royce Avon turbojet.



This is a cutaway view of Honeywell's HIG-5 hermetic integrating gyro. Compact: six inches high. Accurate: measures the thirteen-millionth part of a circle. Rugged: takes 50 g's and more of shock. The HIG detects and measures any attitude change of aircraft or missiles. Three models of the HIG (HIG-4, HIG-5, HIG-6) are in volume production. They are recommended for radar stabilization, flight control and inertial guidance.

AERONAUTICAL DIVISION, MINNEAPOLIS-HONEYWELL

Washington Roundup

Profits Investigation

Outlook now is that the House Armed Services Investigating Subcommittee's public hearings on the earnings of aircraft firms on military contracts will open late this month. The delay in the opening has been caused by other legislative business—measures authorizing the Navy's shipbuilding program, medical care for military personnel, the military construction programs of the three services, and limiting the authority to negotiate defense contracts.

In an appearance before the House Rules Committee, Rep. Carl Vinson (D.-Ga.), chairman of the committee, assured Rep. Clarence Brown (R.-Ohio), that the investigation would open soon. Vinson pointed out that the Government has invested over $820 million in airframe plants, compared with a private investment of about $212 million and said that the point of the inquiry was to determine how the "partnership" is working out. The inquiry is expected to relate the profits of manufacturers to the private investment.

The plan of the subcommittee, headed by Rep. Edward Hebert (D.-La.), is to notify firms at least a week before their requested appearance date.

Security Troubles

Advertising and public relations representatives must exercise extra caution these days when they submit copy to the Defense Department for approval by the Office of Security Review. It can come back stamped for release without ever having been seen by the service which has responsibility for deciding what is and is not classified. A recent aviation company advertisement was approved with reference to an Air Force project that has not been declassified by the USAF Secretary Donald Quarles. It was withheld from publication only when a top USAF general responsible for the project happened to see a proof of the ad. There are other incidents where USAF has not been given an opportunity to exercise its responsibility, including clearance given a recent magazine article on guided missiles. Philip K. Allen, Acting Deputy Assistant Secretary for Public Affairs, says he knows of the fundamental conflict between Defense Department and the services over security prerogatives, but so far has indicated no program to do anything about it.

His office is working on a new information release schedule, designed to show what data can be made public about missiles at each stage in a new weapon's development and operational cycle. Meanwhile, recent Army announcement about its Redstone missile resulted in a new order forbidding military men to discuss these projects. It is attributed to the White House. Despite the order, expect more to come out about the missile program under pressure from Congress. Capitol Hill rumblings already have brought results in decision to name a special assistant in Defense Department over missile projects.

More Permanent Certificates

A move will get under way in Congress soon to direct Civil Aeronautics Board to grant territorial carriers permanent certificates. Legislation will be introduced by Sen. Warren Magnuson (D.-Wash.), chairman of the Senate Commerce Committee. His prime interest is in giving permanent status to the Seattle-Alaska and intra-Alaska operations of Alaska Airlines and Pacific Northern Airlines.

The legislation, though, will open the way for other bids to permanency. Helicopter operators would like permanent certificate. They made an unsuccessful bid for this in connection with legislation directing permanent certificates for the local service carriers last year.

Both Pan American World Airways and Northwest Airlines are on temporary certificates for their Seattle/Portland to Hawaii operations and would like permanent certificates, although both carriers have contended that the route warrants only one carrier. There also may be bids for permanent certificates on international routes.

Carrier vs. Land Bases

House Armed Services Committee vigorously defended the capability of the Navy's carrier forces—as compared with the Air Forces land base system—to meet atomic attack and counter attack in a report supporting the construction of a sixth Forrestal-class carrier. The next new carrier, according to present plans, will be nuclear-powered.

Pointing out that no surface target, on land or sea, is "invulnerable" to nuclear attack, the House committee declared:

"The carrier is, however, capable of sustaining a great deal of damage and remaining afloat and operable . . .

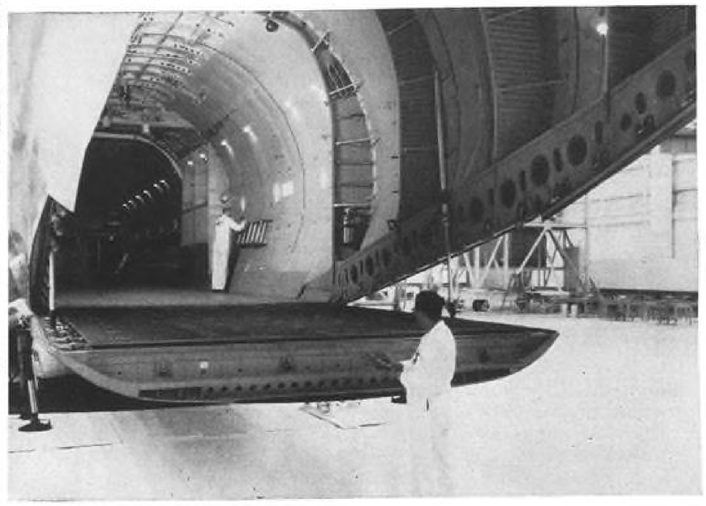
"The carrier can, by reason of speed and freedom of movement, avoid many attacks and minimize the chances of success of all attacks against her. Her maneuverability, speed and underwater protection provided in her design, and the defensive capabilities of the ships designed to accompany her, make her a difficult target for destruction by submarine attack. She is not vulnerable to overrunning and capture by an enemy force . . .

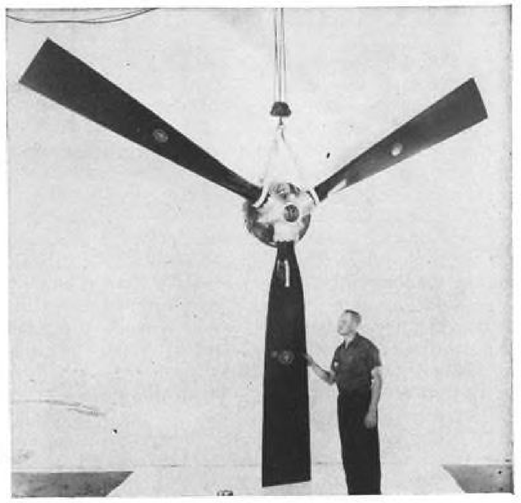
"It is an illuminating fact that a modern carrier task force is frequently, and in any event can be at any time, spread out over an area of 31,000 square miles, which approximates the area of the State of South Carolina. Obviously, a force spread over an area of this size does not present a profitable target to an enemy, regardless of the type of bomb he may be using. This is further emphasized by the fact that the task force is in constant movement, and thereby can avoid most of the secondary effects of thermonuclear weapons. . . ."

Electronics Decree

Some shrewd observers already are discounting reports that important changes will result from the consent decrees signed by American Telephone and Telegraph Company and International Business Machines Corp., to end Government anti-trust actions. One report is that the Government is trying to assure wide competition in the electronics industry. Another anticipates formation of a vast new number of transistor manufacturers. However, qualified observers are skeptical, pointing out that with dozens of firms already in the transistor business, present production capacity already far exceeds current demand. They doubt that any firm that is prepared to invest the $1 or $2 million now required to get into transistor production would have balked at putting up $25,000 advance royalty payment to obtain a license under the previous arrangement. —Washington staff







FIFTY TONS is payload of Douglas C-133, biggest cargo carrier to be ordered in quantity. Rear tailgate and ramp door (above) swings down for loading, showing size and length of tunnel-like interior. Giant 18-ft. Curtiss-Wright props (above right) absorb the 6,000-eshp. of each P&WA T34. Three-view shows general layout.

Douglas Rolls Out Turboprop C-133A Transport

By Irving Stone

Long Beach—The largest cargo plane ever to be put into production, the turboprop-powered C-133A, was rolled out by Douglas Aircraft Co. on schedule last week.

First flight trials are scheduled for the end of March.

The plane gives the Air Force a new cargo potential. Compared to its huge predecessor, the Douglas C-124 Globemaster, largest transport plane now in operation, the C-133A has increased capability with respect to payload, speed and range. Over a given distance, such as U. S. to Europe, two of the C-133As are expected to accomplish the same amount of logistic support as five C-124s.

The plane will be able to operate from the same fields that accommodate the C-124.

Troop Carrying Potential

At present, quantity of C-133s ordered is limited to Military Air Transport Service air freight use, but another potential use seen for the plane is as a carrier for more than 200 troops per flight.

Parts are in work on the Long Beach line for assembly into production items reaching to the No. 7 aircraft.

Design gross weight of the C-133A is 255,000 lb., but maximum (overload) gross may push the figure to about 275,000 lb.

Powerplants are four Pratt & Whitney T34-P-3 turboprops, each rated at 6,000 hp. at takeoff. Propellers are Curtiss-Wright Turboelectric units, 18 ft. in diameter.

Twenty Jet Engines

Fuselage is 148 ft. 2 in. long and 16 ft. 2 in. in diameter. Main door at the rear of the fuselage drops to form a ramp for driving cargo onto the 90 ft. long cabin floor, which is wood and studded with friction strips. Between floor and fuselage ceiling clearance is about 13 ft.

Sample loads which can be driven or hauled aboard by means of the ramp are reported by Douglas to be two prime movers weighing more than 40,000 lb. each, 16 loaded jeeps, 20 jet engines, or various combinations of vehicles, heavy ordnance and general cargo.

Forward loading door on port side of fuselage just aft of the cockpit area provides an opening 100 by 105 in.

Cabin is pressurized for high altitude operation, and heating system has a capacity of about 900,000 BTUs.

At about the middle of the cargo area, along the port side are compartments for the main electrical load center and electronic gear.

About 2½ ft. above the cargo floor along the sides of the fuselage is a 1 ft. wide walkway for easy passage within the hold when the plane is loaded.

Lights are strung along the cabin ceiling sides at about 6 ft. intervals.

Fuel Capacity

Wing span is 179 ft. 8 in. The wing houses integral fuel tanks which reach inboard from the tips to the center wing section. Approximately 16,800 gal. of fuel can be accommodated. Fueling can be done from a single point at the rate of about 1,200 gpm. Fuel tank booster pumps can be changed without draining the tank. Tank is automatically sealed when pump is removed.

Tapered wing skin is thicker than on the C-124 and stringers have greater depth. Wing section between spars incorporates a piece of skin which is the longest (58 ft.) yet used by Douglas. This skin section had to be coiled in order to be heat-treated.

Main landing gear retracts straight up into faired pods mounted on outside of fuselage. Each main gear strut carries four wheels and the fore and aft sets of two wheels can be retracted independently so that tires can be changed without jacking up the plane.

Rear Wheels

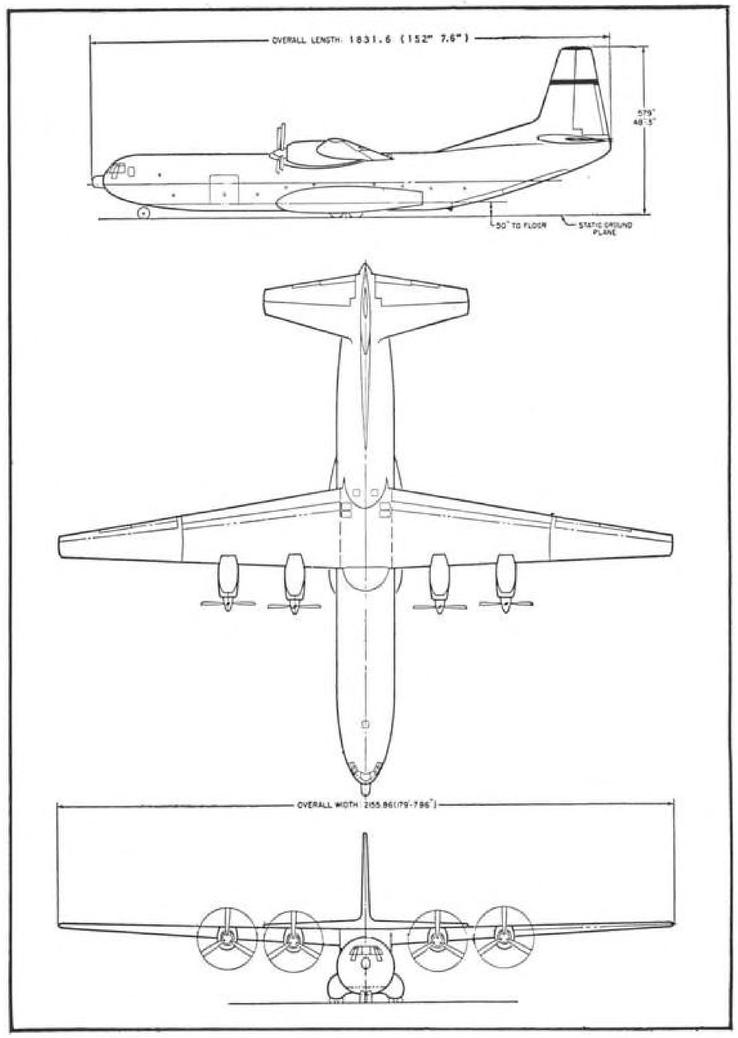
Nose gear has dual wheels. Plane is intended to land in fairly flat attitude, hence aft section, near beginning of loading ramp, is fitted with two small wheels with solid rubber tires which make contact with the ground if plane should land nose high.

Both landing gear pods have phone jack connections for intercommunication from ground to inside plane.

Aft section of port side pod houses two auxiliary gas turbine units for electrical, hydraulic and pressurization services. The auxiliary turbines also supply compressed air to start the main powerplants.

Forward section of starboard pod carries the connection for single point fueling of the integral tanks in the wings.

Plane will be handled by crew of four —pilot, copilot, navigator and systems engineer. There are provisions for housing a relief crew for extended operations.



AIA Cancels Export Conference

Washington—An aggressive program to promote the use of U. S. aeronautical equipment in South America, centered on a two-day international symposium to be held later this month in Miami, has been canceled on orders from DeWitt C. Ramsey, president of the Aircraft Industries Assn.

Following Ramsey's action, Richard B. Swanson, Washington representative of Convair and chairman of AIA's Export Committee, resigned his position as committee chairman. Swanson had spent several weeks organizing the Miami program and arranged for a list of prominent U. S. and Latin American aviation leaders to participate.

The Export Committee held several planning meetings for the Miami conference at which the AIA staff was represented by John Payne, export director, and his new associate, Irving H. Taylor.

On Jan. 25, a month before the planned meeting, Ramsey conferred with Swanson and Payne, then said he would have to clear the plan with his executive committee. Later the same day Payne called Swanson to announce that Ramsey wanted the program to be considered by the two regional aircraft manufacturers' councils.

An AIA spokesman told AVIATION WEEK the meeting has been postponed, not canceled, and expressed hope that Swanson would reconsider and retain chairmanship of the committee. Export Committee members did not share this optimism, feeling that the chairman had made his resignation final.

Purpose of the Miami meeting was to provide U. S. industry representatives with a better idea of the potentialities of the Latin American market, where European aircraft manufacturers have been making substantial sales in recent years. The program included military as well as commercial possibilities.

In addition to future aircraft requirements, there was to be discussion of Latin America's air transport plans, the equipment available for export and the role of international and civil aviation regulatory bodies. The AIA Export Committee voted for the program as a forum where American manufacturers could learn what is needed in Latin America, when it is needed and how financing arrangements can be improved. Representatives of the Export-Import Bank, World Bank, Bank of America and Chase-Manhattan banks were scheduled to attend.

Moderators of the forum sessions were to include Robert Hotz, editor of AVIATION WEEK, and Wayne Parrish, editor and publisher of American Aviation.

Others who had accepted invitations to moderate the forums were J. M. Barr, president of United Aircraft Export Corp., Roy T. Hurley, chairman and president of Curtiss-Wright and Fred E. Hines, vice president of Douglas Aircraft.

Speakers scheduled for the meeting included Senators Homer E. Capehart (R.-Ind.) and Stuart Symington (D.-Mo.), Lt. Gen. Clarence S. Irvine, USAF Deputy Chief of Staff for Materiel, Sinclair Weeks, Secretary of Commerce, Ruben Berta, president of Varig in Brazil and Robert Smith, president of Lacsa, Costa Rican airline.

An attendance of about 200 was anticipated, including representatives of airlines, aircraft companies and Latin-American military attaches.

One representative of a major airframe manufacturer, who is a member of the Export Committee, told AVIATION WEEK he considered the plan "one of the most forward-looking programs ever to come out of an AIA activity." He said he was "amazed" at the AIA staff decision, mainly because it came so late but also because it appeared as though Ramsey had not been cognizant of the committee's program.

Another committee member said he was "disappointed" and that this was true also of his company executives.

A third committee member said he was puzzled by a report that Ramsey thought there was insufficient time to prepare for the meeting, when the committee had the program well organized a month before the session. He added there were no signs of disagreement in the committee.

Three other committee members refused comment, except to say that they considered the affair an internal matter of AIA and that they believe the meeting will be held at some future date.

That there was some effort at coordination is made clear by an export subcommittee memorandum dated Jan. 19 and signed by Payne. It announced that a meeting of the subcommittee would be held Jan. 25 to confirm plans for the Miami session, chartering of a DC-6B to carry the industry participants to Florida, the hotel reservation plan, the agenda and the list of guests.

Military Aviation Funds

Air Force cancellations of aircraft, engine, and parts contracts exceeded new contracts during the first five months of Fiscal 1956 (July 1 through Nov. 30) by more than $373 million. On hand for new contracts: $12.5 billion. Here are the details (000 Omitted):

	OBLIGATIONS July through November, 1955	UNOBLIGATED Balance, Dec. 1, 1955
Aircraft, Engines, Parts:		
Air Force	−373,232	9,368,689
Navy	367,328	2,927,454
Army	− 59,042	224,289
TOTAL	− 64,946	12,520,432
Guided Missiles:		
Air Force	71,454	986,129
Navy	101,194	224,497
Army	111,295	358,404
TOTAL	283,943	1,569,030
Electronics and Communication Equipment:		
Air Force	44,178	788,222
Navy	60,023	151,842
Army	9,828	137,715
TOTAL	114,029	1,077,779
	EXPENDITURES July through November, 1955	**UNEXPENDED Balance, Dec. 1, 1955**
Aircraft, Engines, Parts:		
Air Force	2,102,632	13,360,631
Navy	637,443	5,415,569
Army	35,708	369,696
TOTAL	2,775,783	19,145,896
Guided Missiles:		
Air Force	190,880	1,390,057
Navy	65,044	504,754
Army	108,591	926,565
TOTAL	364,515	2,821,376
Electronics and Communication Equipment:		
Air Force	215,290	1,397,111
Navy	33,742	334,184
Army	48,488	468,131
TOTAL	297,520	2,199,426

USAF Warns Developers:

Production Contract Is Not 'Automatic'

USAF's Air Materiel Command has issued a new double-barrelled warning to the nation's aircraft and component makers:

- **AMC does not recognize** any claim to proprietary rights by industry when a weapons system or component is developed in all or part with USAF money.
- **Firms which develop** new systems or components must resolve internal differences between development and production specialists as an important step toward insuring production contracts.

Maj. Gen. David H. Baker, AMC Director of Procurement and Production, says the Air Force recognizes that the "increased complexity of our weapons and components and the need for speed in development places such a heavy risk on any company that Air Force support is necessary in order to insure that we maintain air superiority.

"However," he continued, "in these cases where the Government supports the development, I would like to emphasize at this point that the award of a Government contract for development does not mean that a production contract award will be automatic."

Air Force Contribution

Speaking before an industrial group at Chicago, Gen. Baker emphasized:

"It is in this area that many factors must be evaluated in placing the production contract and since the Air Force has paid for all or part of the development, the right to go to the qualified elements of the industry on a competitive basis is inherent in any agreement reached between the Government and the development agency."

Gen. Baker made it clear that USAF would prefer to buy an item from the company that developed it. Top considerations are price and the company's capability to produce. The reason is simple: AMC already has made a substantial contribution, with a development contract, toward putting the firm in a favorable competitive position.

He pointed out that the developer "has more knowledge than any one else about the product and the manufacturing problems involved.

"Frequently he has been furnished some tools and equipment, particularly where hardware has been produced as part of the development. These advantages should place the developer in a favored position cost-wise and time-wise and he should be able to compete with any other good development-production company in the industry."

There are cases, Gen. Baker said, where AMC may be willing to pay a price differential in order to place a production contract with a developer.

"However," he continued, "no Government-supported developer can expect to automatically receive a production contract without full consideration of competition and ultimate costs to the Government.

"When a good developer loses production awards to qualified competitors he should carefully examine his production organization to insure that he produces efficiently."

Gen. Baker indicated he has found contractors—"many organizations and many individuals"—who are highly qualified in the development field but inept when it comes to production of the item.

He said:

"The skills, capabilities and knowledge which are needed to produce on schedule and at the most reasonable cost are not the same as that knowledge which, when applied to scientific and development progress, shows such outstanding results."

Payoff Is Production

Gen. Baker referred to some outstanding engineers who are limited in their management and production capabilities.

"In the long run," he said, "it is not the development in itself that gives us superior air power, but it is the actual production of the developed items in quantity and their delivery to our fighting units where we pay off in superiority in the air."

Component makers were encouraged by Gen. Baker to keep in close contact with airframe and engine makers if they want to stay abreast of the state of the art. These firms, he said, "represent the greatest fund of future technical requirements and the greatest potential military market . . ."

He pointed out that all properly qualified potential contractors can benefit from the Air Research and Development Command's Technical Development Symposia.

In addition, Baker said, the prime manufacturers in many cases have access to ARDC facts—sometimes secrets—that will help them guide component makers to the most lucrative fields for development activity.

Importance of Components Emphasized

Air Force's development race with Russia is not confined to areas covered by airframes and engines. Increasing realization that the weapon systems of today comes as much from key component developers as those who work on the vehicle is recognized by the Air Materiel Command. Gen. Baker says:

"In order to be sure that we stay ahead of our potential enemy and thereby insure our existence in this world, it is essential that we maintain superiority in the technical race for survival which is going on today. We all know that in this race our competitor is very capable and has shown by actual performance that he is moving rapidly ahead.

"It is our task to insure not only that we keep up with him, but more—that we stay ahead of him—as we are at this time. In this technical race there can be no question in any of our minds that the most important single element, on either side, is the capability of delivering through the air the tremendous power of our thermonuclear weapons.

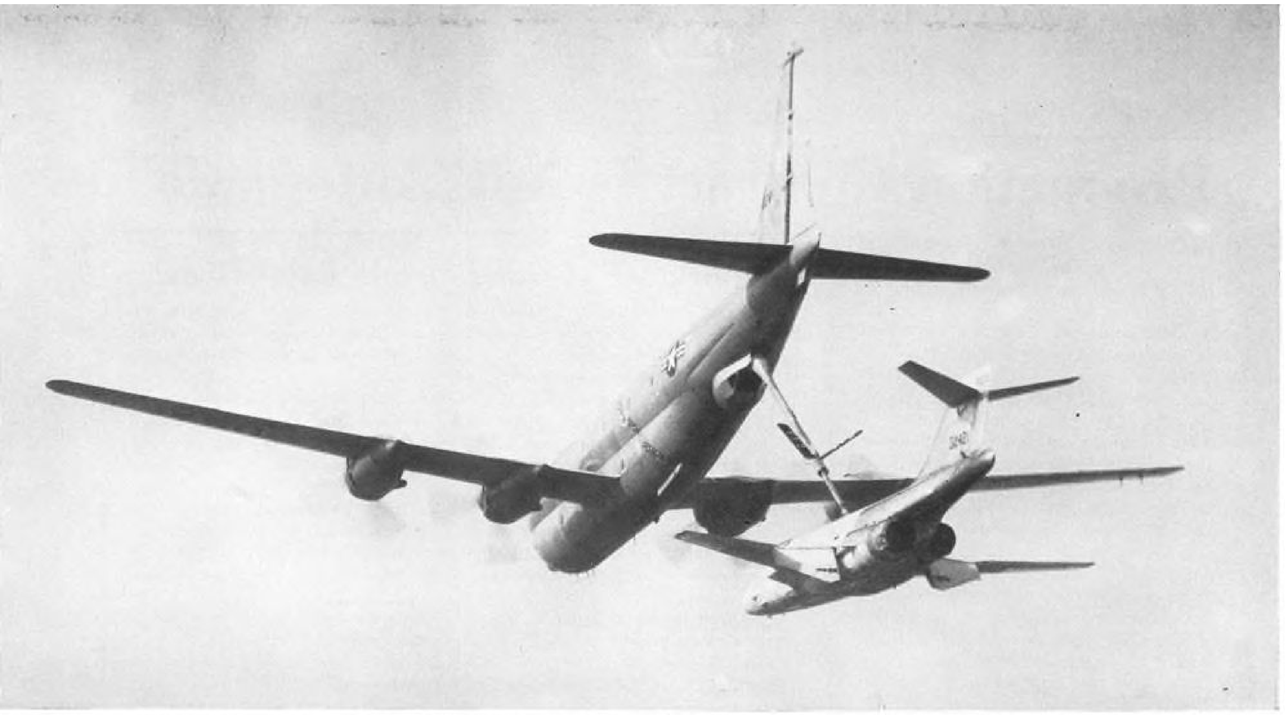
"Therefore, the major emphasis in this race must be toward the development of superior air weapon systems for offense and defense as early as practicable.

"When I speak of the air weapon, I mean more than the airframe and the engines. . . . Principally I refer to the vital components and electronic devices which today are adding more to our combat effectiveness than other improvements have the prospect of giving us," he said.

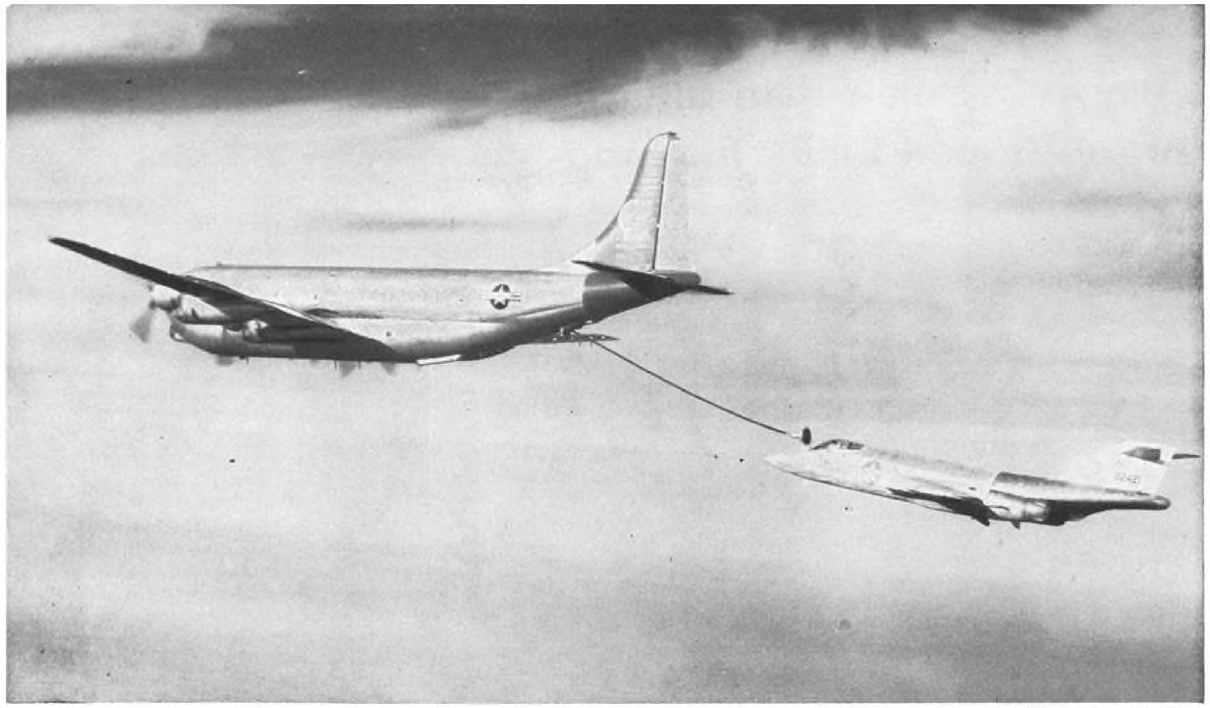
Berlin Named Chairman Of Helicopter Council

Don R. Berlin, president of the Piasecki Helicopter Corp., is the new chairman of the Helicopter Council of the Aircraft Industries Assn. J. E. Leonard, manager for military sales-helicopter of Cessna Aircraft Co., was named vice chairman.

The council is now composed of eleven companies. Gyrodyne Co. of America, St. James, L. I., and Kellett Aircraft Corp. of Camden, N. J., became members during the council meeting which was held in Washington last week.



F101A Voodoo's receptacle for Boeing developed "flying boom" refueling method is located on fighter's back. Note extreme deflection of Voodoo's large-chord flaps and the rectangular outlets on their upper surfaces near trailing edge, suggesting the use of boundary-layer control by supercirculation.



Nose Probe of the same McDonnell Voodoo makes contact with drogue trailed from Boeing KC-97 tanker. Voodoo, first USAF production order for McDonnell, is being built also in photo-reconnaissance version. Two Voodoos crashed recently, one at Eglin AFB. Plane shown has serial number corresponding to fourth airplane built.

Jackson Cites Red Missile Progress

Washington—Sen. Henry Jackson (D.-Wash.), chairman of the Military Applications Subcommittee on Atomic Energy, predicted that the Soviets would win the race for the intermediate-range 1,500-mile ballistic missile. He said this development would nullify the effectiveness of the Strategic Air Command manned with medium-range B-47 bombers.

He told the Senate:

"There is the danger that the Soviets may fire a 1,500-mile ballistic missile before the end of this year—1956.

"Some may minimize the importance of such an achievement. They may say that the Soviets, operating from their present bases, could not reach the American heartland with a 1,500-mile missile. They may contend that ballistic missiles will endanger this country only when the Kremlin achieves a weapon of true intercontinental range.

"This is not the case. The existence of a 1,500-mile Soviet ballistic missile would cancel out our one vital advantage over Russian air-atomic power—our system of overseas air bases. Virtually all of our overseas SAC bases are within easy striking distance of a 1,500-mile missile. Such a missile could level these bases in a matter of minutes.

"Without these bases, our Strategic Air Force would be a shadow of its former self. Without these bases, the effectiveness of the B-47 bomber—the present backbone of our striking force—would be drastically reduced. We would be forced into primary reliance upon the now obsolete B-36, and the long-range jet B-52—only now beginning to trickle off production lines.

"A Soviet 1,500-mile missile could turn our strategic thinking upside down. It might well compel us to write off our overseas bases as virtually useless. A Russian 1,500-mile ballistic missile could force American airpower to retreat 5,000 miles from the Soviet Union."

Mach 1.7 Speed Seen For Rocket-Viper MD-550

Paris—The Marcel Dassault MD-550 interceptor incorporating a SEPR rocket engine is ready for its next set of tests. The French delta prototype has been turned back to the company after several weeks of tests at the French government's flight test center at Bretigny.

The MD-550, which first flew in May, 1955, is powered with two Viper turbines made in France by Dassault under Armstrong-Siddeley license. With the rocket motor, Dassault expects the plane to reach Mach 1.7.

The French have previously experimented with rocket engines on the Trident, which has reached speeds of 1,100 mph. in level flight with the supplementary rocket engine.

Runaway Regulus 'Dumped' in Grove

Los Angeles—A training version of the surface-to-surface Regulus guided missile spun into an orange grove near Porterville, Calif., last week.

The missile took off for the training flight from the Marine Corps auxiliary air station in the Mojave Desert on tests for the Navy guided missile unit there. The Regulus crashed to the ground, missing houses by only 200 yards, and dug a crater about 12 ft. deep.

An official Navy statement said:

"Throughout the entire flight the missile was never without escort and we feel this missile was at no time a hazard to the general public."

The runaway Regulus got into trouble when it broke away from two escort F9F Cougar jets and started to climb and penetrate the overcast. The control aircraft followed the missile to 23,000 ft. where they gained intermittent positive control. The pilots were able to execute a slow let down through the overcast, but because of the missile's low fuel supply at this point, the control pilots were unable to get it back to home base. They were forced to "dump" it to the ground.

Wilson Creates Missile Aide Post

Washington—Secretary of Defense Charles E. Wilson has established the post of Special Assistant to the Secretary of Defense for Guided Missiles to accelerate the nation's missile programs.

The new special assistant will have broad authority, acting in Wilson's name. Wilson said last week that the new man must be primarily "a do-er" and not an advisor.

Mr. Wilson also said in answer to criticism from Sen. Henry Jackson (D.-Wash.) (see page 30) that "everything possible" is being done to push development of intercontinental ballistic missiles and intermediate-range missiles.

Wilson's new assistant will act as chairman of the recently-created Ballistic Missiles Committee and act as Wilson's aide in contacts with the Assistant Secretaries of Defense for Research and Development, Applications Engineering, Comptroller, Properties and Installations and Supply and Logistics whenever their activities affect the missile programs.

The new aide also will advise the Armed Forces Policy Council, the Joint Secretaries, the Joint Chiefs of Staff and other Defense Department agencies.

He will make periodic reports to Wilson, prepare any special reports needed, and be charged with preparation of, and presentation of any missile reports required by the National Security Council and the President.

The new position grew out of efforts started last November to give the missile programs "more urgency" and "a good push," Wilson said. The Army and the Navy were brought into missile work more fully and ordered to develop a mid-range missile based on the Army's Redstone. The Air Force, which is working on both mid-range and intercontinental missiles, had its guided missile program increased at that time.

Wilson said he still is looking for a man for the job. "He'll operate in my name and I'm a little touchy about who does that," the secretary said.

The new aide's job will be similar to that of K. T. Keller's, who was appointed by the Truman Administration to ramrod the guided missile program. Keller stayed on at Defense for several months after Wilson became secretary.

He made some reports to Wilson on missiles and "I've been in reasonably close touch with the situation ever since then," Wilson said.

Symington Protests Air Cuts

Washington—Sen. Stuart Symington (D.-Mo.) charged that the Administration's hopes for a balanced budget for Fiscal 1956, which ends June 30, hinge on weakening the defense program.

"To get this balanced budget this year, expenditures for combat aircraft are being reduced over a billion dollars," Symington said in a Senate speech.

"You have heard a lot of talk recently about our inability to compete with the Communists on a quantity basis, and that, therefore, we must excel in quality, especially technological quality.

"But in order to achieve this balanced budget in Fiscal 1956, expenditures for defense research and development have been cut $27 million."

Symington, a former Secretary of the Air Force, also protested that the sea power program is being reduced by $300 million and the Army is being cut an additional $390 million.

"We have heard a lot of talk and read a lot about being able to cut the Army and Navy and Marines because of the growing importance of air power. Nevertheless, in order to achieve a balanced budget, we are now cutting the expenditures for the Air Force even more than for the Army and Navy. . . .

"All this is even more interesting because of testimony given the Senate in secret session stressing the almost unbelievable build-up in Communist air and sea strength in recent months. Their supremacy on the land has long been known."

Army's Weapon Plan Indicates More Responsibility for Industry

By Claude Witze

Washington—U. S. Army's increasing emphasis on research and development, utilizing better planning and better coordination with operational requirements, indicates a growing role for industry in providing equipment for the foot soldier.

The program is not confined to aircraft and missiles and includes a vast field of military hardware unheard of as recently as the Korean war. Yet the fact remains that the aircraft and related industries probably have the most to gain from intimate knowledge of modern Army thinking, the kind of hardware that will be needed and the Army's research and development philosophy.

William H. Martin, the Army's civilian Director of Research and Development has been on the job for only four months. Yet, he told AVIATION WEEK, he already is convinced that the most important aspect of his program is that of project planning. Martin defines this as "the matching of operational needs with technological potentialities."

This great demand bears a striking parallel to what the U. S. Air Force has learned about the challenge before American industry to speed development and shorten the cycle leading to production of weapons.

Concentrate Responsibility

What must be provided, Martin says, is "data on which to base sound decisions as to what to develop, produce and use." While the Army does not face the heated rivalry from Russia to the extent that is spurring USAF in the air, it is clear that American industry is going to learn much more about its research and development problems.

Martin recently told the Army Scientific Advisory Panel in a meeting at Fort Bragg, N. C.:

"The design-development phase is one which I feel should be placed largely in industry and that for new complex devices, the design-development agency should preferably be the one responsible for the initial production of the new item.

"I have this conviction because my experience indicates that it is advantageous to concentrate responsibility for both design and initial production in one agency. . . . One advantage of this single responsibility (is) the opportunity for interaction of design and production engineering.

"Additionally, we want to draw upon the ingenuity, skill and experience of industry.

"This is particularly important with such new complex devices as guided missiles, fire control systems and communications equipment, where freedom from service failures and ease of maintenance are so desirable.

Penalty Clauses

"Industry has made wonderful progress in the reliability of such things as automobiles, telephones, radio sets and household appliances. The military wants design for service in which the factors of reliability, maintenance and operating cost have their proper weight, along with first cost," he said.

Martin denied his approach is a departure from traditional Army development philosophy but acknowledged it is one already used widely in the aircraft industry. The difference, as he sees it, is that a large proportion of the aircraft makers always have been dependent for the most part on military contracts.

They have been required, when in production, to turn out a serviceable weapon system or suffer the wrath of their only customer. There have been times when this wrath did not do the job.

The complexity of modern weapon systems, the demand for greater economy and dependability, have led the Air Force in 1955 to reemphasize its demand for better industrial performance.

One example of this is the recent move by the Air Materiel Command to include penalty clauses, to be invoked upon failure of a contractor to meet USAF standards.

Martin emphasizes that his own ideas are not official Army policy. But he feels that the best way to introduce a new item into service is to make the initial production contractor responsible for "the initial supply of the special tools, testing equipment and information required for the installation, testing adjustment, operation and maintenance of the new article."

This is a close approach to USAF's weapon system concept, giving entire responsibility to the prime contractor for successful performance of the system in operation.

There are important differences in Army procurement. Most important probably is the fact that traditional ground soldier equipment has come, for the most part, from the Army's own arsenals and contractors who are concerned mainly with commercial products. Tanks are built by factories that make automobiles. Big guns come from huge machine tool or locomotive plants.

Change in System

Entry of the Army into the field of specialized aircraft and guided missiles has altered this picture. The Transportation Corps still has not solved many of its maintenance problems with helicopters, for example, and the Army push is on to speed development of new types of "aerial vehicles" better suited to the mission of the ground forces. These problems are getting intense consideration at the Army Aviation School at Ft. Rucker, Ala. (AW Dec. 26, p. 15).

It is Martin's belief that industry can and will help in these developments. He told AVIATION WEEK that the arrangement at Redstone Arsenal, Huntsville, Ala., where the Redstone missile was developed, was an exceptional case. The program was dictated by the fact that the Army utilized the skills of about 100 German scientists brought here from Peenemuende after World War II.

The same men, still at Redstone, are working now on the new joint Army-Navy 1,500-mile missile. Again, it is a matter of utilizing their knowledge. As in the case of the Redstone, now ready for production at the Chrysler Corp. plant in Detroit, the new missile will be built by private industry.



William H. Martin has been the Army's Director of Research and Development since last September. Before that he was Deputy Assistant Secretary of Defense for Applications Engineering since January 1954. He is a retired vice-president of Bell Telephone Laboratories, a native of Baltimore, Md., and graduate of Johns Hopkins and Massachusetts Institute of Technology. He won a presidential citation for his work on military equipment in World War II. He believes in the future of the U. S. Army, regrets "that it has not gotten its story across to people outside the Army."

Emphasis on Planning

Martin, however, appears to recognize the weaknesses of this system. He says that "a lot of creative development takes place today in, and in preparation for, manufacture, and particularly in engineering for mass production.

"Design-development should be closely related to this production engineering . . . each can interact on the other, in the interest of performance and cost of the product. . . ."

This, he declares, runs "somewhat counter to the arsenal pattern for the development and production of military ordnance. In the newer arts of war such as guided missiles and fire control systems, industry now is engaged heavily in development and production."

Martin feels that his emphasis on planning is the most important part of his approach to his job. He says he found the Army far ahead of where he thought it was in the field of operational plans. Once these are studied by development experts, projects can be selected and plans laid to insure concentration of effort in the field where the promise of progress is brightest.

The Army's research and development director feels strongly that his branch of the services needs more scientific skills among the men in uniform. This he views as essential if soldiers are to intelligently pose problems and appraise the paper studies or actual hardware produced by industrial developers.

Martin believes the Army's program planning should cover up to 10 years and could involve "more than one generation" of items.

"For a field such as guns and missiles for air defense, we currently have available several devices," he says.

"With such operational studies as I have mentioned, and a survey of the research and development potentialities, we can come up with the ideas as to what performances and devices we want, say, in the 1960-1965 period.

"With the current and long-range pictures, we are then in a good position to determine what steps we should take in getting from where we are to where we want to be in 1965 . . . avoid making marginal improvements which are not worth the effort and expense. . . ."

The Army's Scientific Advisory Panel, headed since 1951 by Dr. James R. Killian Jr., president of Massachusetts Institute of Technology, now has a new chairman. He is Dr. Frederick L. Hovde, president of Purdue University.

Martin has suggested that the panel adopt an organization that is divided into four areas to cover Army interests. They are:

- **Fire power.**
- **Mobility on the battlefield** and in getting to the combat area.
- **Communications and reconnaissance** for a mobile and dispersed Army.
- **Logistic support** for a mobile and dispersed Army.

"With today's technological potentialities," he says, "we must increasingly select the critically important projects, rather than try to carry all those that have interest."

Nuclear Power Study

U. S. Army last week awarded a study contract to private industry to determine how nuclear power can be used to propel land and water vehicles.

The $100,000 project was launched by the Transportation Corps in an agreement with the Nuclear Development Corp. of America, White Plains, N. Y.

Items to be considered in the study will include railroad locomotives, harbor vessels and inland waterway craft, including tugs and freight supply ships.

Nuclear-powered vehicles would be useful in remote areas, such as the Arctic, where fuel deliveries are a major logistic problem.

CAB Proposes Copter Pilot Rules

Washington—Helicopter certification and operating rules for scheduled air carrier operations have been proposed by the Civil Aeronautics Board as a new Part 46 of the Civil Air Regulations.

The issuance of air carrier operating certificates for helicopter operations is presently covered by a special CAR which will automatically terminate upon the effectiveness of the Board's new proposal. Since the proposed new rules are being circulated for the third time since February 1950 the Board set Mar. 31 for return of industry comment.

At the same time, CAB is proposing an amendment to CAR Part 21 which would establish provisions for the issuance of an airline transport pilot rating-helicopter.

The proposal is to add a new section to CAR Part 21 outlining the aeronautical requirements for an airline transport pilot rating-helicopter. First such proposal was circulated to the industry in July 1953 and subsequently revised in June 1954.

The revised regulation will require the applicant for an airline transport pilot rating-helicopter to demonstrate aeronautical knowledge, experience and skill.

Each applicant will have to hold valid commercial pilot and instrument ratings, or equivalent as determined by the Civil Aeronautics Administrator, and have had at least 1,200 hours of flight time as pilot within the last eight years, of which:

- **500 hours** shall have been cross-country flight time.
- **100 hours** shall have been night flight time.
- **150 hours** shall have been in helicopters, with five hours no less than 60 days prior to date of application and 75 hours as a pilot in command of a helicopter.

Meanwhile, the Navy has taken the Sikorsky HSS as the first helicopter to be qualified for standard instrument flight under the same rules applied to fixed-wing aircraft. Although rules for instrument flight as set up by the Navy and CAA do not specifically prohibit a helicopter from flying Instrument Flight Rules, no commercial or military helicopter has been considered fully instrument qualified.

The HSS, which is now being delivered to both the Atlantic and Pacific fleets, is considered by the Navy to be the first helicopter to meet all requirements for instrument flight. Navy spokesmen said the HSS has the stability, flight instruments and communication systems which make the rotary-wing aircraft as safe and dependable in blind flight as a single-engine fixed-wing plane fully equipped for instrument flight.

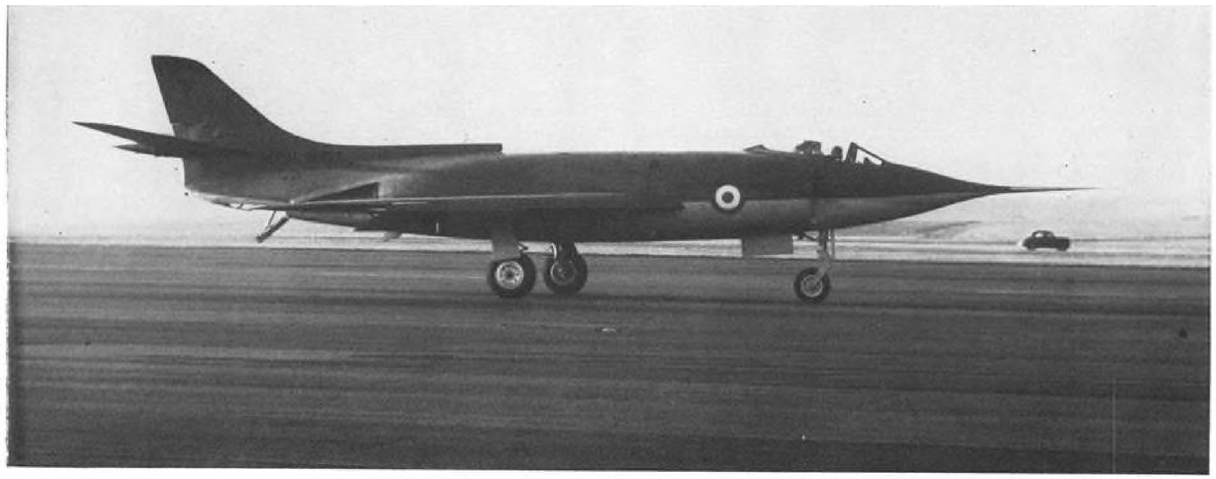
Aircraft stability of the HSS is helped by auto-stabilization equipment, which ensures additional stability required for ease of flying mandatory under IFR conditions.

As part of the helicopter instrument flight evaluation project being conducted at the Naval Air Test Center, Patuxent, Md., certain qualified pilots have been issued helicopter instrument ratings.

The first naval pilot to receive such a rating was Lt. Cmdr. William Casey, chief of rotary wing flight test at Patuxent.

It is expected that Navy and Marine Corps pilots will, in the future, qualify for helicopter instrument rating in the Sikorsky HSS.

The Navy's helicopter IFR project at Patuxent is part of a long-range program of the military services and industry to qualify future helicopters as completely all-weather aircraft, capable of navigation and flying their military missions under any condition of weather or terrain and under all conditions of flight from hover to maximum speed.



Supermarine With Supercirculation

Supercirculation is the main design feature of this Vickers-Supermarine N.113 fighter for the Royal Navy. Developed in prototype form on the V-S Type 525, the system bleeds air from the engine compressors and blasts it over the upper surface of the wing flaps during approach and landing. Powerplant of the N.113 is a pair of Rolls-Royce Avons. First plane in the development series was V-S Type 508, a straight-wing, twin-Avon fighter with a butterfly tail. It was followed by the Type 525, which crashed. Major differences between the N.113 and the 525 include leading edge extensions to delay tip stall and an all-moving horizontal tail. Other changes have been made in vertical tail layout, canopy, cockpit and nose. A production order has been placed for the N.113.

Lockheed Moving Missile Division Into San Francisco Bay Region

Los Angeles—Lockheed Aircraft Corp. will move its Missile Systems Division from Van Nuys to a 275-acre site at Sunnyvale in the San Francisco Bay area. Early step in the move will be construction of 96,000 sq. ft. of manufacturing space at Sunnyvale.

The company also will construct a number of research laboratories for advanced studies in the fields of missiles and unmanned aircraft on a 22-acre site at Stanford University, Palo Alto, about seven miles from the Sunnyvale location.

Construction will begin at once on two laboratories, each encompassing 51,000 sq. ft.

These new Missile Systems Division facilities are the initial steps in a research and development program on which about $20 million will be spent in the next three years.

More Skills Available

Choice of the Sunnyvale and Palo Alto sites undoubtedly is related to the numerous responses Lockheed has gotten to its advertisements for engineers and scientists from the San Francisco Bay area. It has outranked other areas polled by a ratio of four to one.

Another factor for locating in the bay area, Gross pointed out, is that it has become "a center of electronic and other research effort." Lockheed's laboratories at Palo Alto will bring it to a technical center near the area already tenanted by General Electric, Eastman Kodak and Varian Associates.

Dr. Louis N. Ridenour, research director of the Missile Division, has said that Lockheed plans to develop close associations in both education and research with Stanford scientists. Proximity to the university and its laboratories, he says, will give Lockheed researchers an opportunity for advanced study. Consulting opportunities at the Missile Division will be afforded the Stanford faculty.

Van Nuys Plans

The Missile Systems Division's Van Nuys plant is now engaged in more than a dozen secret projects covering virtually every phase of missile technology, Lockheed reports, and the plant will be fully occupied for a considerable period. When the Missile Systems Division's move to Sunnyvale is completed, other Lockheed activities will take over the Van Nuys plant, since Lockheed is planning an expansion of research and development and production facilities in Southern California.

Missile Division personnel are scheduled to be at work at the Stanford site this fall, and at Sunnyvale by the end of the year, with 500 employes expected to be at both sites at that time. The division now employs about 3,000.

The Missile Systems Division has had a troubled past. Organized late in 1953, it moved into the Van Nuys plant in 1954. The following year building plans for Van Nuys were cancelled, partially due to the plant dispersal policy laid down by the Department of Defense.

Late in 1955 there were a number of resignations among top-echelon personnel (AW Dec. 19, p. 16). Elwood R. Quesada, Lockheed vice-president and general manager of the Division, resigned in November. The following month, about 20 more Missile Division scientists resigned, including the head of the research laboratories branch, director of the computer and controls laboratory, chief of the systems laboratory, and assistant head of the nuclear section. The resignations reportedly followed a decision by Lockheed management that the Missile Division's research laboratory would not have a controlling influence in projects of a research nature.

Short Reserve Enlistments Are Closed to Technicians

Because aircraft and engine mechanics, electronic technicians, instrument repairmen and machinists are "urgently needed" by the armed forces, they no longer are eligible to enlist in the three-to-six-month military reserve program.

Office of Defense Mobilization deleted the four skills from the short enlistment list after conferring with the Secretary of Defense and the Interdepartmental Manpower Policy Committee. ODM pointed out, however, that journeymen and apprentices in these occupations still are eligible for occupational deferment.



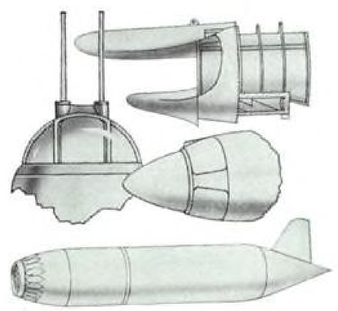
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Just as the bold, firm signature of John Hancock signified full acceptance of the responsibilities contained in the Declaration of Independence, so does the Rheem signature, on a prime or sub-contract, signify full responsibility for every commitment to the most minute detail.

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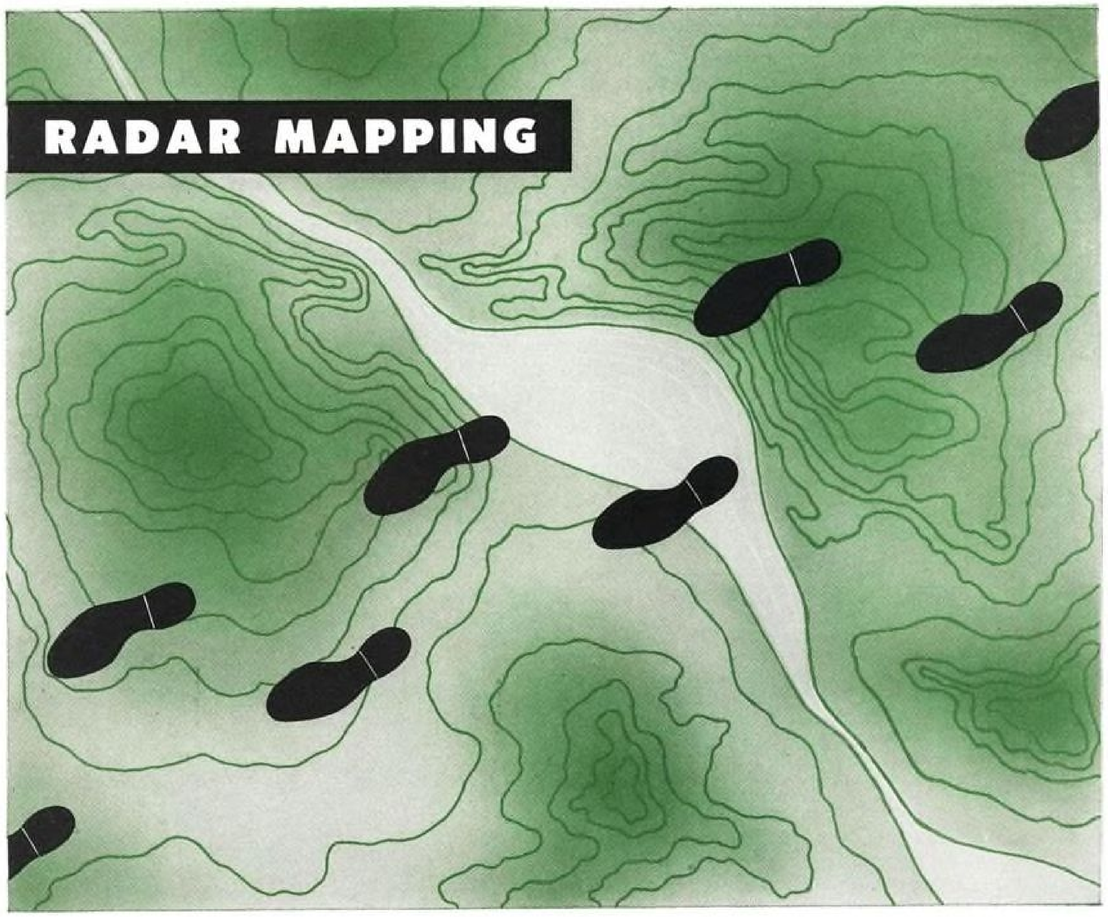
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ALL SWEDISH AIR FORCE attack wings are to be equipped with the Saab A32 Lansen all-weather fighter (above) within near future.

Saab All-Weather Fighter Goes Into Full Production



LINES of the 700 mph. fighter (wings above, fuselages below) come off assembly line three years after prototype's first flight.





RADAR-EQUIPPED Lansens await final assembly at Saab factory.

avien's 'piggy-back' thervel* switch



adds positive level control to any fuel gage

Avien . . . pioneer in the development of aircraft fuel management systems . . . now brings dependable fuel level control to any fuel gage installation.

Employing Avien's service-proven thermistor switch in a new clamp-on design, the "piggy-back" sensor mounts on any tank probe — provides precise level signals for high- or low-limit warning, tank sequencing and other fuel management jobs. External relay unit eliminates moving parts from the tank, assures reliable control of signal lights, pumps or valves.

Weighing less than 0.5 pound, the "piggy-back" Thervel Switch uses only three wires between units; is adaptable to any fuel system without altering present equipment.

Most important — operation is independent of fuel gage circuits, providing positive level monitoring even under emergency conditions.

Additional features:

- **Operates from standard 28 volt DC supply**
- **Unaffected by slosh, vibration or acceleration**
- **Requires no additional mounting holes**
- **Conforms to MIL-E-5272A and MIL-G-8615 (ASG)**

Other Models: Available in 12 volt and bracket-mounted models, as well as special designs.

For complete specifications and application data write Dept. AW-2

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Bill Tightening Contract Policies Probably Won't Affect USAF, Navy

Washington—Legislation tightening the authority to negotiate defense contracts—which seems certain to be enacted—is not expected to have much effect on the contract policies of the Air Force and Navy's Bureau of Aeronautics.

The Assistant Secretary of USAF for Materiel, Dudley Sharp, explained to House Armed Services Committee why the bulk of military aviation contracts must be negotiated, despite the policy of the 1947 Armed Services Procurement Act declaring competitive bid contracting the rule and making negotiated contracts the exceptions:

"During Fiscal 1955, approximately 85% of the dollar amount of all of our procurement actions reflect the procurement of airplanes, engines, complex electronic equipment, fire control and bombing systems, guided missiles, and research and development work. . . . The reason for the very high percentage of dollars which we place by negotiation thus becomes readily apparent. . . . Further, we must frankly advise that we know of no way that these major items can be procured by formal advertising. . . ."

Legislation approved by the House committee would strike out the authority to negotiate contracts because of a Presidentially-declared "emergency." For the past five years, all negotiated contracts have been justified by the emergency declared by former President Truman in December 1950. The measure, sponsored by Rep. Carl Vinson (D.—Ga.), chairman of the committee, would require that an "emergency" be declared by the Congress before it could be used as justification.

The measure would mean that negotiation must be justified under one of 17 permissive exceptions to competitive bid contracting in the 1947 act. Periodic reports to Congress on contracts let under these exceptions are required. The services conceded in House hearings that the reason they had justified negotiations under the Presidential emergency was simply that it was "easier" because it averted this reporting requirement. They insisted that all contracts negotiated since 1950, however, could be justified under one of the 17 exceptions.

Among these exceptions, under which the services are permitted to negotiate contracts, are:

- **If "the public exigency** will not admit of the delay incident to advertising."
- **For supplies or services** for which it is impracticable to secure competition.
- **Contracts for experimental,** developmental, or research work, or for the manufacture or furnishing of supplies for experimentation, development, research, or test.
- **For classified projects.**
- **For technical equipment** when standardization is necessary in the public interests.
- **For specialized supplies** requiring a substantial initial investment or an extended period of preparation for manufacture when it is determined that competitive bidding "may require duplication of investment or preparation already made, or will unduly delay procurement."
- **When it is determined** "that it is in the interest of the national defense that any plant, mine, or facility or any producer, manufacturer . . . be made or kept available for furnishing supplies or services in the event of a national emergency. . . ."

Kits Will Reduce AMC Overhaul Costs

Tinker AFB, Okla.—Purchase of overhaul kits instead of individual parts will be started soon as part of the Air Materiel Command's continuing drive to cut costs, force more efficiency into U. S. Air Force operations.

Oklahoma City Air Materiel Area, site of the world's biggest jet engine overhaul facility, will launch the program on a service test basis with six manufacturers of pumps, valves and similar engine accessories. Later, it is anticipated that the program will expand to include aircraft, engines, electronic components and all other moving equipment purchased by the Air Force.

Twenty-five members of the Aircraft Industries Assn. are attending a two-day meeting at this headquarters to study the new program and lay plans for its application to other commodities.

Figures provided by the Oklahoma City AMA show that under the kit system, USAF actually will spend more money for replacement parts, but savings effected in their purchase, handling and distribution will bring substantial overall economies. In the case of overhaul for one line item, cited as an example, there will be direct savings of $5,252—most of it in paper work and storage expenses.

The new overhaul kits will include only low cost items required for field maintenance or overhaul, as well as those for which there is a high replacement factor. This will eliminate the need for provisioning procedures for each item, nut and bolt and other small item needed by the field mechanic.

It is estimated, for example, that the Oklahoma City AMA is the prime source for 900 end items and that it wrestles with about 11,000 separate spare parts in order to service them. Under the new program there will be only 1,800 kits to do the job, divided into 900 maintenance kits and 900 overhaul kits.

In addition to the cash savings expected from the kit program, AMA sees other advantages:

- **Stock lists** will be cleared of thousands of items.
- **Prime depots** and specialized bases will always have the majority of spare parts needed.
- **Complete repairs** will be possible at more bases.
- **Follow-ups** and expediting orders will be reduced.
- **A slash** in repackaging and transportation costs.

Items which cost less than $1 will be automatically replaced under the new system. This will eliminate cleaning and processing expense, which usually runs to more than the part's original value.

The six companies that will perform the service test of the new program are Adel Precision Products Corp.; AiResearch Division, Garrett Corp.; Utica Division, Bendix Aviation; Pesco Products Division, Borg-Warner Corp.; Thompson Products, Inc.; and Vickers Inc., Division of Sperry Rand Corp.



Army to Test New Air Scout Vehicle



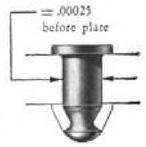
Numerous improvements to increase performance will be featured on 12 de Lackner Aerocycles that will be leased to various Army ground units this summer. Compared to prototype pictured here, new version will have longer coaxial rotor blades, mechanical transmission replacing belt drive and will be 50 lb. lighter. Army will evaluate the one-man scouting vehicles for three months, paying about $15,000 for each machine for this period. Interest in the de Lackner vehicle is part of an Army research program to increase battlefield mobility for ground units under atomic war conditions.

It takes little experience to fly the Aerocycle—the soldier-operator shown flying the craft soloed after only 16 min. of ground instruction.

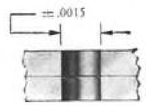
Powerplant is a 42-hp. Kiekhaefer Mercury outboard engine; one-gallon fuel tank, carrying white gas with a mixture of oil, provides range of about 150 mi.

Reversing the usual procedure of inserting a semi-close tolerance fastener into a close tolerance hole—

the HS51P-52P series HI-SHEAR rivet with a close tolerance shank, fits into a semi-close tolerance hole, pilot and core drilled.



This easier made hole



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Additional savings are realized in less drilling skill needed, equipment and inspection.

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Where Money for Base Construction Will Go

Washington—Over $1.1 billion of the $2 billion public works authorization requested by Defense Department is for expansion of Air Force facilities.

Of this total, $660 million is for continental projects and the remainder for overseas and classified projects.

Following are continental projects of more than $1 million:

Air Research and Development Command

Canel AF Plant, Hartford, Conn., $22.4 million.
Edwards AFB, Muroc, Calif., $5.5 million.
Holloman AFB, Alamogordo, N. M., $7.9 million.
Kirtland AFB, Albuquerque, N. M., $5.5 million.
Laredo Test Site, Tex., $1.2 million.
Laurence G. Hanscom Field, Bedford, Mass., $6.9 million.
National Reactor Test Station, Ida., $11.4 million.
Patrick AF Base, Fla., $15 million.

Air Materiel Command

Brookley AFB, Ala., $1.5 million.
Griffiss AFB, Rome, N. Y., $18 million.
Hill AFB, Ogden, Utah, $1.3 million.
Kelly AFB, San Antonio, Tex., $1.6 million.
McClellan AFB, Sacramento, Calif., $1.4 million.
Norton AFB, San Bernardino, Calif., $1.6 million.
Olmsted AFB, Pa., $4 million.
Robins AFB, Macon, Ga., $5.5 million.
Tinker AFB, Oklahoma City, Okla., $3.5 million.
Wright-Patterson AFB, Dayton, Ohio, $17 million.

Air Defense Command

Buckingham AFB, Ft. Myers, Fla., $13.2 million.
Ethan Allen AFB, Ft. Winooski, Vt., $4.2 million.
Geiger Field, Spokane, Wash., $2.8 million.
Glasgow AFB, Glasgow, Mont., $2.5 million.
Grand Forks AFB, Grand Forks, N. D., $2 million.
Grandview AFB, Kansas City, Mo., $1.7 million.
Greater Pittsburgh Airport, Corapolis, Pa., $1.1 million.
Hamilton AFB, San Rafael, Calif., $3 million.
K. I. Sawyer Municipal Airport, Marquette, Mich., $5 million.
Kalkaska AFB, Kalkaska, Mich., $3 million.
Kinross AFB, Sault Sainte Marie, Mich., $2.1 million.
Klamath Falls Municipal Airport, Klamath Falls, Ore., $1.1 million.
McChord AFB, Tacoma, Wash., $1.5 million.
McGhee-Tyson, Knoxville, Tenn., $2 million.
Minneapolis-St. Paul International Airport, Minneapolis, Minn., $3 million.
Minot AFB, Minot, N. D., $21 million.
Newcastle County Airport, Wilmington, Del., $6.8 million.
Niagara Falls Municipal Airport, Niagara Falls, N. Y., $3 million.
Otis AFB, Falmouth, Mass., $11.6 million.
Oxnard AFB, Camarillo, Calif., $2.1 million.
Paine AFB, Everett, Wash., $4.1 million.
Greater Portland, Ore., $13.5 million.
Presque Isle AFB, Presque Isle., Me., $7.8 million.
Richard Bong AFB, Kansasville, Wis., $6.8 million.
Selfridge AFB, Mich., $2.5 million.
Sioux City Municipal Airport, Sioux City, Ia., $2.3 million.
Stewart AFB, Newburgh, N. Y., $1.8 million.
Suffolk County AFB, Westhampton Beach, N. Y., $5.4 million.
Truax Field, Madison, Wis., $2.6 million.
Wurtsmith AFB, Oscoda, Mich., $3.3 million.
Youngstown Municipal Airport, Youngstown, O., $2.3 million.
Yuma County Airport, Yuma, Ariz., $3.5 million.

Air Proving Ground Command

Eglin AFB, Valparaiso, Fla., $21 million.

Air Training Command

Goodfellow AFB, San Angelo, Tex., $8.8 million.
James Connally AFB, Waco, Tex., $4.7 million.
Lackland AFB, San Antonio, Tex., $3.4 million.
Lowry AFB, Denver, Colo., $1.6 million.
Luke AFB, Phoenix, Ariz., $2.9 million.
Mather AFB, Sacramento, Calif., $22 million.
Moody AFB, Valdosta, Ga., $1.8 million.
Nellis AFB, Las Vegas, Nev., $3.4 million.
Perrin AFB, Sherman, Tex., $2.3 million.
Reese AFB, Lubbock, Tex., $4.1 million.
Scott AFB, Belleville, Ill., $3.3 million.
Sheppard AFB, Wichita Falls, Tex., $6.8 million.
Stead AFB, Reno, Nev., $2.2 million.
Williams AFB, Chandler, Ariz., $6.3 million.

Continental Air Command

Beale AFB, Marysville, Calif., $9.6 million.

Military Air Transport Command

Andrews AFB, Camp Springs, Md., $7.4 million.
Dover AFB, Dover, Del., $3.3 million.
McGuire AFB, Wrightstown, N. J., $2.1 million.
Palm Beach AFB, Palm Beach, Fla., $1.6 million.

Strategic Air Command

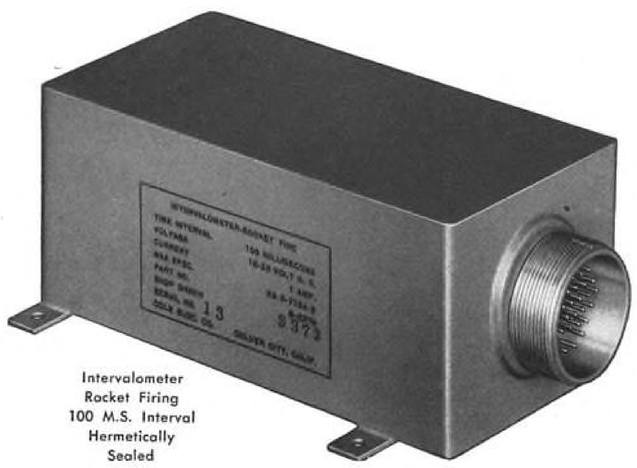
Abilene AFB, Abilene, Tex., $1 million.
Altus AFB, Altus, Okla., $1 million.
Barksdale AFB, Shreveport, La., $2.1 million.
Carswell AFB, Ft. Worth, Tex., $2.4 million.
Castle AFB, Merced, Calif., $2.1 million.
Clinton-Sherman AFB, Clinton, Okla., $7 million.
Columbus AFB, Columbus, Miss., $1.6 million.
Dow AFB, Bangor, Me., $7.6 million.
Fairchild AFB, Spokane, Wash., $4.4 million.
Forbes AFB, Topeka, Kans., $1.3 million.
Greenville AFB, Greenville, Miss., $2.5 million.
Homestead AFB, Homestead, Fla., $1.7 million.
Hunter AFB, Savannah, Ga., $1.1 million.
Lake Charles AFB, Lake Charles, La., $1.5 million.
Lincoln AFB, Lincoln, Nebr., $4.7 million.
Little Rock AFB, Little Rock, Ark., $1.5 million.
Lockbourne AFB, Columbus, O., $4.9 million.
Loring AFB, Limestone, Me., $2.5 million.
McDill AFB, Tampa, Fla., $3.3 million.
Malstrom AFB, Great Falls, Mont., $1.2 million.
March AFB, Riverside, Calif., $5.1 million.
Mountain Home AFB, Mountain Home, Ida., $2 million.
Offutt AFB, Omaha, Nebr., $5.7 million.
Plattsburgh AFB, Plattsburgh, N. Y., $1.5 million.
Smoky Hill AFB, Salina, Kans., $3.9 million.
Walker AFB, Roswell, N. M., $2.8 million.
Westover AFB, Chicopee Falls, Mass., $9.3 million.

Tactical Air Command

Bunker Hill AFB, Peru, Ind., $2.2 million.
Clovis AFB, Clovis, N. M., $4.5 million.
Donaldson AFB, Greenville, S. C., $2.4 million.
England AFB, Alexandria, La., $2.9 million.
George AFB, Victorville, Calif., $3.1 million.
Langley AFB, Hampton, Va., $2.6 million.
Larson AFB, Moses Lake, Wash., $1.1 million.
Myrtle Beach Municipal Airport, Myrtle Beach, S. C., $1.7 million.
Pope AFB, Ft. Bragg, N. C., $1.1 million.
Sewart AFB, Smyrna, Tenn., $1.6 million.
Seymour Johnson AFB, Goldsboro, N. C., $6.6 million.
Shaw AFB, Sumter, S. C., $3.8 million.
Aircraft control and warning system—$8.1 million.
Naval Auxiliary Landing Field, Alice-Orange Grove, Tex., $2.2 million.
Naval Auxiliary Air Station, Chase Field, Tex., $2.2 million.
Naval Air Station, Glynco, Ga., $4 million.
NAAS, Kingsville, Tex., $2.6 million.
NAAS, Meridian, Miss., $1.3 million.
NAS, Alameda, Calif., $2.7 million.
NAS, Brunswick, Me., $3.7 million.
NAS, Cecil Field, Fla., $4 million.
NAAS, Edenton, N. C., $14 million.
NAAS, Fallon, Nev., $8.3 million.
NAS, Harvey Point, N. C., $6 million.
NAS, Lemoore, Calif., $5.6 million.
NAS, Miramar, Calif., $8.8 million.
NAS, Norfolk, Va., $1.2 million.
NAS, North Island, San Diego, Calif., $13 million.
NAS, Oceana, Va., $5.3 million.
NAS, Quonset Point, R. I., $3 million.
NAAS, Sanford, Fla., $6.9 million.
Marine AAS, Beaufort, S. C., $17 million.
Marine AS, El Toro, Calif., $6.9 million.
Marine AAS, Mojave, Calif., $12 million.
John H. Towers Field, Annapolis, Md., $4 million.
NAS, Lakehurst, N. J., $6 million.
Air Missile Test Center, Point Mugu, Calif., $1.7 million.

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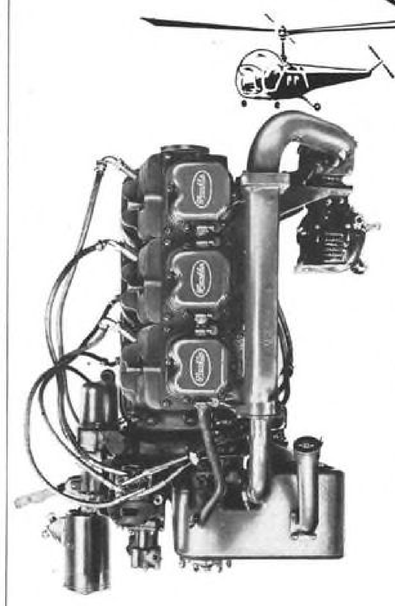
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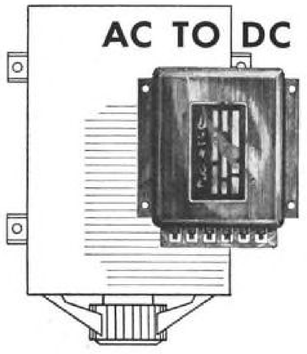
Each year since 1939, at least 4 out of every 5 helicopters under 400 h.p. have been powered by Franklin engines. Probably 75% of all helicopters flying today, regardless of horsepower, are Franklin-powered.

Why this preference? Because no other engine can match the record of Franklins for reliability in helicopter installations, combined with low operational and maintenance costs. *Specify Franklin power in your next helicopter under 400 h.p.*

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In addition to giving you this "look-see" into the weather as far as 150 miles ahead, the AVQ-10 provides detailed ground-mapping information. It is the first weather radar to use the "C-Band" (5.6 cm) frequency, ideal for storm detection and penetration. Because of its lightness, efficiency and dependability, the AVQ-10 has been specified as standard equipment by many of the world's leading air lines and by operators of business aircraft.



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Naval Ordnance Test Station, Chino Lake, Calif., $6 million.
Naval Academy, Annapolis, Md., $7.4 million.
Naval Training Center, Bainbridge, Md., $6.5 million.
Naval Amphibious Base, Coronado, Calif., $5.6 million.
Naval Training Center, Great Lakes, Ill., $8.4 million.

Aerojet Gets Contract for Liquid Rocket Facilities

Air Force has awarded Aerojet-General Corp. a $9,000,000 contract to build facilities for the pilot production and production testing of liquid rocket engines.

Other recent Air Force contracts:

Convair Division of General Dynamics Corp., $2,126,560 for facilities in support of F-102 type aircraft.

The Weatherhead Co., $3,067,001, and Polan Industries, $3,051,720, both for type MA-3 airborne rocket launchers.

Bendix Products Division, Bendix Aviation Corp., $1,268,161 for wheel assemblies and maintenance and brake assemblies for F-104A aircraft.

Wright Aeronautical Division, Curtiss-Wright Corp., $3,795,000 for overhaul and modification of 600 XJ/J65 aircraft engines, and $775,000 for modification of 500 YJ/J65 aircraft engines.

Bill Seeks Death Penalty For Aircraft Saboteurs

Legislation authorizing the death penalty for any sabotage of aircraft which results in death was introduced by Sen. Warren Magnuson (D.-Wash.), chairman of the Senate Commerce Committee. It has Administration support.

The measure sets a penalty of $10,000 or 20 years imprisonment, or both, for aircraft sabotage which does not cause death.

Numerous similar bills have been introduced since the opening of Congress as a result of the explosion of a United Air Lines plane near Denver last fall, in which 44 died. It was caused by a bomb placed in a passenger's luggage.

Army Sending 63 Cargo Helicopters to Germany

Ft. Sill, Okla.—U. S. Army is preparing to ship 63 Sikorsky H-34 light cargo helicopters to Germany. The first unit, the 587th Cargo Helicopter Company, will leave next week for Stuttgart where it will be attached to the U. S. 7th Army.

First shipment of 21 H-34s will be taken to Europe aboard a Navy carrier sailing from Mobile, Ala. Three such units are scheduled to go abroad before June 1.

Air Cargo Group Names Johnson as President

Emery F. Johnson, 45, has been elected president of Air Cargo, Inc., by the board of directors meeting in Washington. Johnson first joined ACI, the scheduled airline's aircraft pickup

FASTENER PROBLEM



Type LH2424, for temperatures to 550° F.



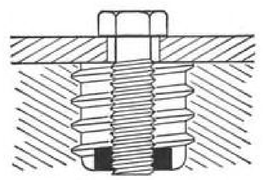
Type N2424, for temperatures to 250° F.

Strong, self-locking threads for tapped holes in soft metals

Tapped holes in soft metals have long presented problems to aircraft manufacturers. Threads wear rapidly, are easily damaged and are susceptible to stripping. Bushings made of harder alloys are a partial solution. Such inserts, however, have a tendency to shake loose under vibration, or to back out when the bolt is removed. The only alternative is to position them with a secondary fastening device such as a key or a "Dutchman" pin which then presents a difficult and costly service problem. In cooperation with aircraft and aircraft engine builders, ESNA has developed a new bushing design which eliminates these problems. Type 2424 bushings are self-locking externally and internally. They provide a one-piece, vibration-proof steel threaded insert that develops AN tensile loads, is dependably self-retaining, yet can be readily removed with simple tools.

Easily inserted in an NC-2 tapped hole, using simple tools, the type 2424 bushings are locked in place by the interference action of the patented Lok-Thred system, which reforms the socket thread to the equivalent of a perfect selective fit.

The internally-threaded sections use one of two thoroughly-proven ESNA self-locking devices. For temperatures up to 250° F., the new bushing is available with the famous red nylon locking collar. For service between 250° and 550° F., it comes equipped with the all-metal LH locking device that has been tested on many types of ESNA high temperature locknuts. Both bushings are available in sizes #10 through ⅜" and the locking devices provide performance and reusability per Specification AN-N-5b and AN-N-10a.



"Lok-Thred" contour displaces metal from crests of socket threads to produce equivalent of a perfect selective fit. Original socket threads can be reworked as many as ten times and new bushings inserted.

Type 2424 bushings can be installed in any material whose hardness is less than 25 Rockwell C, including aluminum, magnesium, plastic and mild steel castings. Simplified installation and field maintenance techniques save costs. And because Lok-Thred method of external locking creates less hoop stress in the base of the casting, edge distance or boss size is reduced . . . with resulting weight savings.

MAIL COUPON FOR DESIGN INFORMATION



Elastic Stop Nut Corporation of America
Dept. N81-225, 2330 Vauxhall Road, Union, New Jersey

Please send me the following free fastener information:

☐ Details of type 2424 bushings.

☐ Here is a drawing of our product. What self-locking fastener would you suggest?

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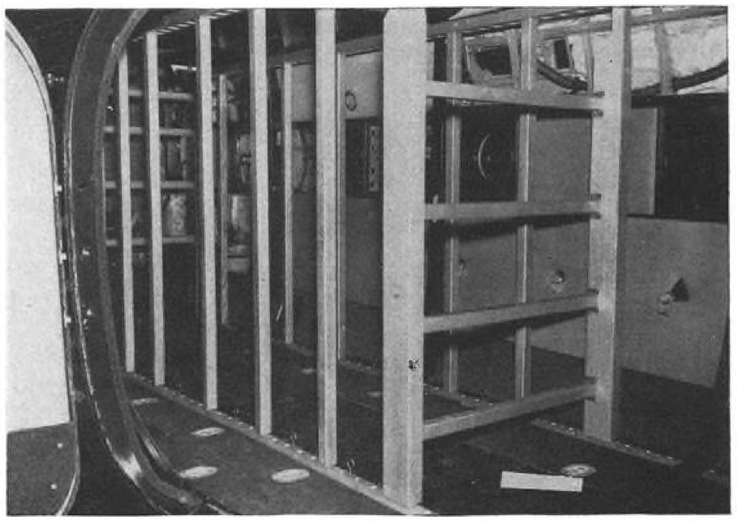
and delivery organization, in 1947 as secretary and tariff agent. He was elected vice president-general manager in 1950. A 25-year veteran of the airline industry, Johnson has worked for Trans World Airlines, United Air Lines and the Air Transport Assn.

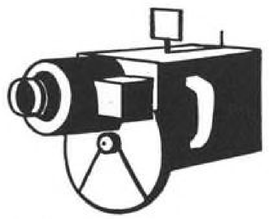
The ACI board action also included the election of two new directors and a general counsel. New directors are Stuart G. Tipton, ATA president, and Alexander G. Hardy, senior vice president of National Airlines. Russell S. Bernhard was named general counsel succeeding Stuart Tipton who resigned. All other officers were re-elected.



Inside New Grumman TF-1 Utility Transport

Stripped of its extensive hunter-killer equipment and weapons, the twin-engine Grumman S2F-1 becomes the new TF-1 passenger-cargo-trainer capable of carrying nine passengers in rearward facing seats (above) or a considerable freight load in special "cages" (below). The well-padded high-strength seats have foam-rubber head rests and are equipped with shoulder and lap harnesses to take jolts of catapult launching and deck arresting gear. The cargo cages consist of two parallel sets of movable vertical bulkheads installed between longitudinal rails. Vertical rails can be inserted anywhere along the cage depending on the size of the load. The cage is capable of restraining cargo during forces to 20G. Lift rafts are stowed in the rear of the engine nacelles, replacing sonobuoys kept there on the S2F. TF-1s are assigned to Fleet Logistic Air Wings as carrier re-supply aircraft for ship-to-shore missions, replacing the World War II Grumman TBF single-engine torpedo-bombers formerly used in this role.





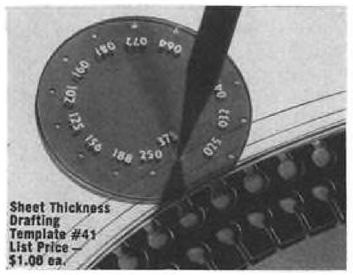
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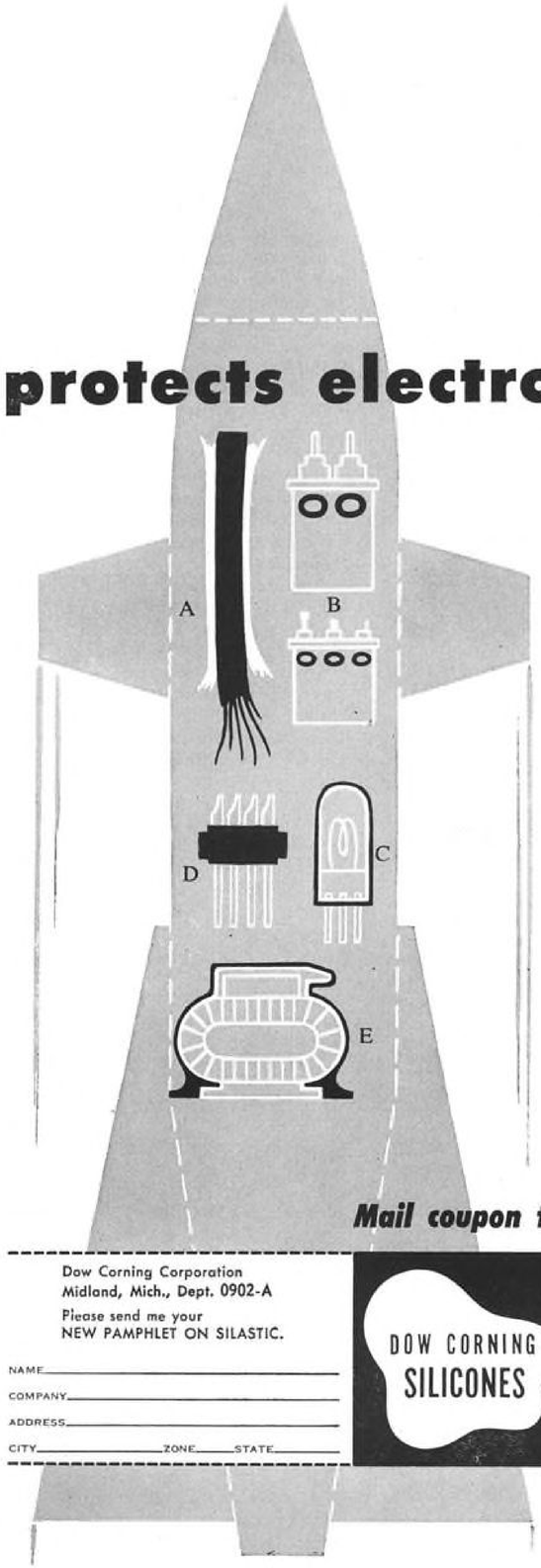
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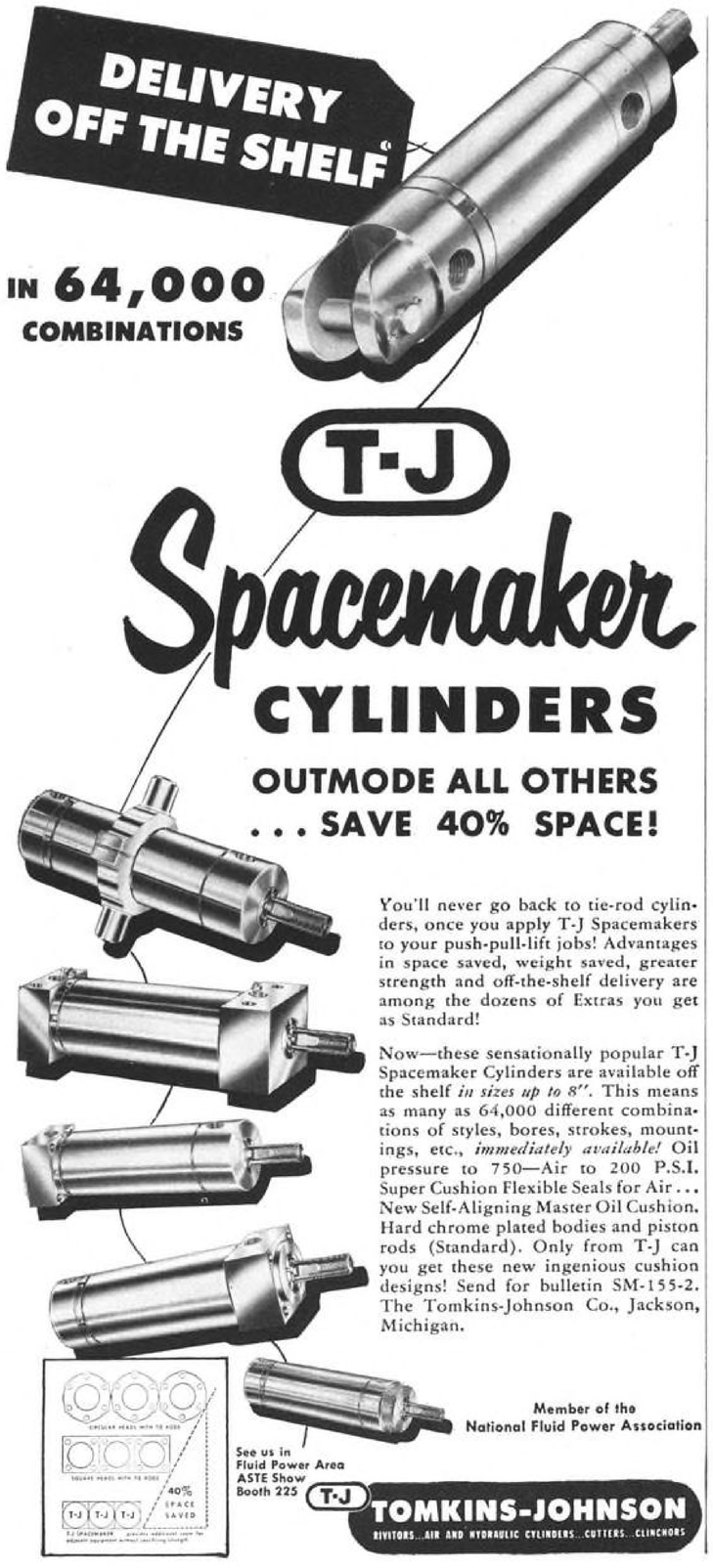
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Machinists Drop Drive For Joint Negotiations

Washington—The International Association of Machinists has decided to drop its drive for joint airline contract negotiations, but it will continue to push for industry-wide uniformity wherever possible.

The decision to abandon several years of effort to establish joint and switch to individual negotiations came out of a meeting of representatives of IAM airline groups last October, where considerable dissatisfaction with joint bargaining was expressed.

In December, the IAM executive council met and decided to go back to individual negotiations between the airlines and the local labor units. IAM President Al Hayes explained that the change was made because of the feeling in Machinist groups that their members were sacrificing something they felt might have been won in last year's negotiations.

The negotiations that caused the unhappiness among Machinist members were between the IAM and six airlines in 1954 and 1955. They began in May, 1954 when contracts were expiring between the union and the six carriers—United Air Lines, Trans World Airlines, Northwest Airlines, Eastern Air Lines, Capital Airlines and National Airlines.

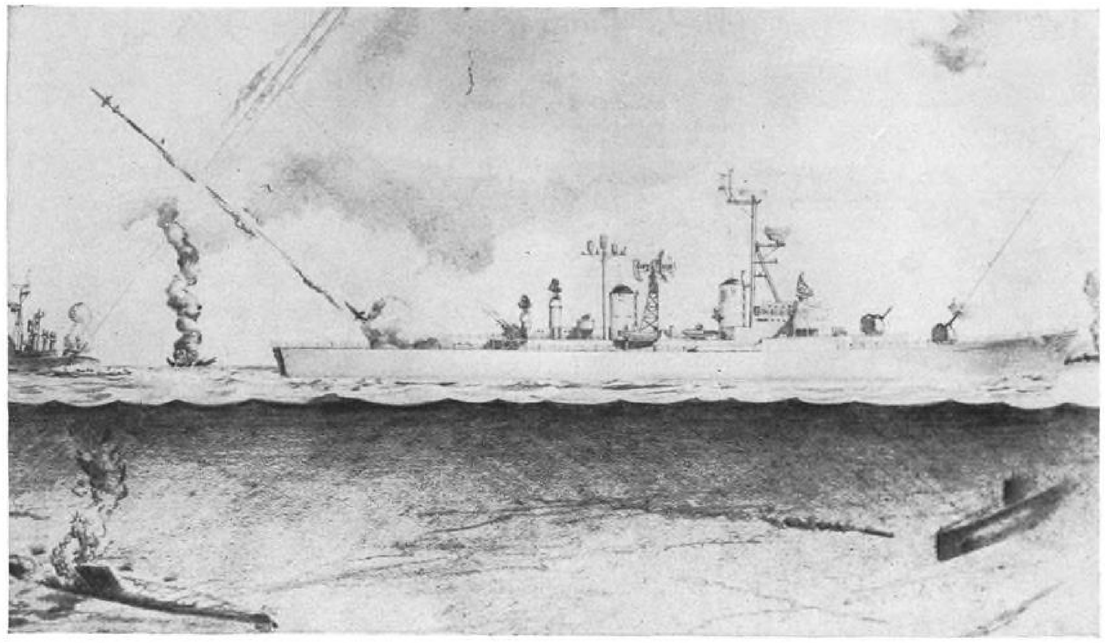
For these negotiations, the IAM gathered ideas from each of the local Machinist unions involved and drew up a set of joint proposals. Five of the airlines agreed to bargain jointly, but Eastern Air Lines finally decided to go its own way and bargain separately with IAM.

After a strike vote was taken and prolonged negotiations between the parties and with the National Mediation Board failed to make any progress, President Eisenhower stepped in and set up an emergency board to stop a strike in November, 1954.

After lengthy hearings and further negotiations, contracts were signed in March, 1955, with the five airlines containing some of the common principles favored by the IAM. Eastern signed a contract in April.

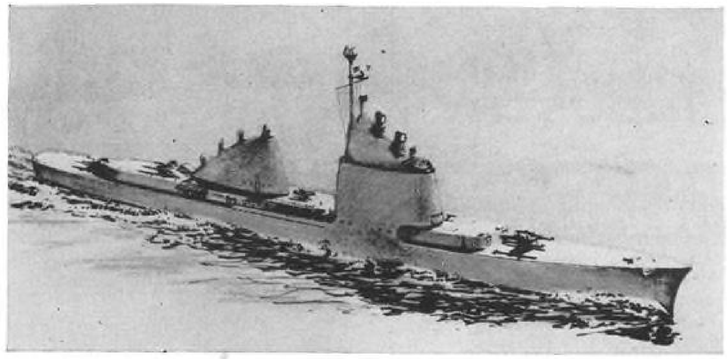
Although the Machinists deal with 39 aviation concerns, efforts to establish joint negotiations were concentrated on the six trunk airlines because they represent about two-thirds of the IAM's 30,000 airline members and are pattern-setters for other contracts.

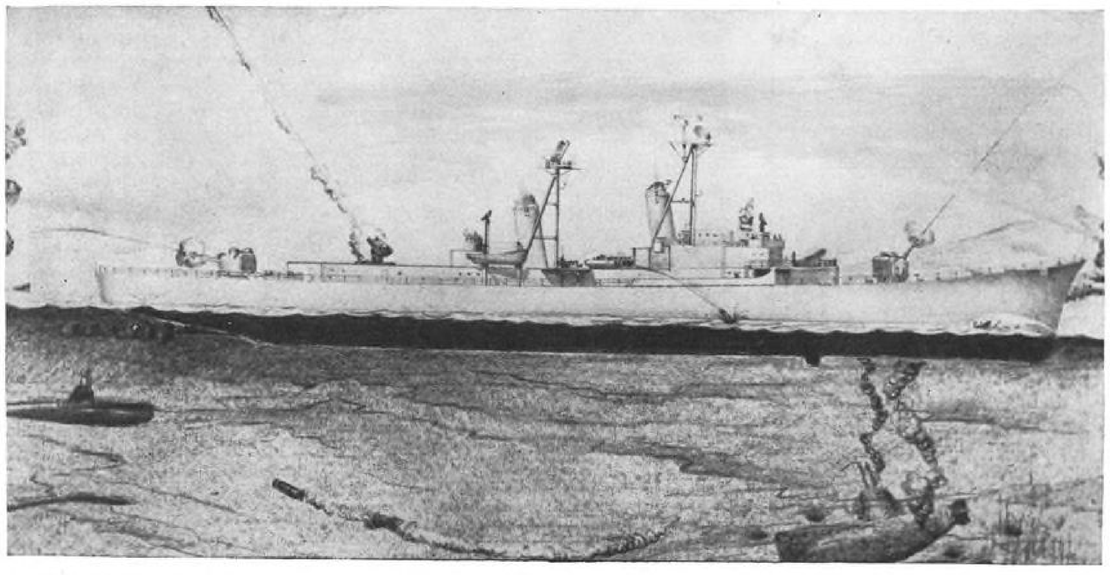
When the contracts between the trunk lines and the IAM expire in October, the union will go back to the old pattern of individual bargaining. But efforts to establish industry uniformity in wages, job classification and other factors will continue indirectly.



How Navy Planners View Tomorrow

The Navy's 1957 construction plans include proposals for three new-type missile-bearing warships. Top drawing shows the proposed frigate-class guided missile ship with anti-aircraft and early-warning capabilities. The center drawing shows an artist's interpretation of a nuclear-powered cruiser of the future equipped with multiple missile launchers. Artist's conception below is of a proposed anti-aircraft, anti-submarine destroyer.



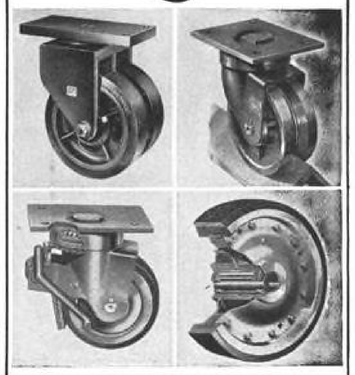


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USAF Contracts

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, Ohio.

American Phenolic Corp., 1830 No. 54th Ave., Chicago 50, Ill., modification of test bench groups, air portable, (PR GE-553709), 14 ea., $150,998.

General Electric Co., Tube Dept., Owensboro, Ky., electron tube, receiving triode, general purpose JAN type 5718A (a/w spec MIL-E-1B dtd 2 May 52, Amend No. 3 dtd 12 Nov 53 and spec sheet MIL-E-1-681C-Navy), 6,000 ea., electron tube, receiving pentode, general purpose, JAN type 5899A (a/w spec MIL-E-1B dtd 2 May 52, Amend No. 3 dtd 12 Nov. 53 and spec sheet MIL-E-1/722C-Navy, dtd 17 May 54), 6,000 ea., RFP 33-604-56-1296, $40,680.

Cook Electric Co., 2700 No. Southport Ave., Chicago 14, Ill., relay, armature, Cook Electric P/N 400-1757 (a/w Sylvania Electric Products, Inc. Dwg. No. 55476, RFP 33-604-55-2708), 3,936 ea., $30,700.

RBM Div., Essex Wire Corp., Logansport, Ind., relay, solenoid RBM Co. P/N 12700 (a/w Colonia Radio Dwg. No. 55585, RFP 33-604-55-2708), 6,000 ea., $27,840.

Olympic Radio and Television, Inc., 34-01 38th Ave., Long Island City, N. Y., tuning unit RF consisting of various electronic components and misc resistors, capacitors, cable and hardware, (Olympic AS7553, RT-11A/APN-12), 200 ea., RFP 33-604-56-1105, $29,950.

Wm. R. Whittaker Co., Ltd., 915 No. Citrus Ave., Los Angeles 36, Calif., motor assy.-actuator, 22 to 28v., d.c. (Saval P/N 21318 appl. Boeing B-47A-B), 200 ea., switch, press., SPST, (Saval P/N/24536-2 appl. T-29A), 300 ea., RFP 33-604-55-3842, $35,107.

Meletron Corp., 950 N. Highland Ave., Los Angeles 38, Calif., switch, pressure, pile-up type, for B-36 brake press. cont. sys., 200 ea.; switch, pressure, SPDT, for SA-16, 100 ea.; switch, press., SPDT for F-89, 200 ea.; switch, pressure, SPDT, 800 ea.; switch, actuating, press., 300 ea.; switch, press., SPDT, for F-94, 100 ea.; switch, pressure, SPDT, for F-89, 100 ea.; switch, pressure, SPDT, 600 ea.; switch assy. selector, rotary, F type, 250 ea.; switch, pressure, SPDT, 200 ea., switch, pressure, SPDT, 100 ea.; switch, press., SPDT, incl. 1 conn. type AN 3102A-14S-7P, 200 ea., RFP 33-604-56-1122, $112,825.

Beckman Instruments, Inc., Helipot Corp. Div., 916 Meridian Ave., South Pasadena, Calif., resistor, variable wire wound (Helipot SL548 per dwg. 24,1000), 200 ea.; resistor, variable, linear precision (Helipot SA778A in a/w Link Avia. Dwg. 67044CC), 200 ea., resistor (Helipot SB-68-C in a/w Link Dwg. 99352A), 200 ea.; resistor, variable linear precision (Helipot SA-768 in a/w Link Dwg. 99741A), 300 ea.; resistor, variable linear precision (Helipot A-734-A in a/w Link Avia. Dwg. 75512A), 200 ea., RFP 33-604-55-3430, $41,839.

American Radio Hardware Co., Inc., 152 Macquiston Parkway South, Mt. Vernon, N. Y. terminal board (Lewis Engineering 8T514), 12,000 ea., RFP 33-604-56-1468, $25,800.

Grumman Aircraft Engineering Corp., Bethpage, L. I., N. Y., antenna, receiving and transmitting (Grumman SP9002), 72 ea., RFP 33-604-56-1439, $27,340.

Taylor Tubes, Inc., 2312 Wabansia Ave., Chicago 47, Ill., tube, electron, type 6278 (in a/w spec MIL-E-1B dtd 2 May 1952 and Amdt No. 3 dtd 12 Nov. 53, individual military spec sheet MIL-E-1/518 (USAF) dtd 20 Jan. 55), 1,800 ea., RFP 33-604-56-1355, $346,500.

Electrical Specialties Co., 729 Washington St., Dayton 7, Ohio, circuit breaker, 3PST (Federal Electric P/N NK 631150 Appl. C-730/FPS-3), 200 ea.; circuit breaker de-ion., 3 PST (Bendix P/N C218413-1), 150 ea., RFP-33-604-56-1126, $37,758.

DeJur-Amsco Corp., 4501 Northern Blvd., L. I. City, N. Y., resistor, variable, linear precision (in a/w Link Aviation dwg. 66407 Rev. B), 200 ea.; resistor, variable, linear precision (in a/w Link Aviation dwg. 238241 Rev. H),300 ea., resistor, variable, linear precision (in a/w Link Aviation dwg, 238238 Rev. H), 300 ea.; resistor, variable, linear precision (in a/w Link Aviation dwg. 238-243), 300 ea.; resistor, variable (in a/w Link Aviation dwg. 238243 Rev. H), 300 ea.; resistor, variable, linear precision (in a/w Link Aviation dwg, 88569 Rev. C), 100 ea.; resistor, variable, linear precision (in a/w Link Aviation dwg. 72099 Rev. F), 100 ea.; resistor, var. (mfg. Dejur Amsco 260-203-K), 200 ea., RFP 33-604-56-1251, $25,-310.

OFFICE OF SCIENTIFIC RESEARCH, Air Research and Development Command, Baltimore 3, Md.

North American Aviation, Inc., 12214 Lakewood Blvd., Downey, Calif., continuation of research on stability and transition of laminar boundary layer, (AF 18(600)-786), job, $51,617.

Cornell Aeronautical Lab., Inc., 4455 Genesee St., Buffalo 21, N. Y., research on chemical kinetics by means of a single pulse shock tube, (AF 18(600)-1332), job, $35,798.

Litton Industries, 336 North Foothill Road, Beverly Hills, Calif., continuation of studies on high vacuum research, (AF 18(600)-1498), job, $46,934.

Carnegie Institute of Technology, Pittsburgh 13, Pa., research study of oxidation, vapor nucleation and surface diffusion of metals and alloys, (AF 18(600)-1572), $66,380.

Rensselaer Polytechnic Institute, Troy, N. Y., research, electrical analogy, (AF 18(600)-499), $30,000.

Horizons, Inc., Princeton, N. J., research, investigation of the corrosive component of mechanical wear, (AF 18(600)-1589), $27,212.

Board of Trustees of University of Illinois, Urbana, Ill., continuation of research on diffusion in semi-conductors and related problems, (AF 18(600)-1310), $39,200.

University of Chicago, 5801 Ellis Ave., Chicago 37, Ill., research, studies in nuclear interactions in cosmic radiation, (AF 18(600-666), $155,000.

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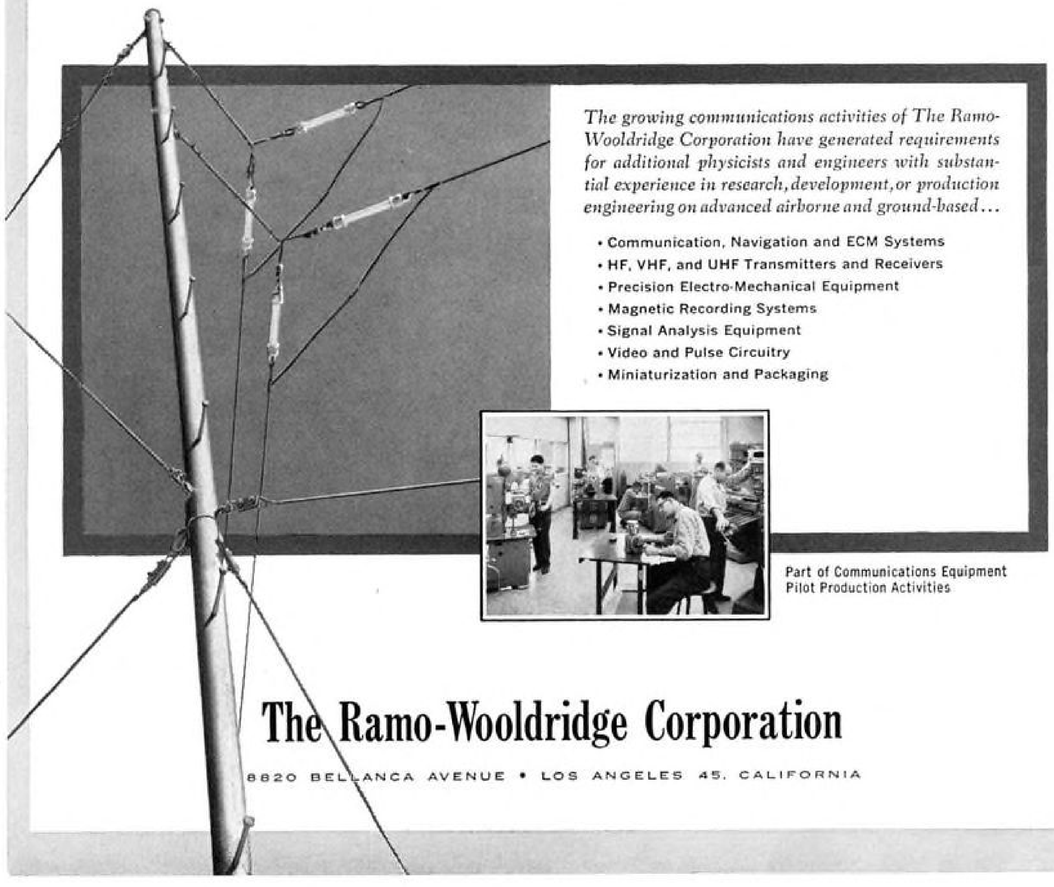
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Navy Contracts

Following is a list of unclassified contracts of $25,000 and over as released by Navy Contracting Offices:

BUREAU OF AERONAUTICS, Washington, D. C.

General Electric Co., French Rd., Utica, N. Y., dummy SSQ-15 sonobuoys, 100 ea., and refurbishing kits, 200 ea., NOas 56-166-f (EL-46-2640-56), $34,964.

New York University (College of Engineering), University Heights, N. Y., 53, N. Y., develop titanium organic compounds for evaluation as high temperature hydraulic fluids, NOas 56-183-d, AE-42-1845-56), $26,340.

Ronan and Kunzl, Inc., Brooks Airport, Marshall, Mich., liquid oxygen servicing trailer, NOas 56-362-f (MA-45-5105-56), 50, $127,162.

Specialties, Inc., Skunks Misery Road, Syosset, L. I., N. Y., angle of attack relay assemblies, NOas 56-371-f (PD-42-1254-56), 1,022 ea., $417,224.

United States Rubber Co., Providence, R. I., fabricate one basic Sealdbin unit together with scale models of seaplane handling equipment and study the behavior of these units under sea conditions to determine the feasibility of adapting the Sealdbin units to Navy seaplane handling equipment, NOas 56-299-f(AC-54-3675-56), $27,260.

Sintercast Corp. of America, 134 Woodworth Ave., Yonkers 2, N. Y., conduct a study to investigate new, high-strength heat-resisting alloys involving the incorporation of five particulate substances for the purpose of strengthening the alloys at elevated temperatures, reports, NOas 56-227-c(AE-43-1863-56), $38,680.

Reeves Instrument Corp., 215 E. 91st St., New York 28, N. Y., set of two console installation REAC 400 series electronic analog computing equipment, NOas-55-603-f, (EL-42-1315-55), $166,500.

Allen B. Dumont Laboratories, Inc., 750 Bloomfield Ave., Clifton, N. J., receiver transmitters, antennas and components, NOas 55-626-f, (PD-33-2639-55), 354 ea., $930,328.

All American Engineering Co., Box USS 2668, du Pont Airport, Wilmington 5, Del., furnish 8,818 man-hours of engineering and technician's services to provide consultation and to conduct evaluation tests in connection with newly developed bridle and pendant arresters, NOas 56-104-s, (SI-34-5780-56), $63,489.

Dayton Aircraft Products, Inc., 812 N.W. 1st St., Fort Lauderdale, Fla., insulators and related equipment, NOas 56-267-f(PD-36-2724-55), 7,000 ea., $66,416.

Texas Instruments, Inc., 6000 Lemmon Ave., Dallas, Texas, APA-56 signal distributor and components, NOas 56-271-f, (PD-31-727-56), 51 ea., $2,564,108; APS-45 antennas, control indicators and radar transmitters, etc., NOas 56-272-f(EL-43-728-56), 48 ea., $1,161,538.

AVIATION SUPPLY OFFICE, Philadelphia 11, Pa.

Consolidated Diesel Electric Corp., Ludlow and Canal St., Stamford, Conn., mobile electric power plants, (383/29065-58S2/2/56) 450 ea., $6,179,539; (383/9504=51/256), 6 ea., $79,986.

Lear, Inc., 110 Ionia Ave., N. W., Grand Rapids 2, Mich., amplifiers, (383/2120-42/55), 36 ea., $25,371.

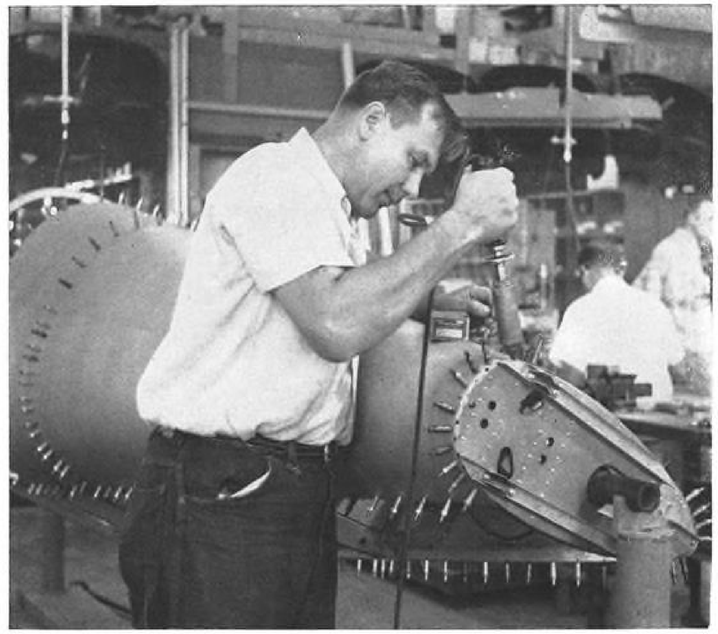
Electric Auto-Lite Co., 1201 Champlain St., Toledo 1, Ohio, spark plugs, (383/29081-8 x 5/1/56), 54,250 ea., $62,225.

Utica Division, Bendix Aviation Corp., Utica, N. Y., services to overhaul Bendix pumps, (MIPR41-608-6-02P-2000), various, $65,566; maintenance parts used on various starters, (383/2116 = 100 x 5/4/53), various, $65,259.

Scintilla Div., Bendix Aviation Corp., Sherman Ave., Sidney, N. Y., maintenance parts used on Bendix magneto assys., (383/2116-39/54), various, $38,581.

AiResearch Mfg. Co., 9851-9951 Sepulveda Blvd., Los Angeles 45, Calif., actuators, (383/2110-130/54), various, $25,456.

Resistoflex Corp., Belleville 9, N. J., kit assys., (383/29023-25P6/5/56), 2,109 ea., $20,484.



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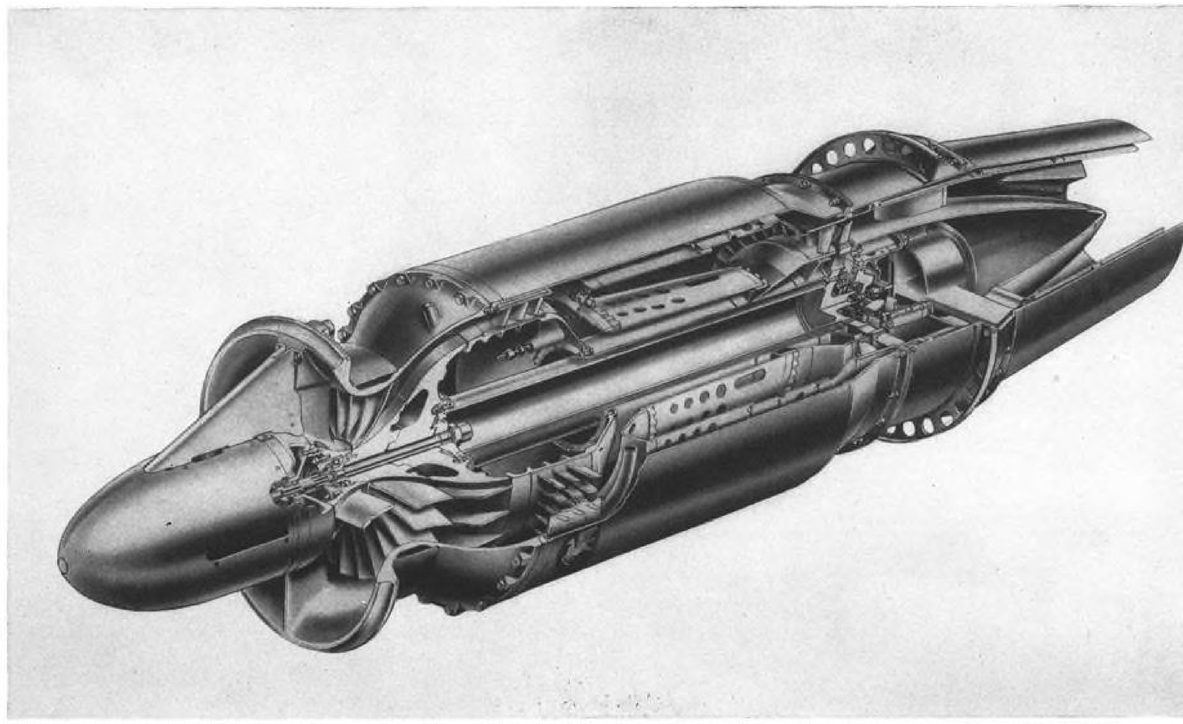
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SIMPLICITY OF THE J44-R-3, long-life version of the Fairchild J44, reflects its short-life origin. The company is confident that ruggedness and low cost, coupled with early delivery, will more than offset the engine's basic conservative performance. The unusual mixed axial-flow compressor is a hangover from the original missile limitations and will not be used in future Fairchild designs.

Fairchild J44 Designed to Replace Rato

By Robert H. Cushman

The Fairchild Engine Division hopes to place its small J44 turbojet engine on the market by late spring with the immediate objective of replacing Rato in civil and military transport and cargo operations. The engine, only U.S.-designed small turbojet in anything more than token production, already has completed 95% of the 150-hr. inhabited aircraft qualification run required by military specifications.

A longer-range goal set by Fairchild for the 1,000-lb.-thrust powerplant is to stimulate aircraft designers into considering small turbojets around which they can plan new-type aircraft that will take advantage of the small engine's desirable features—particularly its large thrust to weight ratio combined with small frontal area.

The J44 also may help pave the way for a new crop of small turbojets expected out of present development programs by Fairchild and its competitors, including: General Electric's recently formed Small Gas Turbine Division (which has a joint study contract with Fairchild on a new 2,000 lb turbojet); Westinghouse (which, because of its agreement with Rolls-Royce, may produce the Soar); Continental (whose J69 is also undergoing a 150-hr. qualification test); Lycoming; Curtiss-Wright's recently organized Turbomotor Division, and possibly Boeing.

J44 Future

Although later engines may come along, Fairchild feels that it will be some time before these engines can be released from their military obligations and that the interim will provide the J44 a reasonably long and profitable sales life. During this life, further improvements and increased volume of production should bring the price down from the present $13,500-$20,000 range to below the $10,000 level, possibly as low as $7,000.

Over the same period, A. T. Gregory, chief engineer of the Engine Division, says the thrust can be brought up to 1,250 lb. and the specific fuel consumption down to 1.3 from the present 1.55 lb. of fuel per pound of thrust per hour. These performance improvements will come through increasing the compressor tip diameter and by increasing the rpm. by approximately 5%. This will raise the compression ratio from the present 2.5 to 3.3.

The small J44's history has been the exact opposite of that of the expendable and larger 4,600-lb. thrust Allison J33. The J44 was conceived eight years ago as the cheapest sort of expendable turbojet powerplant for a still-classified one-shot missile. It was subsequently upgraded in a series of steps. It moved from an engine with uninhabited, expendable applications to uninhabited-reusable and then to inhabited-experimental. Now, it is on the brink of full acceptance for use in inhabited aircraft. The Allison engine, on the other hand, started out as a piloted-plane powerplant and in the J33-A-37 version was re-engineered into an expendable thrust source for the Matador and Regulus missiles (AW, Sept. 27, 1954, p. 58).

Since the J44 and the J33-A-37 have



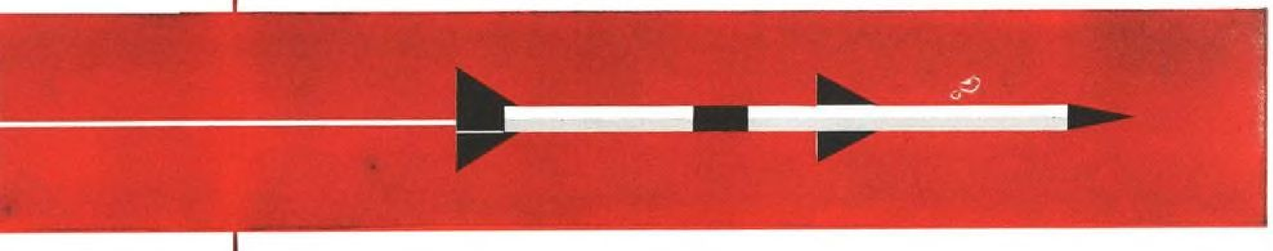
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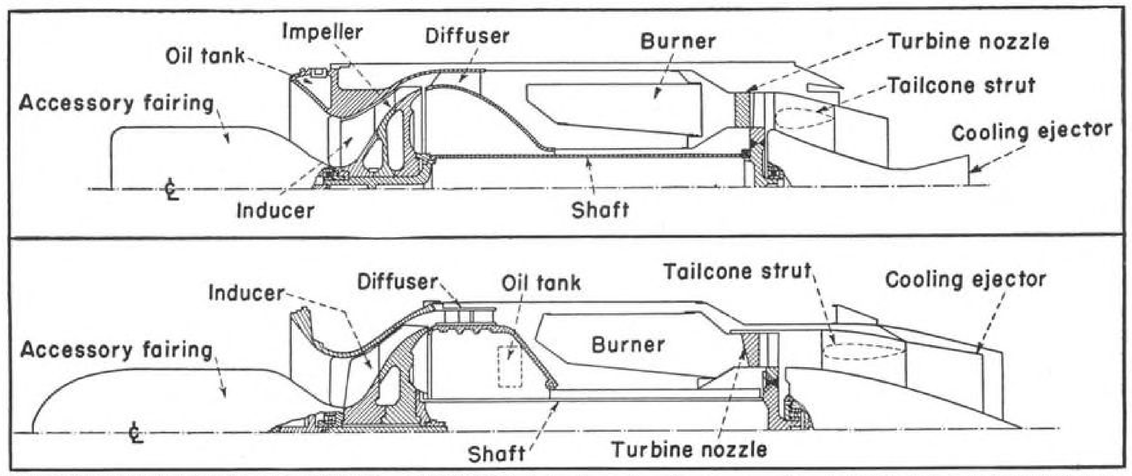
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LONGITUDINAL HALF-SECTIONS of J44-R-6 and J44-R-20 illustrate the major changes as engine progressed from one-shot category to recoverable drone powerplant. The R-20 closely anticipates, in appearance, the R-3 inhabited model (p. 53).

traveled opposite paths, it is not too surprising that the lessons Fairchild learned in the process appear to contradict Allison's.

Fairchild found that too radically "cheap" an engine in initial concept can turn out to be more expensive in production than a more-conventional engine.

Allison, traveling in the opposite direction, found that some of the tricks learned in cheapening an expensive engine could then be fed back to improve the expensive version.

In such a comparison, fundamental differences must be remembered. The J44 is much less complex than the J33, even when comparing the inhabited version of the J44 against the expendable version of the J33 and so far has not achieved similar production volume. To date, the largest annual J44 output has been only 240 engines. And production volume, as Fairchild's A. L. Ervin points out, "can mean more to the cost of an engine, expendable or not, than other design features."

Firebee Powerplant

The J44 received its first boost towards present upgrading when the original powerplant for the Ryan Firebee drone, the Frederick Flader J55, failed to meet the delivery schedule because of troubles in its unique single-stage supersonic compressor. Although the Continental J69 also has been installed in the drone, the J44 has powered the main portion of Firebee flight testing and other programs which have culminated in successful altitude flights up to 45,000 ft. at speeds in excess of the 580 mph. design mark.

To Fairchild's way of thinking, however, the demand (a maximum of less than 600 engines to date) has not begun to tap the small-engine's potential.

Two factors had a major share in influencing Fairchild's decision to upgrade the engine:

• **Long life possibility.** Manufacturing improvements under a 1954 Navy contract to study produceability not only cut costs but indicated that the engine had long life possibilities.

• **The J44 had little competition** on this side of the ocean. At that time, most of the new U.S. designs were headed towards larger and larger thrusts. Two foreign imports, however, were considered as opposition: the Rolls-Royce Soar and the Continental J69 development of the French Turbomeca Marbore II.

The Soar, in spite of its advanced thrust-to-weight ratio of better than double the J44's 3.0, would not last beyond a few hours and the J69, although it had lower fuel consumption, was more complex.

Fairchild, therefore, decided to sink company funds into improving the J44 so that it could stand up to the 150-hr. qualification test. Later, a sales campaign was organized to exploit the idea of small jets, in both the military and civilian markets.

The first use of the J44 as an inhabited aircraft powerplant was in Bell's unusual little VTOL. The 2,200 lb. thrust (above the design rating) of two vertically-positioned J44s lifted the 2,000 lb. test craft off the ground in November 1954 (AW, Feb. 7, 1955, p. 16). Unfortunately, as far as production of the J44 was concerned, this was little more than an isolated data-gathering feat with GFE engines.

First positive step, after some exploratory test cell runs, was stretching out the J44's life by burner fixes so that a production model could pass the 50-hr. military specification for preliminary flight testing.

Then, early in 1955, Fairchild staged a sales demonstration tour of service bases demonstrating what two wing-tip-mounted J44s would mean to a C-123 in added takeoff performance and landing safety.

But some of the most basic changes in Fairchild's thinking on the J44 occurred even before the engine was installed in the original Navy missile for test evaluation in 1949. A. T. Gregory explained: "Since the engine would only live for a few minutes in the missile application, we thought it could be welded together on assembly, once and for all, run a couple of hours for a quick check and shipped it. Then if someone did want to open it for any reason, they would be forced to use a can opener. But by the time our first engine was built and running we had departed considerably from the one-run and can opener concept."

Later in the Firebee program, when the drone's parachute recovery system was proving more effective than anticipated, users wanted to tear the engines down for overhaul between runs. The redesign for serviceability took the J44 one step more away from the "throw-away" or "can-opener" concept.

Lower Cost

Not only did Fairchild change its philosophy on how to go about assembling the components but the manner in which these components were manufactured also was reversed once the engine reached modest production. (How the engine was first built was detailed in AW, Nov. 30, 1953, p. 30).

Two important parts, the diffuser and the turbine nozzle box, were originally castings. It had been thought that once the vendors got these tooled up, it would be just a matter of receiving the single-piece jobs into the plant and

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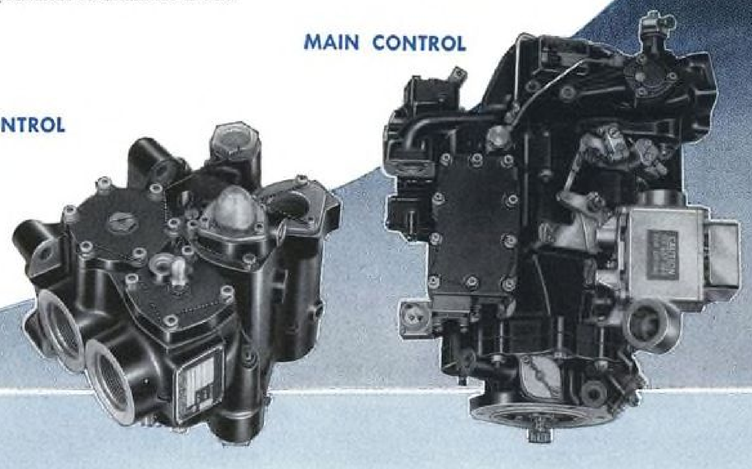
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then assembling them into the engines, according to G. A. Paquin, of Fairchild Production Engineering.

Production Problems

On testing the engines as they came out of manufacturing, it was found that apparently-minute differences in the air passages from casting to casting made component matching a hit-and-miss proposition. At one time, rejects were as high as 50%.

Sometimes the faulty part was detected before it was placed into the engine, but at other times, especially at first, it was not found out until the completed engine had reached the test cell and then only after time-consuming back-checking. When Fairchild resorted to hand re-working, it was found that the individual workman's traits showed up in erratic performance; so sensitive was the engine in this respect that the way in which a particular workman filed a guide vane's leading edge, notably in the higher-velocity diffuser, reflected itself in acceptance-test results.

But when fabricated sheet metal assemblies with die- and lost-wax-cast vanes were substituted on both these parts, Fairchild found the flow passage tolerances could be held and production rates accelerated. It was easier to slip engineering improvements into the production line, and the cost went down one-third. (This agrees with Orenda Engines Ltd.'s (Canada) experience on their production, where it was found that going to a fabricated turbine nozzle after using a steel casting not only lowered the weight but the part-unit cost, from $3,000 to $1,000.)

Simplifying the compound-curvature geometry of the diffuser casting's flow paths to suit the single-curvature limitations of sheet metal forming did not harm the efficiency. Because at the same time three cascaded stages of close-tolerance die-cast vanes were worked into the design, the overall compressor efficiency actually went up.

The original production plan called for a seamless, drawn-steel tube to be used as the turbine shaft. Cutting up commercially available tubing into shafts seemed to be an intelligent approach to a short-life product. But here, also, minute variations caused trouble—in this case because they made balancing the rotating compressor-shaft-turbine assembly a much longer more uncertain operation. After babying this method along for three years, Fairchild reverted to a more conventional machined-inside-and-out shaft, and the cost was reduced by one-half.

Altitude, Performance Gains

The original Navy missile specifications in 1947 called for a maximum altitude of only 15,000 ft., an sfc. of 1.65 and a weight of 300 lbs. Since one of the Firebee's drone missions was to simulate high altitude transonic enemy fighters, however, the J44 had to be improved. As is the case of most engines which enjoy some sort of production life, experience and further development indicated ways in which the basic design could grow in efficiency but at the usual cost of weight. The original weight was 276 lbs. That has grown now to 335 lbs. for the pilotless version, 370 lb. for the piloted.

Modifications

The specific modifications which made the J44 a better engine during its drone development stage were:

- **Inducer changes** which, added to the diffuser alterations, increased the compressor ratio from the original 2.5 to 2.7 which in turn lowered the sfc. to 1.55. Most noticeable change to the inducer is sweepback of the leading edge to increase the airflow.
- **Enlarging the combustion** burner basket and changing its hole pattern to raise its operating altitude.
- **Slimming down** the tailcone struts and moving them further downstream so their bow wave could not reflect back on the turbine blades. The flow cross-section area changes resulting from these alterations benefited the exhaust nozzle efficiency. Instead of breaking up the convergence of the nozzle flow by a divergence behind the struts, the flow now becomes more continuously convergent.
- **Lubrication system alteration.** While still of the non-return or waste type, it was changed from the "fine-rain" to the true "mist" variety.
- **Fuel pump was changed** from a special centrifugal unit to the more conventional gear type to overcome control instability at altitude. The centrifugal pump not only needed a gear pump boost for its inlet but was overly sensitive to rpm. changes. Pump cavitation at altitude aggravated this.

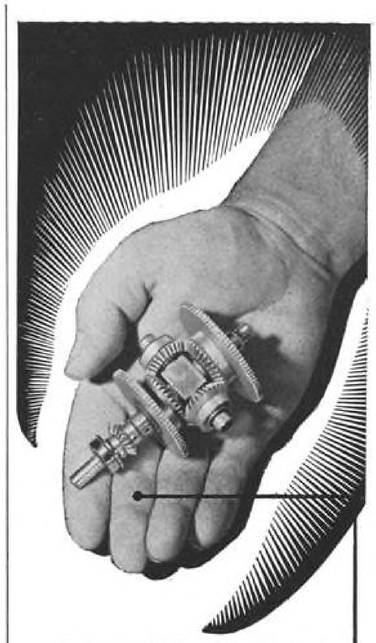
The pay-off from these changes was a successful test at 650 mph. at a simulated 50,000 ft. in the Philadelphia Navy yard test facility. More important, during the same test the improved J44 showed that it could be throttled back to less than the operational criterion of 80% without flame out in the re-designed burner.

Redesign For Inhabited Use

During February 1955, management told the J-44 project to go ahead and make the changes which would see the J44 through the full 150-hr. inhabited aircraft qualification test. By October, the J44-R-3 group had their new model ready to start.

The changes made during those eight months were:

- **Heavied up sections,** changed mate-



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rials and improved internal cooling to add life to critical parts.

• **Improved compressor** rotor resistance to foreign objects and fatigue by machining both the inducer and impeller halves from aluminum forgings. On the drone version, this had been a combination of aluminum sand casting for the inducer and magnesium forging for the impeller. The replacement of magnesium with aluminum at the rear of the compressor will prepare the engine for the higher temperatures of future increases in the compressor ratio.

• **Changed the rear bearing** to more conventional roller type. Originally both bearings had been identical. The forward bearing which takes the thrust is still a ball type but the rear bearing, which used to allow for thermal expansion by letting the inner race slide over the shaft journal, now does the job by letting the rollers allow the shaft to move back and forth inside.

• **Improved engine acceleration** limiter was worked into the control.

• **Replaced the single low-tension** igniter with a dual high-tension system.

• **Regular trunnion mount option** added to original method of hanging engine by marmon type clamp from air inlet housing.

• **Added provisions for a fireseal.**

• **Conventional fir-tree attachments** instead of welding for the cast X-40 turbine blades. The qualification is being run with the older welded joints, however.

• **Various plumbing changed** from solid tubing to flex hose. Although not too important in itself, this was found to be another example of how the seemingly more-expensive way can actually be cheaper. The elimination of special jigs and extra labor in fitting the solid tubes was found to offset price difference.

There is one change which may not have to be made. The single-element fuel pump used in the drone has proved so reliable that the USAF is tentatively allowing a deviation so that it can be retained. This only applies to the present intended use of J44 as auxiliary thrust units.

In Jet Assists

Flight time on the C-123 has shown that two wing-tip mounted J44s can, at a weight cost of half that added by equivalent power increases of the piston engines, either increase the payload 10% or the engine-out rate of climb from 100% in the light condition to over 400% in the overloaded state. Therefore, using J44s on transport wing tips can best be justified by the way they increase a cargo plane's emergency safety factor. This would be especially true for those operators who might want to add the tip jets whenever their operations called for working in and out of high-altitude, mountainous fields. The Air Force Academy near Denver is considering putting J44s on their Convair T-29s for just this reason.

For such application, the J44's good handling characteristics tie in nicely. It is, according to C. F. Inglee, J44 program project leader, a sure starter, coming up to its 4,900 rpm idle in 25 seconds and staying there quietly with relatively low fuel consumption because of its unusual mixed centrifugal-axial flow compressor. From this standby status, the pilot can safely accelerate it to maximum thrust, 15,780 rpm., in 12 seconds. Since the J44s might be operating off the same fuel supply that the main engines are relying on, these qualities should be highly appreciated by the transport pilot who changes his mind after starting to land in a small field. Without too much drain on his fuel reserve he could have the assurance that his tip jets were ready to go from idle to maximum almost instantly.

CAA Certification

The CAA is following the J44's AF 150-hr. qualification test with the intention of issuing a CAA Type Certificate upon its successful completion. S. Rolle, of the CAA Washington office, said that, because the military has so much more experience with gas turbines, the CAA is relying on military test specifications, but it is also conducting its own surveys to learn as much about the engines as possible before gas turbines come into the civilian picture.

Since the J44 is the first small gas turbojet to ask for certification, the CAA is watching it with particular interest. Items beyond the 150-hr. test the CAA is looking into on the J44 are:

• **Vibration** as it pertains to the strength of the engine.

• **Adequacy of turbine housing** as armoring against turbine explosion.

• **Ability of the compressor to swallow** foreign objects without undue loss of engine performance.

• **Acceptability of noise levels.**

Apparently definite requirements on these points have not yet been established. Also, once the J44s are chosen for particular airframe, the combination will have to be re-examined by the CAA for certification.

Engine Noise

Fairchild's E. M. Lester, assistant general manager of the engine division says that the company hasn't really gotten into the commercial application problems as yet. Fortunately, though, the engine's small size and ruggedness will be in its favor. Due to its small size, the basic noise should be less on the outside, while remote wing-tip locations (if used), coupled with the small amount of mechanical vibration typical of jets in comparison with piston engines, should make the added power hardly noticeable to the passengers inside.

Working against this, however, is the way which the light gage sheet metal parts of these smaller engines resonate under the exciting forces of combustion roughness. While this didn't bother anybody on the drone—"Who was there to hear it?"—it may be a problem for commercial use.

Foreign object ingestion ability of the compressor is said to be good due to the straight inertial paths of air flow, as compared to multi-stage axial types and as previously mentioned the use of more ductile aluminum forging.

Small Jet Future

For the future, Gregory predicts small turbojet thrust-to-weight ratios will go up to 10:1, thrust per unit frontal area will reach 1,700 lbs. per sq. ft. and sfc. will be whittled down to 0.8. These improvements will be realized by 1960, after which their progress, barring radical new innovations, will taper off. Gregory does not think that small gas turbines, although definitely favoring axial flow like their larger counterparts, will ever go to the complications of dual spool. In special circumstances the higher compression ratios of the future may make afterburning more attractive. One instance could be a short-life missile which would use continuous afterburning to keep the temperature through its cheap turbine down.

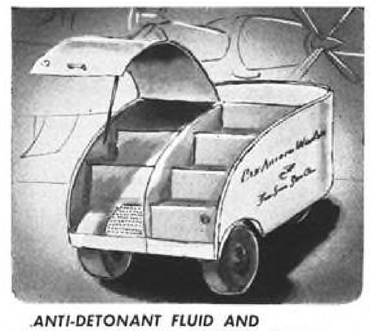
Republic Installs All-Steel Silencer

Republic Aviation Corp. has adopted the Dura-Stack jet engine silencing system for widespread use at its plant, according to Industrial Acoustics Co., Inc., New York, maker of the system.

Dura-Stack combines an augmenter and muffler, and is adaptable to silencing all forms of high-velocity jet streams, such as those created by turbojets, ramjets and rockets, Industrial Acoustics says.

The Dura-Stack is made completely of steel at least ¼ in. thick, with no filler, such as fibrous materials or stainless steel shavings or copper wool. The company claims this gives all the advantages of the high attenuation characteristics of conventional splitter systems plus the durability of heavy steel plate.

The Dura-Stack muffler uses less than half the water required by conventional silencers, the company says, because the all-steel construction can withstand higher operating temperatures than conventional silencer systems.



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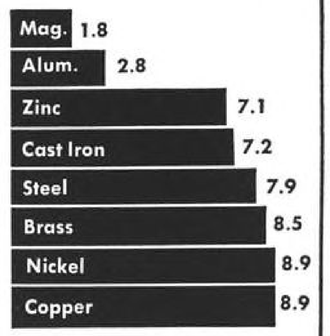
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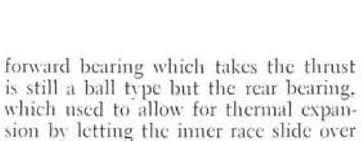
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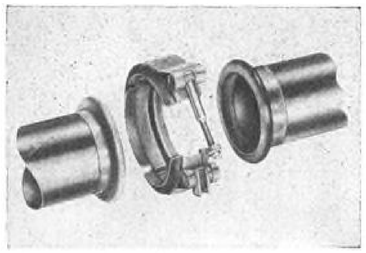
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Leakage is stated to be held below the specified 0.01 cfm. per inch of duct diameter, independent of number of times disconnected. Seal is metal-to-metal only, no gaskets being used. Units are designed for pressures of 250 psi. at 750F. Connect and disconnect is facilitated by simple latch assembly with no loose parts and low torque on the lock nut, allowing blind installation.

Janitrol Aircraft-Automotive Division, Surface Combustion Corp., Columbus, Ohio.



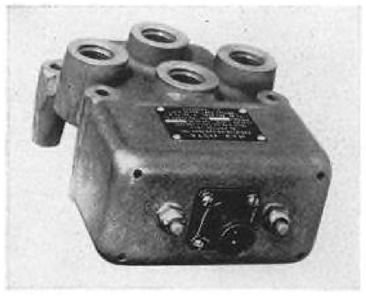
Air Transportable Shelter

U.S. Air Force is evaluating a mobile or air transportable shelter of high strength/weight ratio suitable for housing communications equipment, maintenance facilities and other field uses. Called Helicop-Hut, the unit measures 96x76x76 in. inside, weighs less than 1,000 lb., and is constructed of aluminum or fibrous glass skins bonded to a foam core.

It is adaptable to dolly tow, air pick-up and truck transport. Unit can be supplied with an astrodome for visual observation. USAF has conducted tests of the unit at Langley AFB, Va., fitted out as a radio relay station as part of Project Wagon Wheels, designed to provide Tactical Air Command with mobile units.

The photo above shows a Piasecki H-21 carrying the Helicop-Hut.

Craig Systems, Inc., Danvers, Mass.



New Range of Four-Way Valves

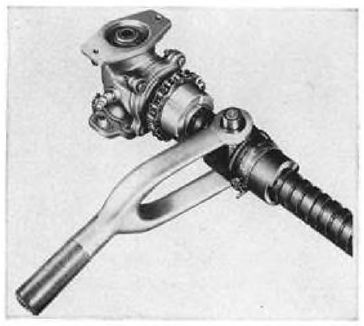
Model 40 series four-way valves are available in ¼-in. and ½-in. tube sizes and flow rates up to 10 gpm. Operating range is 0-5,000 psi., temperature range —65F to 275F. Continuous-duty operation, explosion-proof design and fast action are other features.

Mar Vista Engineering Co., 5420 W. 140th St., Los Angeles 45, Calif.

Actuator Needs No Oil

Aircraft ball screw actuator, designed for wing flap system of a large military transport plane, is designed to operate without a lubricant, a necessity because space envelope and arrangement made it necessary to run the screw exposed to the elements.

It was necessary to incorporate a



resilient non-jamming stop into the nut and screw, in event of malfunction of the normal stroke-limiting device. Engagement of nut and screw during stopping is accomplished tangentially to avoid imposition of additional axial load on the balls and eliminate their jamming and brinnelling. Cantilevered reeds deflect during stopping to deflect and absorb the system's kinetic energy and avoid generation of high-peak stopping loads.

Sargent Engineering Corp., 2533 E. 56th St., Huntington Park, Calif.

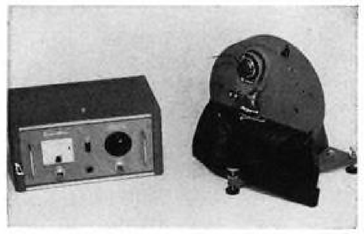


Tiny Motor Has 10,000:1 Ratio

A subminiature motor with brake designed for small micro-switch actuated servo and follow-up systems, ram air pressure regulators and the like, has ratios from 11.6 to 10,000:1.

Envelope size of the motor is 1.250 in. diameter; overall length is 2 in. Optional shaft diameter is 0.1875 in. Torque output is 3 in. lb., with output capacity of 20 rpm.; current at 320 ma. is from 17 to 30 v. Motor is rated for a duty cycle of one second on, one second off, 500,000 cycles. Subminiature brake stops the output shaft in less than two degrees, the maker reports, with stopping time of about eight milliseconds. Unit is built to MIL M-8609.

Motoronics Corp., 241 Concord St., Glendale, Calif.



Highspeed Research Camera

General-purpose research camera for laboratory or field use permits writing speeds from 4 to 400 fpm. of film, when used as an oscilliscope recording unit. Accessories permit its use as a streak camera, or using a pulsed light source, as a framing outfit.

Model 224 consists basically of a 50-in. circumference drum carrying 35-mm. film on its inside surface with a turret-mounted 45-deg. first-surface mirror orienting the optical axis perpendicular to the drum plane.

Control unit includes a 1-hp. 115-v. 60-cps. motor, a contact-type voltmeter

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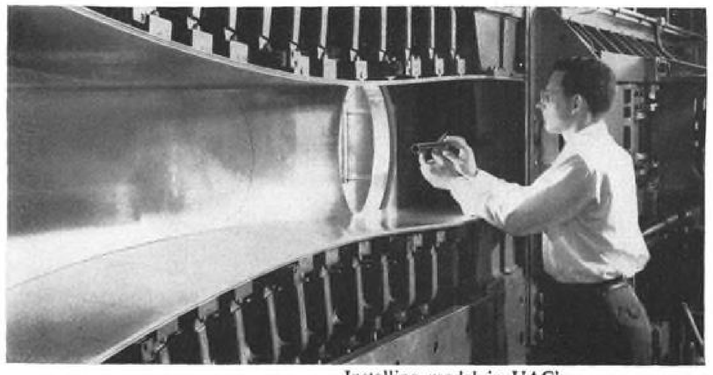
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Beckman & Whitley, Inc., 906 E. San Carlos Ave., San Carlos, Calif.

Pump for Jet Fuel Systems

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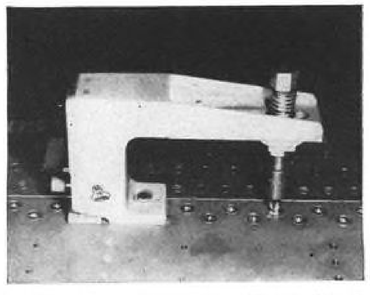
Model RR-15460 has square four-hole mounting flange and spline drive shaft. Mechanical shaft seal is flexible type, self-aligning for shaft misalignment. Weight is 4 lb.

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

ALSO ON THE MARKET

Aluminum aircraft cleanser, Oakite composition No. 74, is water-mixed, lessening fire hazard, and is said to wash down without streaking. Material costs about five cents a gallon in solution.—Oakite Products, Inc., 19 Rector St., New York 6, N. Y.

Recessed-head screw extractor uses a bit to back out the screw. Accessories



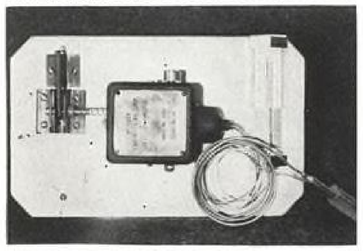
take out various-sized screws.—Deejl Pacific Co., 1149 N. Palmas Ave., Los Angeles 38, Calif.

Plastic wafer measures relative humidity by changing electrical resistance according to the amount of moisture to which it is exposed.—El-Tronics, Inc., Philadelphia, Pa.

Aircraft dolly is used inside cargo aircraft, obviating need to move one piece of freight at a time, or chancing damage by skidding.—Roll Rite Corp., 8th & Jefferson Sts., Oakland 7, Calif.

Snap-action switch controls six circuits simultaneously from a single actuation. Model K3-4 triple-pole switch simultaneously reverses current flowing through two windings of a three-phase motor up to 1 hp. and is also useful in other types of multi-switching operations.—Electro-Snap Switch & Manufacturing Co., 4218 W. Lake St., Chicago 23, Ill.

Automatic lock for refrigerated rivet cabinet closes the container when temperature rises above —10F. Settings can be adjusted for desired temperature,

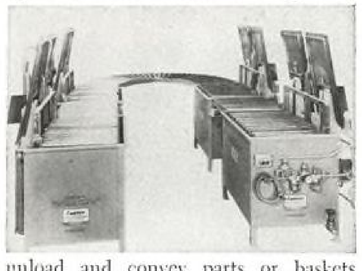


preventing employes from obtaining rivets that have been subjected to temperatures above those required.—Webber Engineering Corp., Indianapolis, Ind.

Edge-lighted control knobs have engraved characters inlaid with resin for long life. Inlay will not discolor with age, the maker reports.—Kerrco Products, P. O. Box 228, Havelock Stat., Lincoln, Neb.

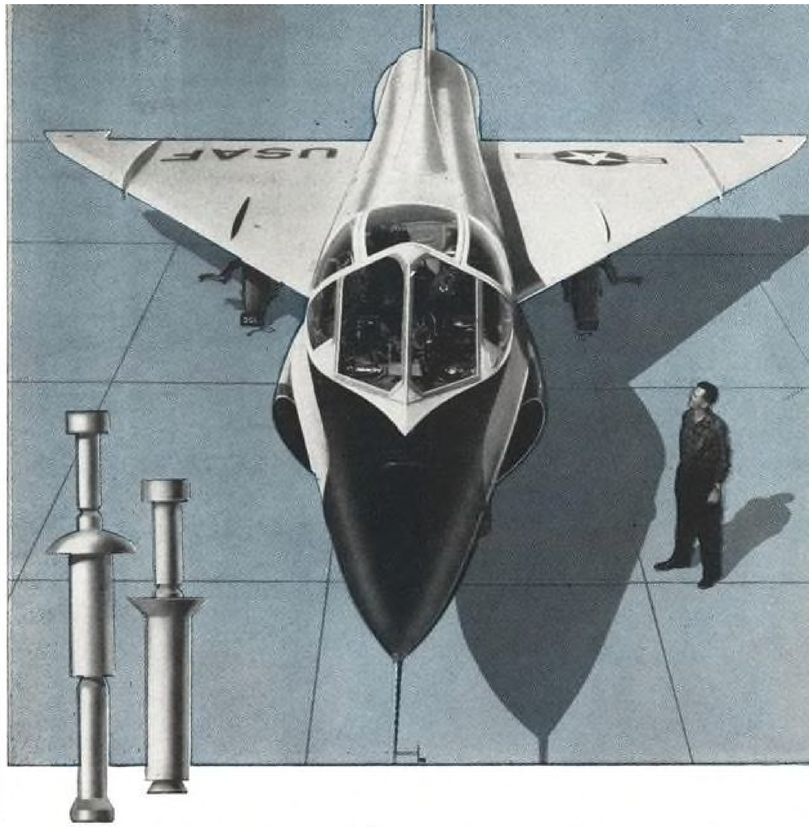
Machinability test lathe, for metal cutting research, provides infinitely variable cutting speeds from 625 to 3,775 rpm., and higher with special pickoff gears. Clearance diameter is 15 in., with swing over the compound of 8 in.—Monarch Machine Tool Co., Sidney, Ohio.

Automatic conveyorized metal cleaning and dipping machine can be furnished with solenoid-operated relays and cam-operated timers to automatically load,



unload and convey parts or baskets through various phases of operation.—D. C. Cooper Co., 1467 S. Michigan Ave., Michigan, Ill.

Purge-type thermocouple assembly is especially developed for temperatures to 2,900F at high pressures in reactors, catalyst beds, glass plants and the like. Unit consists of a silica-free ceramic tube housing the platinum purge tube and platinum-rhodium couple.—Trinity Equipment Corp., Roselle Park, N. J.



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The primary duty of Convair's TF-102A, the combat proficiency trainer version of the Convair F-102A all weather jet interceptor, is to familiarize trained jet pilots with the performance of the F-102A as an integrated weapon. It is the first trainer developed specifically for any of the "century series" of combat aircraft and could be flown as a fully tactical interceptor aircraft according to officials of Convair Division of General Dynamics Corporation.

Convair personnel are justly proud of their achievement in developing the side-by-side, two-place interceptor which handles just like Convair's supersonic F-102A. They appreciate the confidence placed in them by the Continental Air Defense Command for which they are producing these aircraft. Likewise, Cherry Rivet personnel realize that Convair depends upon them for quality fasteners, and for that reason devote all planning and production facilities exclusively to products for aircraft.

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Britain's Aircraft Production:

Too Little, Too Late Plagues Industry

By Sir Roy Fedden*

What are the nation's needs in aircraft? I presume we should all fully agree that they are primarily to have an adequate Air Force to defend ourselves against an aggressor and then, in the very pressing and ever-increasing air transport field, to have a sufficient range of competitive types to meet our own needs, as well as to reap a reasonable share of the valuable world market for the next 10 years ahead, so as to occupy the hard core of our now important aircraft industry, which employs about 250,000 people.

There can, I venture to say, be no doubt at all of the vital need for these requirements. In spite of all the "soothing syrup" of the Summit talks (at Geneva) way back in the summer, followed by the Geneva fiasco, let there be no doubt whatsoever there has been no change in the Kremlin's tactics or ultimate aims. Recent articles in the press have, I hope, at least brought home the true facts to the man-in-the-street.

The Times reported fully on a NATO conference held on October 10 last, at which General Sir John Whiteley, Chairman of the Permanent Chiefs of Staff, said that Russia retains the same number of active divisions, but they are greatly improved in quality and equipment, and the same remarks apply to her Air Force. The Soviet Bloc, therefore, retains the initiative, and, in Sir John's view, the threat is now greater than ever.

At the same conference Admiral Wright, U. S. N., Commander-in-Chief Atlantic, stated that the Russians possess the largest submarine fleet the world has ever known, exceeding that of all other nations put together.

During 1955, the press has been full of statements and reported speeches, relating to the expansion and competition on main line world air transport. The stakes are indeed high, and are stated to be of the order of 2,500-3,000 aircraft, costing the colossal figure of $6.3 billion spread over the next 10 years.

Export Market

These figures take no account of the smaller feeder and personal types of aeroplane. These requirements bring home how important it is for the calibre of our civil air liners to be capable of attracting a fair share of this important world export market.

The next question before us is: "Has the nation sufficient aircraft of the right type to meet these widely differing needs? The answer is definitely "no."

Money But No Planes

On the defense side, sufficient money and effort have been expended, and time elapsed, so that we could have had by now 2,000 modern swept-wing fighters and 500 strategic bombers: but actually, we must have in service I imagine under 600 of these fighters and less than 50 "V" bombers.

Sombre fact though it is, America cannot, therefore, look to us for the next few years to make a serious contribution in the air in the event of an emergency. In fact, our position in this respect is not far removed from what Poland's was at the beginning of the last war.

Civil Air Needs

As regards civil aviation, we have achieved outstanding success in one new world market. The next 12 months is a tremendous testing time for certain other new types which are just coming along and have still to "win their spurs." To hold what we have already gained in the world civil transport markets and consolidate the field on the other new types coming forward, is a needle question mainly on account of the following.

A main line civil air transport is a highly specialized form of aeroplane and its design features and constituent parts are all vital to the end result. The accessories, systems and functional design are relatively just as important as the structure or the aerodynamics. Such a complex piece of engineering cannot be undertaken except by a large firm with considerable financial resources, equipment and with adequate highly skilled design, development and production staff. When I say "large," I mean large, and in the past we have made the regrettable mistake of believing that a comparatively few capable, hardworking people can attain the desired results on this type of aeroplane.

Development Cost

Of course, given time, anyone can design, make and develop a successful prototype, but long before it was finished it would only be fit for the scrap heap, as it would be entirely out-of-date. I am not enunciating that numbers per se are the be-all and end-all, but sufficient of the right number and type is an absolute necessity to go quickly enough, and in this respect up to the present, we have sadly failed to appreciate the position.

Many of us who had the privilege of attending the Anglo-American Air Conference last summer visited one firm that estimates its costs over the next five years for a new transatlantic air liner will be $36 million on engineering alone (i.e. design and development), and this sum will be expended up to the time of the certification stage. This figure does not include material or labour costs in the manufacture of the prototypes or tooling for production. I am not suggesting that it will be necessary to spend the same amount of money in this country, but nevertheless I want to emphasize that it is a very big and serious undertaking.

Successful Airliner

A successful civil airliner is one in which the objectives have been properly understood by the designers, not merely dictated to them by the customer or the government. Only by intensified design investigations at the outset can the framework of design be safely laid down and a basis provided upon which successful development and effort thereafter can be possible.

This demands superb leadership from the chief design executive, who is accepting an assignment calling for a supreme test of human judgment and control of a considerable engineering

First of a Series

Sir Roy Fedden, three-time president of the Royal Aeronautical Society, delivered perhaps the most damning analysis of Britain's post-war aviation troubles yet to be made at the recent fourth Conference on Problems of Aircraft Production. Because of its importance and timeliness, Aviation Week has decided to publish the entire address. It will appear in four parts, the first of which begins on this page.

* *Former aircraft adviser to the North Atlantic Treaty Organization and three-time president the Royal Aeronautical Society.*

staff. He must have all-round knowledge to do this, be receptive, as well as knowing his own mind. To be successful, he will require an exceptionally well-balanced judgment to guide his lieutenants to make the right decisions all the way down the line.

Lack of Experience

One of the big problems confronting our industry is lack of experience in designing for airline operation. In other words, the design groups have not sufficient men who have been through the hard school of experience in this complex business. No technical brilliance can short-cut this necessity of experience, although to appreciate and admit the present poverty of the land will go some considerable way to adjusting this condition.

Because of this lack of experience, few British design teams on civil work possess an adequate maintenance engineering design group.

There is also a serious dearth of good mechanical engineers, and it has been common in the past to see excellent conceptions ruined by bad detail engineering. Often it will be seen that these classes of important engineers are outweighed by performance considerations, and it is not unusual to find structures and aerodynamics dominating the whole team. Such a short-sighted policy, if pursued, inevitably ends in serious trouble.

Lack of engineering manpower on British civil aircraft presents a formidable difficulty. Certain post-war projects embarked upon in this country have fallen down, not only because of their lateness in delivery, but in their basic conceptions as pieces of equipment.

This has occurred because of inadequate leadership and too small a number of suitable engineers, not only to design the aircraft itself but to cope expeditiously with the whole gamut of other component systems, layout of different elements and other various detail installations, which altogether add up to a formidable undertaking. Because of this lack of personnel, far too many compromises have to be taken, and there is an absence of ruthless determination to scrap something which will not "fill the bill," because of the time factor. Some of these bad habits are inherited from the military side where such compromises have to be accepted fairly often.

Too Late, Too Little

Consequently, in the final analysis, the mock-up stage is reached too late, and often the mock-up is merely a mockery, representing what is already unchangeable.

The representative of the airline dealing with the manufacturer is generally a sophisticated person, who is not going to be taken in with rough performance compromises, especially when millions of pounds are at stake. He expects a complete description of the article which is offered for sale, including detailed performance information, presented in such a form that a proper operational evaluation of the machine can be readily made.

Borrow U.S. Sales Book

Unfortunately, some British firms do not yet seem to appreciate the need for presenting their technical sales data in an internationally acceptable form, which, owing to their immensely wider experience, is another way of saying according to American standards. It is curious how often we rise to this opposition to accept anything American, no matter how good it may be! We have had to alter our sales publicity and catalogues in many other directions when we have entered new markets already occupied by U. S. A., so that it would seem strange that we should balk over this one.

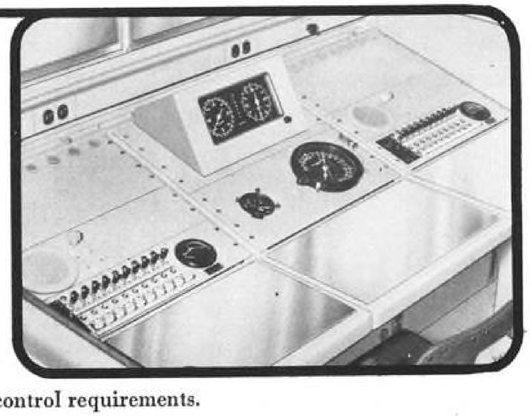
Another point where we might with average take a leaf out of the U. S. A.'s sales book, is to include thoroughly qualified engineers to act as go-betweens, who can discuss performance and other technical features of their firm's products in full detail. These

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The ACC-10B Console (inset) is a part of the Wickes T-4 Portable Control Tower. The ACC-10B exemplifies the "building block" concept of console design. Such design offers a completely unitized, *functional* control system which can be expanded and adapted to meet any operating condition.



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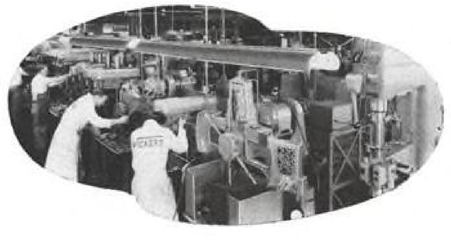
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WITH THE AMPEX 800 AIRBORNE MAGNETIC TAPE RECORDER

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The Ampex 800 that you install in your aircraft is a vital link in a new data speed-up program. It records data on magnetic tape in a form most readily used by automatic data reduction systems. These are now being installed at government test facilities and at certain major aircraft manufacturers. Their objective is to get digested flight test data back to the engineer sooner.

The Ampex 800 has all the practical requirements for airborne recording in the most advanced military aircraft. It can record hundreds of simultaneous data channels (multiplexed onto 7 or 14 tape tracks). By interchangeable amplifiers it can encompass practically any conceivable combination of data. And the Ampex 800 is light in weight — low in bulk — and designed to high altitude environmental requirements.

You have greatest assurance of data compatibility when you choose the Ampex 800. It performs to precise standards and furnishes data for reproduction on other Ampex Recorder-Reproducers. These are the most widely used magnetic tape equipment and their standards are now accepted everywhere.

Ampex Corporation is prepared to give information and assistance on the entire data acquisition and reduction system of which the Ampex 800 Airborne Recorder is a part. For descriptive literature on the recorder, write Dept. UU-2460



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men should take much of the load off the design office and the inevitable waste of time for these hard-pressed people resulting from going round mock-ups and discussing various questions with the succession of prospective customers and visitors.

A brief reference should be made to electrical systems and propellers. By the introduction of the latest a.c. techniques substantial savings in weight and all-round better results can be obtained, all of which is fully appreciated. For high power prop-turbines and cruising speeds of 450 mph. and over, an efficient quiet propeller will be essential.

No future large type of transport will be acceptable without such improvements, but it is problematical where we can put our hands on proven British equipment at the present time that will meet these needs.

Better Tooling

The production problems of big civil airliners made in comparatively small series have not received sufficient thought in this country.

A better break down of the design for jigging and tooling than has been usual practice is necessary. More component endurance testing than is today standard practice would speed up production.

Closer understanding and appreciation of each other's problems between design and production from the early design stages would help considerably; everything tends to be too rushed and ill-considered because everyone is overstressed.

The production executive must know enough to be able to say when he can release production, and he must be a sufficiently senior and balanced individual for his views to hold full say.

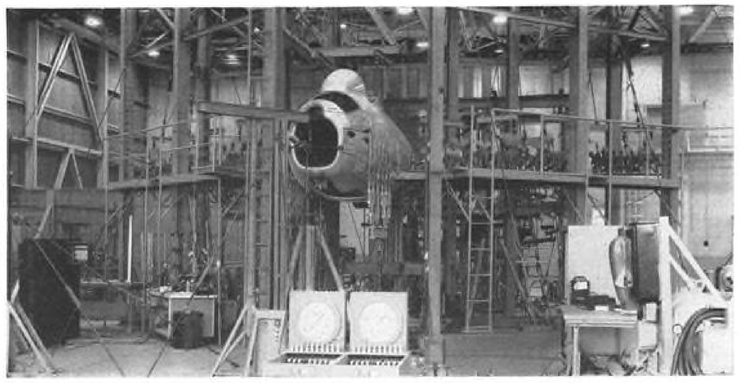
While working as Aircraft Adviser at NATO, I had an American colleague, who had been production manager at a West Coast airframe plant of over 15,000 hands for seven years and was really knowledgeable on all production problems. After touring the British industry, he was shocked at the weakness of some of our production management.

For the class and quantities of modern airliner production it is most important to pin-point responsibility. A basic requirement is a definite principle of decentralisation. Each superintendent in the set-up must have a clearly defined job.

Cost consciousness of all departments and at all levels is essential.

The delegation of responsibility all the way down the line to the lowest levels of supervision and the careful daily checking on this supervision can revolutionise a production plant. It is surprising to me that more considera-

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With the highly-successful NAVY FJ-4 FURY JET* in production, and with other, years-ahead designs being developed, North American's Columbus Division has become a self-sufficient, proficient organization within North American Aviation, the company that has built more airplanes than any other in the world.

Geographically, a complete airframe manufacturer in Ohio offers individual advantages to many engineers. The Division's complete design, development and manufacturing responsibility for North American's Naval planes is its own Challenge. North American Aviation means Stability plus availability of vast engineering data and resources. The Division's youth and success mean greater Individual Opportunity.

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For the Full Story On Your Ohio Future, Write Today: Mr. J. H. Papin, Personnel Manager, Department 56AW, North American's Columbus Division, Columbus 16, Ohio.

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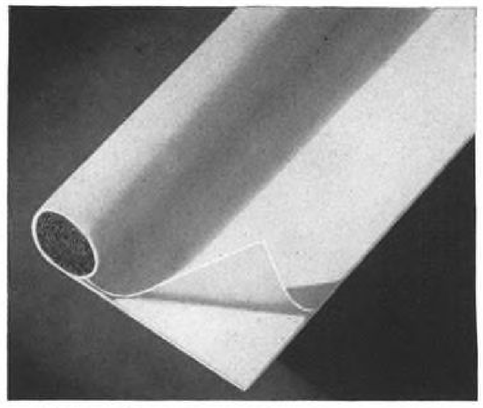
NORTH AMERICAN AVIATION, INC.
COLUMBUS DIVISION

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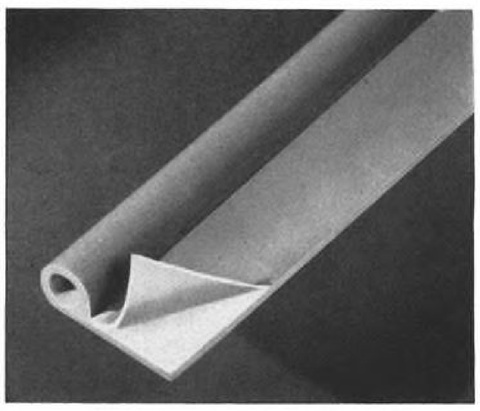
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NEW PRODUCTS



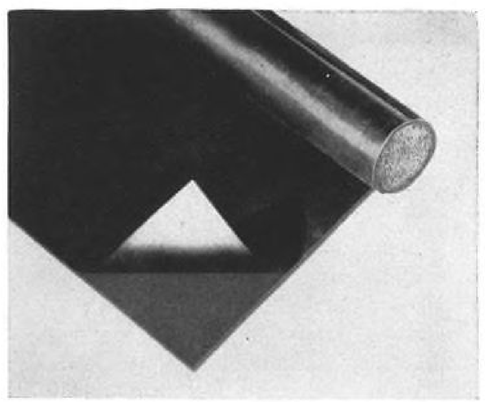
TEFLON COVERED SILICONE RUBBER SEALS

The non-adhesive quality of Teflon Covered Seals is best utilized where smooth, sliding action is desired. Teflon is bonded securely to the rubber, giving excellent impact and tear strength. Hydraulic fluids, jet fuel, gasoline and washdown fluids have no effect. Suitable for use at extreme temperatures ranging from 450°F. to —100°F. Available with hollow or silicone sponge rubber cores and with any type of slab.



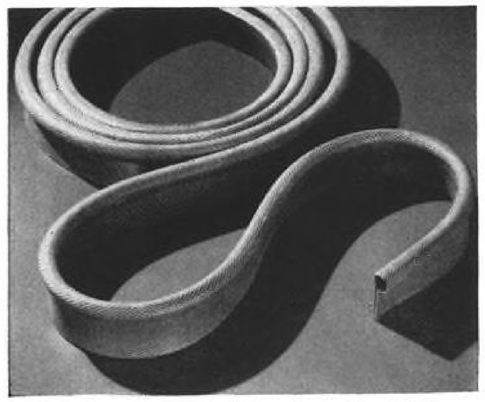
HT 600 SILICONE RUBBER SEAL WITH DACRON REINFORCED TAIL

High tensile and elongation properties, approximately double the best comparable properties offered in other silicone rubbers, make this new HT Silicone Rubber Seal ideal for many sealing applications. Abrasion and tear resistance has been vastly increased by the Dacron-reinforced tail, which prevents the seal from tearing loose from rivets. In addition, the materials used offer a broad range of temperature serviceability (—100°F. to 400°F.), and good resistance to oils, lubricants, and hydraulic fluids. Hollow or sponge cores; any type tab.



MYLAR COVERED SILICONE RUBBER SEALS ARE CHEMICALLY INERT

Hydraulic fluids, anti-freeze solutions, washdown solutions, gasoline, jet fuels have no harmful effect upon this Mylar bonded-to-silicone-rubber seal. Completely inert to virtually all chemicals and solvents, it can best be utilized around any enclosure where seepage of destructive fluids is a problem. COHRlastic Mylar Seals are extremely tough and offer dependable service in temperature extremes of —100°F, to 300°F. Available in any lengths with hollow or sponge rubber cores. Tabs as desired.



DACRON-FABRIC REINFORCED SEAL BENDS WITHOUT KINKING

COHRlastic's new Dacron-Reinforced Silicone Rubber Seal has excellent abrasion resistance and its reinforcement stretches to allow bending around corners without kinking. This stretchable seal possesses good tear strength, resists weathering conditions, and is suitable for continuous use in temperatures of —100°F. to 350°F. Can be furnished with hollow or silicone sponge rubber cores and any type tab desired in lengths up to 10 feet.

For additional data on the properties of these Seals, please write to:

THE CONNECTICUT HARD RUBBER COMPANY

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tion is not given to such matters at high level.

For over 30 years I have been going round aircraft and engine factories in most parts of the world, and I am most grateful for the experience this long apprenticeship has given me, in summing up the production approach of an organization. Two or three days' tour of any works I consider should enable a first-class thoroughly experienced production engineer from outside the plant to estimate the possible production potential for at least the current work on the floor of the shop.

The importance of a close watch on realistic charting and scheduling is essential. It is not the obvious big things that count, but the little ones.

I am not impressed, if I see a row of dust-coated fuselages, that production is in good shape. Management by exception is a valuable key to production.

That which stays on the schedule requires little attention: the exceptions are the things that want watching.

Dormant Talent

Quality control, apart from inspection, wisely administered is a great help.

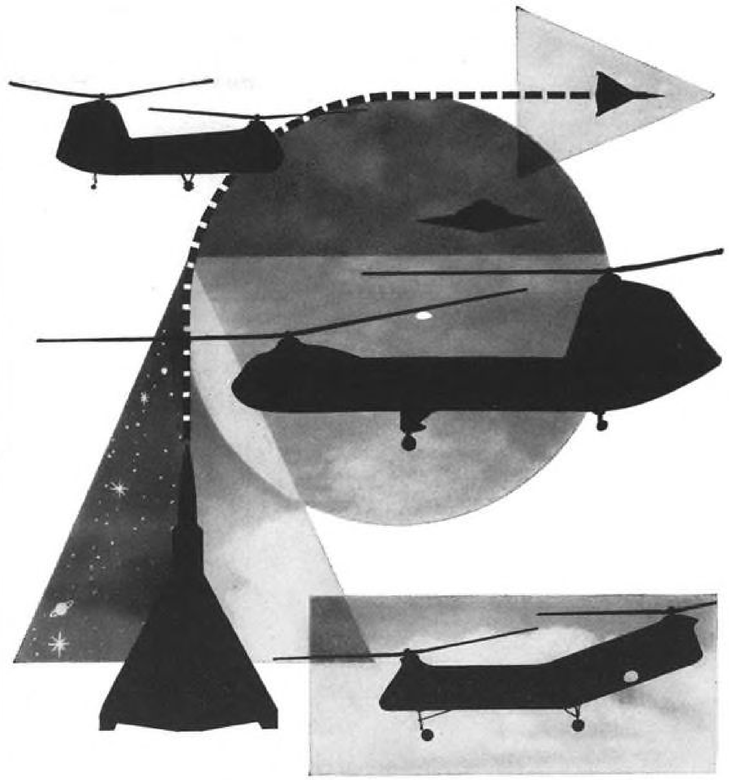
Enthusiasm and interest for the application of all practical modern techniques are important amongst the supervisory staff, and gadget-mindedness of the rank and file is always useful.

A modern airliner is a specialized, detailed, complex structure, and it will not just arrive on date by the old shop methods; it wants a new approach. We possess the right talent for this, but in so many cases it is lying dormant, and it requires time and leadership to bring it out.

Apart from these vital questions of adequate defense and civil transport opportunities, the man-in-the-street is beginning to wake up to the fact that holding our place in the air internationally is a definite "must" and is a measure of our virility and creative genius as a nation.

In fact, it is realized that it will be impossible to remain a great nation or lead in the industrial and mechanical world markets if a country's aircraft industry is not efficient and up-to-date. The prestige value is incalculable, apart from the air transport field, and affects even the export market of more mundane things such as socks and washing machines. Aviation and everything to do with it has caught the imagination of the youth of the world, in the same way that the British Navy and Mercantile Marine did at the end of the last century, to the tune of successfully providing the name brands of many of our best-known commodities.

Lord Halsbury said, in a recent speech on "Stock-taking on the Research Front," that aeronautical engineering



NEW SHAPES of things to come from Piasecki ...

Startling new flight concepts are taking shape on the drawing boards—in the test cells—of the Piasecki Research and Development Division.

New airfoils, new control devices, new lift configurations—these are the building blocks of future Piasecki developments.

Looking to the immediate future, progress has already been made in Vertical Takeoff aircraft. New and improved helicopter designs—projections of Piasecki's long research and engineering experience in high performance helicopter design and production—are nearing the flight stage.

Today, many different models of Piasecki helicopters are flying for the three Armed Services . . . everywhere . . . doing dozens of difficult jobs. Tomorrow, the shape of Piasecki aircraft to come will be a vital part of our Defense picture, our air transport scene.

In the future, as today, Piasecki will design and build aircraft for performance, for versatility—*for the toughest jobs.*

ENGINEERS NEEDED FOR: DESIGN • AERODYNAMICS
TESTING • STRESS ANALYSIS • AIRFRAMES

Send resume to John Tannone, Jr., Employment Representative

Piasecki HELICOPTER CORP.
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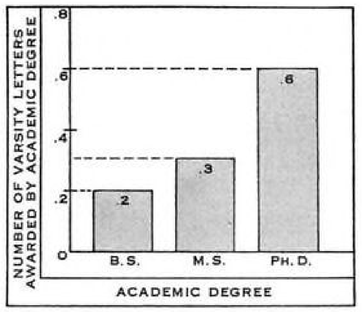
SIDELIGHTS ON THE SCIENTISTS *number* **3** *of a series*



Brain and Brawn

Some of the young fellows on our staff have been analyzing our files of personal data regarding scientists and engineers here at Hughes. What group characteristics would be found?

With additional facts cheerfully contributed by their colleagues they have come up with a score of relationships—some amusing, some quite surprising. We shall chart the most interesting results for you in this series.



Contrary to popular belief, higher academic study goes hand in hand with increased school athletic activity—as shown in the above chart. This is based on data obtained from a 20% random sample of the 2400 professional engineers and scientists of Hughes Research and Development Laboratories.

In our laboratories here at Hughes, more than half of the engineers and scientists have had one or more years of graduate work, one in four has his Master's, one in 15 his Doctor's. The Hughes research program is of wide variety and scope, affording exceptional freedom as well as exceptional facilities for these people. Indeed, it would be hard to find a more exciting and rewarding human climate for a career in science. Too, the professional level is being stepped up continually to insure our future success in commercial as well as military work.

Hughes is pre-eminent as a developer and manufacturer of airborne electronic systems. Our program includes military projects in ground and airborne electronics, guided missiles, automatic control, synthetic intelligence. Projects of broader commercial and scientific interest include research in semiconductors, electron tubes, digital and analog computation, data handling, navigation, production automation.

DUE TO THE *expanding use of Hughes electronic systems, new positions are open for engineers who have demonstrated ingenuity and inventive ability in the areas of product design.*

SCIENTIFIC STAFF RELATIONS

Hughes

RESEARCH AND DEVELOPMENT LABORATORIES

Culver City, Los Angeles County, California

is the most technologically advanced and difficult branch of engineering: and later in this same speech he said that the aircraft industry first tackles, then solves and finally dominates the solution of problems, which no other branch of engineering would have the incentive to attempt.

I believe this to be true, and there is little doubt that the finished aeronautical designer or development technician is amongst the most disciplined and mature mechanical engineers in the world today, and can adapt himself to any branch of this engineering field with distinction.

Extra Weight, $500 a Pound

In support of this, Mr. Heinemann, Chief Engineer (Douglas El Segundo Division), and one of the greatest exponents of the art in the military field said at our Anglo-American Air Conference in Los Angeles last June that on modern aircraft the cost of one pound of extra weights amounts to $500 per aeroplane, if performance and strength are maintained.

In fact, redundant weight literally "costs its weight in gold." Such standards can only be maintained by experienced and matured technicians of a very high order, and we are extremely short of first-class men of this type.

Assuming these statements are correct, it would seem all the more necessary to investigate why we have arrived at this unsatisfactory impasse, seeing that from the early days of this century we have successfully pioneered in the design and construction of aircraft, and we finished up both World Wars as the victors, without aircraft superior in an aerial combat to those of our enemies.

PRODUCTION BRIEFING

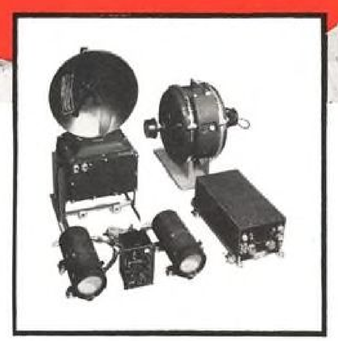
▶ **Chemically milled airframe parts** are scheduled for large-volume production by United States Chemical Milling Corp., Los Angeles, Calif., following basic process developed by North American Aviation (AW Mar. 7, 1955, p. 40).

▶ **Kollsman Instrument Corp.,** Elmhurst, N. Y., has appointed Filotecnica Salmoiraghi, Spa., Milan, Italy, as exclusive agents and licensee in that country.

▶ **Contract exceeding $500,000** for F-100 Super Sabre pitot boom assemblies has been granted Darco Industries, Inc., El Segundo, Calif., by North American Aviation, Inc., with deliveries to begin in March. Darco employs about 80.

▶ **New spark plug assembly plant** will be built in Burlington, Ia., by Iowa





Whatever your airborne radar requirement, you will be right . . . with Bendix-Pacific equipment.

The invaluable experience Bendix-Pacific has gained in specializing in the development and production of radar for navigation, mapping, terrain clearance, tail warning and missile guidance guarantees you performance and reliability in the equipment we can design and build for you.

A Bendix-Pacific Radar Systems Engineer will gladly call on you at your convenience to discuss your requirements.

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60 seconds a minute

Whatever you do, wherever you are, you reach the Future at precisely the same rate as every other living creature — sixty seconds a minute.

Countless millions travel along at this unwavering rate. Yet no two reach their ultimate destination at the same time, nor by the same route. For what the Future has to unfold is individually determined.

Consider your own Future.

Suppose you are prevented from using those abilities with which you are endowed. For you, the passage of time creates a kind of vacuum in which your Past, your Present, and your Future are as one.

If, because limitations are continually being imposed upon you, you can but partially use your gift, your Future is marred by starts and stops, and time is lost that can never be regained.

Should you be encouraged to use to the fullest your special talents — and you so use them — you are among the fortunate few. Yours is a Future filled to the brim with satisfaction and marked by success.

At Sikorsky Aircraft we take great pride in the achievements of our talented engineers. We do our utmost that every second may count for them in their sixty-second-a-minute journey to the Future. For anyone who has talents like theirs, we would do no less.

Please write to Mr. Richard Auten, Personnel Department.



SIKORSKY AIRCRAFT

BRIDGEPORT 1, CONNECTICUT

ONE OF THE DIVISIONS OF UNITED AIRCRAFT CORPORATION

Industries, a wholly owned subsidiary of Champion Spark Plug Co., Toledo, Ohio. Production at the 100,000-sq. ft. facility will get underway this fall, employing about 300 persons.

► **Unification of research facilities** operated by Plessey Group, England, is reason for establishment of a new company, Plessey Research, Ltd. Chairman and managing director of new firm is A. G. Clark.

► **New $2.5-million plant** for cold rolling stainless steel and titanium strip to thinner gages than previously handled by Crucible Steel Company of America will be installed by the firm of its Midland, Pa., works. Completion is scheduled for 1957.

► **Presetting of hydraulic tubing sleeves,** resulting in 500% leak reduction at joints, has been developed by Chance Vought, Inc., Dallas. Firm's tooling personnel designed hydraulic and pneumatic-operated machines to preset the MS21918 or equivalent sleeve on either medium thick-walled or thin-walled stainless steel tubing. Engineers are also studying use of a new double-ended sleeve and short nut to save weight and provide higher fatigue properties. First tryout will be on the 3/16-in. diameter tube used on a gun-charging line.

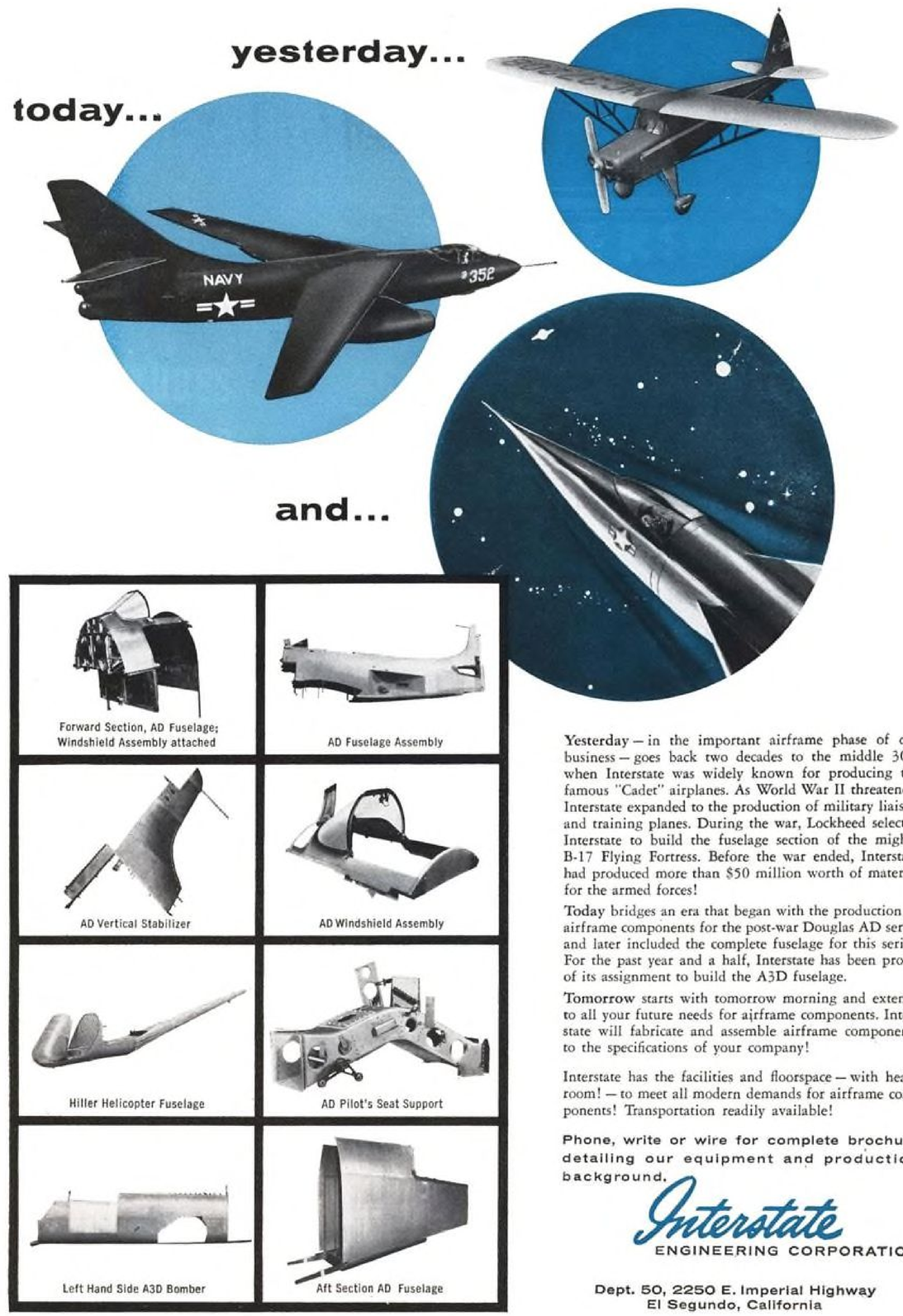
► **High-alloy and superalloy steel** capacity of 500,000 lb. ingots monthly in sonsumable electrode vacuum remelting furnaces is planned by Allegheny Ludlum Steel Corp., Pittsburgh, Pa. Project will double the firm's current capacity of these metals.

► **Mallory-Sharon Titanium Corp.** has opened new Pacific Coast offices at 1418 N. Highland Ave., Hollywood, Calif., to better serve its aircraft customers in that area.

► **Motronics Corp.,** subsidiary of Gladden Products Corp., has occupied larger quarters near it Glendale, Calif., plant to provide additional production and research and development facilities for aviation electronics.

► **New general office building** will be finished late this year for North American Aviation, Inc., on Imperial Highway in El Segundo, Calif. Costing about $3 million, the structure will contain about 143,880 sq. ft. of office space for the executive, payroll, accounting and public relations departments.

► **Resinite Corp., has moved into** new $200,000 plant in Lincolnwood, Ill. Firm makes corrosion and moisture-resistant coil forms for the electrical and electronics industries.



Yesterday — in the important airframe phase of our business — goes back two decades to the middle 30's, when Interstate was widely known for producing the famous "Cadet" airplanes. As World War II threatened, Interstate expanded to the production of military liaison and training planes. During the war, Lockheed selected Interstate to build the fuselage section of the mighty B-17 Flying Fortress. Before the war ended, Interstate had produced more than $50 million worth of material for the armed forces!

Today bridges an era that began with the production of airframe components for the post-war Douglas AD series and later included the complete fuselage for this series. For the past year and a half, Interstate has been proud of its assignment to build the A3D fuselage.

Tomorrow starts with tomorrow morning and extends to all your future needs for airframe components. Interstate will fabricate and assemble airframe components to the specifications of your company!

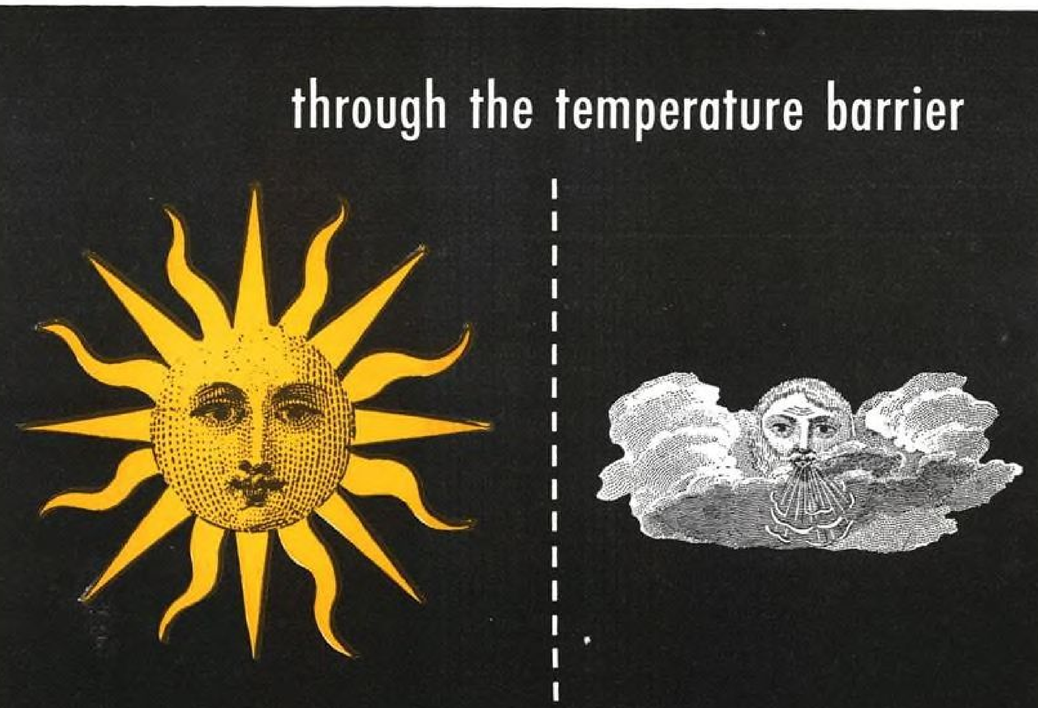
Interstate has the facilities and floorspace — with headroom! — to meet all modern demands for airframe components! Transportation readily available!

Phone, write or wire for complete brochure detailing our equipment and production background.

Interstate
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you have the
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Heinemann Type AM Circuit Breaker. Incorporates vibration and shock resistant construction. Available in odd ratings or fractional ratings, instantaneous trip or a selection of time delay characteristics.

One *outstanding* and *exclusive* fact explains why HEINEMANN alone qualifies for protection of critical airborne equipment: The current rating of a HEINEMANN circuit breaker is *not* affected by ambient temperature.

The current rating of a HEINEMANN circuit breaker is always the same . . . whether on a hot tropic field or aloft at a cold 40,000 feet.

In addition, HEINEMANN circuit breakers provide a self-adjusting time delay . . . delay is longer when cold, shorter when warm. No other circuit or equipment protective device can match this performance.

There are many other advantages which are exclusive with the HEINEMANN circuit breaker. Send for your copy of the *"Heinemann Circuit Breaker Engineering Guide."* Just request Bulletin 201.

HEINEMANN

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Circuit breakers

Arinc Tests Pinpoint Major Cause Of Avionic Equipment Failures

By Philip J. Klass

Tube failures may be slashed by as much as 80% in aircraft which have 27.5-volt d.c. power systems, if tube heaters are operated at their rated 6.3 volts instead of the widely used 6.9 volts.

This conclusion is based upon two-year tests on a number of AN/ARC-27 UHF transceivers conducted by Aeronautical Radio, Inc., under Navy sponsorship.

The tests revealed that modified ARC-27s whose tube heaters were operated at 6.3 volts operated 57% longer between malfunctions than did other standard ARC-27s whose heaters were operated at the customary 6.9 volts.

Voltage vs. Longevity

It comes as no surprise to avionic equipment designers that excessive tube heater voltage shortens tube life.

In d.c.-powered aircraft, avionics equipment tube heaters usually are operated from d.c. in order to minimize the consumption of a.c. power, which is provided by low-efficiency inverters, and to save the weight of heater supply transformers.

When four tube heaters are connected in a series string across the d.c. line, approximately 6.9 volts (27.5 divided by 4) is applied to each tube—nearly 10% over its rated voltage. A dropping resistor could be inserted in series with the heater string to lower each heater voltage to 6.3 volts when the supply is at 27.5 v.

But if, under emergency conditions, the supply voltage falls to 20 or 22 volts, the heater voltage becomes too low for proper operation of the equipment.

Service Test Comparison

The objectives of the Arinc tests were two:

- **To determine the effect** of reduced heater voltage on tube life and equipment reliability.
- **To compare the effect** of reduced voltage on standard JAN tubes with its effect on the newer improved (ruggedized) tubes.

For Arinc's tests, 40 sets of ARC-27s were divided into two equal groups by a random selection process. One group of 20—the "experimental group"—was modified by inserting dropping resistors to reduce heater voltage to 6.3 v. when the ship's supply was at its center value of 27.5 v. d.c. The other 20 sets—the "control group"—were unmodified.

Assignment of standard and new improved tube types was made at random, except that some of each type were used in every set. Also, the tubes used in each generic socket (i.e., first i.f. amplifier, audio amplifier, etc.) were divided equally between the two tube types in the 40 sets. This was done so any difference in tube life between the two groups of equipment would reflect modification and not the differences between individual circuits.

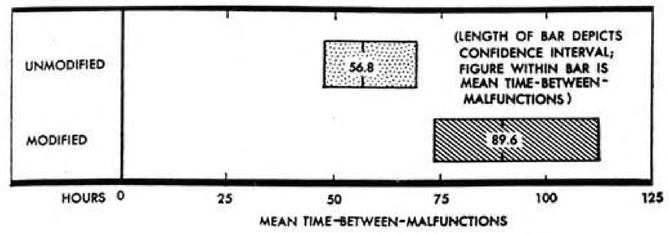
The 40 ARC-27s then were installed in aircraft at the Naval Auxiliary Air Station, Cabiness Field, Tex., and used in normal operations until failure. When a malfunction occurred, the set was removed and sent to a central repair shop.

By inserting a 0.26-ohm dropping resistor in series with the ARC-27 heater circuit, all tube heaters were operated at approximately 10% under their normal voltage in the modified sets, with one exception—a pair of 2C39A power amplifier tubes used in the transmitter.

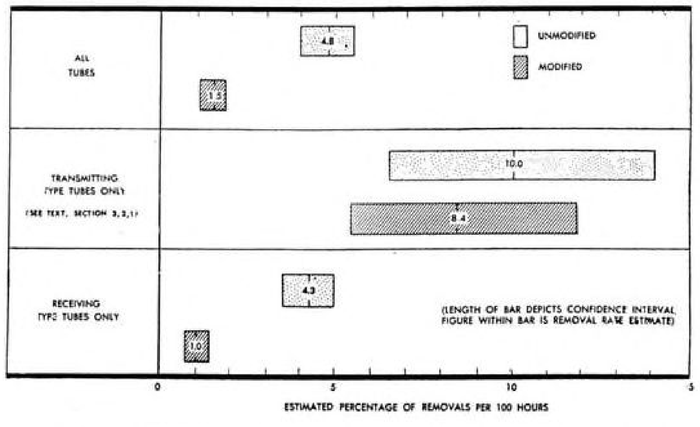
In standard ARC-27s, a series dropping resistor is used to lower the voltage applied to the 2C39A heaters to 5.8 volts. When the heater-string dropping resistor was added in the Arinc modification, the voltage on the 2C39As dropped to 5.2 volts—too low for satisfactory operation.

To get the 2C39A heater voltage back up to 5.8 volts in the modified ARC-27s would have involved a messy modification, so Arinc decided to merely short out the original dropping resistor (in series only with the 2C39As), with the result that the 2C39As and all other tubes would be operated at 6.3 volts in the modified sets.

Thus, in the modified sets, the 2C39As were operating at a heater voltage about 9% above that in the



MEAN TIME-BETWEEN-MALFUNCTIONS FOR UNMODIFIED AND MODIFIED AN/ARC-27 EQUIPMENTS AT CABANISS, WITH 95% CONFIDENCE INTERVALS



ESTIMATED REMOVAL RATES PER 100 HOURS, WITH 95% CONFIDENCE INTERVALS, FOR TUBES IN UNMODIFIED AND MODIFIED AN/ARC-27 EQUIPMENTS

COMPARISON OF TIME between malfunctions (top) and tube life (below) in ARC-27 transceivers whose tube heaters operate at 6.9 volts and modified sets whose tubes operate at 6.3 volts.



F8U-1
Chance Vought
"Crusader" Day Fighter

On the prowl, the glint in its electronic eye made more deadly by use of MINIATURE RATE GYROS manufactured by AMERICAN GYRO (Division of Daystrom Pacific Corporation).

CHANCE VOUGHT relies on Daystrom Pacific Corporation for the highly-accurate, miniature rate gyros necessary to complete the deadly, top-secret flight-control system used in the Navy's "hot" new day-fighter, the "CRUSADER."

MINIATURE RATE GYROS built by Daystrom Pacific Corporation incorporate the latest advances in flotation design, assuring reliable performance under the most difficult conditions.

Manufacturers everywhere are relying more and more on control components and systems produced by Daystrom Pacific Corporation. Write today for descriptive literature covering control systems, stable platforms, miniature and sub-miniature rate gyros, vertical gyros, free and directional gyros, accelerometers, integration, intervalometers, potentiometers, synchros, resolvers, sensing and actuating components.

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MINIATURE RATE GYROS (AC or DC.
Weight 0.6 to 0.7 pound
Diameter 2.2125 inches
Length 2.34 inches
Will meet any known requirements.

regular (unmodified) sets, while all other tubes were operating at a **lower** heater voltage than in the regular sets.

Test Results

After a total of 14,478 hours of operating time on the 40 sets, averaging 372 hours per equipment, Arinc's tests revealed the following:

- **Mean time between equipment malfunctions** was 89.6 hours for modified ARC-27s, compared to only 56.8 hours between failures in the unmodified sets.
- **Estimated removal rate** for all tube types was only 1.5% per 100 hours in modified ARC-27s, compared to 4.8% in standard sets.

The reduction in failure rate is even more pronounced when the figures are broken down between receiving and transmitting types:

- **Receiving type tubes:** 1.0% per 100 hours (modified) versus 4.3% (unmodified).
- **Transmitting type tubes:** 8.4% per 100 hours (modified) versus 10.0% (unmodified).

The higher failure rate for transmitting tubes reflects the fact the 2C39As in the modified equipments were actually operating above their normal heater voltage. This one tube type accounted for nearly 75% of all transmitting tube failures.

Big Pay-off in Some Types

A breakdown of tube life, by tube type, shows that the improvement resulting from reduced heater voltage runs as high as 90%. For example:

- **6AG5 failures were cut 90%.**
- **12AT7 failures were cut 83%.**

Although there have not yet been sufficient failures of improved-type tubes to provide a statistically reliable sample, the available data suggests that reduced heater voltage has a comparable effect on life of the newer improved tube types.

Designer's Dilemma

Arinc recognizes that the present design practice of operating tube heaters at 6.9 instead of 6.3 volts is due to military specs which require that key avionics equipment be able to operate when the ship's supply voltage has dropped as low as 20 volts.

Obviously a jet fighter trying to make an emergency landing with its engine (and d.c. generators) out, is in dire need of radio communications. Yet at such time, the aircraft's battery is its sole source of power, and battery voltage is quickly pulled down.

Thus the military and avionic equipment designers face a dilemma: Arinc's tests indicate an easy way to much-desired increased reliability and reduced tube failures, but only by sacrificing equipment performance under emergency (low-voltage) conditions.

Although the Arinc report does not suggest how this dilemma should be resolved, a third alternative suggests itself.

If, in addition to adding heater-string dropping resistors, a voltage-sensitive relay with reliable drop-out characteristics is added, the tube heaters could operate at approximately their rated voltage until the ship's supply voltage dropped below, say, 24 volts. At such time, the voltage-sensitive relay would drop out, shorting out the dropping resistors, and placing the heater-string directly across the ship's supply.

Arinc's Airline Electronic Engineering Committee (AEEC) has been investigating this possibility for use in airline avionics equipment for essentially the same reason.

Amplifier Boosts Light 10,000-40,000 Times

A radically new type amplifier that can intensify light reflected from dimly lighted objects by a factor of 10,000 to 40,000 was unveiled last week in a demonstration by its developer, the Friez Instrument Division of Bendix Aviation.

The device, which could have revolutionary applications in night aerial reconnaissance and warfare (as well as in medical X-ray and astronomy), is essentially a closed-circuit television system with a camera and cathode ray tube display.

The Friez demonstration featured a girl seated in a large room in front of a Lumicon camera. The room was completely blacked out except for a small "exit" light approximately 250 ft. from the subject. Despite the fact that the human eye could barely discern the girl's silhouette, her face appeared on the Lumicon's viewing screen with detail and clarity comparable to that of commercial TV on a home receiver.

The Lumicon can be used to amplify any form of radiation capable of being converted into visible light, Bendix officials reported. They were tight-lipped, however, on details of just how the Lumicon operates, except to say that it uses a conventional image orthicon in the camera and that the amplification is accomplished "with electronic circuitry."

Bendix officials also declined to discuss the Lumicon's military possibilities but indicated that the military services are very much interested in the development.

One interesting characteristic of the Lumicon, which may be a tip-off as to the type of amplification circuitry employed, was observed during the demonstration. As the system gain was increased (beyond the optimum setting), small areas of the console picture would

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Outputs: Linear and nonlinear functions of applied pressure.
Resistances: 100 to 50,000 ohms.
Ranges: 0-5 to 0-5000 psi.
Types: Absolute and differential.
Vibration Ambient: 0 to 55 cps, 0 to 500 cps, and severe vibration 25g to 2000 cps.
Construction: Hermetically sealed.

Write for Pressure Operated Potentiometer Bulletin



ULTRA-SENSITIVE PRESSURE SYSTEM

Output: 50 volts at full scale.
Range: ±¾ psi, differential.
Resolution: 1 x 10^{-6} psid.
Zero stability: Better than 1 x 10^{-3} psid.

Write for Bulletin EPMS



RESISTANCE BRIDGE PRESSURE PICKUPS

Sensitivity: 5 mv/v at full scale.
Ranges: 0-10 to 0-1500 psi.
Types: Absolute and differential.
Construction: Hermetically sealed.

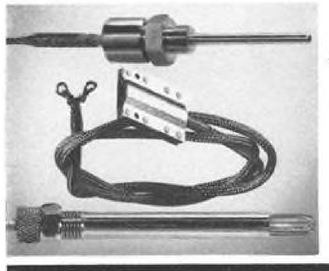
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RATE OF CLIMB

Outputs: 5 volt signal and/or dial indicator.
Range: ±25,000 ft./min.
Time constant: 0.2 sec. at sea level to 2 sec. at 50,000 ft.

Write for Vertical Speed Transducer Bulletin



RESISTANCE THERMOMETERS

Resistance: 5 to 500 ohms at 32°F.
Materials: Platinum or nickel.
Range: −350 to +2000°F.
Types: Liquid, surface, gas.
Characteristics: Corrosion proof, severe vibration ambient, fast speed of response.

Write for Resistance Thermometers Bulletin

"For Transducers See Trans-Sonics"

Trans-Sonics, Inc.

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instantly "wash out," instead of the gradual "wash out" experienced with a TV receiver. This characteristic was not unlike that experienced in weather radars equipped with iso-echo contouring circuitry as the gain is increased.

The Lumicon system uses 1,029 lines per picture, instead of the 525 used in commercial TV, but the same frame rate of 30 per second is employed.

Expansions, Changes In Avionics Industry

General Electric has formally entered the industrial computer field with the formation of an Industrial Computer Section at its Electronics Division headquarters in Syracuse, N. Y.

The move is intended to put GE in "a better position for aggressively promoting and marketing a full line of computers," including analog, digital, and simulators, the company says. GE's diverse computer activities will be centralized in the new section under H. R. Oldfield, Jr., general manager. K. R. Geiser has been name manager of engineering; C. C. Lasher is manager of marketing.

• **North American Aviation** will build a new $3.3-million headquarters building for its recently formed Autonetics Division (AW Dec. 12, 1955, p. 45) in Downey, Calif., on Imperial Avenue, between Ardis and Clark Aves.

The new 300,000-sq. ft. building will house Autonetics Division administrative offices, research and development and some manufacturing facilities. When completed next fall, the new division will occupy a total of 900,000 sq. ft.

Other recent expansions within the avionics industry include:

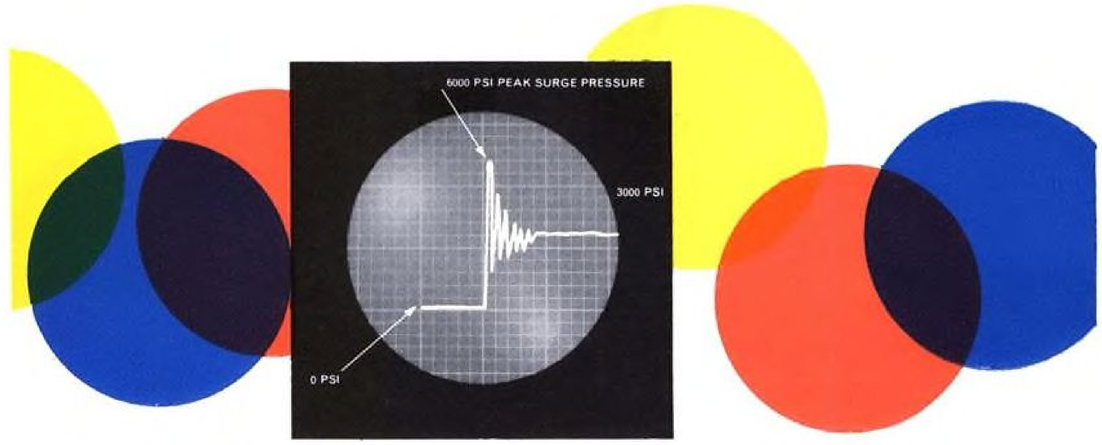
• **Simpson Electric Co.**, Chicago, has formed an Avionics Division to produce omnirange indicators.

• **G. M. Giannini & Co., Inc.**, Pasadena, Calif., has moved its Gyro Division to enlarged quarters in Pasadena. Correspondence, however, should continue to be addressed to corporate offices at 918 East Green St., Pasadena.

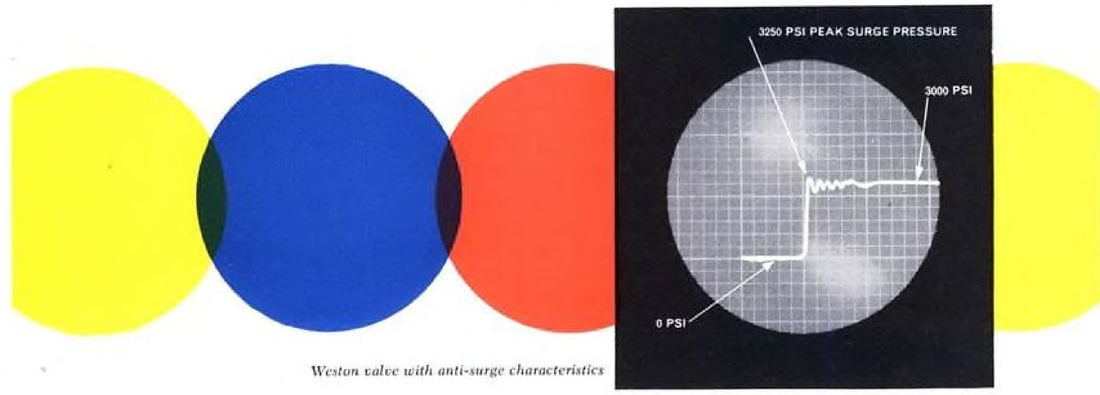
• **Minneapolis-Honeywell's** Aeronautical Division is constructing a 45,000-sq. ft. addition to its present Minneapolis facility to house expanded research and engineering activities.

• **Kearfott Co., Inc.**, will construct new 240,000 sq. ft. facility for its engineering and sales activities, opposits present home office and plant at Little Falls, N. J. When new facility is completed early in 1957, it will raise total floor space to 600,000 sq. ft.

• **Norden-Ketay Corp.**, New York, will acquire the assets, business, and name of Gyromechanisms, Inc., Halesite, Long Island, producer of gyroscopes. Stokley Webster, president of Gyro-



Normal solenoid operated selector valve



Weston valve with anti-surge characteristics

CONTROL OF PRESSURE SURGE SHUDDER IN HYDRAULIC SYSTEMS

...WITH WESTON ANTI-SURGE VALVES

Pressure surges are normally the worst enemies of hydraulic systems. Specifications now limit surge pressures to 135% of the normal system pressure, but in many installations it has been difficult to achieve this limitation.

The solution to this problem is now being produced by Weston Hydraulics, whose designers have designed anti-surge characteristics into the pilot-operated 3-way and 4-way solenoid valves. This modification can be incorporated at no increase in weight and only a slight increase in cost. If you have pressure surge problems, our engineers will be happy to recommend the best configuration to meet your needs.

Available in a variety of body styles as illustrated, and in port sizes from one-quarter to one inch.



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Autonetics, Dept. 991-20 , 12214 Lakewood Blvd.
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mechanisms, will become general manager of the new Norden-Ketay division.

• **International Business Machines Corp.** has established a new independent research group "to develop business machines of the future." New group will be headed by Ralph L. Palmer, former IBM director of engineering.

• **Viking Instruments, Inc.,** East Haddam, Conn., will build a new production facility at its present location.

• **Packard-Bell Co.,** Los Angeles, has purchased the assets of Technical Reproductions, Inc., producer of printed circuits. New department will be under the direction of Richard B. Leng, Packard-Bell vice president.

• **Acton Laboratories, Inc.,** Acton, Mass., maker of lab test equipment, has purchased the instrument division of Technology Instrument Corp., also located in Acton.

• **Hughes Aircraft Co.,** Culver City, Calif., has purchased a former Nash assembly plant at El Segundo, providing 500,000 sq. ft. of manufacturing and office space.

• **Acrophysics Development Corp.,** Santa Monica, Calif., a subsidiary of Studebaker-Packard, is planning to build a million-dollar research facility in Santa Barbara.

• **Birdair Structures, Inc.** is name of new company formed by Walter W. Bird, and other former employes of Cornell Aeronautical Laboratories who developed the air-supported radome for air defense radars. Company will develop new applications for the technique. Address: 290 Larkin St., Buffalo, N. Y.

FILTER CENTER

▶ **Bright Radar Display Coming**—All three manufacturers of airline weather radar (Bendix, Collins, and RCA) are experimenting with bright tube displays employing storage-type tubes developed by Hughes Aircraft, Farnsworth or RCA.

▶ **Airborne Teletype Evaluation**—Flight tests on airborne teleprinters for use by North Atlantic air carriers (AW June 13, 1955, p. 76), to handle routine messages and weather information, are slated to begin shortly. The evaluation, sponsored by Nartel, an informal organization of North Atlantic airline operators, is code-named "Narcast." One ground station will be located at Halifax, Nova Scotia, the other in Britain.

▶ **Sprague to Produce SB Transistors**—Philco Corp. has licensed Sprague Electric to produce it surface barrier transistors, providing a second source for the high-frequency devices. Sprague

8 OF THE 15 "MILLION MILER" SAFETY AWARDS IN 1955 WENT TO PILOTS FLYING AIRWORK OVERHAULED ENGINES

... and nine of the 19 companies receiving meritorious safety awards for having flown one million or more miles without an accident or an injury were Airwork customers.

All awards were made by the National Business Aircraft Association.

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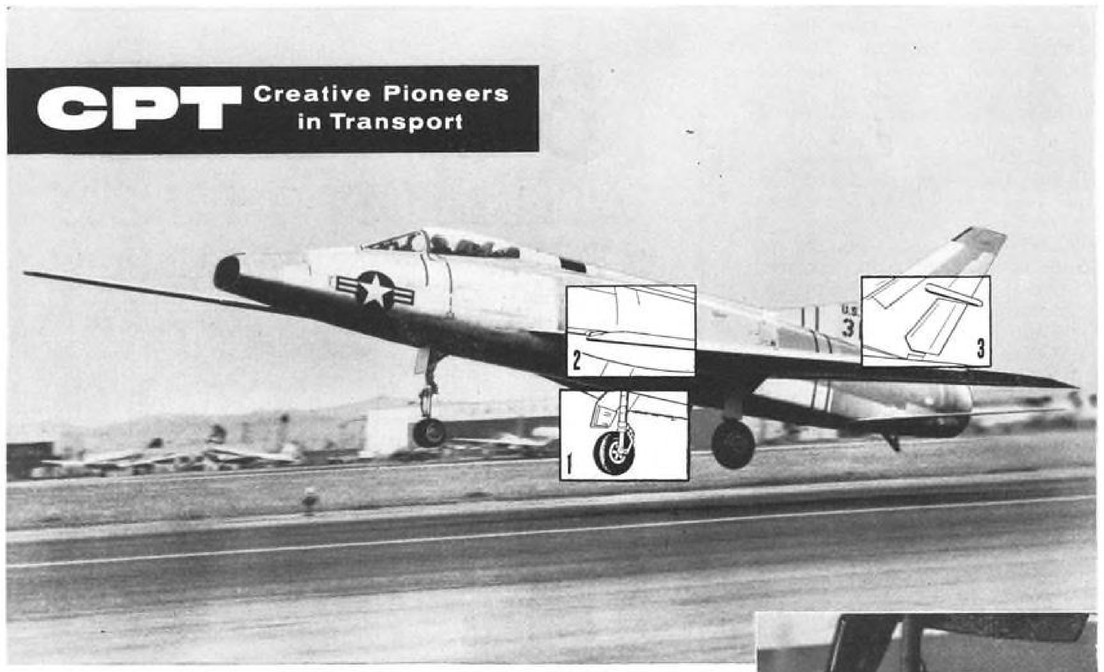
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The "Super Sabre" gets off to work on CPT landing gears . . . and they bring her safely down to earth again.

North America's F-100, world's first operational supersonic fighter, has nose and main landing gears built by CPT (Cleveland Pneumatic).

The F-100 also has a unique steel fin beam assembly fabricated by CPT, using the world's largest flash-butt welder and our giant heat-treating and machining facilities.

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2 ACTUATORS—Wing flaps, landing gears, and rudder trim controls on leading aircraft are operated by CPT ball-screw mechanisms and actuators.



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production will begin this summer. The company also is carrying out its own semi-conductor research and development program.

► **Flare-Out Adaptor Tests**—Mohawk Airlines will soon begin second phase of its flight test work on an improved model of the automatic flare-out adaptor, AN/APN-71 (XA-4), developed by Hazeltine Electronics Corp.

► **New Automation Handbook**—Ramo-Wooldridge Corp. is spearheading the preparation of a new three-volume series entitled "Handbook of Automation, Computation and Control." Approximately 20 universities and industrial firms are participating in the project.

► **New Midwest Computing Facilities**—Cook Research Laboratories, Skokie, Ill., a division of Cook Electric Co., has established a computing and data reduction service facility, available on a contract basis. Facility, which includes both digital and analog computers, is described in Bulletin R-16.

► **Arinc Eyes Scatter Communications**—Aeronautical Radio, Inc., has obtained authorization from Federal Communications Commission for a possible future scatter-communication type radio teletype link between Miami and Puerto Rico. Immediate implementation is not intended.

► **Midget Airborne Teleprinter**—A lightweight (57 lb.) airborne teleprinter which reportedly can be tied easily into existing HF or VHF communications sets will be announced soon. Teleprinter was developed by Bell & Gossett, Morton Grove, Ill.

NEW AVIONIC PRODUCTS

Components and Devices

• **Delay line,** Model SIP4, lumped constant type, for pulse coding and decoding circuits, is tapped every 2 microseconds. Total delay time is 200 microseconds, with rise time of 4 μs. Attenuation reportedly is under 12 db. with an 8 μs pulse. Temperature coefficient is less than 40 ppm./Deg. C. Litton Industries, Components Div., 336 No. Foothill Road, Beverly Hills, Calif., or 215 S. Fulton Ave., Mt. Vernon, N. Y.

• **Miniature relays,** Series G, for operation under high shock and vibration at temperatures up to 125C, measure $\frac{5}{8}$x$\frac{5}{8}$x1$\frac{1}{8}$ in. Units are hermetically sealed, come in DPDT style, with contacts rated 5 amp. at 28 v. d.c. Opera-



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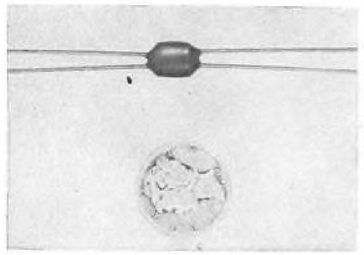
Just now going into production is the new high-altitude Bendix Type 2894 Automatic Diluter Demand Pressure Breathing Oxygen Regulator. It's another advancement resulting from *pioneering* by Bendix—the world's most experienced manufacturers of oxygen regulators and converter systems. For full details on the new Type 2894, or on other oxygen equipment, write PIONEER-CENTRAL DIVISION, BENDIX AVIATION CORPORATION, DAVENPORT, IOWA.

West Coast Office: 117 E. Providencia, Burbank, Calif.
Export Sales and Service: Bendix International Division, 205 E. 42nd St., New York 17, N. Y.

Pioneer-Central DIVISION | Bendix AVIATION CORPORATION

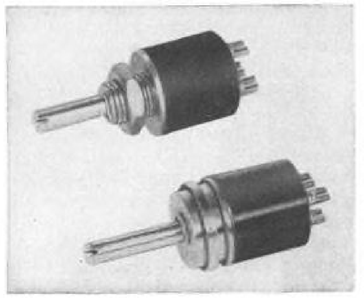
ting voltages up to 75 v. d.c. are available. Globe Electrical Manufacturing Co., 1729 West 134th St., Gardena, Calif.

• **Miniature d.c. voltage divider** with three resistance sections and four output terminals is completely encapsulated and can be operated at temperatures of −55C to 125C. Unit measures ¼ in. in dia. x ⅜ in. long, is available



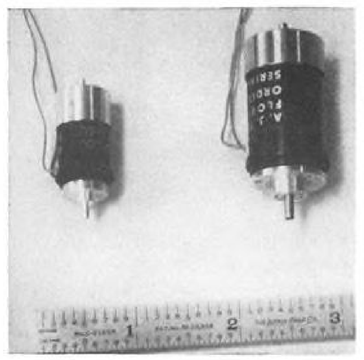
with up to 100,000 ohms per section, wound to accuracy of ½%. Power rating is ½ watt at room temperature, ¼ watt at 125C. Daven Co., 530 West Mt. Pleasant Ave., Livingston, N. J.

• **Miniature precision wire-wound pot,** type AP-½, is now available in 50,000 and 100,000 ohm values, 2 watt rating



at 80C, with 2% linearity. Catalog sheets are available on request. Waters Manufacturing, Inc., P. O. Box 368, So. Sudbury, Mass.

• **Miniature electrical brakes** and clutches in variety of sizes and torque ranges, with operating voltages from 6 to 120 v. d.c., for use in servo and



instrument systems are now available from A. J. Thompson Co., Route 1, Box 812, Florissant, Mo.

• **Sine-cosine miniature potentiometer,** Model RVG-17XS, may be operated at speeds up to 60 rpm. Standard resistance is 18,000 ohms, but other resistances between 4,000 and 25,000 ohms are available. Angular and amplitude accuracy is quoted at 1%. Unit measures 1⅛ in. in dia. x 2⅝ in. long, including shaft. Gamewell Co., Newton Upper Falls 64, Mass.

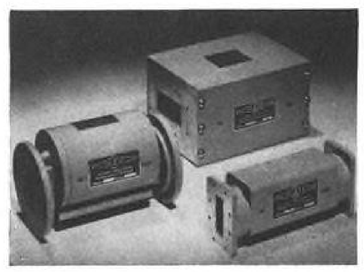
Microwave Devices

• **Millimeter-wave pulse magnetrons** for operation at 35 kmc. are designed for short-pulse operation in airborne or mobile applications. Model MA-200 is rated at 40 kw. peak power, while



the MA-206 is rated at 20 kw. Both units are fixed-tuned. RF spectrum of the magnetrons reportedly is unchanged under 15G vibration at 1,000 cps. Microwave Associates, Inc., 22 Cummington St., Boston, Mass.

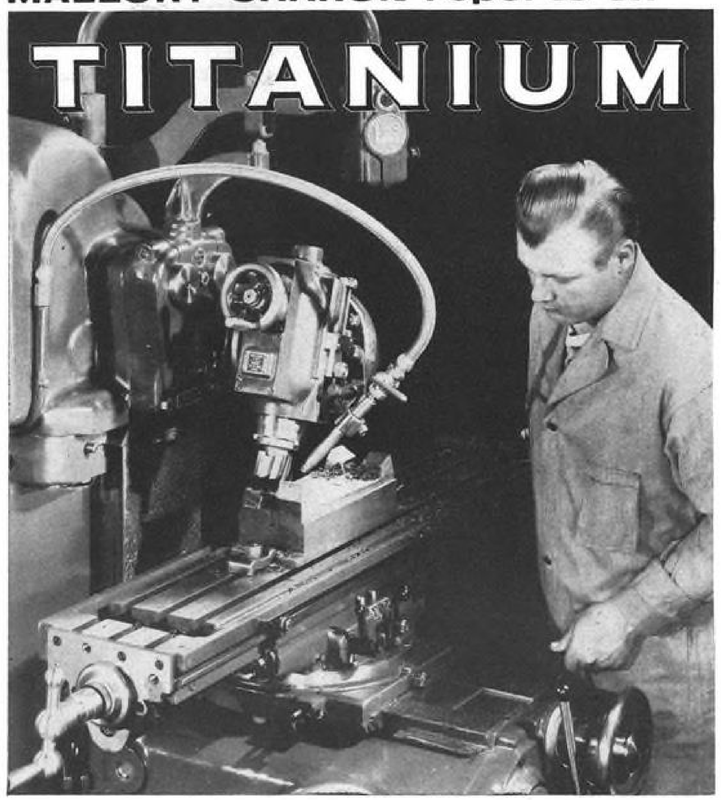
• **Load isolators** are a new family of C-band units designed especially for airborne weather radar, microwave communications and missile guidance. Units provide up to 30 db. isolation, with insertion loss of 1 db. or less. Models cover band of 5.9 to 6.5 kmc.,



at average power levels up to 700 watts and peak powers up to 1 megawatt. Litton Industries, Components Div., 336 No. Foothill Road, Beverly Hills, Calif., or 215 So. Fulton Ave., Mt. Vernon, Calif.

• **Traveling-wave tube amplifier,** Type HA-11, covers frequency range of 2 to 4 kmc. and reportedly has a noise

MALLORY·SHARON reports on



GUARANTEES
faster titanium machining

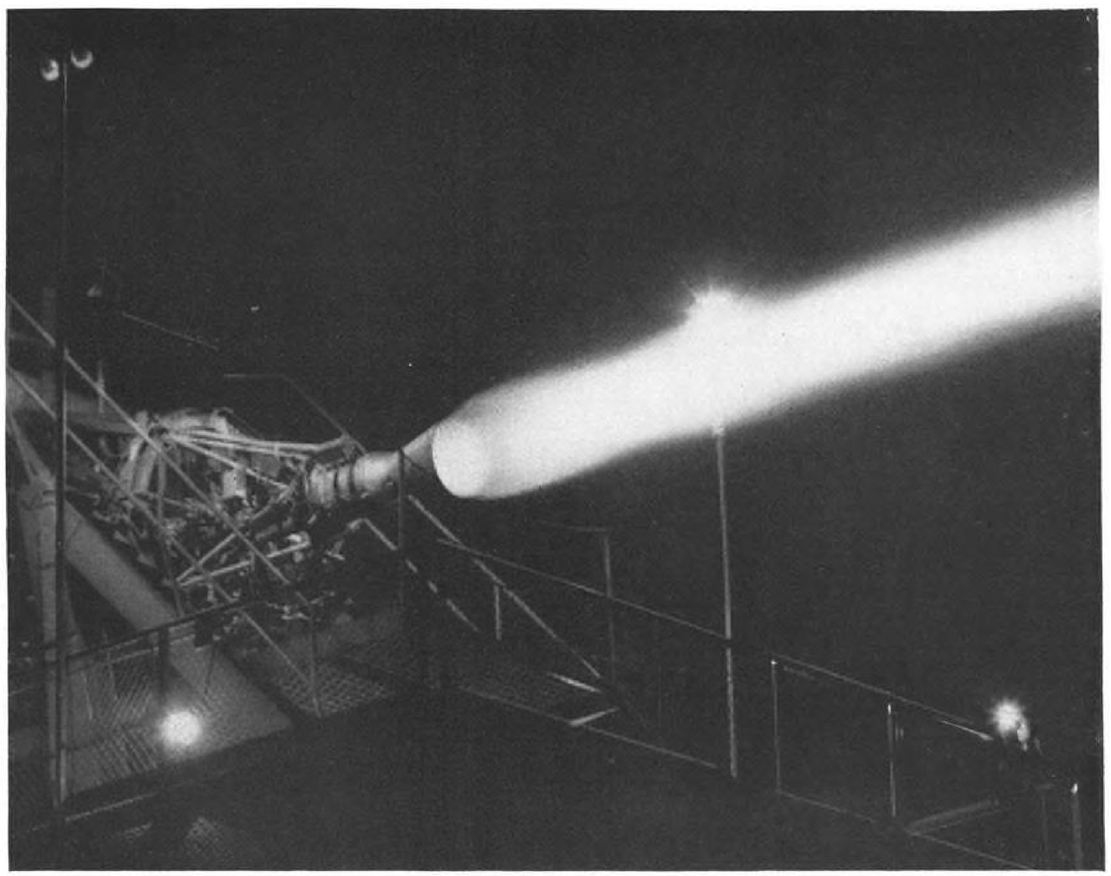
• Mallory-Sharon now guarantees that MST titanium and titanium alloy mill products contain no more than 1/10 of 1% carbon, maximum. Since larger percentages of carbon result in formation of hard carbides which greatly reduce machineability, this guarantee assures you that MST material has the optimum machining characteristics obtainable.

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figure of only 12 to 15 db. over this band. Device has a 30-35 db. gain, and more than 10 mw. output. Huggins Laboratories, Inc., 711 Hamilton Ave., Menlo Park, Calif.

• **Waveguide detector,** Model 509, for use in the K_u band reportedly has very low VSWR (less than 1.5). Unit operates over frequency range of 12.4

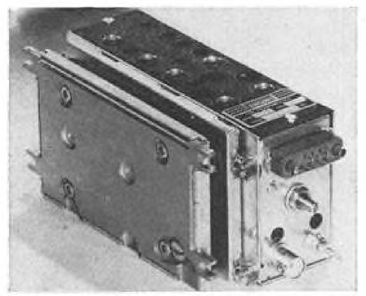


to 18.0 kmc. and can be used for absolute or relative power measurement. Narda Corp., Mineola, N. Y.

• **Sensitive silicon diode,** Type IN23D, reportedly can lower overall system noise to only 7½ db. Device is designed for X-band mixer use. Bomac Laboratories, Inc., Beverly, Mass.

Instrumentation

• **FM telemetering transmitter,** Model 7501, crystal stabilized, weighs only 26 oz. and occupies 40 cu. in. Unit puts out 3 watts of RF power, maintains carrier frequency within 0.005% and has a frequency response flat to within 1½ db. between 100 cps and



100 kc. A 1-volt input produces 125-kc. deviation, and maximum modulation distortion is quoted at 2%. Manufacturer says that 10G vibration between 20 and 5,000 cps. produces less than 500 cycles deviation within the RDB spectrum. Temperature variation of —40C to 85C reportedly results in frequency shift of less than 5 ppm. deg. C. Ralph M. Parsons Co., 135 West Dayton St., Pasadena 2, Calif.

Communications Equipment

• **VHF receiver,** Type 51M-8 single-channel, AM receiver for aviation ground station use, covers the frequency band of 108 to 152 mc. Receiver uses mechanical filter to provide 80 db. rejection of adjacent channel signals, also pro-

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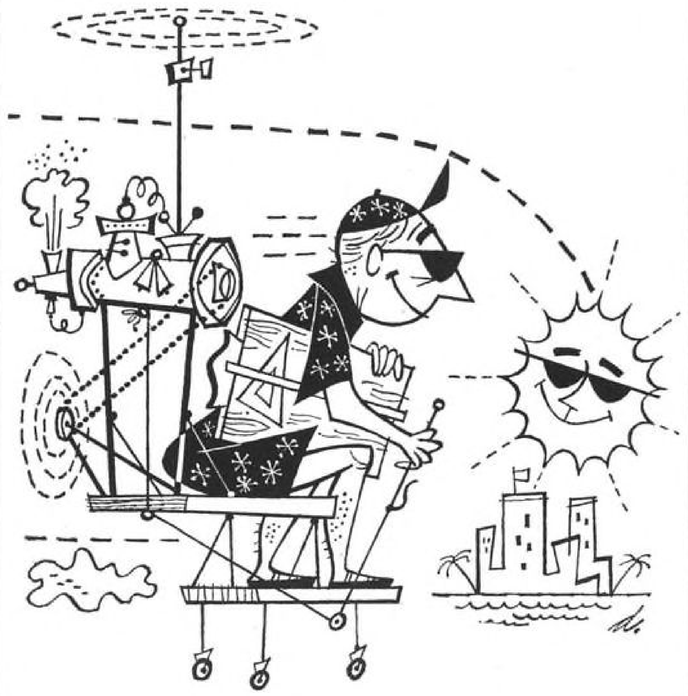


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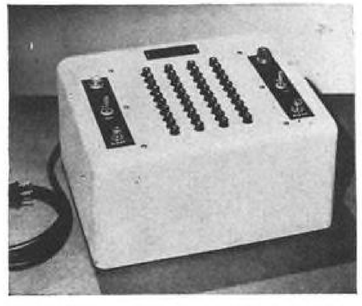
• **Mobile receiver,** Model 5, operating in the 25 to 50 mc. band, is crystal controlled, provides 2½ watts audio output and has a sensitivity of one micro-



volt. Device measures 4½x6¼x7¾ in., weighs 7¾ lb., and operates from 6 or 12 v. d.c. West Coast Electronics Co., 5873 Rodeo Rd., Los Angeles 16, Calif.

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• **Digital-to-analog decoder,** Model 1002, is an all-electronic converter which can accept up to 200,000 ten-bit binary codes per second, with a precision of 0.1%. A similar unit, with identical speed and precision, is available for binary coded decimal conversion. Long-term decoder drift reportedly is less than 0.3%. Company also has announced a Model 1050 analog-to-digital encoder, which can make conversions at a rate of up to 15,000 ten-bit codes per second, also with a 0.1% precision.

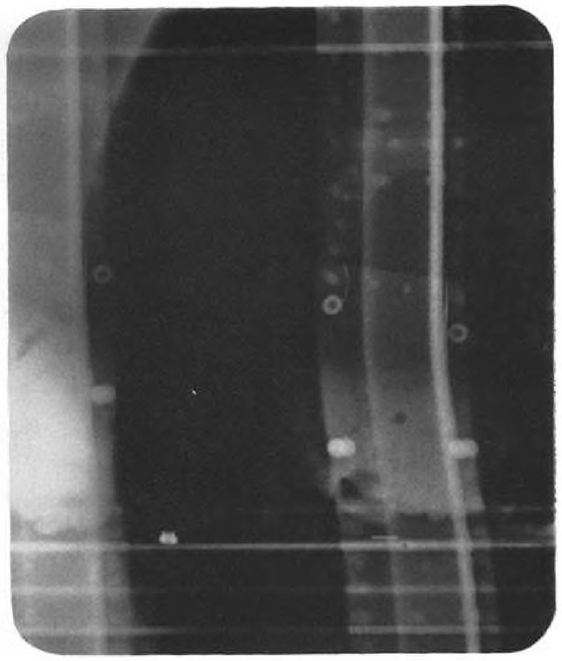


ACF Electronics, Dept. 204, 800 No. Pitt St., Alexandria, Va.

• **Decimal-to-binary converter** changes a four-digit decimal number punched in a manual keyboard into 14 straight binary digits. A keyboard interlock retains the established number until a "clear" button is pushed. Provision for establishing plus or minus sign is included. Device operates from 115 v., 60 cycle power. It measures 10½x12½x6½ in. Hanson-Gorill-Brian, Inc., 85 Hazel St., Glen Cove, N. Y.



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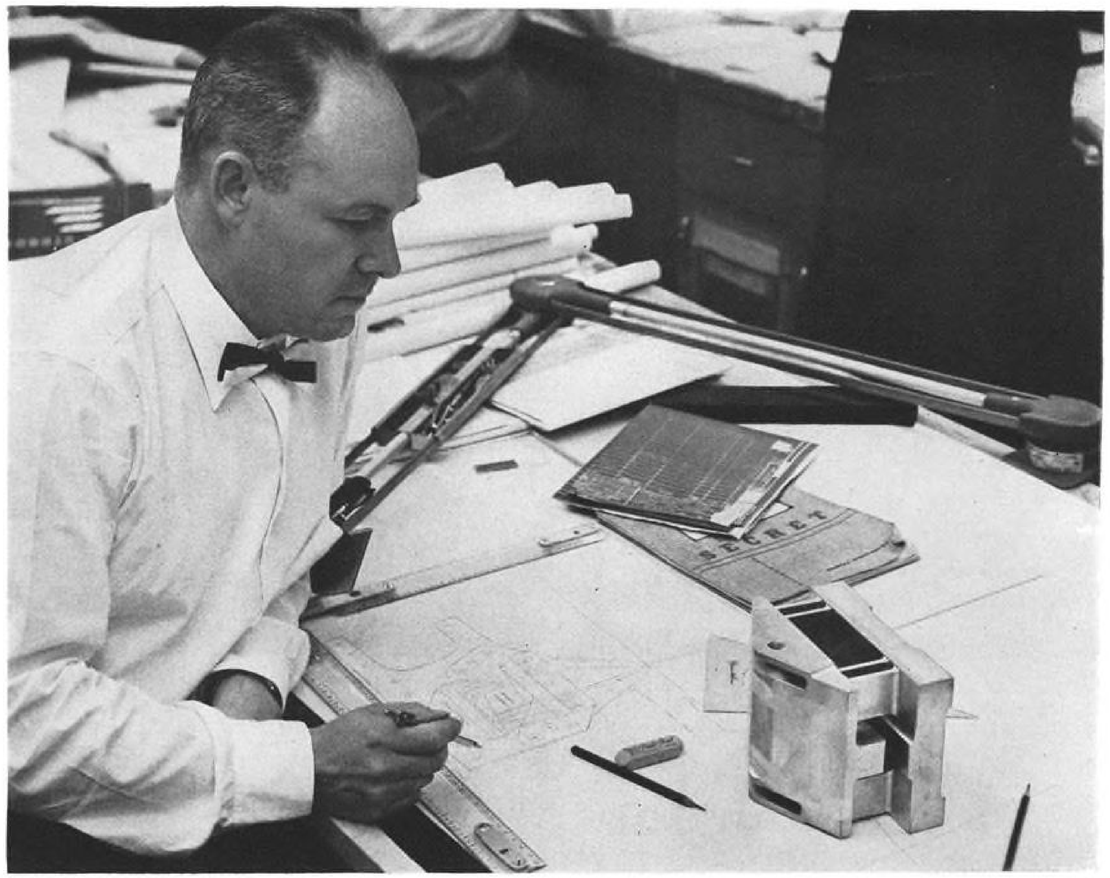
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CAB Report on Stratocruiser Hitting Fence

Prop Reverse Circuits Were 'Off'

A Boeing 377, N 74601, owned by Northwest Airlines, Inc., and operated as Flight 410, went through the airport boundary fence beyond the far end of runway 31L after landing on that runway at Chicago Midway Airport, on August 5, 1955, at 1301.[1] No injuries were incurred by the passengers or crew. The aircraft was substantially damaged.

Flight 410 originated at Minneapolis, Minnesota, with its destination Chicago, Illinois. Departure was from Minneapolis-St. Paul International Airport at 1130 on an IFR (Instrument Flight Rules) flight plan which designated a flight to be made via Victor Airway 25, Victor Airway 97, and Red Airway 28, at a cruising altitude of 15,000 feet.

The crew consisted of Captain George A. Stone, First Officer Ralph T. Gray, Flight Engineer Harry L. Camm, Flight Engineer E. S. Lunde (deadheading), Stewardesses Helen L. Kennedy and Louise Holden, and Flight Service Attendants Michael D. Leahy and Earl Williams. There were 60 passengers on board.

According to company records the gross weight of the aircraft at the time of takeoff was 116,760 pounds and the load was properly distributed. The maximum operational takeoff gross weight was 120,770 pounds.

When the flight reported over Janesville, Wisconsin, ARTC (Air Route Traffic Center) clearance was received to descend and cross the Wilson Intersection (15 miles NNW of Chicago Midway) at 3,500 feet. The IFR clearance was canceled by the pilot shortly after passing Wilson Intersection. At 1256 radio frequency was changed to Midway tower and the flight was then advised to report west of the field for a left turn for landing on runway 31L.

Goes Through Fence

Flight 410 was number three to land in a sequence pattern of five aircraft. Touchdown was about one-quarter down the runway, and the landing roll continued to the end of the runway without appreciable deceleration. At the end of the runway a slight turn to the left was made and the aircraft crossed several hundred feet of grassy area before crashing through the chain link fence bordering the airport.

The aircraft stopped upright, heading west, with its main landing gear on the pavement of Central Avenue, the street bordering the west side of the airport. Passengers and crew left the aircraft via the emergency evacuation chute at the main cabin door and also through the exit door of the lower lounge compartment.

Chicago Midway Airport weather at the time of the accident was: Ceiling 10,000 feet, broken clouds, overcast at 25,000 feet; visibility 10 miles; wind west 8 knots. During the period 1000 to 1300 there had been intermittent light rain showers (.01 inch); however, the runway surface was dry at the time Flight 410 landed.

[1]All times herein are Central Standard and are based on the 24-hour clock; all altitudes are mean sea level.

INVESTIGATION

It was determined, from the observations of competent eyewitnesses and statements of the crew, that a touchdown had been made in the intersection of runways 31L and 36R. This location is approximately 1,600 feet beyond the approach end of runway 31L, which is 6,410 feet long.

The first discernible braking marks of N 74601 on the runway were approximately 3,000 feet beyond the point of touchdown. These marks were light in character and extended on the runway for approximately 600 feet.

The next 800 feet of marks reflected light to fair braking action, and the final 300 feet of marks at the end of runway 31L indicated heavy braking action, as did the marks across the 300 feet of grassy area leading to the boundary fence.

The substance of crew testimony is that airspeed at touchdown was approximately 95 knots. Following touchdown brakes were applied lightly.

No Prop Reversal

When the throttles were moved into the reverse quadrant forward thrust was experienced. When this occurred the captain put the throttles into the forward idle position, called for antiskid (a device designed to prevent locking of the wheels) off, and after getting no deceleration from use of the normal brakes, used full and continuous application of the emergency system.

The captain stated that he turned the aircraft to the left at the end of the runway to avoid striking the large concrete marker just off the end of runway 31L.

All crew members stated there was no indication of propeller reversal at any time during the landing roll. This absence of the noise and deceleration accompanying propeller reversing is substantiated by many passengers and ground witnesses.

Captain Stone testified that he felt there was sufficient runway remaining after the unsuccessful propeller reversal attempt to stop the aircraft with braking. He further stated he has had incidents at Midway Airport of slippery runways not due to snow, ice, or rain.

Surface Slippery When Warm

The surface of runway 31L is asphalt with a topping of crushed rock screenings. At the time of the accident the crushed rock covering was more in evidence near the ends than in the middle area of this much-used runway. When temperatures are above 90F the asphalt exudes an oily substance that creates a slippery surface. Temperature at the time of the accident was 85F and the runway was free of moisture.

Although Midway tower had received no pilot reports of poor braking action on the day of the accident, controllers stated there had been instances of pilots reporting poor braking when temperatures were high and the runway was free of moisture.

The flight manual for B-377 aircraft indicates that with a gross load of 110,000 pounds (the approximate landing weight at Chicago of Flight 410), head wind of 8 knots, and temperature of 85 degrees, the aircraft should stop in 3,400 feet when landing over a 50-foot obstacle using normal braking, and without the use of propeller reversing. The minimum runway length under these conditions is 5,700 feet.

Aircraft Damage

The aircraft received considerable structural damage. A majority of the blades of all four propellers were damaged by contact with the fence. The No. 3 engine mount was damaged to an extent requiring replacement of the powerplant. The four tires of the main gear indicated heavy braking action, as evidenced by large abraded areas extending almost through the casing. The wing flaps and the nose gear received damage from contact with the fence.

The left side of the fuselage was sliced open from the top down to the "crease" line by the whirling of the steel fencing which became entangled in the propellers as the aircraft passed through the fence. The right side of the fuselage received lesser damage in the same manner. Contact with a street lighting pole indented the outer leading edge of the left wing.

Cockpit readings taken immediately after the accident revealed, among many other items, the following: Normal brake system pressure 1,500 psi.; emergency brake system pressure 1,500 psi.; antiskid master switch "off"; the reversing control "outboard and inboard" circuit breakers on the overhead panel in the "out" position. All other circuit breakers on this panel were "in."

The deadheading flight engineer, who had no assigned duties on the flight, was in the observer's seat behind the captain at the time of the landing. On his own initiative he pulled and immediately reset the oleo relay circuit breaker after the captain had tried unsuccessfully to obtain propeller reversing. The action of the "deadheading" flight engineer in pulling out and resetting the oleo relay circuit breaker after the one reversal attempt was an unrequested check on his part to ensure a good contact of this circuit breaker in the event that propeller reversal was again attempted. According to testimony of crew members, this was the only circuit breaker on the overhead panel moved during the entire flight.

Circuit Breaker Location

The overhead panel is located in the forward part of the cockpit ceiling between and slightly to the rear of the two pilot seats, and immediately above and ahead of the flight engineer's seat. Dimensions of the panel are approximately 36 inches for and

aft and 18 inches wide. The forward halt contains the engine ignition switches, feathering buttons, various engine operation and aircraft lighting switches. The rear half of the panel has five spanwise rows of approximately 25 circuit breakers each.

The oleo relay circuit breaker is located in the rear row eighth from the left side and the two reversing control circuit breakers are located in the fourth row, from the rear, at the approximate center of the row. The two antiskid circuit breakers are immediately aft of the propeller reversing control circuit breakers. All circuit breakers can be reached from any of the three crew seats.

Following the accident the aircraft was removed to a hangar on Midway Airport. Structural repairs were made and No. 3 powerplant was replaced before actual testing of the braking and propeller reversing system.

Ground Investigation

On August 19 functional tests of these units were performed at Midway Airport. A preliminary ground runup included the following checks: Magneto, propeller reversing, and manual feathering. No discrepancies were noted and the aircraft was then turned over to the flight test crew.

After taxiing, in which there were several effective applications of emergency brakes, a thorough engine runup was made. During this runup a check was made of autofeathering, manual feathering, and propeller reversing with normal results.

The two reversing control circuit breakers were then pulled and a check was made of engine r.p.m. in the forward idle and reverse idle throttle positions. This test revealed the reverse idle r.p.m. to be from 300 to 500 higher than forward idle r.p.m. on all engines.

The captain and first officer stated that forward thrust was experienced when the throttles were moved past the detent into the reverse quadrant. Forward thrust is obtained when the throttles are moved into the reverse quadrant if the reversing control circuit breakers are "out" at the start of the throttle movement and remain "out" while the throttles are in the reverse range.

Three accelerated stop-runs were made in which the aircraft speed reached was 70-80 knots. During the first run normal brakes were used with the antiskid feature turned off; the second run was with the antiskid on; the third run used propeller reversing only. In all three runs normal braking and deceleration was obtained.

No Malfunctions

On August 20 the aircraft was ferried to the Northwest Overhaul Base, St. Paul, Minnesota. Thorough checks were then made on the electrical systems and propeller domes and no malfunctioning was found.

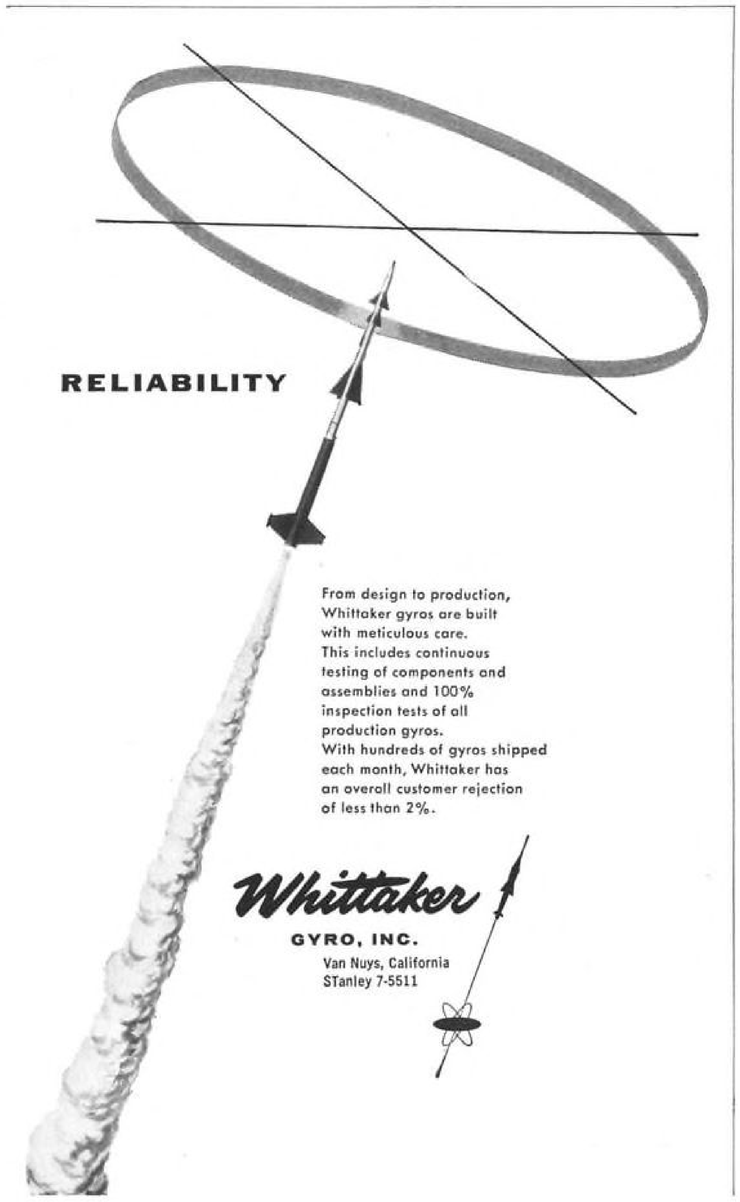
The reversing control circuit breakers' being in the "out" position does not prevent the moving of the throttles back into the reverse quadrant and the increase of engine power in that position, but it does deactivate the propeller control circuits associated with reversing. Thus the propeller blades would remain in forward pitch producing forward thrust. When the oleo relay circuit breaker is "out" a throttle-locking solenoid prevents the throttles from going rearward past the throttle detent.

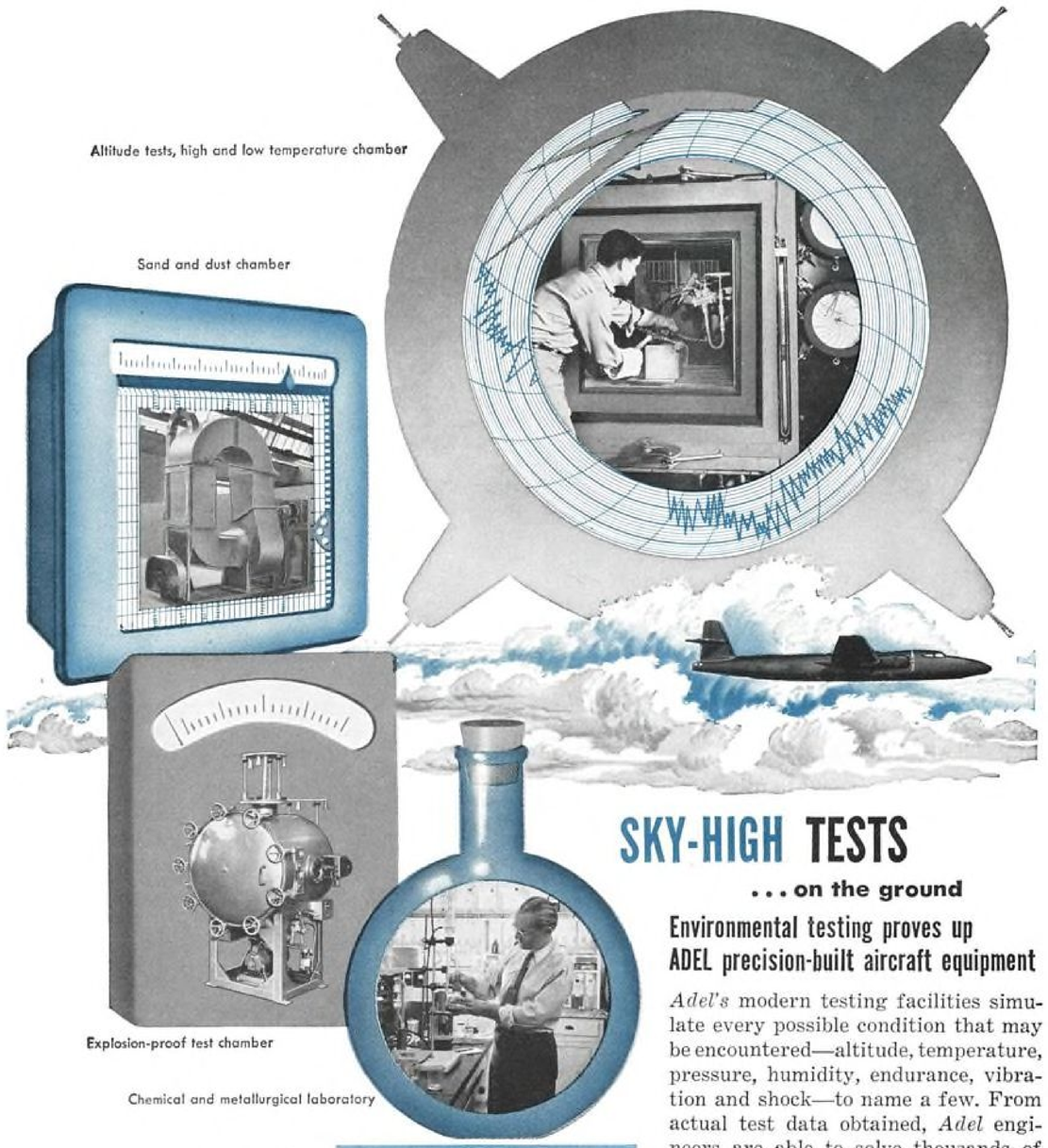
The Northwest Airlines Supervisor of Flight Engineers testified that this aircraft had been used the day of the accident for a captain's proficiency check and that he acted as flight engineer on that flight. He further testified that during the landing roll of the last flight, one or more of the engines started to die. As a corrective action one, and possibly both, of the propeller reversing control circuit breakers had been pulled and were in this position (off) when he left the aircraft a short time before the crew of Flight 410 took over.

It was explained that a number of incidents had been experienced wherein propeller blades moved to the feathered position when coming out of reverse on landing, due to a malfunction in the signal circuit.

Such an increase in blade angle is accompanied by an increase in propeller load that tends to stall the engine. Meanwhile, the auxiliary pump motor temperature increases and the motor will burn out if electrical power is not removed. Pulling out the appropriate circuit breaker results in shutting off the pump which in turn permits the propeller blades to move toward low pitch and the engine to regain normal idle speed.

The flight engineer of Flight 410 testified that he had made a thorough preflight inspection of this aircraft at Minneapolis, including checking the reversing control circuit breakers for "in" position. However,





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he could not recall whether the check was made by actually touching the breakers or visually. He further testified that he thought it would be possible to overlook a circuit breaker position in a visual check.

NWA Check Procedure

The "checklist and procedures" section of Northwest Airlines Manual-Flight Operation-Boeing 377, lists the items to be checked by each crew member during all procedures from "Before start" to "After landing" and "Parking." The manual does not call for a mandatory propeller reversing check for preflight on domestic operations. The flight engineer ground check lists "Overhead circuit breakers—checked."

In the amplified flight engineer's ground check are listed items to be checked on originating aircraft. On page 10 in the "Aft Cockpit Area" paragraph this item (7) appears: "Overhead circuit breakers—CHECKED (a) all circuit breakers IN or ON."

There are no items covering a check of the circuit breakers on the overhead panel of the cockpit area during "Descent procedure," "Approach cockpit check," or "landing cockpit check."

The manual does not specify how (i.e. visually or by touch) the circuit breakers are to be checked.

As a result of the subject accident Northwest Airlines took action on September 6, 1955, to incorporate in its flight operation manual a check of overhead panel circuit breaker positions prior to landing. In addition, instructions were issued to flight instructor and check personnel to place emphasis during periodic training and check flights on the proper checking of circuit breakers.

ANALYSIS

The severely scuffed condition of the main landing gear tires, observed after the accident, proves that the normal and emergency brake systems had effectively stopped wheel rotation and the marks found on the runway indicate that brakes were used during the latter part of the landing roll.

The accelerated stop-run tests conducted at Chicago Midway Airport subsequent to the accident showed that the brake system of the aircraft was in normal operating condition and that by using these brakes alone the aircraft could be stopped in the required distance. It would require approximately 20 seconds to travel the 3,000 feet of runway between the touchdown and the first braking marks if a speed of somewhat less than the touchdown speed of 95 knots was maintained.

During this short interval normal brakes were used while preparing to go into reversing, the throttles were moved in and out of the reverse quadrant, and the antiskid device was taken off.

The sudden surprise of being confronted with lack of propeller reversing and the ensuing cockpit activities undoubtedly were the factors which determined where the emergency brakes were applied.

The captain testified that he applied emergency brakes when halfway down the runway or approximately 1,600 feet from the point of touchdown. Since no evidence of braking of the aircraft was found in this area it appears that the friction coefficient of the runway surface was considerably less during approximately 1,400 feet of the landing roll than it was where the first braking marks were observed.

It was early in the afternoon of a warm day (85F) and the temperature may have induced some slipperiness on the surface of the asphalt runway where the crushed rock screenings were worn away. However, aircraft landing just before and just after the accident did not report such a condition.

Unwanted Acceleration

Although the crew stated there was no application of power during the entire landing roll, a feeling of acceleration occurred when the throttles were moved into the reverse quadrant. The propellers remained in forward pitch in this instance and engine r.p.m. increases appreciably when throttles are moved to the reverse idle position.

Thorough examination and tests of the propeller and electrical systems showed that these systems were functioning in a normal manner. Air carrier employes on Chicago Midway Airport and tower controllers testified that it is standard practice for operators of Boeing 377 aircraft to use propeller reversing on all landings at Chicago Midway Airport. This is the practice even though the lengths of the NW-SE and NE-SW runways, which are always used for this type aircraft, are in excess of the criteria specified for braked stopping in the flight manual for B-377 aircraft. Captain Stone

Royal AMPHIBIAN NEWS

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

THIS "GULL" WAS STANDING STILL 35 SECONDS BEFORE PHOTO WAS TAKEN



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Province of Quebec, Canada

Yes, 35 seconds before this dramatic picture was taken, this standard Royal Gull amphibian was at a complete stop. This scene is on the famous Horsetooth Reservoir, Fort Collins, Colorado, about 60 miles north of Denver. The reservoir's altitude is 5400 feet.

It was on July 18, 1955, at 11:30 a.m., and the outside air temperature was 79° F. We were fully "grossed out" (6000 lbs). The wind was from the north at 5 miles per hour. Royal Aircraft's test pilot, Wally Watson, applied forward pressure to the throttles and with a manifold pressure of 22.0 at 3400 rpm, America's only new twin-engine amphibian was soaring gracefully in the warm Colorado air after a take-off run of only 35 seconds.

A number of other high-altitude take-off tests were also run at a 6780-ft elevation in Rawlins, Wyoming. At 5780 lbs. gross weight, take-off time was 19 seconds from paved surface . . . 38 seconds from the waters of Seminoe Reservoir.





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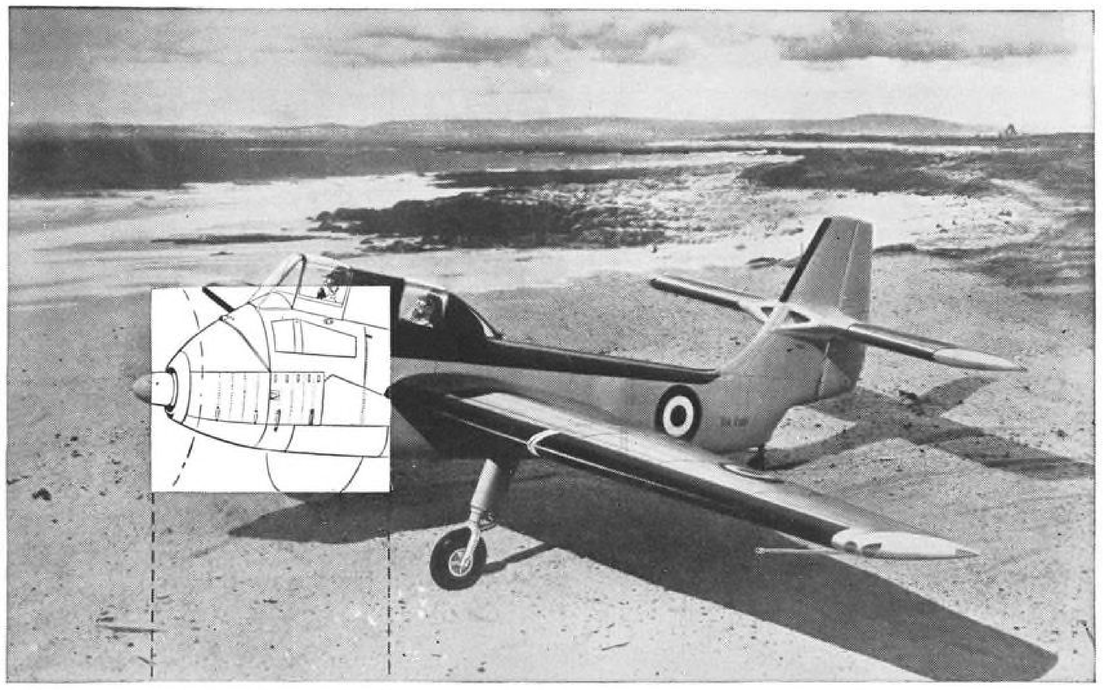
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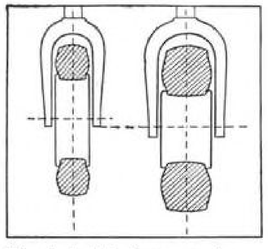
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Sand strip – *Seamew* base

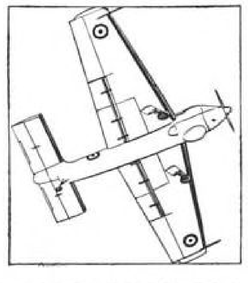


Simplicity of design ensures simplicity of maintenance—and economy in initial cost and in use of spares and manpower. Removable panels make components easily accessible.



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SAFETY

testified that he fully intended to use reversing on the subject landing.

Since the propeller reversing circuit breakers were found in the "out" position and as this can be the only reason why propeller reversing could not be effected in this instance, it is apparent that they were not thoroughly checked during the preflight check at Minneapolis or the prelanding check at Chicago.

The Board concludes that the "out" position of the reversing control circuit breakers was the only reason to account for the captain's inability to obtain reversing when the throttles were moved into the reverse quadrant.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The company, the aircraft, and the crew were currently certificated.
2. The aircraft was properly loaded with respect to gross weight and location of its center of gravity.
3. The flight between Minneapolis and Chicago was routine and in good weather.
4. The structure, powerplants, propellers, brakes, and electrical systems were found to be capable of normal operation.
5. The propellers did not reverse when the throttles were moved into the reversing quadrant.
6. After the accident the circuit breakers of the propeller reversing system were found in the "out" or inoperative position which precluded propeller reversing.
7. Evidence indicates that the propeller reversing circuit breakers were pulled during a prior flight at Minneapolis and were not reset prior to the accident.

PROBABLE CAUSE

The Board determines that the probable cause of the accident was the inability of the pilot to stop the aircraft by means of conventional braking and the unavailability of propeller reversing due to the improper position of the reversing circuit breakers.

By the Civil Aeronautics Board:

Ross Rizley
Joseph P. Adams
Chan Gurney
Harmar D. Denny

SUPPLEMENTAL DATA

The Civil Aeronautics Board was notified of the accident at approximately 1315, August 5, 1955. An investigation was immediately initiated in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended.

A special investigation was ordered by the Board and depositions were taken at Chicago, Illinois, on September 15-16, 1955, at Minneapolis, Minnesota, on September 19, 1955, and at Washington, D. C., on September 22, 1955.

Air Carrier

Northwest Airlines, Inc., is incorporated in the State of Minnesota and maintains its principal place of business at Minneapolis, Minnesota.

The company possesses a certificate of public convenience and necessity issued by the Civil Aeronautics Board and an air carrier operating certificate issued by the

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Write: Les Stevenson, Engineering Personnel, Dept. 56,
North American Aviation, Inc., Los Angeles 45, California

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Civil Aeronautics Administration which authorize the carriage of persons, property, and mail over route described in report.

Flight Personnel

• **Captain George A. Stone,** age 39, was employed by Northwest Airlines on August 28, 1942. He holds a valid airman certificate with an air transport rating and type ratings for DC-3, DC-4, M-202, C-46, DC-6, and B-377 aircraft. Captain Stone had, according to company records, 11,993 hours of logged flight time, of which 65 hours were acquired in Boeing 377 aircraft. He received his Boeing 377 checkout on July 14, 1955. His last first-class physical examination was successfully passed, no limitations, on February 24, 1955.

• **First Officer Ralph T. Gray,** age 32, was employed by Northwest Airlines on February 6, 1946, and was assigned to co-pilot duties June 23, 1948. He holds a valid airman certificate with an air transport rating and commercial pilot, multi-engine land and instrument ratings. First Officer Gray had, according to company records, 7,131 hours of logged flight time of which 1,231 were acquired in Boeing 377 aircraft. His last first-class physical examination was successfully passed, no limitations, on April 18, 1955.

• **Flight Engineer Harry L. Camm,** age 31, was employed by Northwest Airlines on December 17, 1948. He holds a valid Flight Engineer certificate with rating on Boeing 377 aircraft. He completed flight engineering training on October 4, 1954, and February 18, 1955. His total logged time as flight engineer was 220 hours on Boeing 377 aircraft. He successfully passed a second-class physical examination, no limitations, on August 13, 1954.

• **Stewardess H. L. Kennedy,** age 25, was employed on June 8, 1955.

• **Flight Service Attendants** M. D. Leahy, age 23, and E. P. Williams, age 22, were both employed by Northwest Airlines on April 15, 1955.

The Aircraft

N 74601, a Boeing 377, serial number 15947, was owned by Northwest Airlines, Inc. Its manufacture was completed on February 18, 1949, and the airframe had accumulated 16,861 flight hours at the time of the accident. The airframe had 1,374 hours since its last major inspection.

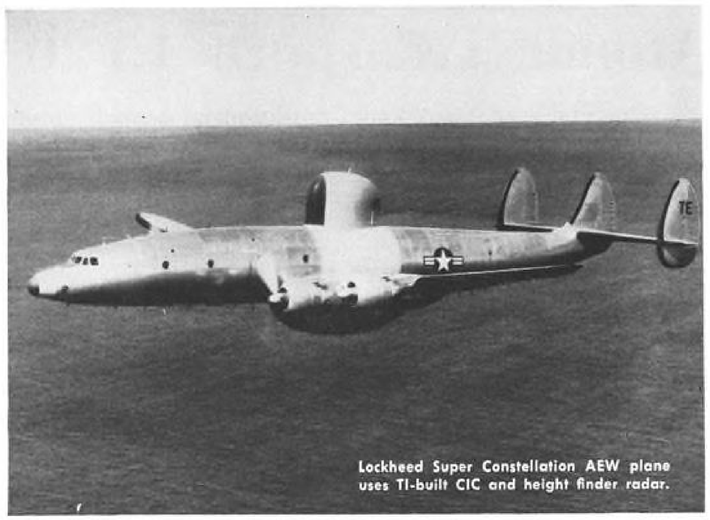
Powerplants were four Pratt and Whitney R-4360-B6 engines and four Hamilton Standard model 24260-43 propellers.

Time since overhaul on the engines varied between 24 hours and 539 hours. Time on the propellers since overhaul varied between 483 hours and 1,155 hours.

Persia Lets Contract For Aerial Survey

Air Survey Co., Ltd., of London, has been awarded a (£250,000) contract by the Persian government to provide essential data for the general development of the middle eastern nation. The contract includes provisions for topographical mapping and surveys for town planning, road rail and airport development and geological exploration.

about **dollars, decibels, and delivery...**



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Atomic Transports 15-20 Years Away

Special study panel says commercial use will depend on military development, cites high costs hazards.

By Evert Clark

Washington—Atomic-powered aircraft will have no "real impact" on civil aviation in this country for at least 15 or 20 years, a special study panel predicted last week.

The report was prepared by the nine-man civilian Panel on the Impact of the Peaceful Uses of Atomic Energy, appointed last March to make a study for the Joint Congressional Atomic Energy Committee (see box).

Cargo planes "undoubtedly" will be tried if a successful nuclear-powered military plane is developed, the panel said.

But atomic-powered airliners are not likely to be considered seriously until after a "second or third generation nuclear aircraft" has taught scientists and engineers enough about shielding passengers from harmful radiation.

Although nuclear-powered commercial planes "are unlikely to appear for a decade or more after military types are first operated," the panel said it nevertheless considers atomic power "a potential propulsion source for the future."

Evaluation Basis

"Results of the U. S. military program in this field during the next decade should give a fair basis for evaluating possibilities of commercial application," the report said.

"It is premature to attempt to evaluate now, however, the eventual impact of nuclear-powered aircraft on commercial aviation and the United States economy."

With its report the panel sent the Joint Committee a background report prepared by the Aircraft Reactors Branch of the Atomic Energy Commission's Division of Reactor Development.

The two reports cited cost, weight, radiation hazards, and the technical problems of developing a light but powerful and economic reactor as the major stumbling blocks.

It said the advantages of a nuclear-powered atomic plane would be virtually unlimited range, "freedom from a system of overseas refueling airfields," and reduction of the supply problem associated with demand for fuel stocks.

The panel's report pointed out that commercial atomic planes "seem achievable only as by-products of military development"—primarily because of high development costs.

Problems to be Solved

Here is what the two reports had to say about the hurdles:

• **Cost.** There is no way yet to estimate "the eventual costs of construction and operation," but the initial capital investment "would seem likely to be much greater" than for comparable conventional planes. Atomic-powered planes would then be competitive only "where savings in operating costs over the life of the aircraft" compensate for the high initial cost. Operating costs for conventional planes increase rapidly beyond a few thousand miles, so atomic aircraft might be competitive over distances of more than several thousand miles.

But "the actual economic competition would be influenced by such factors as special maintenance facilities and personnel" needed for atomic planes. Airports for early models "presumably would be located remote from urban areas, which would adversely affect comparative operating costs."

Operating expenses of nuclear aircraft probably "will be related closely to the operating expense of the nuclear system"—which will depend on such large uncertainties as "depreciation, fissionable material costs, nuclear aircraft and reactor costs and operating procedures."

• **Weight.** Shielding assemblies "undoubtedly will be quite bulky and highly concentrated, which means that conventional aircraft structures must be "redesigned to accommodate such loads." Another adverse design factor is "the inherent heavy landing weight . . . which results from the negligible fuel consumption during operation." Operating weight will exceed that of conventional planes "by the weight of the reactor" plus the shielding. This is significant from the commercial standpoint because "experience shows that the inventory cost is closely related thereto."

• **Radiation hazards.** "A very substantial amount of shielding would be required to limit radiation dose levels to accepted tolerances, and this would probably have the effect of reducing the passenger payload to uneconomical values. It is possible that second or third generation nuclear aircraft will incorporate improved shield designs that would permit reconsideration of such service." Regardless of whether airliners are developed, "The most grave concern is the danger to personnel downwind from an accident involving any nuclear plane. It is likely that a serious accident will release some portion of the fission products generated in the nuclear powerplant," the AEC background report said.

The report noted that restrictions may be required for safe operation of nuclear-powered aircraft. "No doubt the use of airways over sparsely-populated areas will be adopted for the purpose of diminishing the hazards of fission product contamination in the event of a crash." The report said that it would be preferable to use only relatively isolated airports. "By proper reactor design, incorporation of safety devices, and the application of certain operating techniques, the hazard can be reduced to acceptable limits," the report said.

The report listed these problems in connection with ground handling of nuclear-powered aircraft:

• **Spare runways** in event of runway contamination.

• **Shielded engine** run-up stations.

• **Remote "hot" shops** for maintenance and nuclear fuel handling.

• **Disposal system** for contaminated materials.

• **Shielded vehicles** and other special equipment.

The report concluded that these various considerations will make future ground operations complex and relatively expensive.

Editor Headed Panel

The Panel on the Impact of the Peaceful Uses of Atomic Energy was headed by Robert McKinney, 45-year-old editor and publisher of the Santa Fe New Mexican.

Other members were:

Ernest R. Breech, chairman of the board of the Ford Motor Co. He was president and director of the Bendix Aviation Corp. from 1942 to 1946.

George R. Brown, engineer, president of Brown Engineering Corp. and executive vice president of Brown & Root, Inc.

Sutherland C. Dows, engineer, president and chairman of the Iowa Electric Light and Power Co.

Dr. John R. Dunning, physicist, dean of engineering at Columbia University, and a director of the Oak Ridge Institute of Nuclear Studies.

Frank M. Folsom, president of the Radio Corporation of America.

T. Keith Glennan, president of Case Institute of Technology and a former Atomic Energy Commissioner.

Samuel B. Morris, a civil and hydraulic engineer and geophysicist, general manager and chief engineer of the Water and Power Department for Los Angeles.

Walter P. Reuther, president of the United Automobile Workers and vice president of the American Federation of Labor-Congress of Industrial Organizations.

Nuclear Plane Progress

The Atomic Energy Commission said in its semi-annual report to Congress last week that its aircraft nuclear propulsion program was accelerated in the last half of 1955 and "the prospects for nuclear-powered flight continued to show promise."

"Some test work commenced" at recently-completed initial test facilities at the National Reactor Testing Station in Idaho Falls, Idaho, where General Electric Co.'s Aircraft Nuclear Propulsion Department is operating contractor, the AEC said.

"In the early fall," the report said, "design and construction work began on a new Air Force plant and laboratory at Middletown, Conn., which will enable Pratt & Whitney Aircraft Division of United Aircraft Corp. to enter more extensively into the aircraft nuclear propulsion program. The facility will be used for both AEC and AF work."

In a report to the Joint Congressional Atomic Energy Committee, the Panel on the Impact of the Peaceful Uses of Atomic Energy noted that the joint AEC-Department of Defense program for atomic propulsion of military aircraft "is thought likely to require between half a billion and one billion dollars to accomplish, and has as its objective a military airplane in which economics are not a primary consideration."

House Bill Would Help Airline Buy New Aircraft

Legislation to encourage and aid subsidized carriers in the financing of new equipment has been introduced in the House by Rep. Oren Harris (D.-Ark.), chairman of the Commerce Subcommittee on Aviation, and Rep. Carl Hinshaw (R.-Calif.).

The measures would permit carriers to retain the profits from sales of old equipment "for a reasonable time" to finance new equipment, without being penalized on subsidy allowances.

Airline Pilots; Engineers Given B-47 Instruction at USAF School

Washington—Fourteen pilots and aircraft engineers of the certificated scheduled airlines recently completed a two-week indoctrination course in the operation of B-47 jet bombers.

The course, sponsored by the Air Force, was set up to familiarize airline personnel with the development of specifications, operations and maintenance of commercial jet transports the airlines now have on order.

Liaison between the Air Force and airlines was handled by Col. Jack Taylor, director of the Air Navigation Development Board.

The B-47 course—the same one given to senior Air Force officers—was authorized by Trevor Gardner, Assistant Secretary of the Air Force for Research and Development.

Airline personnel taking the course included seven pilots and seven operations and maintenance engineers. The course, modified only to eliminate certain combat phases, was held at McConnell AFB from Jan. 16 to Jan. 27.

It was patterned after a previous Air Transport Assn.-Air Force jet training course for airline pilots held two years ago at Moody AFB, Valdosta, Ga.

Important difference in the course just concluded was that training was designed around the six-jet B-47, which is more comparable to the Boeing 707s and Douglas DC-8 jet airliners.

The main purpose of the course, according to Milton W. Arnold, ATA vice president-operations and engineering, was to show airline personnel the difference between the operation of piston engine and jet aircraft and to show them the specific problems presented by operation of high speed jets.

First civilians to take the top level training course were Arnold, I. E. Soinmermeyer, United Air Lines, director of flying; and W. Waldo Lynch, Pan American World Airways, assistant vice president-communications.

Curriculum included approximately 55 hours in ground instruction covering B-47 electronic hydraulic pressurization, heating, operational planning, engines, performance, and simulators in addition to eight hours of pre-flight inspection. Each pilot was checked out in the B-47 and logged an average of 10 hours of flight time.

Pilots attending were Capt. Harry L. Clark, American Airlines; Capt. Frank Junger, Eastern Air Lines; Capt. S. E. Stoia, National Airlines; Capt. M. B. Cahill, Northwest Airlines; Capt. Ben Herrel, Pan American; Capt. C. M. Horstman, Trans World Airlines; and Capt. J. A. Anderson, United.

Engineers attending were Norman Rice, American; Albert M. Smith and G. H. Pearson, Eastern; H. M. Thorson, Northwest; Robert Blake, Pan Am; M. B. Sannon, TWA; and D. W. Layman, United.



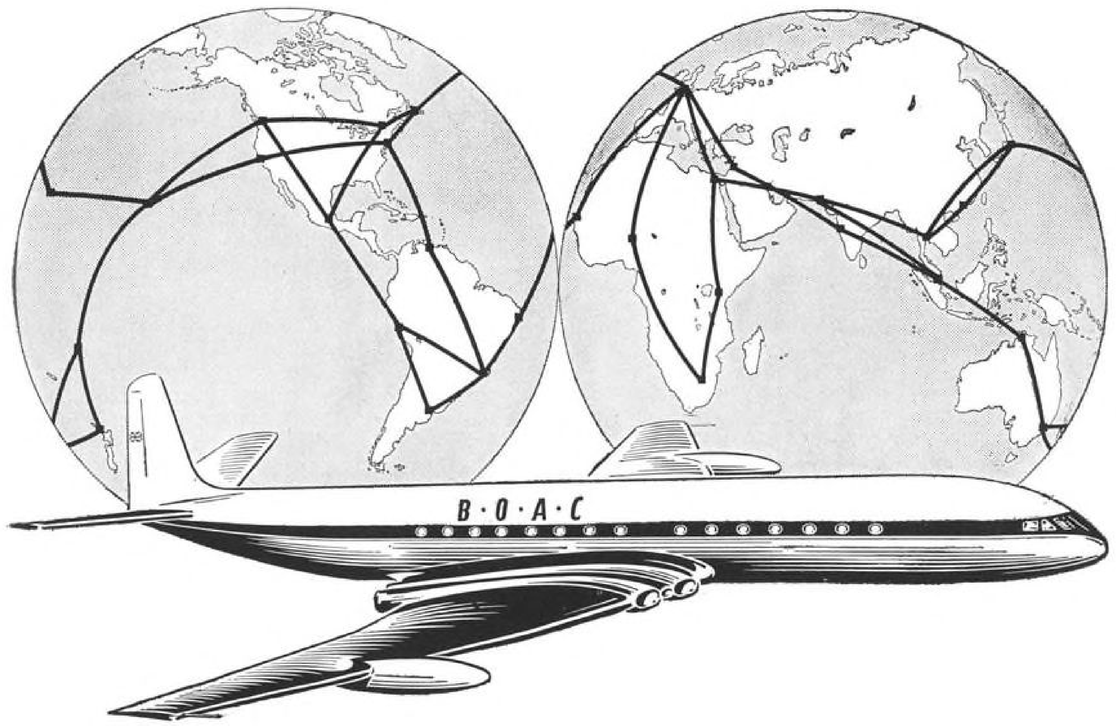
Ground-Bound $250,000 'Jet'

Full-scale wood mockup of the DC-8 jet transport is taking shape in Douglas Aircraft Company's Santa Monica plant. The quarter-million-dollar model follows DC-8 blueprints except for one wing, which will be omitted as an unnecessary duplication.

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The new Comet, carrying 60 first-class passengers on 3,000-mile stages, is of ideal size for linking the world's many traffic centres. It makes possible high frequency with profit-earning loads.

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B.O.A.C. will introduce the Comet 4 into world service in 1959.

DE HAVILLAND of GREAT BRITAIN

TCA Cargo Gains

Trans-Canada Airlines carried 25% more cargo in 1955 than in 1954, a total of 25,217,340 lb. TCA also reports that it carried more airfreight between Canada and Great Britain via the North Atlantic than any other carrier—some 1,614,492 lb., up 30% from 1954.

North American Loses Atlantic Service Bid

Washington—North American Airlines' request for authority to operate a cut-rate aircoach service across the North Atlantic has been turned down by the Civil Aeronautics Board.

The CAB refused to issue the authority asked by North American without a careful examination of the situation. The nonscheduled airline wanted immediate exemption authority to start its proposed service.

"This does not mean that we believe that there is no room for improvement in the quantity or quality of coach services by the regular carriers or that services have already achieved the optimum level attainable," the Board said. "Competition of new carriers frequently serves as a spur to the improvement of services by existing carriers."

The position of the CAB is that before additional scheduled coach competition is put on Atlantic routes, an orderly hearing process should be followed to avoid jeopardizing existing services. The Board said that the proposed service could have far reaching consequences and shouldn't be approved through an exemption order without public hearing or presidential approval.

North American also has asked for a certificate of public convenience and necessity for the proposed service.

The Board observed that the question of passenger operations by the new supplemental air carriers on overseas routes was considered in the Large Irregular Case. In its decision, the Board decided such service is not needed.

Revocation of North American's operating authority was cited as a factor which raises questions on the fitness of the airline to operate the service. The CAB revoked North American's authority last summer, and the matter is currently being reviewed by the U.S. Court of Appeals.

The service proposed by North American would have offered aircoach flights on high density transatlantic routes at fares substantially lower than present coach fares. The airline asked for an exemption to operate two flights a day for a three year experimental period between New York and London, Paris, Frankfurt and Rome.

N.Y. City Plans Heliport Hearing As CAA Backs Authority's Plan

New York—Prospects for a commercial heliport in Manhattan seemed brighter last week as Mayor Robert F. Wagner announced he would call a special meeting of New York's Board of Estimate to decide the controversy between his Department of Marine and Aviation and the Port of New York Authority over the heliport plans (AW Jan. 9, p. 105).

The mayor's announcement followed receipt of a letter, also addressed to Port Authority Chairman Donald V. Lowe, in which Civil Aeronautics Administrator Charles Lowen endorsed the Port Authority's proposed ground-level "bulkhead" temporary heliport at the foot of West 30th Street. The Authority's plan, Lowen concluded, was suitable for "a safe and reasonably regular passenger operation" by S-55 helicopters with pneumatic flotation gear.

On Commissioner of Marine and Aviation Vincent O'Connor's proposal for a million-dollar combined freight-terminal heliport at the same location, Lowen wrote "we do not believe that a passenger operation from the proposed roof-top heliport is feasible or safe" with either wheel-type gear or pneumatic floats.

Only with the use of steel pontoon gear, which involves a severe penalty in weight, could the roof-top operation be certified by CAA, Lowen said.

Far from authorizing immediate construction of the Port Authority's $50,000 temporary heliport, Commissioner O'Connor attacked the Authority for releasing the Lowen letter. He called the move an attempt to becloud the issue.

One crystal-clear point, however, is the fact that New York City will not get a commercial heliport, which everyone agrees is urgently needed, until the City and the Port Authority get together on plans for one. Neither agency can operate a waterfront heliport unless the other agrees.

O'Connor welcomed the mayor's announcement of an early Board of Estimate hearing on the controversy, and was "confident" that he would win his case. The Port Authority had no comment on the announcement pending further developments.

The Department of Marine and Aviation is still "unalterably opposed" to the Port Authority heliport despite CAA's official pronouncement. Grounds are economics, O'Connor claims the freight facility-heliport is the better use for waterfront property and safety.

O'Connor contends that the "whirling blades" of the NYA helicopters would threaten motorists along the West Side Highway and the sight of suddenly rising rotor craft would goggle their eyes and lead to accidents.

The Port Authority and New York Airways point out that, under the Authority's plan, the helicopters would be using overwater approaches and stay well clear of the highway.

Marine and Aviation thinks its plan is good even in view of the weight penalty the CAA-approved landing gear for roof-top operation would involve.

Congress Asked to Ban Jets at City Airports

Washington—Legislation to preclude ground damage from the landings and take-offs of high-speed jet aircraft by banning their operation from commercial airports located within the boundaries of a city was introduced by Rep. Albert Bosch (R.-N. Y.).

Bosch's bill would ban the operations of any aircraft "propelled in whole or in part by jet propulsion to or from an airport located wholly or partially within the boundaries of any city having a population of one million individuals, or more."

Two other measures introduced by Bosch would increase the visibility standards at airports and impose criminal penalties for air safety violations, now subject only to civil prosecution. Bosch's bills would raise the visibility minimum of aircraft with more than two engines from 200 ft. to 600 ft. and for aircraft with one or two engines from 400 ft. to 1,200 ft.

Meanwhile, Rep. Albert Morano (R.-Conn.) declared that Air Force and Navy jets are not only breaking the sound barrier, but are breaking up a lot of houses throughout the country, and urged the House Armed Services Committee to take action to protect home owners from jet shock waves.

Bosch pointed out in a speech on the House floor numerous accidents caused by jammed conditions at the Idlewild, N. Y., airport, located in his congressional district. He said:

"On Dec. 18, 1954 an Italian DC-6B airliner roared low over homes and densely populated areas in the vicinity of Idlewild airport, not once, but three times, and finally on a fourth approach ripped into a Jamaica Bay pier, burst into flame and sank in the water—the toll 26 persons killed. It is not hard to imagine that this plane, lost in the fog, could just as easily have fallen and crashed into homes. . . ."

PLANE FAX



Your Best Week-end Flight Plan for February

Fly to a week-end of colorful winter sports February 11-12, when Reno's annual Snow Carnival takes place. Plan to land at Reno Municipal Airport or the Reno Sky Ranch for quality Standard aviation products and service.

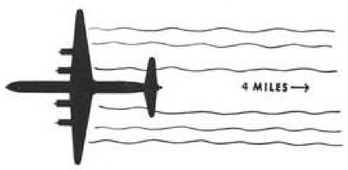


Flying rescues—one mile down in Hell's Canyon

"Roughest terrain in the country"—that's what most pilots call the 5500-foot-deep Hell's Canyon of the Snake River. But every winter George Foster of Grangeville, Idaho, makes several emergency flights to isolated ranches inside the canyon's narrow gorges and flies accident victims out to hospitals for medical aid.

"The land is all straight up and down, inside the canyon rim," says Mr. Foster. "Flying between thousand-foot cliffs calls for plenty of attention, and for lots of power when I need it, too. But I always get the extra power I have to have, with Chevron Aviation Gasoline 80/87 in my Super Cub. Chevron 80/87 never fouls spark plugs for me; delivers smooth, dependable performance. I can lean it down for economy in level flight, too.

"Because nearly all of my flying is over wilderness, I can't risk any engine trouble. However, I've had such complete success with RPM Aviation Oil that I don't even need top overhauls between majors. Rings and valves stay in perfect condition right up to the last hour in the air. I'll never use any oil but 'RPM' in any plane I own."



TIP OF THE MONTH

It's wise to stay away from the backwash of large aircraft of any kind; extreme turbulence often exists more than 4 miles in their wake.

T.M.'S "RPM," "CHEVRON," "PLANE FAX," REG. U.S. PAT. OFF.

CHEVRON AVIATION GASOLINE — RPM AVIATION OIL

STANDARD OIL COMPANY OF CALIFORNIA

Shortlines

▶ **Airlines Clearing House** handled interline business worth $45,496,365 in December, 13.7% more than was handled in the previous December.

▶ **Canadian Pacific Airlines** has increased its Toronto-Mexico City service to two flights a week. CPA has taken delivery on the first of four DC-6B aircraft scheduled for delivery this year. The new equipment will be used on routes between Amsterdam, Vancouver and Sidney, and between Toronto and Mexico City.

▶ **Central Airlines** has inaugurated its new service to St. Louis with four flights daily to Fayetteville, Ft. Smith, McAlester, Paris, Sherman-Denison, Dallas and Ft. Worth.

▶ **Delta Air Lines** began service to Washington and New York from Atlanta with an initial schedule of three flights a day. The new service includes a DC-7 first class flight and DC-7 and DC-6 coach flights.

▶ **Peru and Spain** have signed an air navigation agreement. Iberia, the Spanish airline, reportedly will extend its Buenos Aires route to Lima under terms of the new agreement.

▶ **Silver City Airways** has made a slight fare cut on its service across the Irish Sea. SCA plans to double its present service for the coming tourist summer season.

▶ **Trans World Airlines** will occupy the engine overhaul shop and test cells in its new Kansas City base this spring. A new hanger is scheduled for completion later this year. . . . TWA started service at Denver with six first class and tourist flights daily. New service at Tulsa and Oklahoma City began with four flights a day.

▶ **United Air Lines** finds that machines and machine parts still head the cargo commodity list in total weight carried. Cut flowers, electrical equipment, auto parts and accessories, printed matter, wearing apparel, hardware, aircraft parts and accessories, film and advertising matter complete the list of top ten items.

▶ **Vancouver** will build a second airport 25 miles from the downtown area at White Rock, British Columbia, to divert light plane and executive traffic from Vancouver's large International Airport.



SCALE MODEL of New York International Airport "terminal city" development features illuminated buildings, detailed roadway, parking lot layouts. Port Authority says the $30,000, 32 by 42 ft. model is no "fancy display" piece but a valuable tool for architects and planners and has already more than paid for itself in design economies.

Port Authority Defends Idlewild Planning Criticized by N.Y. Mayor

New York—Reacting to Mayor Robert F. Wagner's charge that the terminal facilities at New York International Airport are "a disgrace to New York and the whole United States," the Port of New York Authority last week unveiled a giant model of its new "terminal city" now under construction at Idlewild and reviewed its multi-million-dollar plans for the airport.

Mayor Wagner made his blast at a Young Democratic Club meeting, but later toned it down somewhat and said "inadequate" would be a better way to describe the Idlewild facilities.

Calling criticism of the "temporary" terminal inherited in 1948 from the City of New York "preposterous," Port Authority Director Austin Tobin admitted "we don't like it either . . . and God knows the passengers want to be out of it." He pointed out that plans for the new $60-million passenger facility had been announced in Feb. 1955, the first construction contract had been let 30 days later, and the major buildings would be in operation in 1957 to provide the New York metropolitan area with "the most modern and efficient terminal facilities available anywhere."

City Threat

Later in the week, City Comptroller Lawrence E. Gerosa classified the Port Authority presentation as "window dressing" and threatened to consider suing the authority unless a specific date was set for completion of airport improvements.

Gerosa claimed delays and broken promises on the Port Authority's part in developing Idlewild and LaGuardia Airports, and he attacked the development of tax-free private enterprises on airport

LaGuardia Rehabilitation

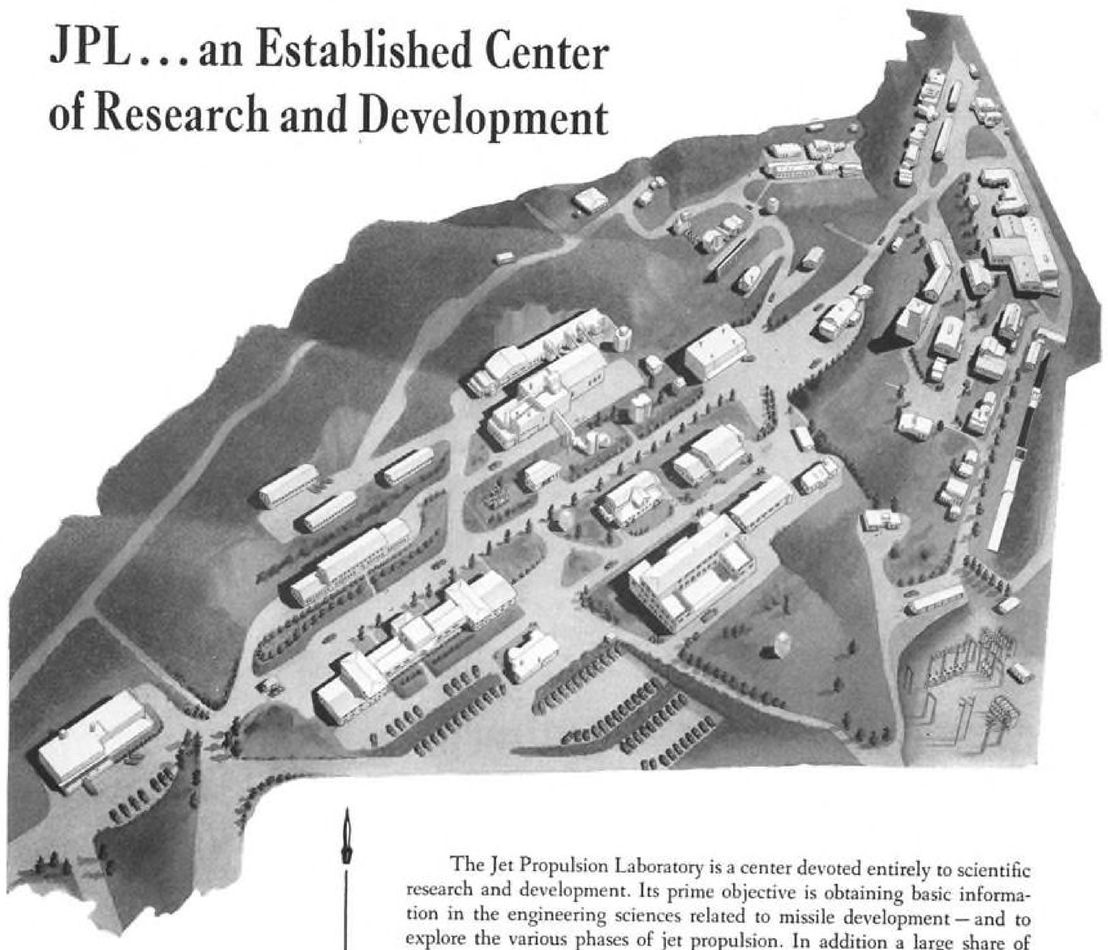
The Port of New York Authority is "very anxious and ready" to go ahead with a major rehabilitation of LaGuardia Airport, Austin Tobin, the agency's executive director, said last week.

"Friendly discussions" about financing such a program are under way with airlines using the field, according to Tobin.

LaGuardia, he promised, "Will never sink . . . we'll keep it afloat," and actually the east end of the airport is sinking at a rate of three inches a year. Rebuilding of the perimeter dike and other continuing maintenance compensates for this sinkage.

"We need LaGuardia," Tobin affirmed.

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The Jet Propulsion Laboratory is a center devoted entirely to scientific research and development. Its prime objective is obtaining basic information in the engineering sciences related to missile development — and to explore the various phases of jet propulsion. In addition a large share of its program is devoted to fundamental research in practically all of the physical sciences.

The Laboratory extends over more than 80 acres in the foothills of the San Gabriel mountains north of Pasadena. It is staffed entirely by personnel employed by the California Institute of Technology and conducts its many projects under contracts with the U.S. Government.

Exceptional opportunity for original research coupled with ideal facilities and working conditions have naturally drawn scientists and engineers of a very high caliber. These men, working in harmony, are building a very effective task force for scientific attack on the problems of the future.

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★ At this time we are particularly interested in interviewing graduate engineers and scientists in the fields of aerodynamics, aircraft structures, mechanical engineering, chemistry, chemical engineering, heat transfer, electronics, systems analysis, electromechanical instrument design, instrumentation, metallurgy, nuclear physics and solid state physics.

These men should be definitely interested in scientific research and development relating to the problems of the future.

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PASADENA, CALIFORNIA

property, among which he listed a proposed airport hotel.

Takeover Problems

Tobin reviewed the problems which delayed planning when the Port Authority first took over the airport. Although the field had not yet opened for traffic, the city had written 40-year leases with airlines. These had to be renegotiated for "there was no hope of making it self-supporting the way they had it." Tobin said the airlines "wanted no part" of the airport buildings planned by the city.

To the mayor's charge that "very little money is being spent out there," Tobin answered that the Port Authority had invested $83 million in the airport since leasing it from the city in 1947, and that by the end of 1956 the investment would reach $135 million. In addition to the "terminal city" development, he listed hangars, runways, taxiways, control tower and Government and industrial buildings as among the improvements the Port Authority had brought to the 5,070-acre airport.

Idlewild, which handled 3,645,000 domestic and international passengers in 1955 and expects 9,500,000 in 1956, will be served by a "unit terminal" system comprising of an International Arrival Building flanked by individual airline terminals in a ring around a 655-acre central oval. Previous plans for a 20 million dollar centralized terminal, Tobin said, were "thrown in the wastebasket" in 1954 when traffic predictions called for a "totally new concept."

Two Impressions

In a brief statement at the model presentation, Deputy Mayor Dr. John Theobold, attending for Wagner, said he was impressed with two things: that the Port Authority believes it is doing a thorough job at Idlewild, but that "when we're told a complete set of plans was scrapped, that's enough to give cause for wonder." He remarked that there was no idea on the city's part of "any battle" with the Port Authority.

The city and the authority have, however, been in a running hassle over airport spending and plans for a badly-needed commercial heliport in Manhattan (AW Jan. 9, p. 105) Vincent O'Connor, Commissioner of Marine and Aviation for the city, has opposed the Authority in the heliport matter and also has been hostile to suggestions from any quarter that some New York docks be controlled by the Authority.

The terminal area model is itself impressive. Built to a scale of ¼ inch to the foot, the plywood, felt and lucite 32-by-42-foot unit cost about $30,000. It is not, the Port Authority says, a "fancy display" piece but a working tool.

Washington Airport Improvement Planned

Washington—New construction at Washington National Airport, aimed at increasing capacity 10 to 15%, will begin this spring at a cost of $3 million following completion of an engineering survey Mar. 1 by the Ralph M. Parsons Co. of Los Angeles.

The engineering studies, which will cost $115,000, will seek ways to attain the maximum possible use of existing facilities at the airport by modernization and any necessary additional installations. They will involve study of existing facilities and services, runways, taxiways, aprons, expansion and modernization of the fueling system, improvement of aircraft parking areas and more gate positions.

Washington National Airport is one of the busiest in the country, handling between 750 and 800 aircraft operations daily. The expansion and improvement program at National is independent of efforts to obtain a second airport in the Washington area.

Bennett H. Griffin, National airport director, said the $3 million program, for which funds have already been appropriated, will cover such facilities as new turnoffs, a new gasoline storage tank, a new terminal finger providing another four gate positions, a new air-freight building and additional baggage space. He said, "it's an effort to get the most out of our airport."

New DC-8, 707 Orders

U. S. jet transport orders have been placed by two foreign-flag airlines. Sabena announced that it would buy its fourth Boeing 707-320 Intercontinental, at an undisclosed price, with delivery expected in June 1960. The first of Sabena's 707's is scheduled for delivery by the end of 1959. Previous order totaled $15,450,000.

Swissair placed a $12.4 million order for two Douglas DC-8's, with delivery expected in early 1960.

U. S. jet transport orders now: 104 Douglas DC-8s, 73 Boeing 707s and 104 Lockheed turboprop-powered Electras.

CAB Orders

(Jan. 19-25)

GRANTED:

Riddle Airlines an exemption to lease three C-46 aircraft from Meteor Air Transport.

United Air Lines permission to serve Pittsburgh through the Greater Pittsburgh Airport.

Leave to Intervene in the Florida-Texas service case the Greater Miami Traffic Assn., the Panama City Chamber of Commerce, the City of San Antonio and the San Antonio Chamber of Commerce, the Sarasota Manatee Airport Authority and the Chamber of Commerce of Sarasota, Fla., the Chamber of Commerce of Bradenton, Fla., the City of Tampa and the Greater Tampa Chamber of Commerce and the West Palm Beach Chamber of Commerce.

Riddle Airlines permission to use airports at various points named in the carrier's certificate.

APPROVED:

Los Angeles Airways' flight pattern revision which delegates one round trip between Los Angeles Airport and Long Beach, and consolidates two round trips between Los Angeles and Santa Ana.

Interlocking relationships between Roy W. More, Emery Air Freight Corp., and the New York City Omnibus Corp.

Agreements between Eastern Air Lines, Seaboard and Western Airlines and various other carriers relating to intercarrier arrangements.

New York Airways' flight pattern revision eliminating one passenger and cargo stop at Teterboro, N. J., on a flight from Newark to New York International Airport.

ORDERED:

Suspension and investigation of certain local first class fares proposed by Braniff Airways between various points.

Investigation to determine whether Allegheny Airlines should be authorized to serve Hazleton, Pa.

Suspension of domestic air freight forwarder letters of registration of Airways Parcel Post Service and 4-A Air Freight Consolidators and Forwarders, unless certain delinquent reports are filed by Feb. 3, 1956.

Examiner's decision in the United-Western Route 68 acquisition case made final. Western Air Lines was permitted to withdraw its exceptions to the decision.

Star Route for transportation of mail between McCall, Idaho, and Cabin Creek Landing Field, Idaho, certified to the Postmaster General.

DISMISSED:

Applications of Arnold Air Service, Air America, Caribbean American Lines, Federated Air Lines, Royal Air Service and Seaboard and Western Air Lines, for lack of prosecution. Exemptions granted to Arnold Air Service, Caribbean American Lines and Royal Air Service are terminated 60 days after the date of the order.

Gondrand Brothers Inc. as a party in the investigation of international air freight forwarding, since Gondrand has ceased to operate as a forwarder.

Riddle Airlines application for fixing of surface mail rates, since the rates have been fixed in another proceeding.

DENIED:

Petitions for reconsideration of the CAB decision in the North-South air freight renewal case filed by American Airlines, National Airlines, Northwest Airlines, United Air Lines, Eastern Air Lines, Trans World Airlines, Capital Airlines and American Air Export and Import Co.

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ROCKETDYNE not only offers the advantages of a constantly growing and expanding company, but also the stability that comes from its broad range and volume of projects... the stability of rocket engine contracts with all branches of the Armed Services and the guided missile industry. Though it is currently emphasizing the production of the most powerful large liquid-propellant rocket engines in the Western World, ROCKETDYNE is also designing, building, and testing many other types and sizes. For the future, it is carrying on research for even more powerful and startling rocket engines.

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Airline Income and Expenses—November, 1955

	Passenger Revenue	Mail Revenue	Express Revenue	Freight Revenue	Subsidy	Total Operating Income	Total Operating Expenses	Net Operating Income (before taxes)
DOMESTIC								
American	$17,764,832	$508,470	$388,444	$1,307,226		$20,216,907	$17,997,095	$2,219,812
Braniff	2,898,960	75,295	48,641	85,686		3,188,600	3,094,598	94,001
Capital	3,573,296	89,739	100,872	111,813		4,151,595	4,318,754	−167,159
Colonial	448,429	7,656	3,906	15,698	$81,119	569,817	666,069	−96,252
Continental	1,134,340	31,615	11,143	35,189	146,084	1,402,829	1,380,565	22,263
Delta	4,071,560	110,116	84,767	151,725		4,508,862	4,176,252	332,610
Eastern	13,521,259	314,348	208,896	261,542		14,583,982	13,655,905	928,077
National	2,978,162	−323,607	24,850	94,740		2,904,259	3,124,919	−220,660
Northeast	522,451	8,452	8,081	13,562	160,215	724,967	802,620	−77,653
Northwest	3,078,654	124,157	72,756	176,259		3,544,523	3,853,858	−309,335
Trans World	11,370,265	347,834	320,643	456,212		12,678,555	12,905,039	−226,484
United	14,183,759	682,995	437,303	531,448		15,943,002	16,392,589	−449,587
Western	2,203,450	79,863	31,357	58,088		2,395,328	2,283,536	111,792
INTERNATIONAL								
American	325,702	13,659	154	47,539		404,457	368,048	36,409
Braniff	374,423	115,945		31,881		562,588	648,523	−85,934
Caribbean Atlantic	79,453	1,329		4,438		92,718	111,502	−18,784
Colonial	67,071	408		2,194	4,318	80,454	113,803	−33,348
Delta	291,769	6,100		19,467		327,176	395,382	−68,206
Eastern	755,716	30,060		15,462		815,707	775,907	39,800
National	280,356	5,528	1,504	10,773		313,627	318,264	−4,637
Northwest	819,237	528,876	4,807	241,761		1,614,569	1,852,844	−238,274
Pan American								
Alaska	272,000	16,000		54,000	117,000	682,000	609,000	73,000
Atlantic	5,008,000	670,000		656,000	−3,390,000	3,345,000	7,799,000	−4,454,000
Pacific	3,462,000	516,000		490,000	−733,000	3,873,000	4,676,000	−803,000
Latin America	3,895,000	246,000		869,000	480,000	6,065,000	6,251,000	−186,000
Panagra	1,067,646	70,406		92,792	4,031	1,450,899	1,464,253	−13,353
Trans World	2,707,287	545,004		338,322		3,811,187	4,916,577	−1,105,390
United	669,267	34,307		11,507		740,148	749,835	−9,687
LOCAL SERVICE								
Allegheny	271,217	7,451	9,345		130,793	425,324	492,973	−67,649
Bonanza	127,368	2,300	1,136	2,788	81,294	225,430	224,084	1,346
Central	76,182	3,421	658	2,593	361,674	447,244	249,103	198,141
Frontier	173,302	236,807	3,607	16,892		438,451	457,639	−19,187
Lake Central	99,579	6,358	8,016		109,876	227,188	232,444	−5,255
Mohawk	323,000	3,188	2,700	5,018	37,726	390,429	463,381	−72,952
North Central	374,212	13,250	12,125		158,103	561,973	556,397	5,576
Ozark	209,555	179,983	5,966			400,281	434,620	−34,339
Piedmont	346,765	8,218	4,492	7,338	145,306	525,851	537,444	−11,593
Southern	136,879	6,285	4,736		141,733	297,254	311,673	−14,418
Southwest	215,454	6,442	2,772	3,901	78,948	324,600	360,008	−35,408
Trans Texas	174,412	9,426	3,136	4,633	203,359	401,588	393,994	7,594
West Coast	142,312	3,982	1,409	2,537	120,513	271,792	338,974	−67,182
HAWAIIAN								
Hawaiian	276,369	3,013		52,738	19,921	357,969	428,747	−71,778
Trans Pacific	115,556	762		5,308	4,160	130,306	156,954	−26,648
CARGO LINES								
Aerovias Sud Americana				205,621		207,749	188,110	19,638
Flying Tiger				875,626		968,701	1,082,207	−113,506
Slick				916,035		916,035	965,952	−49,916
Riddle				245,083		314,282	294,997	19,285
HELICOPTER								
New York Airways	17,233	2,448	2,386	2,298	120,737	151,056	140,316	10,739
Los Angeles Airways	3,672	10,474	6,713		74,031	95,116	84,940	10,175
Helicopter Air Service		38,297				39,554	37,051	2,502

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Occasionally there comes to light a particularly hairy episode which shows some of the possibilities at the larger airports. One such close shave occurred back in November. It was shortly after dark on a clear night when an itinerant Lockheed landed on Runway 18 at one of our major terminals.

The tower issued the usual advice to make a right turn and contact ground control on 121.9 mcs. Immediately after this transmission, a waiting Constellation called ready for take-off on the same runway. Before clearing the Connie, it was necessary for the tower operator to about face in order to check on the progress of a DC-6 approaching from the south.

Seeing that there would be ample time to get the Constellation off, a clearance was issued by the operator while he was turning back around towards the field.

Confused Itinerant

All this action took but a few seconds but imagine the horror of the tower controller when, upon focusing on the "live" runway again, he saw the Connie bearing down on the same Lockheed which had presumably long since cleared the runway. As luck would have it the itinerant had had a complete radio failure at the instant of turning clear of the runway. The pilot being unfamiliar with the airport became confused, he said later, by one of CAA's little direction signs and thought he had made a wrong turn. Thereupon he immediately did a 180 and taxied back onto Runway 18.

Several things are evident from this episode. First, the pilot of the Lockheed was wrong, terribly and stupidly wrong, to return to the active runway. Second, the pilots of the Constellation should have been more alert to the condition of the runway they were about to use. Third, the tower should have checked the runway before issuing a take-off clearance.

But let us not be too hasty about fixing the blame. We will always have "itinerant Lockheeds" who are unfamiliar with large airports. We will always have transports in a hurry for take-off and blessed with numerous cockpit chores. And it will always be necessary for tower controllers to face the other way to spot traffic. In the day-in-and-day-out, routine frenzy of modern aviation, these things are humanly unavoidable.

Ground Direction Signs

But this does not mean that all is lost—there are some things that can be done. First the signs. Back on Sept. 1, 1952, this column commented on the total inadequacy of signs a la CAA. Basically, they are too small and use too many abbreviations. The good old plain English type, found at Boston, are still best. In addition to signs, a system of red and green, "stop-and-go" traffic lights is needed to assist the controllers in the direction of ground traffic. Perhaps we should also add signs which screech *Danger, Live Runway—Do Not Enter* in large, vulgar red letters.

It might also be mentioned that perhaps stricter qualifications should be required for pilots flying into major terminal areas (this subject was covered here on Nov. 30, 1953).

Suffice to say that incidents like this are occasionally going to happen one way or another. The picture of two flaming wrecks in the center of an airport is not a cheery one. Some steps can and should be taken, for this problem of ground direction is but another phase of the total air traffic story.

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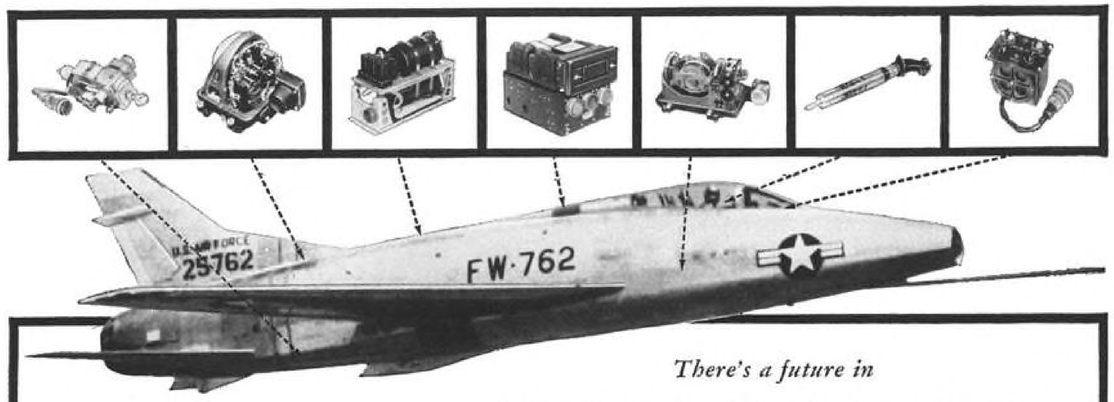
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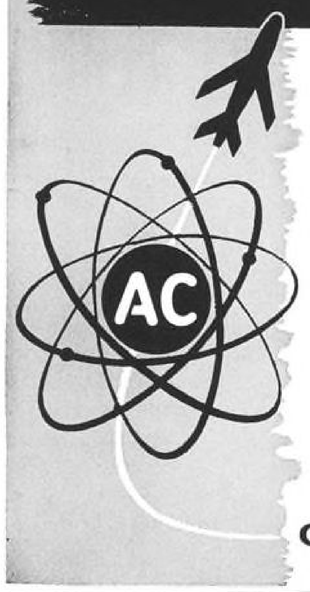
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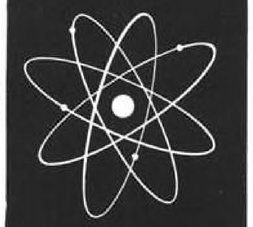
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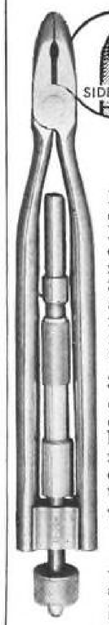
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LETTERS

Pilot Training Fund

Having read your interesting and factual report on airline and military pilot and ground personnel shortages, I feel compelled to set down some of my own personal thoughts on the subject.

Myself and several other staff members of our squadron, devote considerable time and effort in the training of senior and cadet members and currently, we are completing courses in C. A. R. meteorology, navigation, Immediately following completion of the aforementioned courses, we are starting classes in Theory of Aircraft and Engines and C. A. R. Interest in these classes has been most satisfactory and we intend to continue on various aviation subjects indefinitely.

However, we do have one serious drawback.

We cannot possibly assume personal financial responsibility, to fly a sufficient amount of air minded cadets, to keep them interested enough to continue their training at a certificated flight school. Our squadron has a scholarship, sponsored by civic minded citizens of Wichita, but that is so little for so many (cadets).

What is really needed, all over the country, is the establishment of a fund, for the purpose of training the young men and women of America in aviation subjects. This fund should be the responsibility of: the Federal Government, the U. S. airlines, airframe and engine mfgs., the state government, local civic minded groups.

The Civil Air Patrol can be very instrumental in the training of large numbers of ground and flight personnel, who, when they become of age, will be available to military and civilian phases of American aviation.

The commendable foresight of our government in setting up NATO, should be followed through at home. The Civil Air Patrol is needed for civil defense, disaster, liaison, air search and rescue, and most importantly, to interest and train the young men and women of America in all phases of aviation.

Why wait till it is too late?

Financial support to the unselfish and hard working members of the Civil Air Patrol, who gladly donate their time and experience, will assist in producing satisfactory numbers of interested and trained personnel for military and civilian aviation.

A. E. Campbell
Engineering Officer
Civil Air Patrol
Squadron No. 1
Wichita, Kansas

M-Day Effort

We hear a great deal about the planning that has been and is currently being done regarding Air Force Production Reserve Programs and other Mobilization Day preparations.

Such planning is of course valuable and extremely necessary, but one must admit all too theoretical. Why, and I would like to address my question to the AF planners, do they not set aside a specifically appropriated sum and execute a full scale M-Day effort covering a particular type of commodity?

For example, on some set date (known only to themselves) call the previous supplier of B-47 gun turrets, or some other comparable item, and actually place an order for an "X" number of units for immediate (best possible) delivery at maximum effort.

This type of item is suggested for, even though it is well on its way to obsolescence, it is still operational, and would in the event of an actual emergency (tomorrow, for instance) in all probability still be used.

It is realized that such a "rehearsal," if it could be called that, would be expensive, but I think it will be agreed that it would be money well spent inasmuch as the material produced would be useable, and it would give some indication of the actual time involved in releasing "moth balled" equipment, tooling, machines, etc., and switch from current commercial production at a period of time when civilian demands have raw material in rather close supply. It would not only test the function of DMS routine, but would give the AF planners a more accurate conversion time factor which might possibly be projected to many other types of commodities.

H. A. Perry
Burlington, Vermont

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.

WADC Openings

Wright Air Development Center has a continuing need for Engineers and Scientists skilled in Aeronautical Research, development and design. Usually this need exceeds the available supply from Civil Service registers.

At the present time we have several vacancies ranging in salary from $5440 to $8990 per year. Duties of these positions are to advise on, administer, direct, supervise, or perform the engineering research, development or design of aircraft to meet specific requirements and characteristics. This work on aircraft such as airplanes, airships, rotorwing aircraft, pilotless aircraft and guided missiles involves the application of the specialized science of aerodynamics as well as the basic principles of higher mathematics, physics, and chemistry and intimate knowledge of fundamental engineering concepts and terminology and units of measurement and their interrelationships in the process of determining basic configurations or aerodynamic profiles, performance and flying characteristics, static and dynamic loads, and the strength requirements necessary to meet such loads.

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Chief, Employment Section
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Lightplane Approach

Lightplane operations would probably be far more welcome at congested major airline terminals if the pilots were indoctrinated in power-on airline approaches.

For instance, a Cessna 140 can easily come in power-on at 110 IAS until about ¾ down the runway, cut the power, and land in the last third, speeding traffic all the way around.

Similar procedures, of course, would apply to Bonanzas, etc.

It is indeed frustrating waiting takeoff or landing clearance as a lightplane makes a 70 mph. straight-in approach from two miles out.

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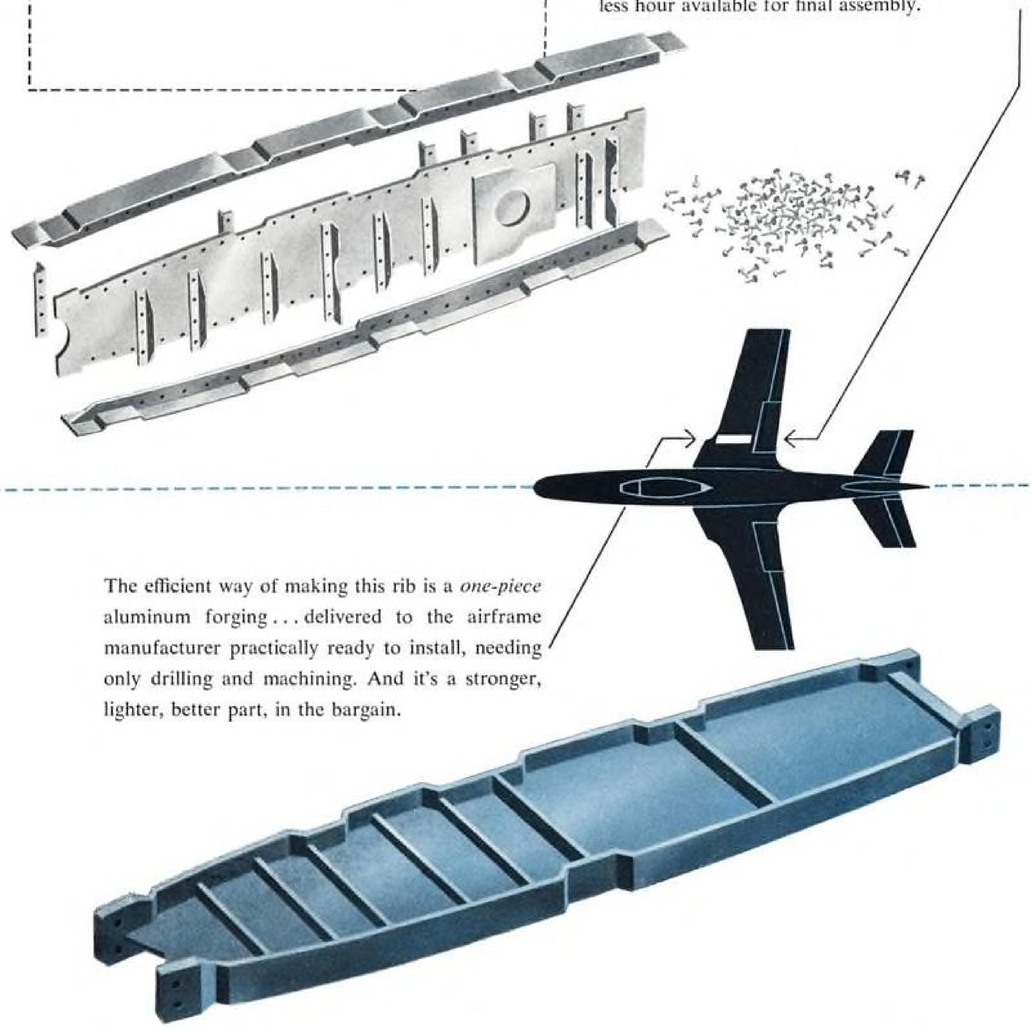
Investigate CAA

I heartily agree with you that the CAA should be investigated.

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n Eddie Rickenbacker chooses

Allison Prop-Jet Power

for Eastern Air Lines

☆ *Serving more United States cities than any other airline* ☆

Eastern's new Lockheed Electras—world's fastest, smoothest, most luxurious airliners—will fly at well over 400 miles an hour!



AFTER years of engineering research covering all types of aircraft power units, Eastern Air Lines has selected Allison Prop-Jet engines and Aeroproduct Propellers for our fleet of 40 new radar-equipped Lockheed Electra airliners.

This decision represents a great step forward in Eastern's progress into the jet age, and reflects our conviction that Allison Prop-Jet power, a product of General Motors, is the most efficient and dependable engine-propeller team for the new Lockheed Electra.

This new Allison engine harnesses the vast power of a modern gas turbine to a propeller. It uses less fuel than a straight jet, yet it enables aircraft to fly faster with greater payload than any other propeller-type aircraft engine in commercial use today.

Allison-powered Electras will be in service on Eastern Air Lines routes in the Fall of 1958. Flying at speeds of well over 400 miles an hour, these 66-passenger airliners will offer unprecedented smoothness of flight, a new standard of quiet, restful comfort, and the highest degree of dependability.

We of Eastern congratulate General Motors on this great achievement in aircraft power, an achievement that will help bring the untold benefits of modern air transportation to more millions of people in the years to come.



I AM happy to announce that Captain Eddie Rickenbacker, one of the most highly respected figures in aviation and dean of the air transportation industry, has chosen Allison Prop-Jet engines and Aeroproduct Propellers for Eastern's new fleet of Lockheed Electra airliners.

Captain Rickenbacker's decision is a magnificent tribute to General Motors and the Allison Prop-Jet engine, the first gas turbine engine to receive Civil Aeronautics Administration approval for commercial service.

The Allison Prop-Jet engine is the most advanced power plant of its type and is backed by more than 7 million hours of turbine engine flight time in military aircraft.

In Allison Prop-Jet power, General Motors again demonstrates its leadership in the development of power for all kinds of transportation. In aviation, in motor vehicles, in locomotives and in marine engines, GM has gained the confidence of millions of people who daily depend upon GM power units.

In air transportation, Eastern Air Lines has earned and held the confidence of the traveling public for over 27 years. General Motors and Allison Division are proud to join Captain Rickenbacker and Eastern Air Lines in this great contribution to the future of commercial aviation, national defense and the progress of American-designed and American-powered aircraft.

Eddie Rickenbacker

Chairman of the Board, EASTERN AIR LINES

I. F. Curtice

President, GENERAL MOTORS CORPORATION

The Allison Prop-Jet engine is backed by more than 7 million hours of turbine engine flight time—experience where it counts most—in the air.



ALLISON

PROP-JET POWER

ALLISON DIVISION OF GENERAL MOTORS

Indianapolis, Indiana

BUILT IN THE UNITED STATES FOR THE NEW ERA IN AIR TRAVEL