AVIATION WEEK

A McGRAW-HILL PUBLICATION

November 12, 1956 50 cents

Eastern Handles Colonial Merger Detail Problems

Vickers Valiant

How Chemical Fuels Boost Performance

Rocket-Tube Ejector Raises Escape Margin

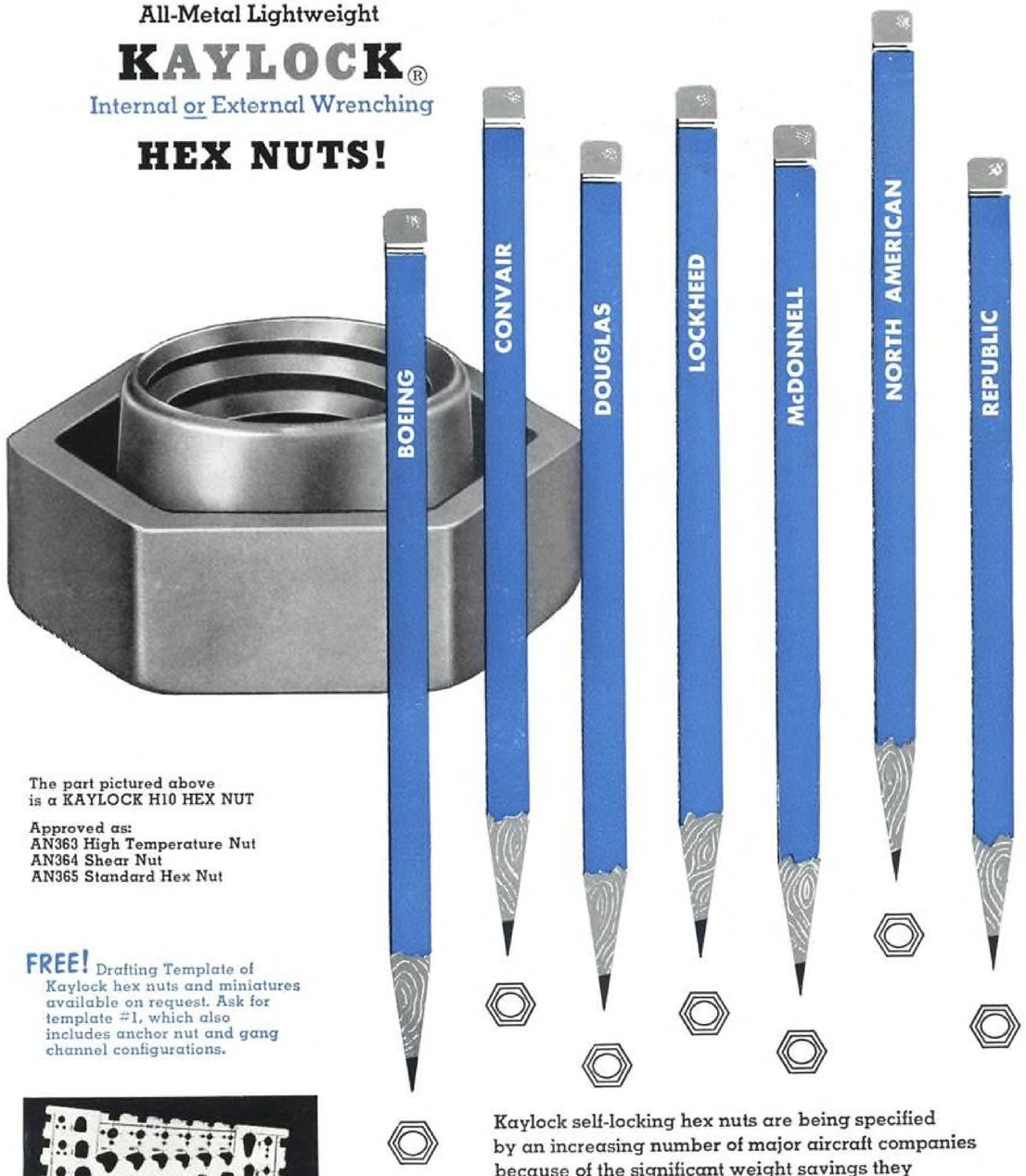
Leading Aircraft Companies Specify

All-Metal Lightweight

KAYLOCK®

Internal or External Wrenching

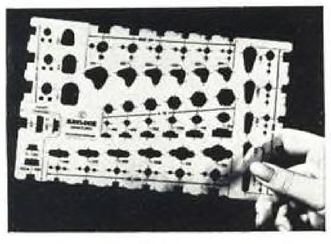
HEX NUTS!



The part pictured above
is a KAYLOCK H10 HEX NUT

Approved as:
AN363 High Temperature Nut
AN364 Shear Nut
AN365 Standard Hex Nut

FREE! Drafting Template of Kaylock hex nuts and miniatures available on request. Ask for template #1, which also includes anchor nut and gang channel configurations.



Kaylock self-locking hex nuts are being specified by an increasing number of major aircraft companies because of the significant weight savings they provide. Exceptionally low in height and high in strength, they are precision products designed for aircraft and guided missile applications. They conform to all requirements of appropriate military specifications. For more information, write:

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PRODUCING radomes—protective plastic housing for gun-laying radar—is one of the many challenging tasks of Goodyear Aircraft as a member of America's aeronautical team.

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The Goodyear foamed radomes have made it possible to raise the quality of difficult void-free laminates — to exercise greater uniformity of control and thickness.

The bore-sight testing equipment makes it possible for Goodyear Aircraft to *pre-test* every radome before it leaves the plant—ascertain its accuracy while it utilizes simultaneous lobing or conical scanning antennas. And Goodyear's latest bore-sight developments have a special significance for prototype programs.

Such assurance of quality is a source of real satisfaction to both the manufacturer of the aircraft for which the radome is produced and for the military air arm which gets final delivery.

It's typical of the way we go the whole way to better serve our customers.

Goodyear Aircraft Corporation, plants in Akron, Ohio, and Litchfield Park, Arizona.

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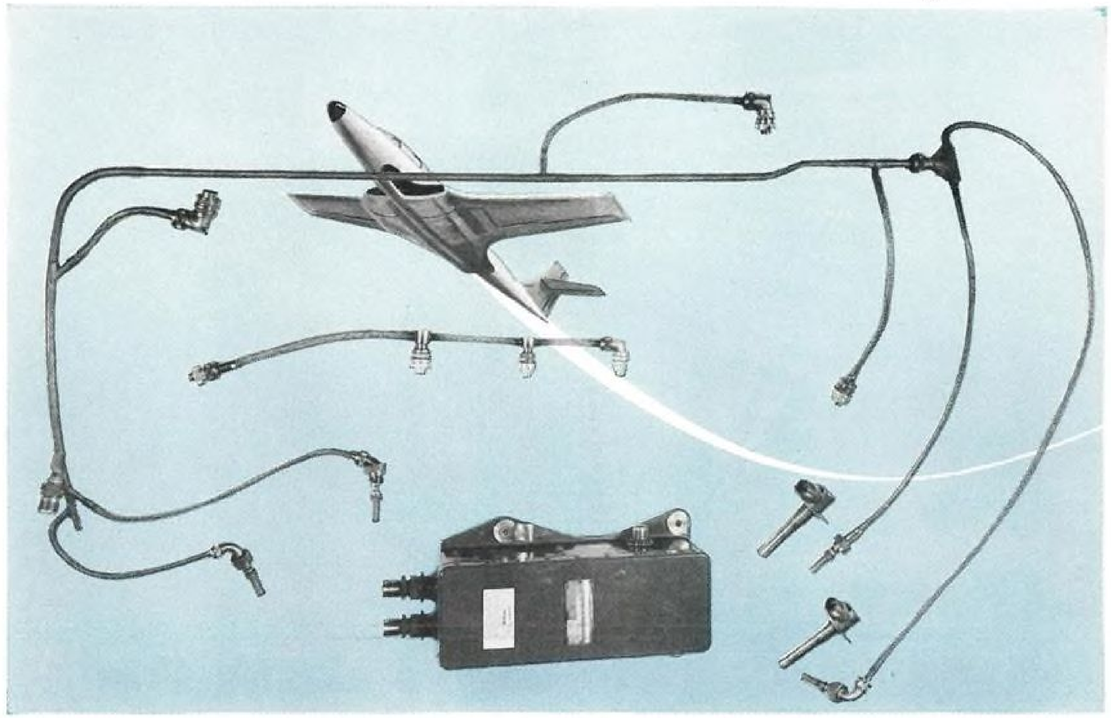

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Bendix SCINTILLA DIVISION — Bendix AVIATION CORPORATION

AVIATION CALENDAR

Nov. 12-15—Thirty-Sixth Annual Meeting, American Petroleum Institute, Hotels Conrad Hilton, Palmer House and Sheraton Blackstone, Chicago, Ill.

Nov. 13-14—Sixth Transport Aircraft Hydraulic Conference, sponsored by Vickers, Inc., Park Shelton Hotel, Detroit.

Nov. 14-16—Symposium on Optics and Microwaves, sponsored by the Institute of Radio Engineers Professional Group on Antennas and Propagation, Lisner Auditorium, George Washington University, Washington, D. C.

Nov. 14-16—Latin American Aviation Conference, sponsored by Export Committee, Aircraft Industries Assn., Miami, Fla.

Nov. 14-16—Jet Engine Overhaul Symposium, General Electric Co., Evendale, Ohio.

Nov. 15—Conference on problems and issues concerned with control and protection of airport approaches, sponsored by Institute of Transportation and Traffic Engineering, University of California, International House, University of California, Berkeley, Calif.

Nov. 15-16—Guided Missile Branch and Committees, American Ordnance Assn., Naval Ordnance Test Station, Inyokern, Calif.

Nov. 15-16—Metropolitan New York Material Handling Conference, sponsored by N. Y. Chapter of the American Material Handling Society, Brooklyn Polytechnic Institute, Brooklyn, N. Y.

Nov. 16-17—Air Mail Pioneers Eastern Division Reunion, Ambassador Hotel, Washington, D. C.

Nov. 25-27—Aviation Distributors & Manufacturers Assn., 28th Meeting, Drake Hotel, Chicago, Ill.

Nov. 25-30—Aviation Division, American Society of Mechanical Engineers, Annual Meeting, Hotel Statler, New York.

Nov. 26-27—International Meeting Canadian Aeronautical Institute and the Institute of the Aeronautical Sciences, Royal York Hotel, Toronto, Ontario.

Nov. 26-30—Human Engineering Conference, Third International Automation Exposition, Trade Show Building, New York City.

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Vol. 65, No. 20

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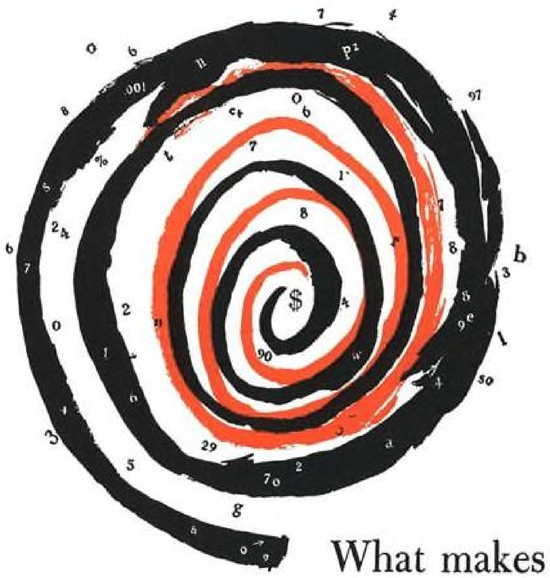

What makes a wind tunnel *commercially* successful?

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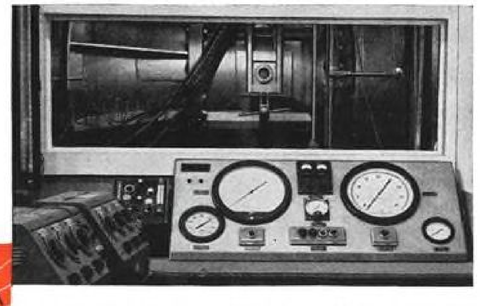

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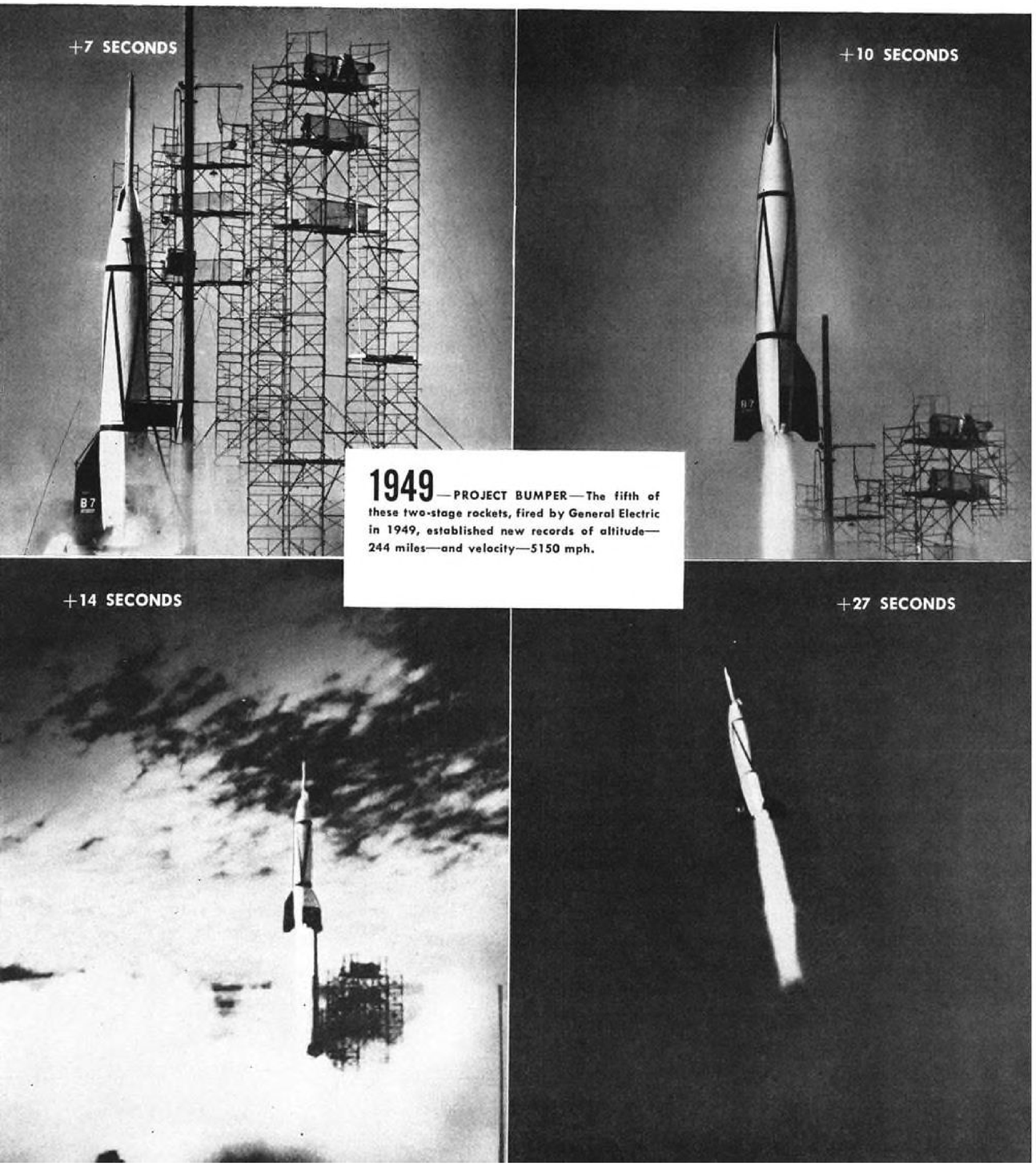
How General Electric Experience Advances Missile Technology



1949—PROJECT BUMPER—The fifth of these two-stage rockets, fired by General Electric in 1949, established new records of altitude—244 miles—and velocity—5150 mph.

General Electric's Project Bumper established new records of altitude and velocity. But far more important is the valuable research data compiled in the successful completion of the Bumper project. Many problems were overcome with Bumper—problems in temperature, telemetry, separation, and aerodynamics. Bumper helped solve the problems of communicating with missiles at extreme altitudes, and was a major preliminary step in the development of a satellite. In solving these and other problems, General Electric has contributed a wealth of research data to the missile industry—information that is being utilized on the nation's top priority ballistic missile project.

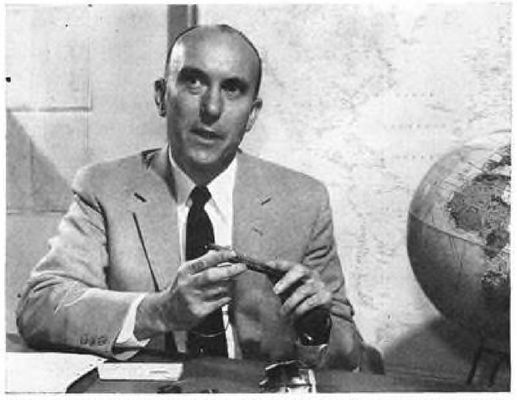
General Electric's Missile & Ordnance Systems Department presently is working on an Air Force prime contract to develop the ICBM nose cone. Programs are being carried out in such varied fields as communications, hypersonics, metallurgy, mathematics, and thermodynamics to support this nose cone contact.

General Electric has formed the Missile & Ordnance Systems Department to act as a Company focal point for large, highly complex missile projects. Scientists in the new department, backed up by the vast resources of many General Electric operating departments and laboratories, are currently working to solve the perplexing problems associated with the ICBM nose cone and other missile projects.

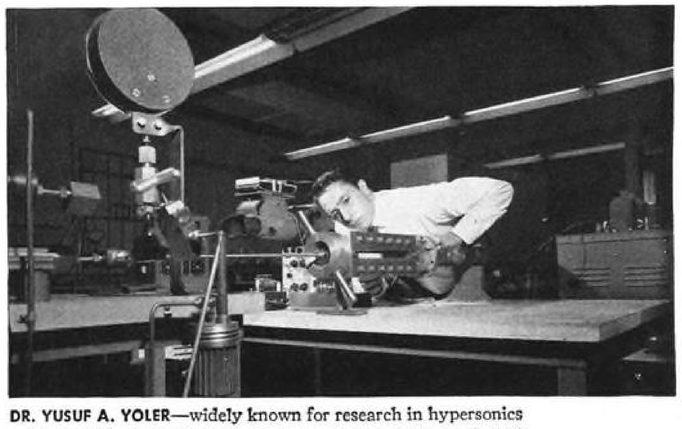
By focusing this wide range of specialized talents of General Electric personnel on highly complex defense system problems, the Missile & Ordnance Systems Department is making significant contributions to America's defense program. Section 224-5, General Electric Co., Schenectady 5, New York.

ENGINEERS: G.E.'s Missile & Ordnance Systems Department is currently expanding its staff of highly skilled engineers and scientists. If you have a background of successful creative engineering, send your qualifications to: Mr. George Metcalf, General Manager, Missile & Ordnance Systems Department, General Electric Co., 3198 Chestnut St., Philadelphia, Pa.

TODAY—CONTINUED RESEARCH AND EXPERIMENTATION in advanced missiles and missile systems is helping solve such advanced problems as development of the ICBM nose cone. Headquarters for General Electric's participation in these programs is the Missile & Ordnance Systems Department in Philadelphia, Pa.



MR. ROBERT P. HAVILAND, Flight Test Engineer at MOSD, directed Project Bumper and other advanced programs, gaining valuable experience which he is currently applying to present missile programs.



DR. YUSUF A. YOLER—widely known for research in hypersonics—is currently engaged in the design and development of wind tunnels, shock tunnels, mass accelerators, and other facilities for continued progress in missile systems.

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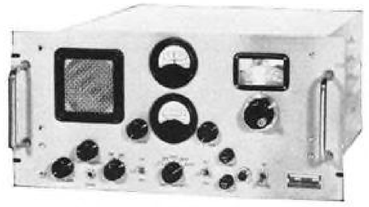

TYPE 1502

AM, FM or CW.....55-260 Mcs

IF BANDWIDTH.....300 Kcs

SQUELCH: BUILT-IN LOW NOISE PREAMP

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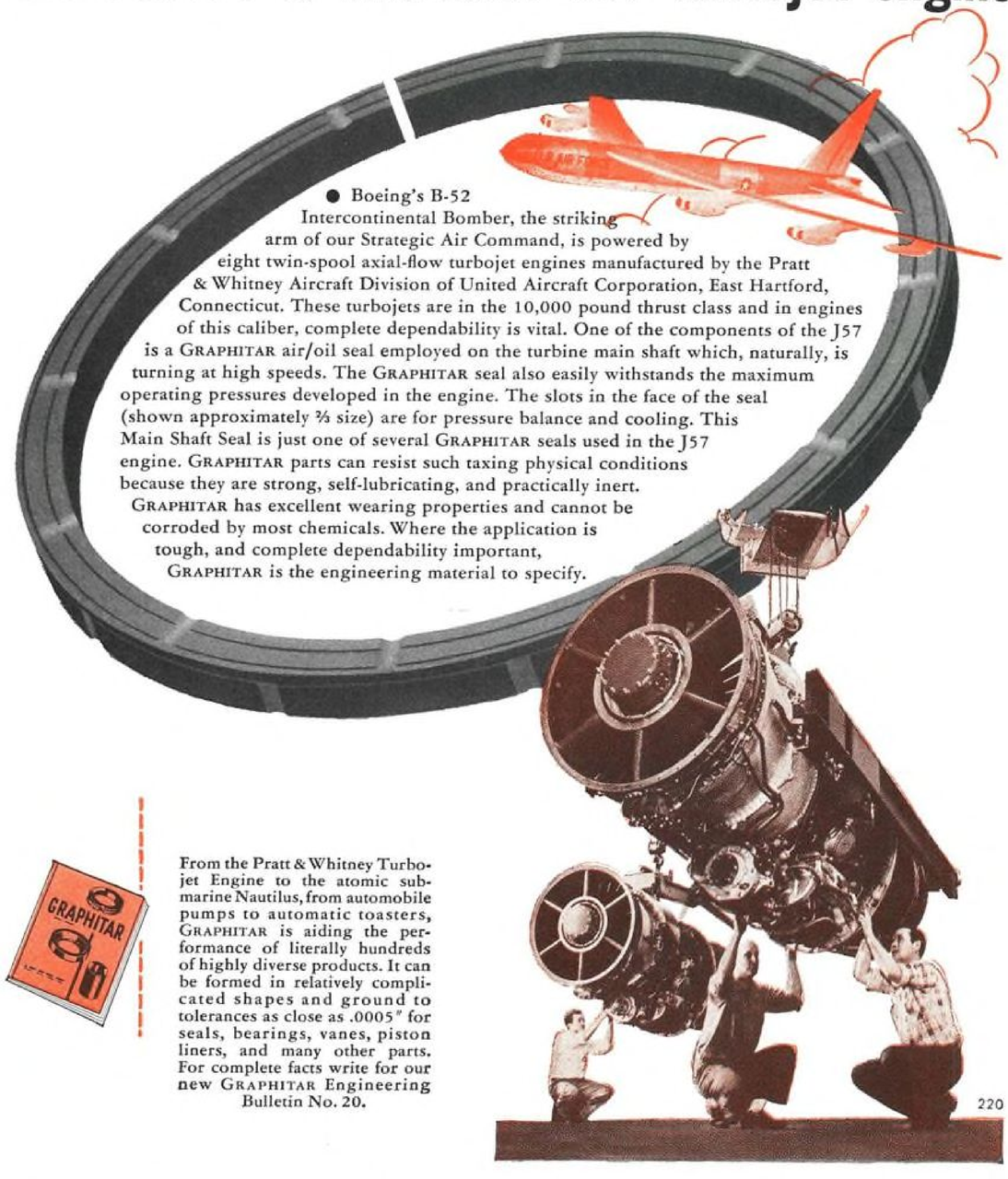

● Boeing's B-52 Intercontinental Bomber, the striking arm of our Strategic Air Command, is powered by eight twin-spool axial-flow turbojet engines manufactured by the Pratt & Whitney Aircraft Division of United Aircraft Corporation, East Hartford, Connecticut. These turbojets are in the 10,000 pound thrust class and in engines of this caliber, complete dependability is vital. One of the components of the J57 is a GRAPHITAR air/oil seal employed on the turbine main shaft which, naturally, is turning at high speeds. The GRAPHITAR seal also easily withstands the maximum operating pressures developed in the engine. The slots in the face of the seal (shown approximately ⅔ size) are for pressure balance and cooling. This Main Shaft Seal is just one of several GRAPHITAR seals used in the J57 engine. GRAPHITAR parts can resist such taxing physical conditions because they are strong, self-lubricating, and practically inert. GRAPHITAR has excellent wearing properties and cannot be corroded by most chemicals. Where the application is tough, and complete dependability important, GRAPHITAR is the engineering material to specify.

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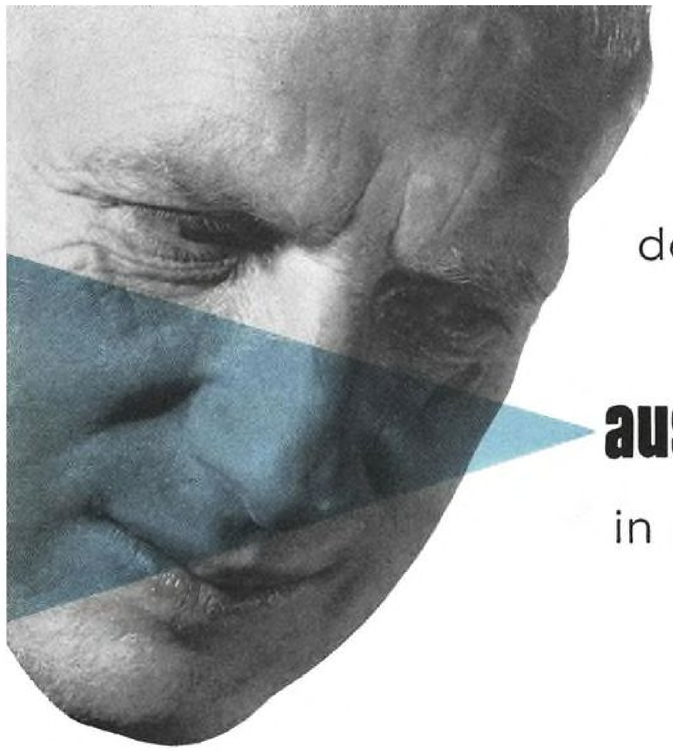

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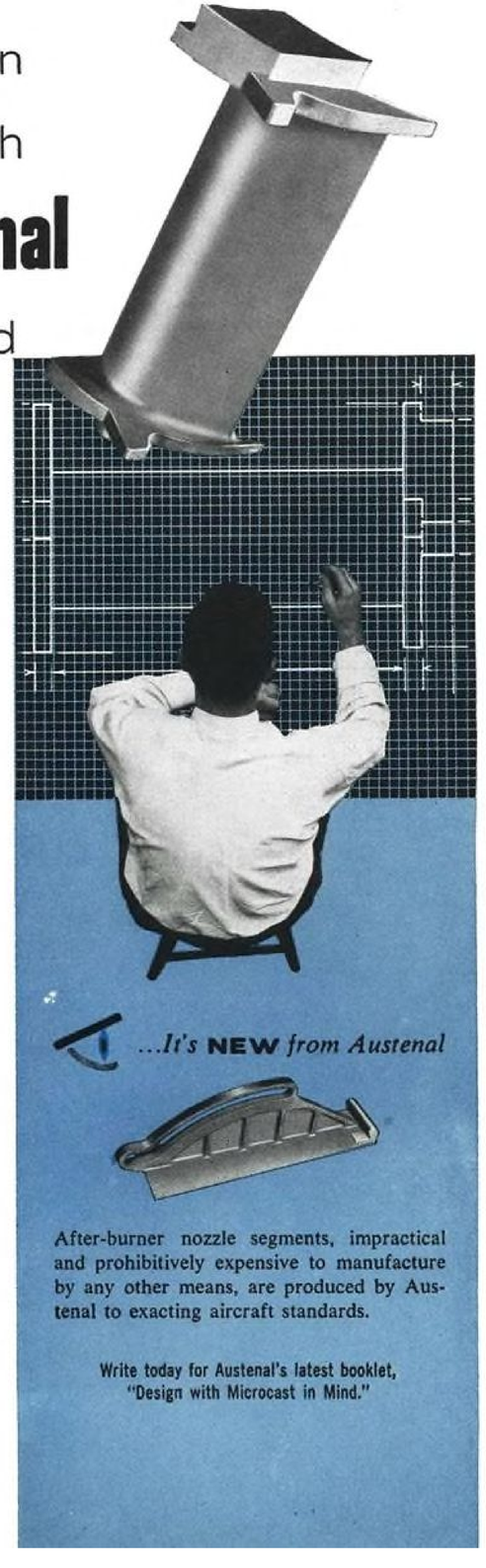

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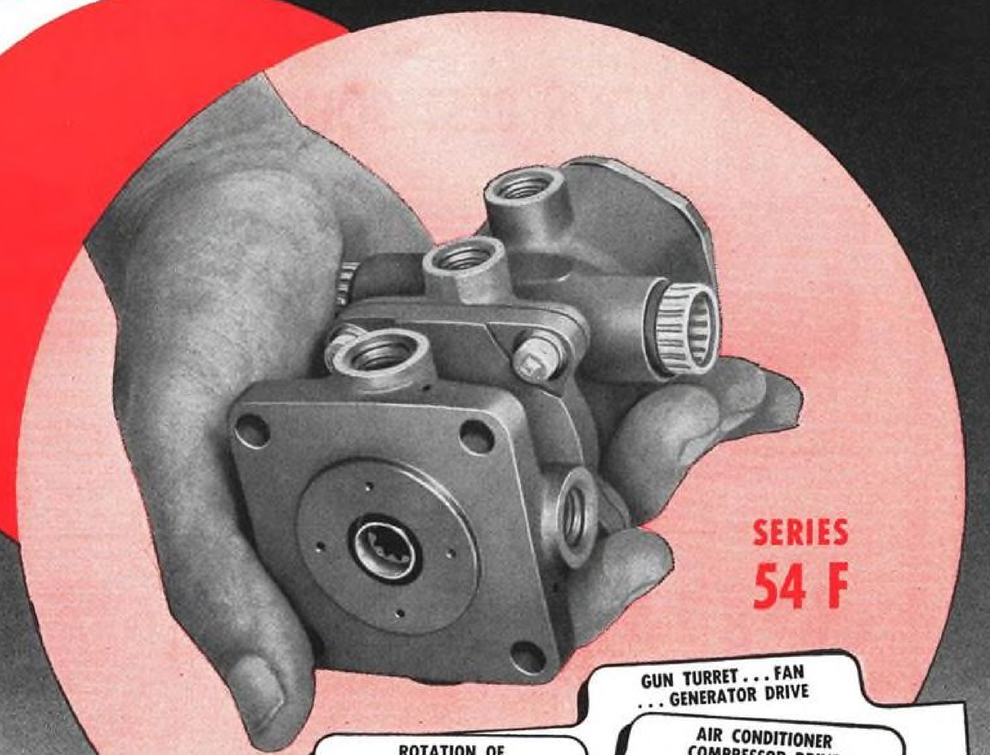

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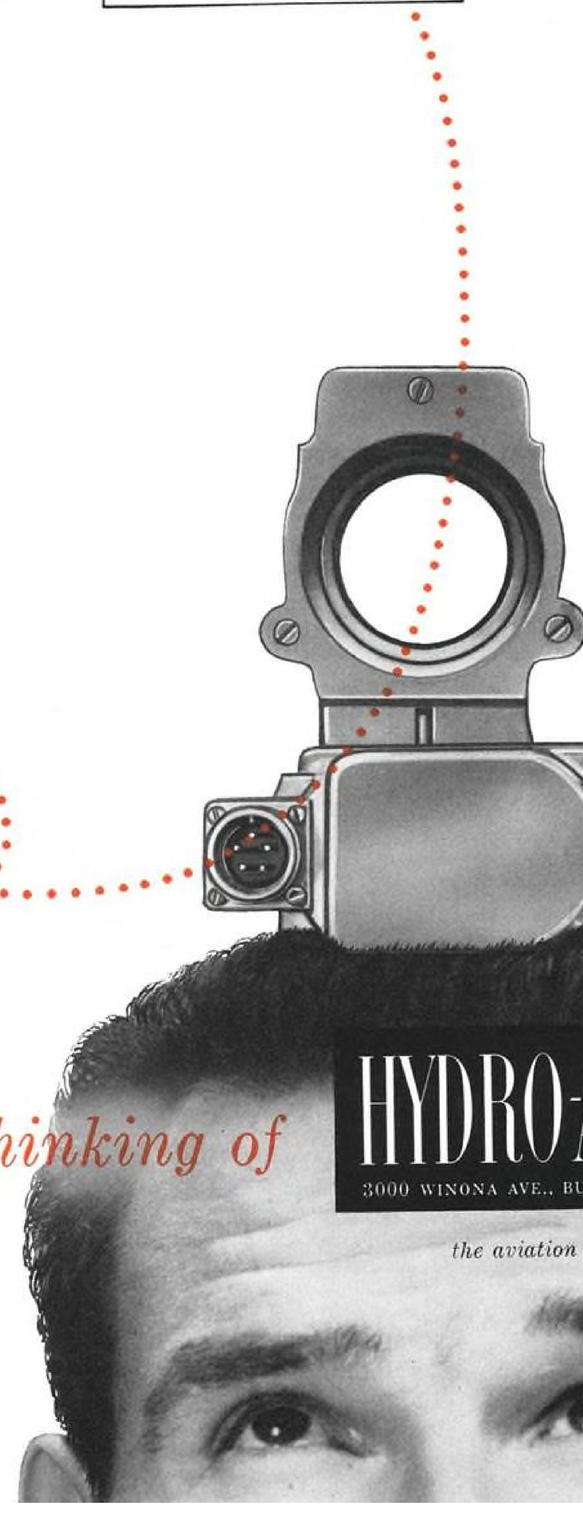

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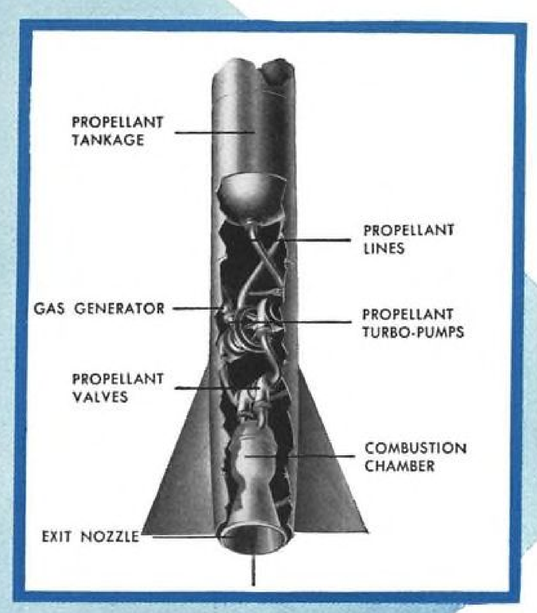

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Currently, RMI is engaged in the development and production of complete rocket propulsion systems for major military requirements. Important supporting programs are also in progress concerning advanced liquid and solid propellant chemistry, combustion research, and the development of improved rocket system components.

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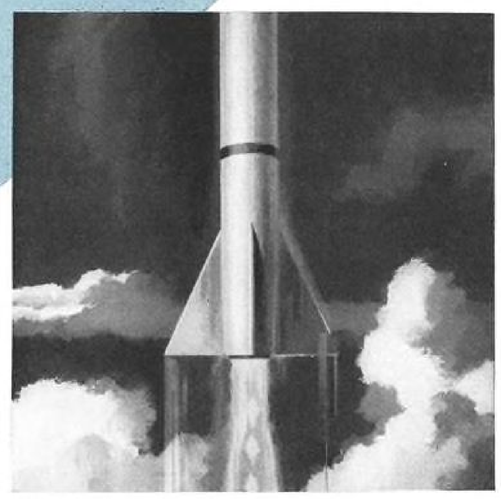

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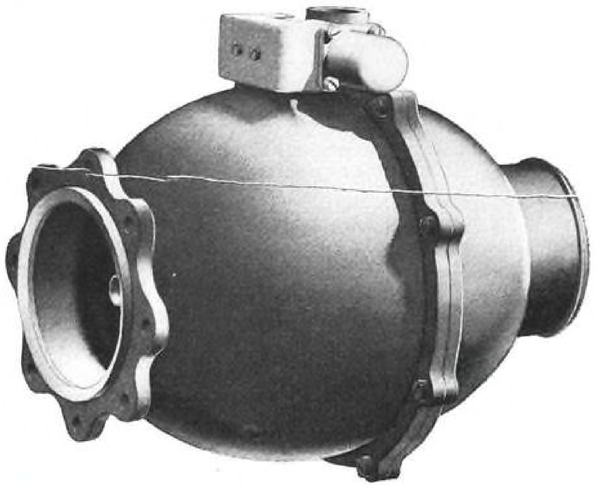

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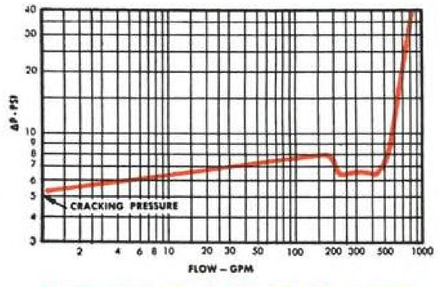

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COVER: Vickers Valiant B.1 bomber, first of the V bombers to be supplied to the Royal Air Force, was used by British along with Canberras to bomb Egyptian airfields. Valiants were based on Malta. Four Rolls-Royce Avon turbojets power the Valiant, which has a crew of five. De Havilland Super Sprite rocket engines are a recent development for takeoff assist (AW Aug. 20, p. 34).

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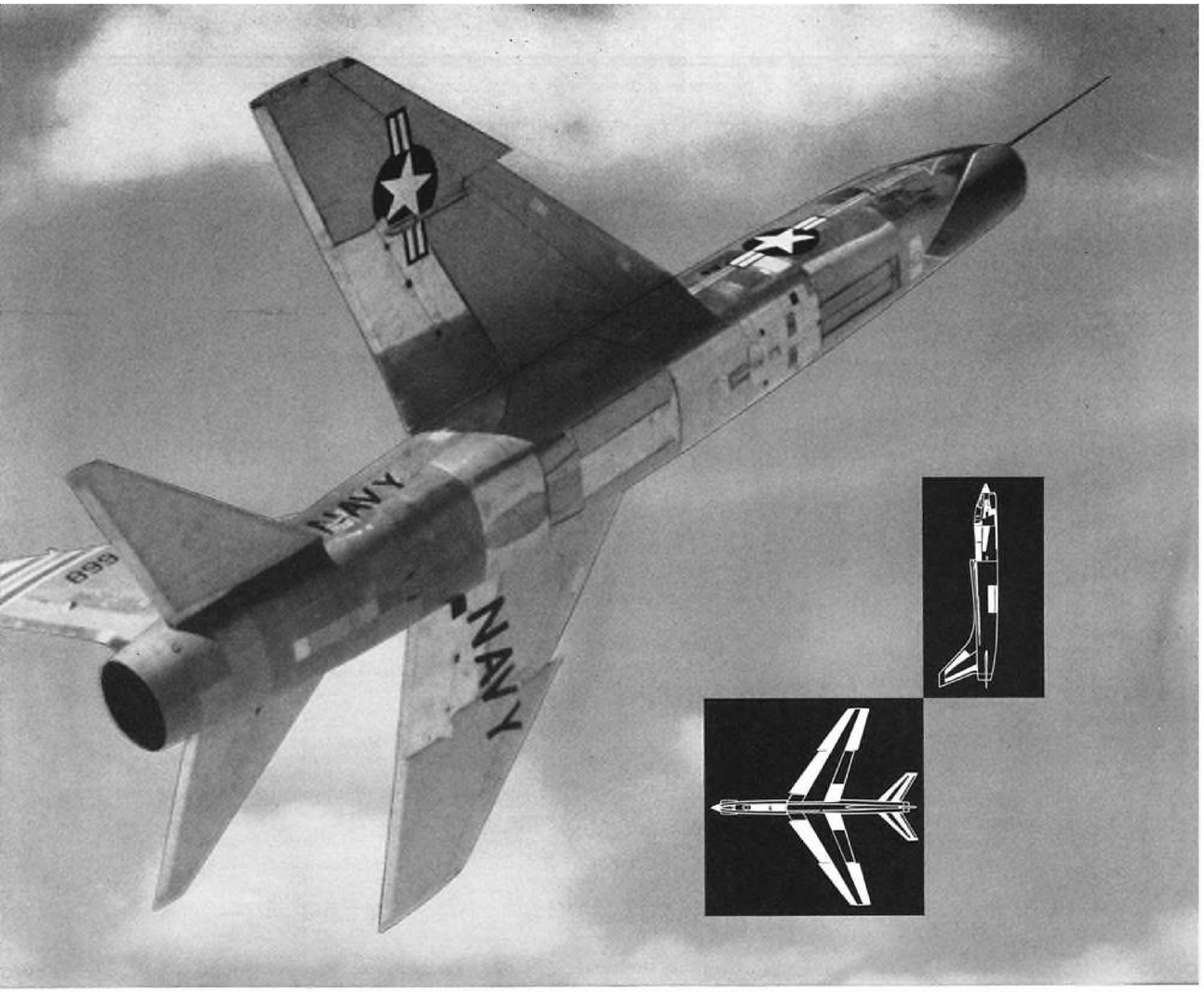

Weight-saving magnesium sheet (white areas) is used for leading edges, empennage, wheel doors and many other parts of F8U-1 Crusader.

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

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

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EDITORIAL

The Prospect Ahead

Last week's national election produced no change in the political forces battling over federal aviation policy, but a number of new issues will face the now familiar combination of a Republican executive branch of the government and a Democratic-controlled Congress. These new issues have been spawned by the explosive political situation in the Middle East and Europe and the fantastic speed and scope of aerial weapon technology.

The prophets of peace and universal disarmament—it hardly seems possible that the summit conference at Geneva was only 18 months ago—have been badly jolted by bomb blasts in Egypt and tank battles in Budapest. These echoes, underscored by the blunt Russian note to Britain and France with its threat of atomic missile attack, make it clear that significant superiority in the weapons of atomic airpower are still an indispensible ingredient of effective foreign policy. The threat of atomic missile attack in the Russian note to Britain and France is the first appearance of the inevitable Soviet use of their growing aerial delivery capability for atomic and hydrogen weapons for political blackmail.

Current Strategy Obsolete

The contrast between the painfully slow aerial and amphibious attack mounted by the Anglo-French forces against Suez from Cyprus and the swift destructive capability of an offensive by hypersonic missiles tipped with atomic or hydrogen warheads is all too obvious. The issue of U.S. aerial weapon superiority and the relation of our progress in this field to that of the Soviet Union will be a burning issue not only domestically but also among our friends and enemies around the world.

Within the Pentagon, the galloping technology of new weapon system development has—as we have often emphasized—made current military organizations, tactics and strategy obsolete. The process of reorganizing our military forces to cope with the full effectiveness of modern weapon technology will be a painful and bitter battle against entrenched tradition and atrophied imagination that will inevitably spill out of the Pentagon's concrete corridors into the White House and the Congress.

A rise in the Fiscal 1958 defense budget is already conceded to be inevitable. Defense Secretary Charles E. Wilson, slated for replacement in the second term cabinet of President Eisenhower, estimates a 4 to 6% increase is already necessary, but pressure of foreign crises reflected in Congress may boost this bill even higher. The aircraft industry will get more defense dollars in Fiscal 1958 regardless of the result of this military policy debate.

Industry has shifted into high production rates on such key weapon systems as the Convair F-102, an all-weather interceptor, the Boeing B-52 strategic bomber, the Lockheed F-104 supersonic day fighter and others. Higher delivery rates will be reflected in higher gross sales on down the line from prime contractors through the tier of subcontractors, components manufacturers and suppliers. Margin of profit to be allowed for the aircraft industry's military business will continue to be a bone of contention between the Pentagon, Congress and the industry.

Increased Soviet use of military force and aerial weapon superiority, both as a threat and actuality, will place heavier emphasis on the need for an accelerated and expanded U.S. research and development program. Without a research and development program keyed to achieving major scientific breakthroughs in minimum time and maintaining a recognizable qualitative superiority in atomic airpower, it will be difficult for any nation to push an effective foreign policy in the international jungle that looms ahead.

Traffic Control

In civil aviation, the vast economic, technical and political problems of building a modern air traffic control system that will safely handle the enormously increased demands of air transport and air defense will be the major issue for the foreseeable future. During the final year of the first Eisenhower Administration, a good start was made on this problem, both at the operational and long-range planning levels. There should be no reason for not continuing to push this program as hard as possible. Airport modernization and economic health of the air transport system will continue to be issues.

The events of the past few weeks that saw the peaceful facade of the world broken by resort to naked force should emphasize again, if any such emphasis should be needed, the absolute necessity for a sound research, development, production and operations program for both military and civil aviation. In the kind of a world we face today, a nation without superior airpower will not last long enough to contemplate or use the other elements of its national strength and character.

—Robert Hotz

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WHO'S WHERE

In the Front Office

Lord Kindersley will become chairman of Rolls-Royce Limited, Derby, England upon the retirement of **Lord Hives** in January. **J. D. Pearson** and **Whitney Straight** will become deputy chairmen; Mr. Pearson will succeed Lord Hives as chief executive of Rolls-Royce, and will continue as managing director of the Aero Engine Division.

T. Lloyd Kelly, board chairman, LaSalle Steel Co., Chicago, Ill. **Thomas A. Kelly** succeeds Mr. Kelly as president and chief operating officer.

M. J. Van Der Ploeg, deputy president and head of traffic and sales directorate, KLM Royal Dutch Airlines. Mr. Van Der Ploeg succeeds **Felix von Balluseck** who will retire Dec. 31, but continue in an advisory capacity for a year.

Donald C. Erdman, assistant to the president, Sperry Products, Inc., Danbury, Conn. Mr. Erdman formerly was president and chief engineer of Electro Circuits, Inc.

Robert Logie, executive vice president and director, Firth Sterling, Inc., Pittsburgh, Pa.

John M. Dolan, vice president-general manager, Field Sales Division, Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.

R. G. Ervin, Jr., vice president-manager, Hawk Helicopters, Fort Worth, Tex.

Edward M. Boykin, vice president-field operations; **C. Harper Brubaker**, vice president-planning and programming; **Clarence A. Shoop**, vice president-flight operations; and **Roy E. Wendahl**, vice president-manager (Tucson, Ariz., operations), Hughes Aircraft Co., Culver City, Calif.

Honors and Elections

William J. O'Brien and **Harvey F.** Schwarz of Decca Company Ltd. received the Institute of Navigation's Gold Medal for 1956 for their work in originating and developing the Decca Navigator system.

Changes

Kirke W. Marsh, general project manager (for a major guided missile project), Pacific Division, Bendix Aviation Corp., North Hollywood, Calif.

J. Ralph Holmes, technical assistant to the general manager, Harrison Radiator Division, General Motors Corp., Lockport, N. Y. **Lawrence A. Zwicker** succeeds Mr. Holmes as chief engineer.

A. C. Northrop, New England regional manager (Boston, Mass.), United Air Lines.

Robert C. Downing, manager-flight training; **Fred L. Austin**, manager-flying personnel; and **Max Parkison**, superintendent-flight training, Trans World Airlines, Inc. Mr. Downing succeeds **Bertrand M. Cooper**, now supervisor-flying, Lufthansa German airlines. **R. Parkison** succeeds **Gail A. Storck**, new serving on TWA's recently organized jet planning committee.

Eugene D. Stafford, chief-flight operations, Goodyear Aircraft Corp.'s Litchfield Park, Ariz., Plant.

INDUSTRY OBSERVER

► Commercial version of the Pratt & Whitney J57 turbojet engine will employ concentric fuel manifolds instead of the two separate units now used on the engine. This will prevent coking by having the primary manifold flow cool the secondary one inside. Secondary manifold in current versions does not come into play until 2,000-lbs.-per-hour fuel flow is required.

► **USAF and airframe manufacturers are working with Fairchild and General Electric to provide interchangeability of Fairchild J83 and GE J85 engines for missile and jet-trainer applications. Another projected use of these engines is in executive aircraft. Fairchild's J83 is expected to be running on a test stand before the end of the year. Later models are expected to have thrust-weight ratios of better than eight to one. GE's J85 is already running on a test stand.**

► Eighty senior Army aviators have been summoned to the Pentagon from all parts of the world for a three-day conference Tuesday, Wednesday and Thursday. Called by Maj. Gen. Hamilton H. Howze, chief of Army aviation, the meeting is designed to bring the personnel up-to-date on Army plans and to discuss future programs.

► **Lear Aircraft's Engineering Division, Santa Monica, Calif., is reportedly interested in developing a Napier Eland turboprop power package for use by Convair-Liner operators. A Convair 340 powered by the Napier Eland already is flying in England (AW Oct. 1, p. 42).**

► Third aircraft production agreement being negotiated between the U. S. and Japan calls for 120 F-86Fs and 30 T-33s for the period July 1958, to June 1959. This will bring the total of Japanese-assembled or produced jet fighters and trainers to 300 F-86Fs and 210 T-33s. Japan's Air Self Defense Forces hopes to reach an agreement by the end of the year for production of a Century series fighter to follow the Sabre. Preparations for production of such an aircraft in Japan are expected to take 30 months.

► **Piasecki Aircraft Corp. is considering the purchase of the Bellanca Aircraft plant in New Castle, Del.**

► Royal Aircraft Corp., Milwaukee, Wis., has a backlog of four orders for its new, supercharged version of the Gull twin-engine executive amphibian. Royal Gull Super 200 is priced at $89,925 flyaway at the factory. Delivery schedule of two per month is planned after January.

► **XC-6 and XC-7, two new light fighters developed by Spain's Hispano-Aviacion S. A. and Construcciones Aeronauticas S. A. (AW Oct. 8, p. 23) will be powered by the Bristol Orpheus turbojet engine. An afterburner will be included on later models. Proposed armament for the interceptor version of the XC-6 includes two 30 mm. Hispano cannon. The attack version will carry four 23 mm. Hispano guns and rockets.**

► Convair is developing a trainer version of the F-106, tandem-seat model of the F-102A. The Air Force, which has awarded Convair a contract for development of the trainer, feels the wide nose section of the TF-102A side-by-side trainer cripples performance to such an extent that it cannot double as an operational fighter. Designation of the tandem trainer will be F-106B.

► **In the past three years, U. S. Army has broken away substantially from dependence upon USAF maintenance publications. It now issues more than half of its own required handbooks and hopes eventually to eliminate all dependence upon the Air Force in this regard.**

► Air Force has awarded a $12 million contract for support equipment for Republic F-84Fs stationed in Europe. Equipment will be supplied by Republic Aviation International S. A., Lagano, Switzerland.

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Washington Roundup

'Outside Security Realm'

Censorship of speeches prepared by top Army, Navy and Air Force officials—both civilian and military—will be a major issue before the House Government Information Subcommittee this week.

Latest to complain that Robert Tripp Ross, Assistant Secretary of Defense for Legislative and Public Affairs, and his staff are mishandling their review of speeches is Navy Under Secretary Thomas S. Gates, Jr. Both men are administration appointees, but Gates—like Army Secretary Wilber Brucker and USAF Secretary Donald A. Quarles—has found that Ross' office wields a heavy blue pencil (AW Oct. 29, p. 25).

In a restrained memorandum which Pentagon sources say reflected only a small degree of his anger, Gates told top Navy officials that some of the changes Ross' office made in two of his speeches "appeared to be outside the realm of security and did not appear to me to be in opposition to positive Defense Department policy."

"I did not know whether to take them as suggestions or as directives," Gates' memo said.

Gates noted that Ross' office sends speeches to the State Department, the Atomic Energy Commission and other agencies for advice "when appropriate," and "on occasion, he (Ross) has requested comments from the Secretary of Defense and Adm. Radford." He added:

"He assured me that all comments made on our scripts were merely in the form of suggestions except those dealing with security, and he agreed that all security questions would be clearly designated as such."

The subcommittee, headed by Rep. John Moss (D.-Calif.), will go into a number of other issues involving Defense Department secrecy and information policies.

One will be recommendations made to Defense Secretary Charles E. Wilson last summer by services' research and development experts on whether and how information in their field should be declassified. The recommendations have never been made public.

F-84s in Egypt

Although apparently unknown to Pentagon officials, France has been using American-built aircraft in the Middle East war. The French air force had three squadrons of Republic F-84 Thunderstreaks in the Suez action. Reason for using the F-84s was that the French Mystere 4 is an interceptor, not a fighter-bomber, and lacks the range to permit sufficient time over targets.

The French also were reported using RF-84 Thunderflashes for reconnaissance. British pilots were flying Hunter fighters and Canberra bombers, also committed previously to NATO missions.

'Cold Atoms'

USAF's Office of Scientific Research will seek comment from leading nuclear physicists on a "cold atom" theory which, if correct, might lead to super-energy bombs and space flight at velocities faster than that of light.

The Office of Scientific Research has not yet agreed to test the theory experimentally, but it has had enough interested comment from scientists contacted thus far to feel that further examination of the idea is warranted.

The theory challenges two scientific concepts—first that 459.6 F. is absolute zero, and, second, that the velocity of light (186,300 miles per second) can be exceeded. Author of the theory is Dr. Robert Leon Carroll, 40, former chairman of the Department of Physics at Fairmont State College, Fairmont, W. Va., who has been dean of academics in the pilot training division of Naval Air Test Center, Patuxent, Md., since early summer.

If the theory is correct, an atom would become less active as it grew cooler. Its electrons would gravitate toward the nucleus, and this construction would force them to move faster and faster. Making the atom cold enough, Dr. Carroll believes, would plunge the electrons into the nucleus and disintegrate it, releasing the entire energy of the nucleus.

Flight Scholarships?

The Civil Air Patrol will ask the 85th Congress for a program which will teach 2,000 cadets to fly in its second year, work up gradually to 10,000 pilots a year. The Air Force is supporting the program, and some legislators already have been sounded out. CAP did extensive research, talked to flight schools, cadets, parents and educators in formulating its plan. The program was delayed in 1955 so it would not conflict with the Air Force ROTC legislation, and the CAP has had ample time for polishing.

CAP ties flight scholarship idea to its contention that general aviation, civil aviation and military aviation are all necessary to superior airpower, and emphasizes that there is no government-supported training program now.

'The Airman'

Beginning next April 1, the Air Force will publish a new service journal designed to keep its personnel informed on the missions, training, policies and legislation that affects their jobs. The first USAF internal publication since the World War II "Air Force" was taken over by the Air Force Assn., the magazine will be distributed free of charge, with one copy for each ten personnel. Put out by the Internal Information Division, Office of Information Services and named "The Airman," it will be available through the Superintendent of Documents.

Bloodless Revolution

The pattern of supplemental air carrier associations may be in for a change as the result of a sudden switch in the management of the Air Coach Transport Assn. A dissident group headed by Amos Heacock and supported by U. S. Overseas Airlines, the Trans American Airlines carriers and other ACTA members has taken control of the organization by simply appearing in the Washington office and announcing they were taking over.

The surprise coup has caused unhappiness among many of ACTA's members, and it could result in their forming a new organization or joining ACTA's rival, the Independent Military Air Transport Assn.

ACTA's upheaval occurred after a period of quiet when it appeared that the industry had settled down as a cohesive group under the leadership of President A. J. Rome. Now Rome has resigned, along with five of ACTA's seven directors.

Apparently the split in ACTA has been building up behind the scenes for some time, and the support of Trans American gave the dissidents enough strength to take over.

—Washington staff

F-100 ENGAGES nylon net of barrier, flipping cable over main wheels. Cable has grown taut enough to tilt support posts (obscuring main wheels). As the airplane draws the cable, pins anchoring it to post are sheared, allowing cable to drag 450 ft. anchor chain.

Runway Barriers Planned for Bombers

Impressed by gear's effectiveness in saving jet fighters, USAF plans barriers for B-52, B-47.

By Evert Clark

Air Force plans to extend the use of runway barriers to medium and heavy bombers belonging to the Strategic Air Command.

It also is developing a stronger barrier for larger, faster fighter aircraft which present barriers cannot arrest.

Development of barriers for larger aircraft is an outgrowth of the successful use of 300 chain-type barriers at Air Force bases throughout the world. The Air Research and Development Command estimated last week that the barriers saved USAF $78 million in a 13-month period ending Aug. 1.

Van Zelm Associates, Inc., of Baltimore, Md., has a contract for design, prototype manufacture and testing of the bomber barriers. Testing will be carried out by USAF at Edwards AFB under contractor supervision. Target date for completion of testing is December of 1957.

WEIGHT of anchor chain, caused by dragging cable, stops the F-100. Testing was conducted by Air Research and Development Command at Wright Air Development Center.

Mid-1957 Test

All-American Engineering Co. of Wilmington, Del., is developing the system for heavy fighters.

This system is due to be tested by mid-1957.

Both developments are being supervised by the Catapulting and Arresting Section of the Equipment Laboratory at Wright Air Development Center. Section chief is Capt. John E. Snow, who helped develop the first runway barrier at a Far East Air Forces engineering depot after short runways in Korea and Japan caused an excessive number of crashes.

The bomber barrier system will use linear friction type brakes. A cable will drag a brake along a 1,000-ft. braking surface which parallels the runway. The surface probably will be similar to that used in auto and aircraft wheel brake linings.

Braking Force

Braking force of the bomber system is expected to be 113,000 lb. Peak braking force for the chain barrier is around 40,000 lb., and that cannot be sustained.

The chain-type barrier is activated when the nose wheel of the landing aircraft engages a nylon barrier stretched three feet high near the end of a runway. Nylon ribbons running vertically to a steel cable flip the cable up and over the aircraft's main wheels.

As the plane rolls forward, two pins anchoring the cable to two posts are sheared off, allowing the cable to drag 450 ft. of ship's anchor chain. The chain, stretched along each side of the runway, weighs 100,000 lb.

Since the first barrier was installed in Japan in March 1953, barriers have been used to stop T-33s, F-80s, F-84s, F-86s, modified F-89s and F-100s without external tanks. F-86Hs with tanks also have been stopped.

Tests with Convair F-102s have indicated that current chain barriers will not be adequate for heavier fighters and interceptors with their much higher landing speeds.

Why Failures Occur

An ARDC study of 13 months of operation showed that the 300 USAF barriers were used 327 times. In 205 cases, the barriers functioned perfectly and the damage was confined to the aircraft undercarriage.

The study also showed:

- **In 8% of the 327 cases,** failure was due to pilot error. For example, leaving a dive brake down can deflect the cable so that it does not engage in main landing gear.
- **In 11%** of the cases, the aircraft engaged the barrier at a speed too slow to need a barrier, and some minor damage resulted.
- **In 12%,** failure of the barrier was due to maintenance and installation problems.
- **In 11% of the total,** misses were not sufficiently explained to determine the cause.

Barrier Costs

ARDC estimated that repair costs to the 205 aircraft at $1,200 each ($600 for labor and $600 for parts), or a total of $246,000 as compared with the $82 million it would have cost to replace the planes.

Current barriers, incorporating minor refinements since the first one, are installed at a cost of $10,000 each and have paid for themselves within 15 days, ARDC estimated.

Until recently chain barriers were manufactured by the Acme Precision Products Co. of Dayton, Ohio. Advertisements for a new production contract produced two bidders, Acme and the Snow Manufacturing Co., of Westwood, N. J., a division of the Ferdinand J. Snow Machine Tools Co.

Mr. Snow is a brother of Capt. Snow, who helped to develop the runway barrier system.

ARDC Establishes New Agency To Counsel Small Businesses

Washington—Air Force's Air Research and Development Command has established a new agency to provide a one-stop counseling service for small business.

The agency, designated the Executive for Small Business, is located in the Directorate of Procurement at ARDC Headquarters in Baltimore, Md. It is headed by John C. Eiden, former administrative officer in the Office of the Director for Research and Development, Headquarters, USAF.

One small business specialist will be designated in the procurement directorate at each of 11 ARDC centers and at ARDC Field Development Offices in New York, Los Angeles and Boston. ARDC hopes eventually to have a specialist in Chicago, where there is no field office now.

ARDC defines a small business as one which is not dominant in its field and which—together with its affiliates—employs fewer than 500 persons. It also will accept as a small business any firm so designated by the Small Business Administration.

Change in Attitude

The Senate Small Business Committee said it "welcomes the Air Force announcement of its special program to stimulate small business participation in (research and development) work and recommends that the Army and Navy also place special emphasis on this particular procurement activity."

In Fiscal 1956, the committee said, only 3.7% of USAF's research and development business went to small firms as compared with 9.4% for Army and 9.9% for Navy.

In previous testimony before the committee, Assistant Secretary of the Air Force for Materiel Dudley C. Sharp classified research and development as the type of government procurement in which small business was not qualified to participate.

The report said the committee, headed by Sen. John Sparkman (D.-Ala.), "has long felt that research and development should be a fertile field for small business. . . . It is to be hoped that the steps being taken by the Air Research and Development Command will bring about a substantial increase in the number of contracts going to small firms."

It added:

"Formerly one noted a defensive attitude. . . . They seemed much more concerned with maintaining a status quo."

No 'Paper Program'

The percentage of prime contract business suitable to small firms that actually went to small firms steadily dropped from a figure of 74% in Fiscal 1953 to approximately 68% in the 1956 fiscal year.

On subcontracting, the committee noted that "present plans can channel much work to qualified small firms, but no program carries on automatically. Major prime contractors should be checked periodically to prevent the subcontracting operation from becoming merely a 'paper program'."

While the military departments and other agencies formerly spoke "derisively and contemptuously" of the Small Business Administration, the committee pointed out that this attitude has changed, and that there is now close liaison and cooperation with the small business agency.

Caution from Committee

Despite the encouraging projects that have recently been promoted in the military services, the committee cautioned:

"There is no room for complacency, since there is presently greater competition for military contracts than ever before; large firms are actively seeking contracts which were once almost the exclusive domain of smaller producers. Thus, there is a greater urgency for effective small business programs, since it is universally recognized that these small firms are not only essential for the domestic economy's well-being, but their facilities are indispensable in case of any future mobilization emergency."

Boeing Takes Option For Bomarc Plant

Seattle, Wash.—Boeing Aircraft Co. has taken an option to buy the Ford Motor Co. plant at Richmond, Calif., as a possible site for manufacture of the Bomarc long-range ground-to-air interceptor missile.

William M. Allen, Boeing president, said the option was purchased after investigation of a number of possible sites for a missile facility.

Allen said, however, no decision has been made whether to purchase the Richmond plant.

Boeing is developing Bomarc for the Air Force.

BELL XH-40 helicopter powered by Lycoming T53 engine has begun flight tests at Ft. Worth, Tex. (see page 30).

HILLER YH-32 ram jet helicopters are lined up at Hiller plant, Palo Alto, Calif., for delivery to Army at Ft. Rucker, Ala. The two powerplants of two-place, two-blade single main rotor helicopter develop 40-lb.-thrust each, weigh 12 lb. each. Air frame is welded tube with fibreglas cloth tail boom structure, fiberglas enclosure and fairing, and plexiglas forward windshield.

SIKORSKY HR2S-1W radar helicopter carries AN/APS-20E search radar in bulbous chin, will detect low-flying enemy aircraft.

Helicopters: Two Start Tests, Latest HR2S

LATEST modification to the twin-engine, five-bladed Sikorsky HR2S helicopter makes it an early-warning radar platform for Navy. Intended to detect low-flying enemy aircraft, the helicopter could be carried on an escort carrier or other ship and sent up to extend the normal radar coverage of shipboard units.

HR2S has changed considerably since prototype first flew (center). Design changes include dual wheels on all landing gear legs, dual engine exhausts, large air-cooling grilles on nacelles, redesigned rotor pylon, redesigned tail boom with relocated hinge line, relocated and redesigned horizontal tail, now all-movable.

Dorsal fin and roll in rotor differential fairing (compare top and bottom photos) were necessary because of increase in size of rotor diameter from 68 to 72 ft. and are not exclusively a radar helicopter modification.

Air Force Plans Budget Increase For Contract Technical Services

Washington—USAF's budget estimate for Contract Technical Services in Fiscal 1958 will run in excess of $111 million.

The figure, up about 24% from the $90 million spent in Fiscal 1957, reflects the Air Force's continued shortage of skilled personnel to keep modern, complex weapon systems in combat readiness.

Fast incorporation of new aircraft—such as the Century-series fighters and the B-52 intercontinental bomber—their electronic equipment and the low reenlistment rate of Air Force technicians have combined with USAF's growing size to create new opportunities for industry experts.

With the advent of more complex weapons, including guided missiles, and the expansion of aircraft control and warning facilities, the trend can be expected to continue.

Now almost nine years old, the Contract Technical Services program was shaken down last May with the issuance of Air Force Regulation 66-18. World-wide supervision of the program was turned over to the Directorate of Maintenance Engineering, Headquarters, USAF.

What Contractor Provides

Cost of the service from Fiscal 1950 through 1957 has climbed from $6 million to $90 million. The eight-year total is equivalent to the cost of 492 F-100 aircraft at $750,000 each, or 150 B-47 medium jet bombers at $2,450,000 each.

Currently, the Air Force has 156 contractors working on the program, with representatives scattered all over the world. One of the major maintenance projects of CTS is the Aircraft Control and Warning sites of the Air Defense Command. The work is divided between Philco and the Radio Corporation of America.

The contractor provides five men at each site, manned under normal circumstances by 30 to 110 Air Force personnel.

In addition to a site engineer, the company provides radar, communications and diesel experts to work side-by-side with USAF technicians.

Under the CTS program, the contractor does not confine his interest to products of his own company. He is hired to help the Air Force keep the system in operation, regardless of who made the components.

At the present time, this procedure does not apply to weapon systems, but USAF believes the evolution of CTS eventually will lead to a program passing responsibility in this field to the prime contractor, under a special CTS contract. Until then, weapon system teams will be provided for aircrew indoctrination by the component makers.

Types of Personnel

Here it is important to draw USAF's distinction between the types of personnel provided under the CTS program:

• **Technical representative** is an employe representing a manufacturer of USAF equipment. He is under contract to the manufacturers but assigned to USAF for duty.

• **Contract technician** is an employe representing a commercial firm (such as Philco or RCA) under contract to the concern but assigned to USAF for duty.

• **Field service representative** is an agent of a manufacturer or commercial concern who provides company administration to, or product liaison with, the customer or user of the company's product.

USAF spokesmen also emphasize that the CTS program should not be confused with contract maintenance, which provides a complete package based upon a work specification.

This is applied normally in the IRAN program and does not involve technical work performed by USAF personnel.

Effective at the beginning of Fiscal 1957, the Air Force put all contract technical services under a separate service contract. Previously, the services were provided by the manufacturers under terms of their production contract, which included a fee for the service figured as overhead or a percentage of the cost.

The shift away from this plan actually began in 1950 when the USAF started its post World War II influx of new equipment and found its skill levels spread thin.

In the years since, the need for Contract Technical Service has grown steadily as more new and complex equipment has been introduced and the rate of turnover of military maintenance personnel has lowered USAF's skill level.

Under the terms of AFR 66-18, each major command must have a central office to control the CTS program. The command must budget and provide funds for all of the service required on its equipment.

The amount of detail required from each command in submitting its CTS requirements has been substantially increased. This forces a careful survey to justify the requirements and provides both the command and headquarters with statistics on what is needed.

Army Orders Six YH-40 Helicopters

Fort Worth, Texas—U. S. Army has ordered six YH-40 turbine-powered helicopters from Bell Aircraft Corp. for field service testing. Several additional test programs will be started when the aircraft are delivered.

The new order is in addition to three experimental XH-40 models, the first of which has made its initial flight (AW Nov. 5, p. 23).

Production versions of the new helicopter will be used by the Army for evacuation and utility missions. The aircraft will have a cruising speed of 100 knots and carry a payload of about 1,000 lb. The YH-40 is powered by a Lycoming T53 engine.

Australians Critical of Woomera

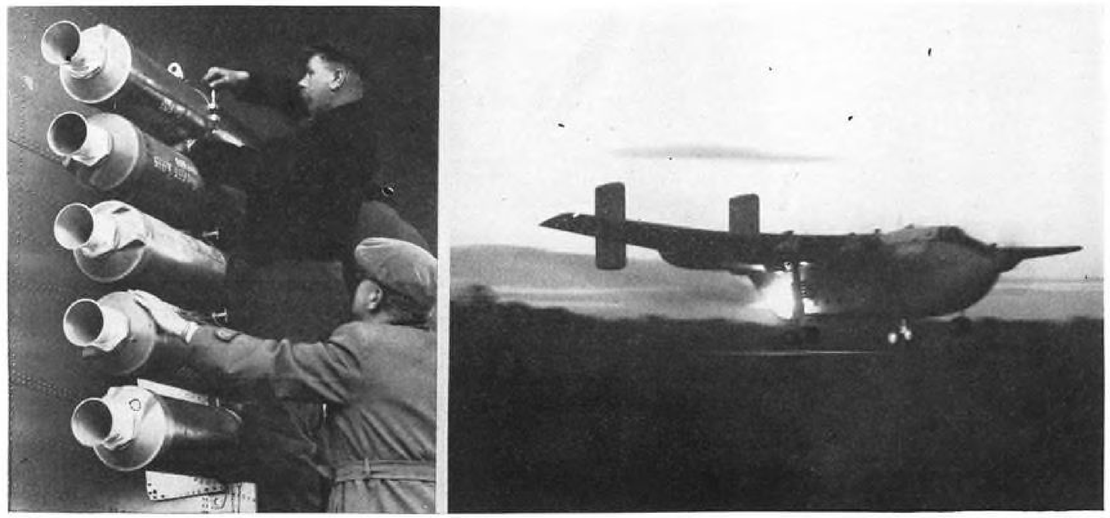
Melbourne—Australian government officials have admitted privately that the results attained with missiles at the Woomera Missile testing range have not justified large research expense.

Australia is a partner in British research work on missiles, and has spent as its contribution more than $100 million, a large sum considering the population of Australia is 9.5 million. As a result discontent is rising in Australia, and pressure is developing to force the government to revise its agreement with the British Ministry of Supply.

Australian military experts are wondering whether Australia ought not to associate itself with the U.S. missile program, which Australians consider in a more advanced stage in its practical preparedness than British work.

Unusual secrecy is being maintained at Woomera, some Australians maintain, only to hide the fact that no real achievements are being made. According to well-informed sources, the trouble is the same as that experienced with British aircraft manufacture. A number of apparently brilliant ideas were brought to a stage where extremely costly testing is proving most of them to be impractical. The long distance between Woomera and England increases the cost of the venture as everything has to be transported each way. A fleet of aircraft is being used for this purpose.

It is understood that the degree of cooperation between the various British aviation manufacturers as well as electronic equipment manufacturers and others established at Woomera is highly unsatisfactory.



Rocket Assist for Blackburn Beverley

Jettisonable rack of five Scarab rockets (left) mounted on each side of Blackburn Beverley provide total additional thrust of 35,000 lb. Each rocket achieves a momentary peak thrust of 6,000 lb. and then continues at 3,500 lb. for full takeoff. Firing time is six seconds. At maximum all-up weight of 135,000 lb., including 44,000 lb. payload, Beverley with rockets can take off or land on a 400 yd. grass or dirt strip. Initial trials included use of two and six-rocket installations.

Nine-Month Aircraft Earnings Reports Generally Show Rises

New York—Aircraft industry sales and earnings for the first nine months of 1956 moved generally upward, with some individual companies setting all-time highs. Some companies, however, reported sales had increased, but earnings had fallen.

Curtiss-Wright Corp. reported a net profit of nearly $31 million for the nine-month period, an increase of about $7 million from 1955. The report caused a spurt in Curtiss-Wright stock.

Consolidated net sales of General Dynamics Corp. for the nine months were higher than all of 1955, and sales and earnings were higher than any comparable period in the corporation history. Lockheed Aircraft Corp. backlog rose to $1.5 billion, 34% higher than a year ago, but sales and earnings were down.

Borg-Warner's earnings were down from last year, $21,765,742 compared with $26,076,149 in 1955, but this was laid to the effect of the steel strike, a "difficult price situation" in appliances, automobile cutbacks, reduced home building and a lag in the farm equipment industry. The company said sales of aircraft equipment increased.

Nine-months financial reports included:

• **Lockheed Aircraft Corp.** sales of $514 million were 2.2% below last year, and earnings of $10 million or $3.83 a share were lower than the $13 million and $4.73 a share figures reported for the same 1955 period. Development costs for the Electra transport caused the lowered earnings.

• **General Dynamics.** Sales totaled $691 million, compared with $506 million for the same period last year. Net income of $21 million or $4.13 a share included a non-recurring profit of $2 million from the sale of the Stromberg-Carlson Broadcasting Corp. Net last year was $13 million or $2.69 a share.

• **Curtiss-Wright Corp.** announced net profit of $30,912,561 compared with $24,012,833 for the same period last year. The company said unfilled orders of Curtiss-Wright and subsidiaries totaled approximately $770 million as of Sept. 30.

• **Borg-Warner Corp.** reported earnings of $21,765,742 or $2.47 a share compared with $26,076,149 or $3.29 per share last year. Nine-month earnings for 1956 included B-W's York Division for the first time.

• **Avco Manufacturing Corp.** announced a loss for the nine months of $3,499,529 after a $16 million reserve for losses was taken out of earnings. Avco announced it would sell its appliance divisions and concentrate on defense work.

• **Firth Sterling** reported sales 50% above the first nine months of 1955. Net income was $567,700 compared with 1955's $68,000.

• **Associated Spring Corp.** earned $2,341,599 for the nine months, a gain of 3% over last year's $2,264,884.

• **Boeing Airplane Co.** announced a quarterly cash dividend of $.25 per share plus a stock dividend of 2%. Sales for the nine-month period ending Sept. 30 were $671,628,000, an increase of $82,912,000 over the similar period last year. Net earnings were $22,971,000 as compared with $20,333,000 for the first nine months of 1955. Total backlog as of Sept. 30 was $3,230,000.

• **Air Reduction Company, Inc.** net income of $11,608,688 for the first nine months was higher than the entire record-high 1955 net and 29% above the $8,354,767 net for the same period last year. Sales at the three-quarter mark were $123,780,975 compared with nine-month sales of $109,534,996 in 1955. Quarterly dividend was $.50 per share.

• **Chance Vought Aircraft Inc.** had a net income of $1,994,838 on sales of $77,147,535 for the first nine months. Backlog is $489,400,000.

• **General Controls Co.** reported nine months sales of $20,014,641 as compared with $19,249,458 for the same period last year. Net income was $1,011,472, down from last year's $1,156,664. However, company officials expect fourth-quarter income to push the 1956 total above the all-time high of 1955.

• **Kawneer Co.**, aluminum fabricators, had a sharp increase in third-quarter earnings which brought net income up

to $923,895 for the first nine months of 1956. Over the same period last year, earnings were $1,482,396.

• **Bell Aircraft Corp.** reported a slight increase in sales and a slight decrease in net income for the nine-month period. Sales were $156,197,799 compared with $154,502,403 for the same period in 1955. Net income was $4,489,053 with income in the same period last year amounting to $4,547,756. Per share earnings for the first nine months of 1956 were $1.73 compared to $1.75 per share earnings for the three quarters of 1955. Backlog of unfilled orders at Sept. 29 was $175,000,000 compared to $241,000,000 for the like period of last year.

Dividend payments:

• **Ryan Aeronautical Co.** declared a quarterly dividend of 10 cents per share plus an extra dividend of 10 cents per share on common capital stock.

• **Fairchild Camera and Instrument Corp.** 25 cents per share cash dividend payable Nov. 22 to stockholders of record Nov. 1.

• **Beech Aircraft Corp.** 30 cents payable Oct. 26 to stockholders of record Oct. 16.

• **Servomechanisms Inc.** 10 cents payable Nov. 15 to stockholders of record Nov. 1.

• **Aeroquip Corp.** a 10-cent dividend payable Dec. 3 to stockholders of record Nov. 15.

• **Aro Equipment Corp.** 25 cents payable Oct. 15 to shareholders of record Oct. 3.

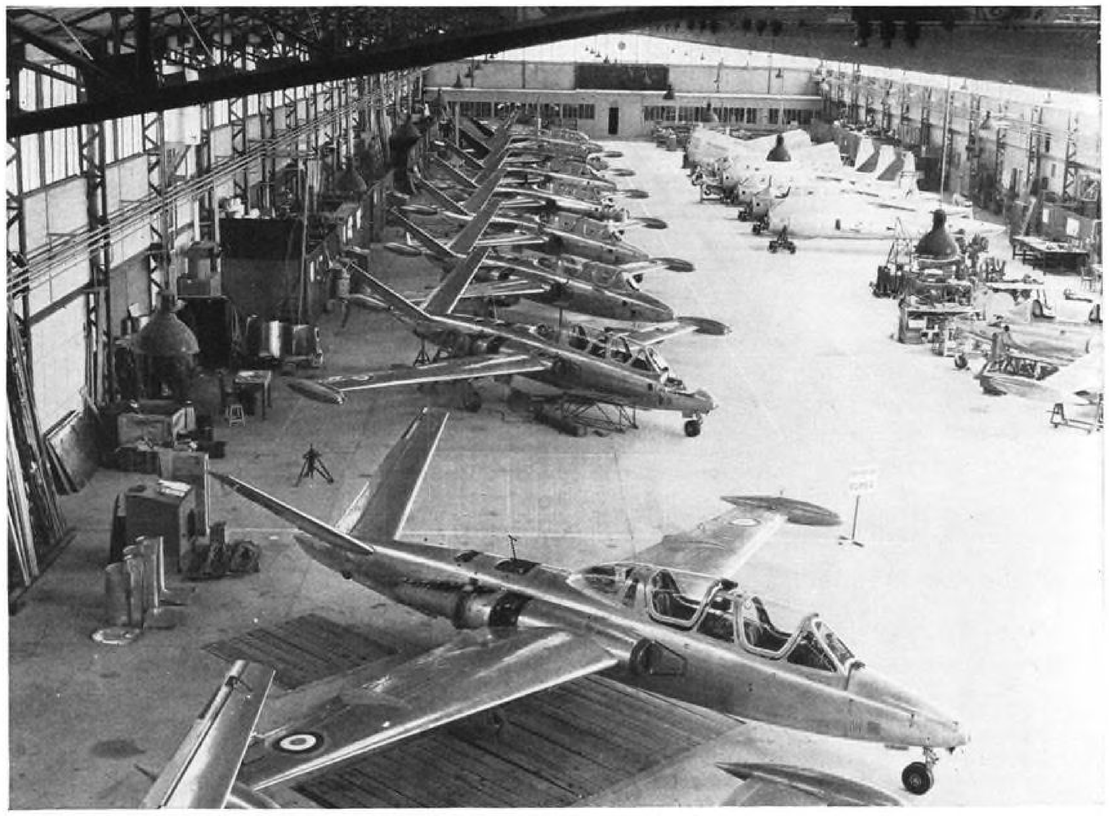
Processing Begins on Data for Curtis Study

Washington—Data comprising the largest and most comprehensive survey of business, private and agricultural aircraft activities yet made is being processed for presentation late next month to Edward P. Curtis, President Eisenhower's special assistant for aviation facilities planning.

The information was collected during a 48-hour survey of general aviation flying made at 900 selected commercial and municipal airports throughout the U. S. by approximately 1,000 volunteers. About 240,000 questionnaires were distributed by the General Aviation Facilities Planning Group, comprising the leading organizations representing private, business and agricultural pilots and operators.

More than 100,000 questionnaires have been returned and are being tabulated and analyzed by data processing machines.

The survey, directed by Booz, Allen & Hamilton, a research firm retained by GAFPG, is designed to aid Mr. Curtis in deciding future facilities required by general aviation. This category comprises all activities not involving airlines or the military services. The survey covered 15% of the nation's 6,000 airports and is expected to provide the most up-to-date and most accurate information available relating to private, business and agricultural flying. Industry and government planners have often stated that lack of such data has been a serious handicap in determining general aviation's true role in the overall industry picture.



Fouga Magister Trainer in Production

Fouga CM 170R Magister jet trainers are in production at Air-Fouga factory at Blagnac, France. Of the 325 airplanes of this type to be built, 195 are for French air force. Experimental versions, the CM 171 and 172, will be powered by the Turbomeca Gabizo turbojet of 2,500 lb. thrust. First experimental prototype will make its maiden flight soon. It is destined for high altitude testing of the engine, which has reached 53,600 ft. with afterburner in a Canberra test bed.

RB-66 Refueling

Douglas B-66B bomber, RB-66B and RB-66C reconnaissance versions, have refueling capabilities built in. Probe and drogue method is used. An example of range extension using refueling: B-66 refueled 875 mi. east of Hawaii on a 2,560-mi. flight from Long Beach, Calif., to Hawaii. B-66 series aircraft are in 600-700 mph. class, designed to operate up to 45,000 ft. altitude.

CAB Blames Stall In Executive Crash

Washington—A low altitude stall caused the fatal crash of an executive Lockheed PV-1 on Long Island last January, according to the Civil Aeronautics Board.

The PV-1 crashed eight minutes after taking off from MacArthur Field on a flight in which a new pilot was to be checked out for the Swiftlite Aircraft Corp., which owned the aircraft. Swiftlite is a subsidiary of Cities Service Oil Co., and the three pilots in the aircraft were employes of the company.

After takeoff the aircraft was seen over Smithtown, Long Island, N. Y., at an altitude of 2,500-3,000 ft. Witnesses saw the PV-1 dip down and pull up, then fall off to the left, make two or three turns of a descending spiral and crash about three miles west of Smithtown. All three pilots were killed.

The CAB found that the pilot apparently let the aircraft stall while practicing familiarization maneuvers and that the stall occurred at an altitude too low to permit recovery.

San Francisco Wins Airport Fee Fight

San Francisco—San Francisco International Airport has won its long fight to peg airport use fees high enough to meet costs of operating the airfield.

Nine airlines have agreed to negotiate new contracts which would call for higher fees and—for the first time—would permit adjustment of the fees to meet rising costs. They also agreed to higher interim fees until the contracts are worked out.

The fees cover use of the field and the terminal.

The voluntary settlement ends a battle over fees which the city took to the U. S. Supreme Court. The city attempted unsuccessfully, through the courts, to modify the 20-year lease it signed in the 1940s with Trans World Airlines.

This lease, and one with United, called for low fees which no longer were commensurate with the various facilities used by the airlines, the airport contended.

Agreement to negotiate new contracts came from TWA, United, American, Flying Tiger, Pan American, Qantas, Slick, Southwest and Western. Three lines using the airport held back—California Central, Pacific Southwest and Japan—but the airport does not expect them to hold out.

The airline may have capitulated at this time because attention is focused on the improved airport facilities that will be added if a $25 million bond issue is approved—improvements which the city said would widen the gap between what the airlines get and what they pay for it.

How New Congress Will Look In Wake of Last Week's Election

Washington—Last week's congressional elections will bring few changes in the civil and military aviation leadership on Capitol Hill. Two notable exceptions:

• **Sen. James Duff (R.-Pa.)**, a top defender of the Eisenhower administration's airpower program, was defeated. Duff has been an active member of the Armed Services Committee and the Airpower Subcommittee, headed by Sen. Stuart Symington (D.-Mo.). His defeat probably will weaken his role in the drafting of the subcommittee's report later this fall. Extensive hearings were held last summer, but the report was postponed until after the election in a move to make it non-political.

• **Rep. Dewey Short (R.-Mo.)**, ranking Republican on the House Armed Services Committee and a veteran of 24 years in Congress, apparently was defeated by a young Democrat, Charles H. Brown. Short has given strong support to both USAF's strategic air program and the Navy's carrier program.

Two other highlights were:

• **Sen. Warren Magnuson (D.-Wash.)**, chairman of the Senate Commerce Committee, was re-elected by a sweeping majority. He sponsored Joseph Adams as a member of the Civil Aeronautics Board.

• **Jacqueline Cochran,** aviatrix and wife of Atlas Corp. president Floyd Odlum, was defeated in her try on the

Republican ticket for the seat of Southern California's 29th District by Democratic Judge D. S. Saund, an American-born Hindu. The seat has been held by a Republican, Rep. John Phillips, for 14 years.

Committee Picture

This is the picture for congressional committee on civil and military aviation next year:

• **Senate Commerce Committee.** In addition to Magnuson, the four other Democrats up for re-election won: A. S. Mike Monroney (Okla.), chairman of the Aviation Subcommittee; Sen. George Smathers (Fla.), Sen. Sam Ervin (N. C.) and Sen. Alan Bible (Nev.), protege of the late Sen. Pat McCarran who co-authored the 1938 Civil Aeronautics Act. The only change on the Democratic side will be Sen. Price Daniel whose election as Texas governor leaves a vacancy.

On the Republican side, Sen. John Marshall Butler (Md.) was re-elected, but Sen. Duff's defeat leaves a vacancy.

• **Senate Armed Services Committee.** The defeat of Duff and Sen. Herman Welker (Ida.) leaves two vacancies for new members on the Republican side. On the Democratic side, the only member up for re-election—Sen. Ervin, a member of the Symington Subcommittee on Airpower—was victorious.

• **House Commerce Committee.** There will be five changes in the leadership next year, three of them caused by the deaths of Reps. Percy Priest (D.-Tenn.), William Granahan (D.-Pa), and Carl Hinshaw (R.-Calif.). In addition, Rep. Arthur Klein (D.-N.Y.) and Rep. James Dolliver (R.-Ia.) have been replaced.

Rep. Oren Harris (D.-Ark.) will step into the chairmanship. Rep. John Bell Williams (Miss.) and Rep. Peter Mack (Ill.). Other top Democrats on the Committee, were re-elected. Rep. Charles Wolverton (N. J.), ranking Republican member, and three other top Republicans, Rep. Joseph O'Hara (Minn.), Rep. Robert Hale (Me.), and Rep. John Heselton (Mass.), were re-elected.

• **House Armed Services.** The entire top Democratic leadership was re-elected, including Rep. Carl. Vinson (Ga.), chairman; Rep. Overton Brooks (Ala.), Rep. Paul Kilday (Tex.), Rep. Carl Durham (N. C.), Rep. L. Mendel Rivers (S. C.), Rep. Philip Philbin (Mass.) and Rep. Edward Hebert (La.).

Short's defeat will make Rep. Leslie Arends (Ill.) the top Republican on the committee. Rep. W. Sterling Cole (N. Y.) and Rep. Leon Gavin (Pa.), two other Republican members, were re-elected, but Rep. Leroy Johnson (Calif.) was replaced by a Democrat from California's 11th District.

• **Appropriations Committees.** The leaders on commercial and military aviation appropriations were all re-elected. On the House side, this includes Rep. Clarence Cannon (D.-Mo.), Rep. George Mahon (D.-Tex.); Rep. Harry Sheppard (D.-Calif.); Rep. Albert Thomas (D.-Tex.); Rep. Prince Preston (D.-Ga.); Rep. Daniel Flood (D.-Pa.); Rep. John Taber (R.-N. Y.); Rep. Richard Wigglesworth (R.-Mass.); Rep. Errett Scrivner (R.-Kans.); and Rep. Cliff Clevenger (R.-Ohio).

On the Senate side, Sen. Lister Hill (D.-Ala.), an aggressive advocate of airpower and the only high-ranking Appropriations Committee member up for re-election, won his fight.

Other key aviation figures re-elected include Rep. Emanuel Celler (D.-N. Y.), who heads the Judiciary Subcommittee investigating monopoly aspects of air transportation, and Rep. Melvin Price (D.-Ill.), a vocal critic of the airpower policies of Secretary of Defense Charles Wilson.

Lockheed to Enter Nuclear Research

Palo Alto, Calif.—Lockheed Missile Systems Division will enter the field of atomic research. This research will be conducted at Stanford Industrial Park in a 14,000 sq. ft. building expected to be completed next year.

The nuclear facility will be a zero power assembly, defined as a reactor that does not have cooling equipment, so that it can only be operated for short periods of time. The assembly, which will be located in a room about 25 ft. below ground, will be part of a laboratory where experimental reactor components will be assembled for testing under simulated operating conditions.

In addition to the zero power assembly, the new laboratory will contain at ground level, a three-million-volt Van de Graaff high-current, horizontal, positive ion accelerator, which will be used for research and development engineering of reactor components and systems of components.

Finland Orders Gnats

London—Finland has signed a contract for Folland Gnat fighters with deliveries to begin next year. Order for Bristol Orpheus powered Gnat follows $8 million order by India placed in September.

Order includes spares and spare engines. Bristol announced Orpheus 2 which will go into production for Gnat next year has completed its 4,520 lb. thrust type test. Company said that in order to gain approval of necessary temperature ratings, the engine was run at Orpheus 3 ratings which resulted in observed thrust over 5,000 lb. during the whole of running at takeoff rating.

$10.7 Million Program Set for Wayne Major

Detroit—Wayne County Major Airport has announced a $10,721,228 construction program, including a terminal building with hotel accommodations.

Leroy C. Smith, county highway engineer and manager of Wayne County Major, said construction will start next spring and will be completed by October of 1958—the approximate date of American Airlines shift from Willow Run to Wayne Major.

Included in the program is an entrance drive to the terminal from the Edsel Ford Expressway, but construction on this turnoff will not start until 1959 and will take an additional $1 million.

Construction will be financed by federal, state and county funds plus $3.5 million from revenue bonds to be issued next year. The federal government will contribute $2,385,614, the state of Michigan $1.25 million and the county $2,585,614. All but $3,320,000 has been committed and this sum is expected to come in the 1957-1958 budgets of federal, state and county governments, according to Smith.

A total of $12 million has already been spent on the airport which is now used by Pan American World Airways and a number of non-scheduled airlines. American Airlines and the KLM Royal Dutch Airlines plan to move from Willow Run.

The terminal building will be four stories high.

Persons leaving on an airline will enter the building from a ramp which takes their automobiles to the front door. Ticket counters and baggage facilities are located just inside the front door. Another road, under the entrance ramp, will pass by the exit door of the terminal. Incoming and outgoing traffic will not use the same doors.

On the third floor there will be 48 single rooms with baths for persons spending the night at the airport. Conference rooms with facilities for serving meals will be located on the third floor.

Paved parking for 3,000 vehicles will be provided and a 600-ft.-long "finger" with spaces for boarding and leaving six aircraft will be built.

According to Smith the program will complete all planned items for aircraft landing facilities—but the major runway can still be lengthened from the current length of 7,892 ft. to 10,000 ft. if new jet airliners require it.

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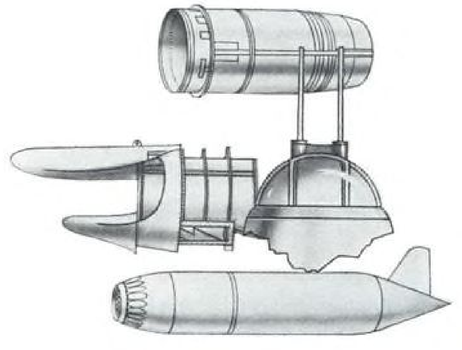

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News Digest

Hamilton Standard Division of United Aircraft Corp. received CAA approval for a new hollow extruded aluminum propeller blade. It will be used on Lockheed Electras and 1649A Constellations. The blade has a synthetic sponge filler for support and is nickel plated for resistance to erosion.

Nucleus of Navy's first 1,000 mph. carrier fighter squadron is training to fly the Chance Vought F8U-1 Crusader. To date, 15 Navy jet pilots have completed a familiarization course on the plane's cockpit, fuel system, and engine and have been briefed by company test pilots on takeoff, flying and landing techniques.

Brazilian air force will receive 14 Lockheed P2V-5 Neptunes by special agreement with the U.S. To be used primarily for training and coastal patrol work, the planes are part of a new plan for re-equipment of the Brazilian air force.

NATO's latest all-weather jet interceptors, North American F-86s assembled in Italy, are arriving in increasing numbers at the First French Tactical Air Force base at Lahr, Germany.

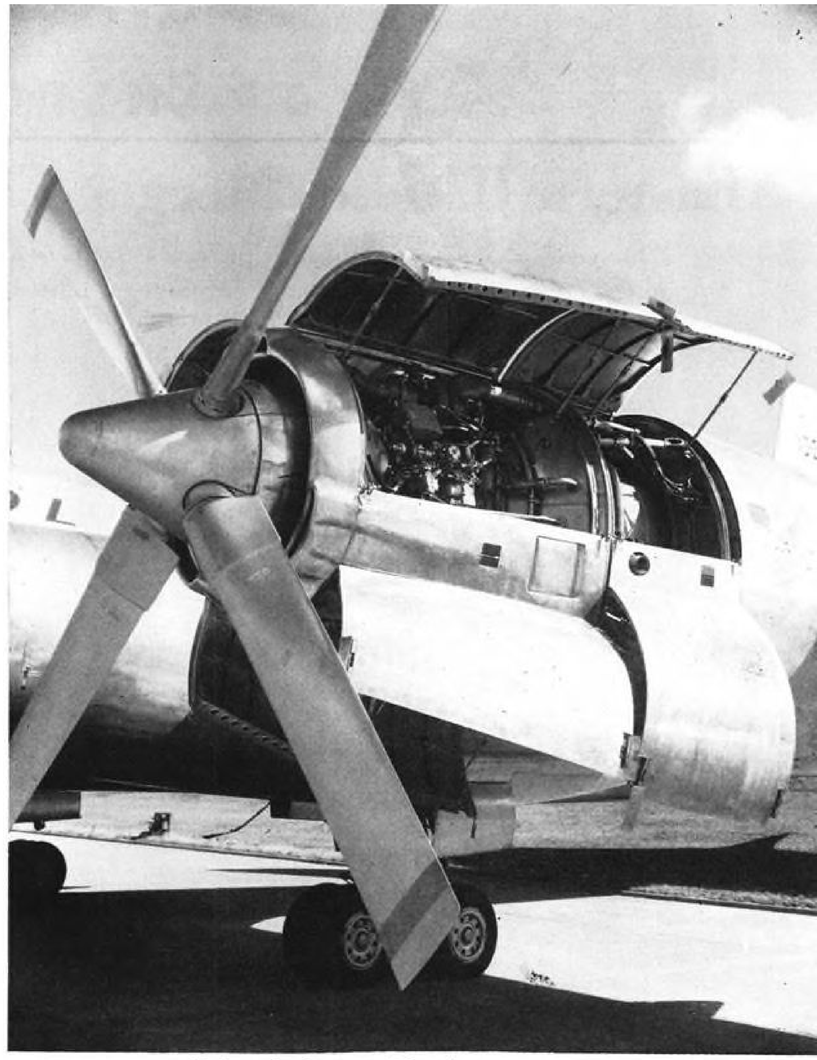
Lockheed Aircraft Corp. Marietta Georgia plant has begun work on tooling, fixtures and jigs for its F-104B Starfighter and for McDonnell's F4H-1 and F-101 Voodoo.

Marine Squadron VMF 122 became the first marine squadron to qualify aboard a Forrestal class carrier and is now operating from the USS Saratoga.

Lockheed's California Division has received a $70 million Navy order for its T2V-1 Seastar, extending production of the two-place jet trainer well into 1958. The trainer, now undergoing check flights at the Naval Air Test Center, Patuxent River, Md., is scheduled to enter service with the Naval Air Training Command in January.

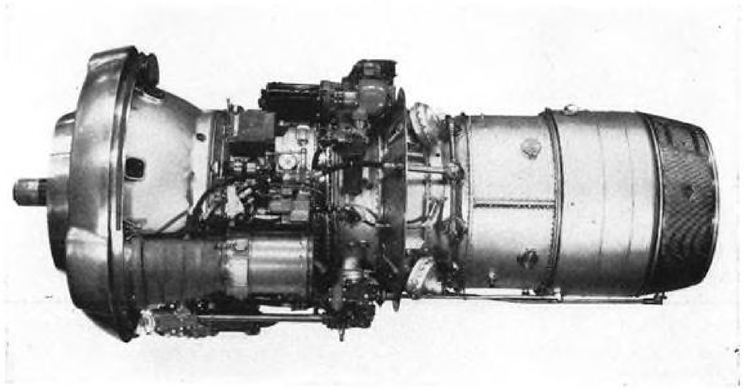
Robert J. Woods, designer of the Bell X-1 rocket research plane, the Bell X-5, and the P-39, died Nov. 3. He had just been named director of engineering and sales of Bell's Aircraft Division.

Hawker Aircraft's chief test pilot, Squadron Leader Neville Duke, is leaving the company because of recurring effects of a spine injury he received more than a year ago in a Hunter emergency landing. In 1953 he flew a Hunter at 727.6 mph. for a world speed record.



Bristol Orion Turboprop

Bristol BE25 Orion turboprop, now running on a test bed, will power later versions of the Britannia 300 series. The supercharged turboprop develops a constant 4,400 shp. from sea level to 15,000 ft. and has a cruising horsepower of 3,700 eshp. at 30,000 ft. Left side of unmounted engine is shown at bottom. Sixty BE25s have been ordered by British Overseas Airways Corp. for Britannia installation. It also is scheduled to power the Bristol/Canadair project for a 102-seat transatlantic airliner providing nonstop service each direction. The engine is 9 ft. 4 in. long and 41 in. diameter at the intake flange.



Eastern Handles Merger Complexities

Four-year delay in Colonial purchase approval aggravates equipment problem; employes retained.

By Glenn Garrison

New York—Eastern Air Lines is about half-way through the complex process of absorbing the personnel, aircraft, ground facilities and route-miles acquired from Colonial Airlines.

Eastern officials expect the integration to be complete by the middle of next summer. At that time Colonial, now keeping its name as a division of Eastern, will lose its identification.

Constellation equipment with Eastern markings already is flying to Bermuda and Montreal over the Colonial routes. By this spring, newer planes will serve these points and Martin 4-0-4s will begin replacing the DC-3s and DC-4s, still in Colonial colors, which operate between the 28 northeastern cities in the former Colonial system.

Market Potential

Linking Canada and Bermuda into its route pattern is the outstanding benefit to Eastern in its acquisition of the smaller airline, and its major competitive efforts will be made over these runs. But increasing business also is expected from other cities on Colonial routes that fit handily onto Eastern's structure.

Market potential in the area is considered by Eastern to be good, with industrial development brought about by the St. Lawrence seaway project an important factor in the region's economy. Tying the smaller points on the Colonial system into Eastern's long-haul pattern is expected to put them on a more profitable basis.

The initial Eastern-Colonial purchase agreement was made in July 1952. Four years passed before final presidential approval of a second agreement became effective June 1, 1956. During the interim, the first agreement, approved by the Civil Aeronautics Board, was disapproved by President Eisenhower in view of the Board's additional finding that Eastern unlawfully controlled Colonial stock. Following a subsequent CAB Office of Compliance report, the Board in May 1955, found that Eastern had terminated such control. The President then approved the second agreement.

Initial Agreement

When Eastern was free to go ahead with the consolidation, the carrier faced some major difficulties:

• **Obsolescence** of Colonial's aircraft and ground equipment which had occurred during the period of waiting. Its future uncertain, the smaller carrier could make no long-range plans, commit itself to no major investments.

• **Training** Colonial's 800 employes in Eastern procedures and policies. As a large, complex organization with 100 stations in its route pattern and 13,000 employes, Eastern's methods and equipment differed greatly from the relatively simple operation Colonial employes were used to.

• **Need for careful** handling of the employe morale problem, so that Colonial people would be assured from the start that their jobs were protected and their opportunities equal with regular Eastern employes.

• **Qualifying pilots** in equipment and routes they would be flying under assignments based on a merged seniority list. This involved checking out many of Colonial's 119 pilots on bigger Eastern aircraft, and some of Eastern's 1,150 pilots on Colonial DC-3s and DC-4s.

• **Settling labor union** problems arising from the transfer of various classes of employes. Some union matters are still before the National Mediation Board.

• **Keeping** the two airlines running while integration was taking place.

Eastern's first job after the go-ahead came was to find out exactly what shape its new property was in, and a survey team of department heads toured the Colonial system. They found that Colonial had been forced to let some things slide during the waiting period.

Detail Survey

The team rode in a Carey limousine between Colonial stations, most of which are 60 to 120 mi. apart, and carried tape measures, cameras and other equipment for an inch-by-inch survey. They found an immediate need at many stops for equipment to handle new airplanes: passenger steps, energizers, numerous ramp items as well as office facilities.

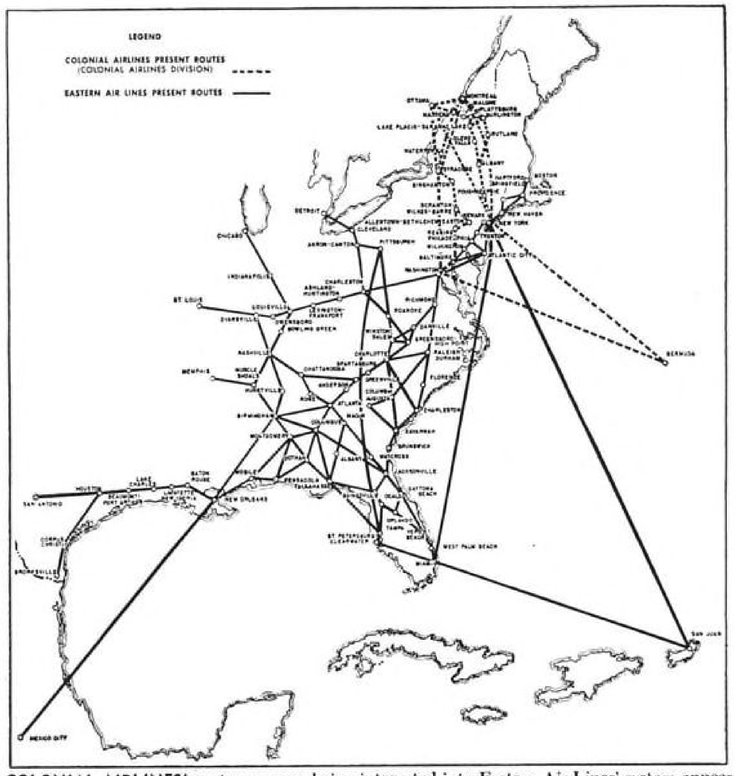
Improvement of Colonial ground facilities alone will cost about $2 million, according to Eastern's treasurer, Thomas E. Creighton.

The survey turned up many important differences between Colonial and Eastern procedures. For example, Colonial passed control of space among several stations, whereas only one Eastern station controls space for each flight. Message systems were different in codes and structure. Teletype equipment required changeover, and as of Nov. 1 all former Colonial stations except Montreal and Ottawa began using the 81-D-1 teletype standard with Eastern.

By way of illustration, the agent at a Colonial flag stop used to come in on Monday morning and find all messages to every point on the system on his teletype machine, accumulated over the weekend. With the newer equipment, only messages addressed to a particular station will appear.

The items that required changeover included everything from reservations records (Colonial used charts, Eastern uses cards) to ground radio aids.

EASTERN AIR LINES' Super G Constellation is type of equipment the carrier plans to put into New York-Montreal service by next spring. The route was added to Eastern's system through acquisition of Colonial Airlines.



COLONIAL AIRLINES' routes are now being integrated into Eastern Air Lines' system appear as dotted lines above. Colonial, operating as a division of Eastern since the consolidation became effective June 1, will be completely integrated with Eastern by mid-summer, 1957.

Next task was to put all the required changes on paper for analysis and coordination. Each department drew up its integration plans, working with complete books of photographs, drawings and data covering Colonial stations and facilities. Joint meetings were held with Colonial traffic and sales, operations, and accounting personnel and procedural changes were spelled out.

During this phase, all managerial personnel in Colonial's operations were advised as to their new titles and pay scales in the integrated system. Similar information also went via the supervisors to the rank and file Colonial employes. Preferences as to jobs and locations were honored wherever possible.

Manager's Choice

For example, the former Colonial station manager at Philadelphia—one of the four cities overlapped by the existing Eastern route pattern—chose to manage another Pennsylvania point rather than serve as assistant manager at Philadelphia.

Next, space control was taken from other Colonial cities into the New York office, and on Oct. 1 physical integration began as all reservations records were shifted to Eastern's offices. At the same time, Colonial traffic and reservation personnel in New York, Washington and Philadelphia also moved over to Eastern.

Indoctrination of personnel began well before the move, however, and other training still is going on over the former Colonial system. The Colonial agents who went into Eastern's New York headquarters attended school full-time for a week prior to the move, and during that time regular Eastern reservations employes were handling all calls that would have gone to Colonial in addition to their own.

Another phase of the training program began last month when five Colonial reservations people from Montreal spent a week at various large cities on Eastern's route, beginning at St. Louis as the station most nearly resembling Montreal facilities. Five additional Colonial employes are scheduled each week for a similar tour, which includes an inspection of Eastern's Miami base and flights on all types of Eastern aircraft.

Another reshuffling was necessary in Eastern's sales territories. Upstate New York, formerly covered by Eastern's New York City office, now is handled through a new sales office in Syracuse. Another example is the territory north of Boston in New England, Canada and Nova Scotia, formerly covered by Eastern from Boston and now split among former Colonial sales managers in the area.

The problem of qualifying and assigning pilots on the integrated routes has been formidable. Seniority lists of the two airlines were merged as part of the acquisition procedure, with equal rights for pilots of each carrier. Bidding by crews for desired runs, awarded on the basis of seniority, meant some junior Eastern pilots shifted to Colonial runs to make way for senior Colonial pilots on the Eastern system. Some Eastern pilots asked for Colonial runs.

Net result was that some pilots of both carriers were checked out in different equipment. Ten Colonial DC-4 captains, for example, drew assignments to Eastern Constellations, and had to be replaced by both Colonial and Eastern pilots, which meant requalification.

Equipment Change

Not only were operating methods of the two carriers different in such matters as flight planning and radio procedures, but flight equipment had to be changed on some Colonial aircraft and training given in its use. Eastern installed new instrument panels on six Colonial DC-4s to standardize them with other Eastern planes.

Target date for ending the training covering seniority assignments is Dec. 1.

Under their new Air Line Pilots Assn. contract now covering all Eastern pilots, Colonial crews are generally taking home more money. Biggest increase reportedly was $4,000 a year gained by a Colonial DC-3 junior copilot now an Eastern DC-7 copilot.

As for the general personnel situation, William L. Morrisette, Jr., Eastern vice president-traffic and sales explained, "We had to make sure the Colonial people didn't feel they were being swallowed by a giant."

This was accomplished, according to both Eastern and former Colonial officials, by scrupulous attention to the welfare and wishes of Colonial personnel.

L. Orville Cameron, former vice president and secretary of Colonial and now a Colonial Division official, said no former Colonial worker is making less money or holding down a lesser job in the integrated company. Of the 800 Colonial employes fitted into Eastern's organization, fewer than 10 have found any problems to contend with, Cameron reports. Relocations have been held to a minimum and in many cases have been made at employe request. Salaries and fringe benefits are better. When the New York sales staff went over to Eastern, more than 80% received promotions, Cameron says.

Cameron points to a paragraph in the purchase agreement which guaran-

Braniff Begins DC-7C Service

'El Dorado' DC-7C domestic service was inaugurated Oct. 20 by Braniff Airways. Braniff, along with Delta Air Lines, is gaining foothold in new route between New York and the south. Delta has ordered DC-7Bs for delivery in spring.

tees Colonial employe rights, and CAB attached a provision to its approval of the purchase which further insured this protection. With careful handling the transition has been remarkably smooth, according to Cameron. With expansion rather than retrenchment in store and with only four duplicated cities on the combined routes, no layoffs are involved and additional hiring is taking place.

With respect to unions, the situation is somewhat complicated. There were 250 traffic and reservations people represented by a union contract with Colonial which expired Oct. 1. The Eastern people in this category (about 4,000 of them) are not unionized and Eastern wants to keep it that way. The matter is now before the Federal Mediation Board.

Labor Negotiations

Negotiations are under way to consolidate the union contracts of two other classes of Colonial employes—flight attendants and mechanics—with similar contracts already covering Eastern employes.

The mediation board also is considering representation of 13 Colonial mechanical supervisory people, and the status of seven communications employes is under negotiation to decide which union shall represent them in their Eastern employment. Pilot's ALPA contracts have been consolidated.

Integrating Colonial into its system has involved virtually every facet of Eastern's operation. In its advertising, for example, there has been the problem of merging Colonial's identity with Eastern's. In Colonial territory, ads which featured "COLONIAL AIRLINES—a Division of Eastern Air Lines," now have become "Colonial Airlines—a Division of EASTERN AIR LINES." New billboards in Montreal six months from now will refer simply to Eastern.

Advertising lineage has jumped since Eastern took over. In Montreal ad lines in newspapers have increased from 400 to 1,000 every other week; in smaller cities where advertising formerly was sporadic, Eastern is now placing 200 lines once a week. Eastern is stressing Montreal and Ottawa service in big ads and plans an 1,800-line ad this winter selling Bermuda service.

Prospects for developing the new route, once facilities and equipment are brought up to date, are considered excellent by Eastern officials. Creighton foresees a growth at least equal to the expected 12% yearly over the rest of Eastern's system. Cameron thinks business over the U. S.-Canada segments will bring in revenues 50-100% higher within the next few years.

With only 40 duplicated route-miles in the two systems, their merging provides "built-in economies," according to Cameron. With the average return on tickets sold at smaller stations increased because of longer hauls over the Eastern systems, those stations will pay more of their own way. Longest haul in the old Colonial domestic system was the 325 mile New York-Montreal run, a segment that produced half of the domestic revenue, according to Cameron.

Newer Equipment

More modern equipment is expected to pay off particularly in the New York and Washington to Bermuda service (Colonial didn't fly to Bermuda from Washington, but Eastern will). How vital equipment is in this competitive service is illustrated, according to Creighton, by the fact that Colonial lost money with DC-4s on the run, moved into the black when it leased Constellation 749s from Eastern.

Plans now call for DC-7B or Super G Constellation equipment on the Bermuda run by spring. By that time, similar "Golden Falcon" aircraft are scheduled to go into Montreal service.

Planned introduction of about 20 Martin 4-0-4s over other former Colonial segments this spring will increase lift about 50% and provide faster service. The 4-0-4s won't be able to get into all Colonial airports on an unrestricted basis, however.

At Poughkeepsie, N. Y., maximum allowable gross is 36,400 lb., which means an Eastern Martin could only handle 10 passengers there under the best conditions. Six other airports have less serious restrictions. Eastern is working with community officials toward improvements, however, and reports a cooperative climate.

Long Delay

When the first agreement with Colonial was signed in 1952, Eastern said, the equipment situation was good, with Super Constellations and 4-0-4s immediately available. During the wait, however, the equipment situation tightened and it remains for arrival of Eastern's Convair 440s, beginning in February, to ease the situation. The 440s will go into original Eastern routes at first, partly to simplify the training problem, Eastern says.

On the maintenance side, line work on Colonial aircraft will continue to be performed at LaGuardia Airport, where the two airlines have shared a hangar for some time. Former Colonial mechanics are still handling maintenance of the division's aircraft, inasmuch as Eastern had no setup for taking care of DC-3s. Later on, new facilities at Idlewild, in addition to existing facilities at Newark, will be available. Eastern will sell the obsolescent Colonial aircraft and no distinction will remain between planes of the integrated fleet.

Airlines Attack N. Y.-Florida Decision

By Craig Lewis

Washington—Major airlines made a series of attacks against the Civil Aeronautics Board's New York-Florida route awards last week in asking the Board to reconsider its decision.

Northeast became the major winner in the big New York-Florida Case when it was awarded a new route between northeastern cities and Florida points.

This award is the focal point of the attacks made by the other major carriers in the case.

Two airlines—Capital Airlines and Pan American World Airways—are willing to accept certification of Northeast on the route, but they insist there is a need for a fourth carrier.

National Airlines and Eastern Airlines, which currently compete for New York-Florida traffic, continue to insist that there is no need for a third carrier on the route.

Eastern told the CAB that present service on the East Coast routes is adequate, and that it will be improved with the new equipment ordered by Eastern and National.

Eastern's Contention

The carrier also questioned the wisdom of increasing competition in the area, pointing out that three-carrier competition fostered by the Board in the Southwest-Northeast Case has resulted in financial losses for Eastern, Delta Air Lines and Capital Airlines on the New York-New Orleans route involved.

Eastern said the failure of the CAB to add Norfolk to its system deprives the city of competitive service to points in the South and Southwest. The carrier also said the Board made several procedural errors in its handling of the case, including the new practice of releasing the decision in a press release before the opinion and order was ready.

National calls the Board decision to certificate Northeast on the route to Florida "a colossal gamble in which National's future is wagered on the assumption that present economic trends will continue unabated." The airline predicts serious diversion of its revenues if a third carrier is permitted to operate along the East Coast.

National said competition from a third carrier threatens "the further aggressive development of service" and asked the CAB to withdraw Northeast's new route authority.

The airline also attacked the strengthening of Eastern's position in the Tampa-Northeast and Tampa-Miami markets and joined Eastern in objecting to the extension of Delta's system to Tampa. National also said that there is no need for the new authority granted Capital to operate nonstop between Norfolk/Newport News and Philadelphia/New York, and renewed arguments that Charlotte, Raleigh-Durham and Hartford-Springfield should be added to its system.

Delta made a bitter attack upon the CAB's decision in its petition, saying that the majority opinion "violates reason and judgment," that it "patches up illogical reasoning with cliches" and it "sugar coats distasteful problems."

Delta Disputes CAB

Delta maintained that the CAB majority was too preoccupied with Northeast's particular needs when it decided the case. The Board's choice of Northeast for the route was heavily influenced by Northeast's relatively weak position among trunk airlines and its need for strengthening.

Delta argued that the CAB should have paid more attention to determining which carrier could provide the best service to fill a public need, rather than concentrating upon which carrier needs the route.

Pointing out that it already is established in the markets involved, Delta said it can provide service superior to what Northeast has to offer and can provide it immediately. On this basis, the carrier asked the board to cancel Northeast's authority and certificate Delta for the New York-Florida route.

Delta also asked the Board to extend its Tampa route segment to Miami. The new route was granted in the New York-Florida Case. The airline said the new stub-end Tampa segment could be integrated better with its service pattern and would be more economical to operate if it were extended to Miami.

PAA Wants Route

Pan American chooses not to argue with the CAB's decision to certificate Northeast on the Florida route, but it proposes a peak period service to be superimposed over the new three-carrier competitive pattern.

Pan American asked the CAB for authority to operate turnaround service between Miami and Northeastern cities between December and April, and for authority to operate through service between the Northeast and Latin America for a five-year period.

Arguing that the demand for service on the New York-Florida route is seasonal, Pan American told the Board that it can fill the demand easily since it is established in all the markets involved. The airline pointed out that its heavy season is the summer, and it has surplus equipment available in the winter to operate a peak-season December-April service.

Resort Airlines, a cruise carrier now operating under military contracts, also is pressing for a peak-season type of authority that would be designed to supply service only during heavy traffic periods, leaving the route to the regular carriers when traffic is slack.

Pan American also told the Board that the need for through service between northeastern U.S. and Latin America has not been filled and asked for authority to operate through flights without turnaround privileges at Miami, Cuba or the Bahamas.

'Whispering Campaign'

In its petition, Pan American said it feels that the Board was influenced in its opinion by "the whispering campaign as to the existence of an alleged 'government policy' that Pan American is not to have domestic routes."

The airline said there may have been such a policy before World War II, but that it ceased to exist when nine domestic airlines were extended abroad to compete with Pan American.

National's Vice President Alexander G. Hardy termed Pan American's proposal for winter service "another example of deliberate and misleading distortion."

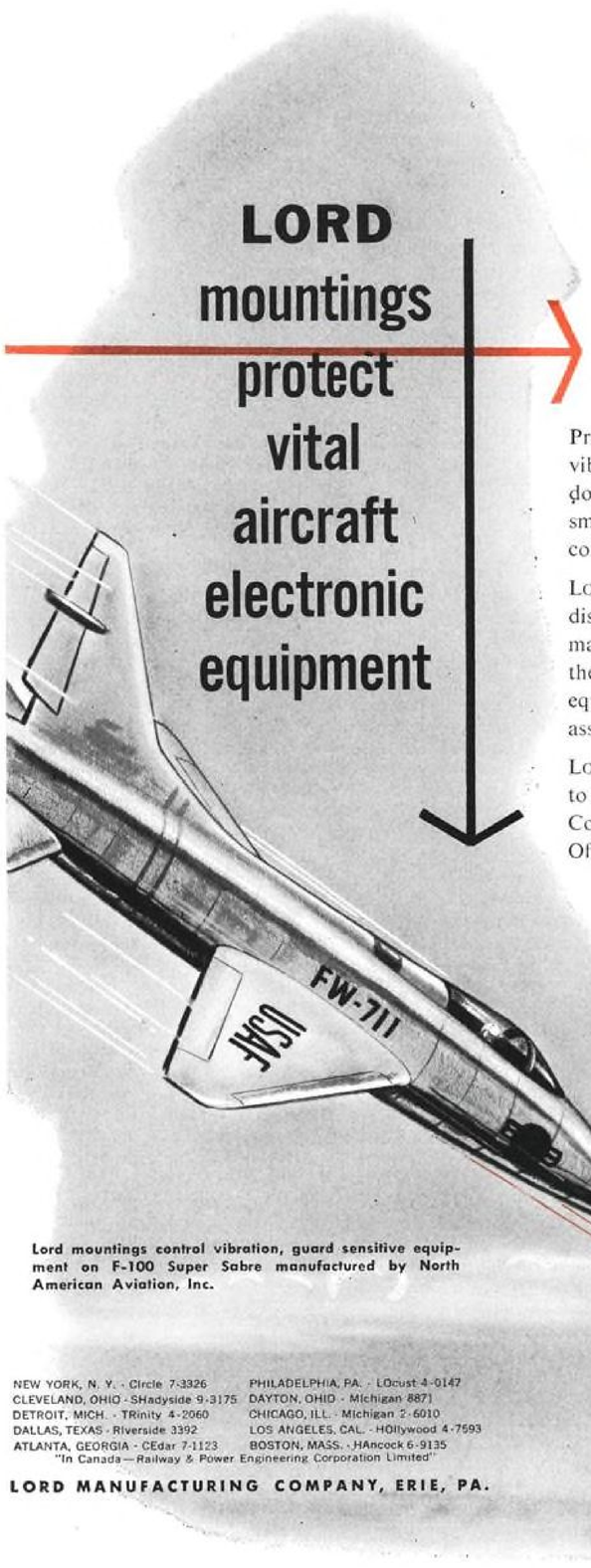
He also stated the airline knows there will be plenty of seats available between New York and Florida this winter and that "Pan American is still fighting the battle of the press releases."

Although Capital still believes it could offer better service than Northeast on the East Coast route, its petition accepts certification of Northeast. It says, however, that Capital should be certificated along with Northeast.

"Should the Board continue to believe that Northeast's economic need is the determining factor in the disposition of the issues in this case, Capital submits that Capital should be certificated over the Boston-Miami route in addition to Northeast in order that the service needs of the traveling public also will be satisfied," the petition said.

Capital said the Board should think of the needs of the traveling public as well as the economic needs of Northeast and establish a four-carrier pattern on the Florida route.

The carrier told the CAB there is sufficient traffic on the route to support four carriers.



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Domestic Trunk Lines Committed To $1.5 Billion Jet Program

San Francisco—Security analysts meeting here generally accepted industry reasons why domestic trunk airlines with assets of $1.3 billion and net worth of $650 million committed themselves to a $1.5 billion jet transport order program.

Four airline and jet transport manufacturing company officials who weighed speed and size advantages against potential problems of maintenance, traffic control and initial cost before the Security Analysts' Society were asked only one challenging type of question:

"Can the airlines convince the public that jets are safe?" They were told the airlines felt they could.

More Jet Orders

Various points made by the four speakers:

• **Paul S. Ford,** director of finance of the Boeing Transport Division, Boeing Airplane Co., on sales:

Large, long-range jet transports—in addition to 136 Boeing 707s and 115-120 Douglas DC-8s on order now, Ford estimated there would be 100-150 more such orders for delivery in the next 5-6 years and another 100-150 in the succeeding five years.

Medium and short-range jets and turboprops—over and above the 400 U. S. and foreign types now on order, Ford estimated a world market through the 1960s up to 1,500 airplanes of these types.

• **Arthur E. Raymond,** vice president-engineering, Douglas Aircraft Co.:

Like Ford, Raymond estimated traffic growth rate would continue into the 1960-70 period at the same as the 15% growth from 1950 to 1955. In the transition from the DC-6B, an economical piston airplane with a unit productivity (payload speed) of 3.45 units per dollar of average cost, to the DC-8 with 4.2 units per dollar, Raymond said that the airlines are getting a total cost reduction in effect, of 22%.

Asserting that airlines thus are increasing capital investment under favorable conditions, Raymond also pointed out the prevailing resale value of transport aircraft. As examples he quoted these prices:

DC-3 new, $110,000; going price today, $75,000-$100,000.

DC-4 new, $425,000; today $250,000 to $700,000.

DC-6 new, $600,000-$900,000; today $1.2 million.

DC-6B new, $1.5 million; today $1.75 million.

Constellation new $700,000 to $1.3 million; today $500,000 to $1.6 million.

The "trickle down" process by which jet aircraft will work their way into the hands of smaller operators will continue, Raymond said, because jet transports will be reaching a speed plateau that will remain constant for at least 10 years and will protect against technical obsolescence.

• **C. R. Smith,** president of American Airlines:

In the 1950-55 period, Smith said, air transportation grew at four times the rate of increase in gross national product. For the 1955-61 period, American estimates the growth rate will be 3.2 times gross national product.

As a result, American presently estimates the airlines will sell 34.5 billion passenger-miles in 1961 compared to 19.9 billion in 1955 and 8 billion in 1950.

Tempering this bright prospect is that productive capacity of the airline fleet will increase accordingly, and there will be increased competition. "If the security analyst is expected to evaluate opportunity for individual companies," Smith then cautioned, "it would be well to examine the relative ability of each to merchandise the product."

Increased speed, Smith said, will heighten the tendency of passengers to prefer specific arrival departure times and day flights. This difficulty toward high daily utilization can be balanced, Smith believes, by speed also, since a jet transport can make a round trip New York to San Francisco in a 12-hr. period. In the end, he said, utilization should average about what it does today.

• **A. M. Voursney,** treasurer of United Airlines:

United's paper jet operation over a year has indicated jet schedules can be readily integrated into normal traffic patterns. The federal airways improvement program and better ground handling techniques will help, Voursney said.

Operating Costs

As for operating costs, Voursney said that at very short ranges the jet costs more to fly than the DC-7 or DC-6, but above 500 mi. it becomes more economical than the DC-7 and over the 2,000 mi. range the jet curve begins to approach the DC-6B, heretofore United's lowest unit cost four engine transport.

From 1,000-2,000 mi. ranges the jet is approximately 10% cheaper to run than the DC-7.

At 1,000 mi. the jet has a breakeven passenger load factor of 32% against 34% for the DC-7 and 31% for the DC-6B at 2,000 mi., he said the DC-8 breakeven load factor drops to 30% compared to 31% for the DC-7 and 29% for the DC-6B.

Cost assumptions were made allowing fuel price at 15 cents per gallon; airframe overhaul time, 1,500 hr.; engine overhaul time, 750 hr.; airframe and engine depreciation, seven years; residual value 10%. Voursney said the seven year depreciable life of the jet is quite conservative in view of the difficulties presented by the next technical step into the sonic region.

Voursney pointed out that the price of the airline ticket is only 1% above 1940 levels in terms of yield per passenger-mile.

He expressed hope that the CAB would either leave fares at current levels or permit an increase.

Maintenance problems, which were discussed with a certain amount of pessimism at an airline seminar presented by USAF at Oklahoma City (AW Oct. 29, p. 32) were touched by Ford, using Boeing experience as a basis. His estimates:

• **Jet engine maintenance** hour will be approximately 75% of piston engines per flight hour when jets reach the 11,000 hr. overhaul period.

• **Airframe maintenance hours** will be approximately 80% of piston engine airplanes per flight hour.

Military Experience

Related to thousands of passenger seat-miles, he estimated maintenance costs would give jets better than a 3.5 to 1 advantage over piston engine types.

Based on military experience with General Electric J47 engine in the B-47 and the Pratt & Whitney R-4360 engine in the KC-97 tanker, Ford said, the J47 exceeded the piston engine of the tanker in terms of flight hours between overhaul, reaching a 1,750-hr. overhaul period, thus pointing to an eventual 2,000-hr. overhaul period for commercial operations.

Premature engine failures of the J47 of .45 failures per 1,000 engine hr. and the J57 rate of .27 per 1,000 engine hr. were well below the .65 rate of the Wright TC-18 piston engines used on the DC-7, Ford said. The improvement from J47 to J57 indicates a possibility of matching the .16 failures per 1,000 engine hr. experienced on the R-2800 piston engine of the DC-6.

He said the in-flight shutdown rate per 1,000 engine hr. and .29 for the J57, .30 for the R-2800.

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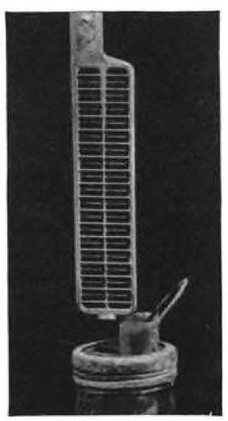
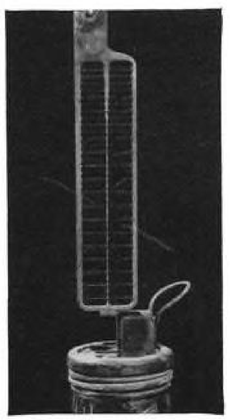


Silvium alloy grid after corrosion test.



Non-Silvium alloy grid after same test.

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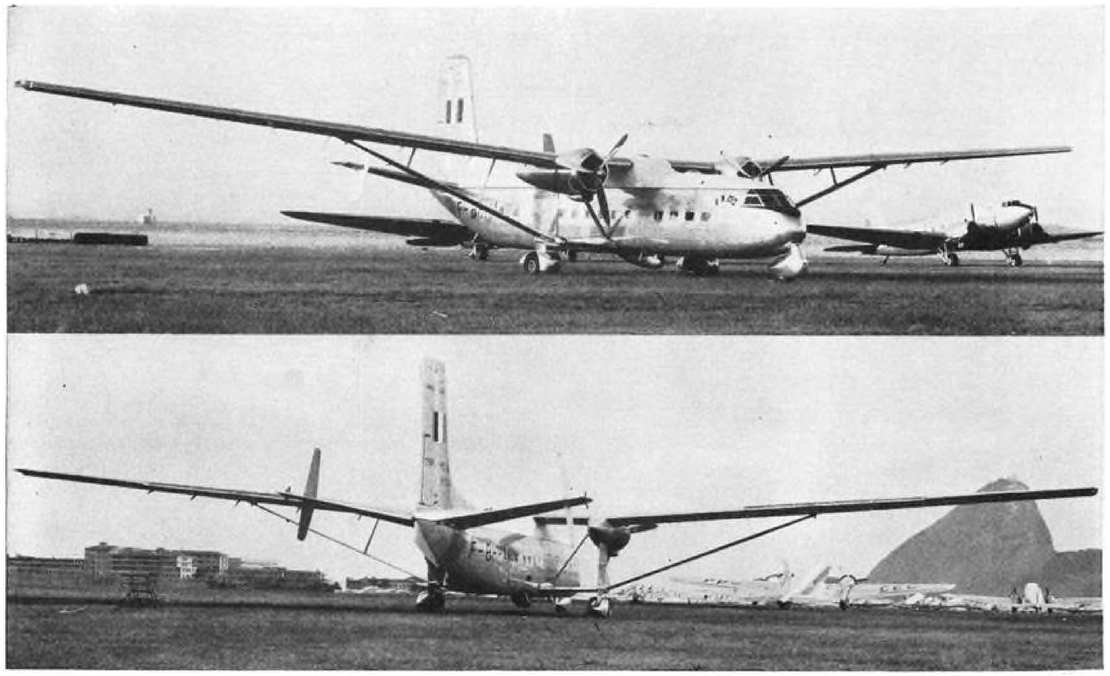

Hurel-Dubois HD-321 in Brazil

Hurel-Dubois HD-321 at Santos Dumont Airport at Rio de Janeiro attracted most attention of Brazilians in French manufacturers' sales show which also included Nord 2501 Noratlas and Djinn helicopter. Powered by two 1,525 hp. Wright 982-C9HE1 engines, HD-321 has a 1,200 mi. range and carries 46 passengers or 6.5 tons of cargo. Although it demonstrated takeoffs in less than 970 ft. and landings in less than 900, Brazilian pilots felt low air scoop and wheel spats might prove troublesome in rough, muddy interior fields such as Sao Paulo and Parana. Photos show tail design progression. HD-31 had twin-fin layout. Prototype HD-32.01 had single high fin to which two smaller outboard fins were added for production HD-321, the one shown in Brazil.

Arthur Vining Davis Defends Loan To Avlee, Fights CAB Complaint

Washington—Arthur Vining Davis has accused Civil Aeronautics Board attorneys of using unprecedented interpretations of the law in charging him with illegally acquiring control of Avlee, Inc.

The complaint, filed by the CAB Office of Compliance, said Davis controls Avlee through a large loan he made to the company. Davis is a Florida financier who has interests in Riddle Airlines and Mackey Airlines.

In asking the Board to dismiss the complaint, Davis' attorneys said the Board would establish a new precedent if it found Davis controls Avlee through his loan. According to the petition, such a precedent would upset financing arrangements of the nation's largest carriers.

Agreement With Avlee

The dispute involved Davis' relationship with Avlee, Inc. The company was organized by Albert J. Leeward and Ray J. Leeward, who bought half the company's stock issue for $5,000.

Avlee and Davis signed an agreement under which Davis would lend the company $102,400 to help purchase and dispose of five C-82 transports from the Air Force. When three of the C-82s were destroyed in an accident, the insurance proceeds were used to reduce the debt to about $30,000.

The agreement included a provision that the management of Avlee would rest with Leeward Aeronautical Sales, Inc. Davis plans to buy the remaining half of the Avlee stock issue once he gets CAB approval.

Credit vs. Control

In its complaint, the CAB Compliance Office said Davis acquired control of Avlee by virtue of the fact that his loan is so much larger than the investment in the stock issue.

Davis contends that the fact that the management of the company rests with another company precludes the possibility of his controlling it. He also said that an interpretation of the law which found that his loan does constitute control would force a reappraisal of recent airline financial arrangements.

Such a finding, Davis said, would put the aviation industry "in great danger—the danger that the extension of any substantial credit to an air carrier raises a presumption of 'control'."

Citing examples of financial situations which could come under such a doctrine, Davis' petition pointed out that American Airlines, with a net worth of $125,543,000, has borrowed $75 million from Metropolitan Life Insurance Co., and that United Air Lines, with a $107,140,000 net worth, has borrowed $120 million from Metropolitan, Prudential Insurance Co. and Mutual Life Insurance Co. of New York.

Other airlines mentioned by Davis were: Eastern Air Lines, net worth $88,819,000 and a $90 million loan from Equitable Life Assurance Society; Continental Air Lines, net work $5,977,000 and a $10 million loan from Chase National Bank; Western Air Lines, net worth of $13,784,000 and loans of $13.5 million from the Bank of America and $12 million from Prudential.

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SHORTLINES

► **Australian National Airways** has taken delivery on a DC-6B, bringing the carrier's DC-6 fleet to a total of six aircraft.

► **Babb Co.** has sold two Convair 240s to Trans Iranian Airways. Babb bought the Convairs from Linee Aeree Italiane.

► **Central African Airways** is beginning Viscount service to Nyasaland this month. Viscount flights serving Nairobi, Kenya, will now stop at Nyasaland's Chileka Airport at Blantyre.

► **Emery Air Freight Corp.** will have General Electric two-way radios in its trucks serving the New York metropolitan area after Dec. 1.

► **Flying Tiger Line** reports traffic up 17% in the third quarter to a total of 16,321,325 ton-miles. Flying Tiger freight revenues were $1.1 million in October, 25% higher than October 1955, revenues.

► **Mohawk Airlines** has opened ticket offices in Erie and Detroit and will inaugurate service to the two cities on Dec. 1. Mohawk has decided to serve Detroit through Willow Run Airport.

► **National Airlines** will offer Florida and Caribbean package vacations for the third year during the coming winter season. The package features 56 Miami Beach hotels and 18 motels, making 12,000 rooms available between Dec. 20 and April 15. Accommodations also are available in Havana.

► **North Central Airlines** flew 54,921 passengers in October, 30% more than in the previous October and 711 passengers more than in September. This marks the first time North Central's October traffic exceeded September totals and brings traffic for the first ten months of the year to 472,629 passengers as compared with 430,455 for all of 1955.

► **Ozark Air Lines** carried 34,662 passengers in October, a gain of 38% over passenger traffic in October 1955.

► **San Francisco International Airport** handled 324,251 passengers in September as compared with 288,731 in the previous September. Aircraft movements totaled 10,272, a 1.7% decrease from September 1955, traffic.

► **United Air Lines** reports October passenger traffic at 399,907,000 passenger-miles, an 11% gain over the previous October. In the same period, freight traffic rose 41% to 5,329,000 ton-miles.

AIRLINE OBSERVER

► Airport abandonment is being noted by Civil Aeronautics Administration although Acting Administrator James Pyle sees no obvious trend developing. However, he has warned that recent surveys indicate more than a normal number of the nation's airports are making way for shopping centers, housing developments and industry. For example, Grand Central Airport, Glendale, Calif., is scheduled to give way to industrial facilities; Armonk Airport, Westchester County, N. Y., to a shopping center and Trohs Airport, Portland, Ore., to a housing project.

► **Caravelle jet transport is being studied by a ten-man Russian delegation. Group, which is now in France, includes Aeroflot officials and is headed by the top official of the Soviet Aeronautical Institute.**

► Civil Aeronautics Administration is polling its regions for comments on a proposed air traffic control procedure that will redefine all "essential traffic" as "conflicting traffic." This will require issuance of traffic information to all aircraft under certain conditions, adding to the already heavy workload of controllers. Also slated for adoption is a revised procedure that will eliminate controllers' use of "1,000-on-top" for holding IFR traffic during daylight hours. It already is taboo during hours of darkness.

► **Capital Airlines, after experiencing a fall-off in load factors on its Chicago O'Hare Airport flights, has switched a number of trips back to Midway Airport. Drop in traffic is ascribed by Capital to insufficient West Coast interline connections at O'Hare as compared with the large number of around-the-clock connections at Midway.**

► National Assn. of State Aviation Officials has adopted a resolution urging the CAA to encourage construction of runways and landing areas at terminal airports for small or STOL aircraft in addition to regular runways. NASAO argues that assignment of small aircraft to long runways is uneconomical and causes unnecessary traffic delays of large aircraft and transports.

► **Boeing 707 jet transports ordered by Qantas Empire Airways probably will be powered eventually by Pratt & Whitney J75 engines as a result of a special arrangement with Boeing that permits a trade-in of J57 engines for J75s, Rolls-Royce Conways, or any other engine further improved than the J57.**

► Trans World Airlines engineers have developed a new refrigeration and ventilation system for TWA's Model O49 Constellations. Installation of the system on the airline's 32 O49 Connies starts this month.

► **Sabena Belgian World Airlines will inaugurate service between Paris and Brussels next March with its new Sikorsky S-58 helicopters. The Belgian carrier will fly two flights a day on the new route. A morning flight will be scheduled to connect with transatlantic services, and Sabena says it will get travelers to downtown Paris faster than regular airline services.**

► United Air Lines has dropped the DC-3 from its schedules and is replacing it with Convair service. United is the last of the Big Four to drop the DC-3 from scheduled service. The carrier's DC-4 service is being curtailed and will be gradually phased out in 1957.

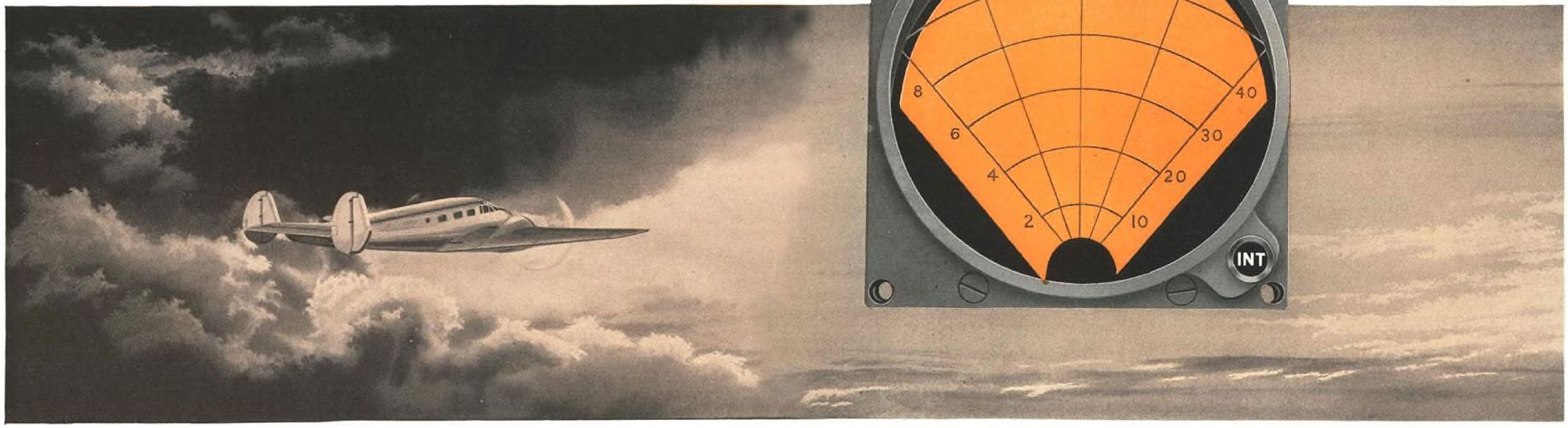
► **Civil Aeronautics Board's investigation of Air Traffic Conference and International Air Transport Assn. travel agent agreements will deal only with the questions of "selection and retention" of agents. The inquiry will not involve financial agreements on the commissions paid to agents by the airlines.**

► American Airlines has found the majority of business executives commenting on the new time-limit ticket pickup plan are in favor of it. Out of 461 letters, 430 were favorable, and many of them expressed support for a system of penalties to put teeth into the no-show program.

► **General Motors' Allison Division has ordered a Lockheed Electra for delivery in June 1958. The Electra will be used as an executive transport, as well as for testing of the Allison 501 turboprop engines that will power it.**

RCA announces a new weather avoidance radar, the AVQ-50

for installation in aircraft where weight. space, and power are at a premium.



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ENGINEERING BULLETIN
ON MICRO-BEARINGS
Miniature Instrument Ball Bearings

NEW HAMPSHIRE BALL BEARINGS, INC.
PETERBOROUGH 1, NEW HAMPSHIRE

Subject: **MEASUREMENT OF RADIAL RUNOUT**

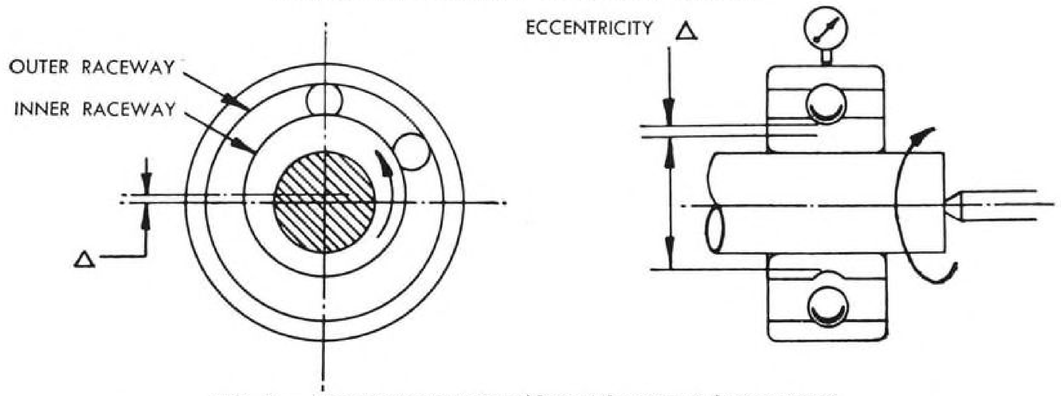

FIG. 1 — *Measuring eccentricity of bore with respect to inner raceway.*

Occasionally questions are raised about the methods of measuring "radial runout" and "out-of-round". In order to define "radial runout" properly, a discussion of "eccentricity" and "out-of-round" is necessary.

The amount of out-of-round, or lack of roundness of a given part (inner or outer ring or ball) is the difference between the maximum and the minimum diameter of the part in question.

Eccentricity refers to the distance between the centers of two circles. Concentricity refers to the exact coincidence of the centers of two or more circles. In high grade instrument bearings there is a very small tolerance on the permissible eccentricity between the bore and the inner ring raceway, and likewise between the outside diameter and the outer ring raceway.

Inner raceway out-of-round is measured by forcing the ring between the rounded edges of two discs, one of which is fixed and the other of which is mounted on the indicating mechanism. The difference between the maximum and minimum readings reveals the amount of out-of-round. Out-of-round of the outer ring raceway is measured by placing the ring over two rounded points which engage the raceway. One point is fixed and the other actuates an indicating mechanism. As the ring is rotated, the difference between the maximum and minimum readings indicates the degree of out-of-round.

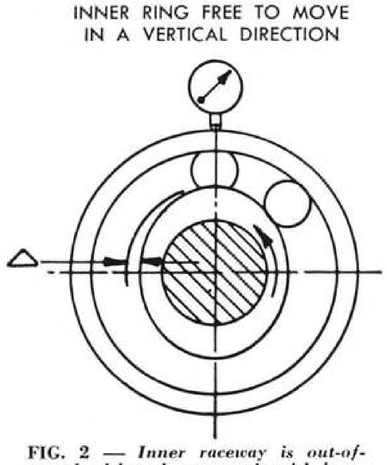

FIG. 2 — *Inner raceway is out-of-round, although concentric with bore.*

The true amount of eccentricity between the bore and the inner ring raceway can be measured, providing these circles are not out-of-round, by mounting the assembled bearing on a slightly tapered arbor, applying a calibrated indicator on the center of the stationary outer ring, and then slowly rotating the arbor. The eccentricity is the difference between the minimum and maximum gage reading as the arbor is rotated through one revolution. Similarly, the eccentricity of the outer ring is measured by the difference in the dial readings with the arbor and inner ring held stationary while the outer ring is rotated one revolution. *Fig. 1* shows the set-up with an inner raceway which is eccentric with respect to the bore.

In the case above it has been stipulated that the bore and inner raceway must not be out-of-round, for only under these conditions is the true eccentricity measured.

If the raceway is out-of-round, while being either eccentric or concentric with respect to the bore, the out-of-round will be transmitted to the indicator, thereby influencing the reading. A condition in which the inner raceway is out-of-round although concentric is shown in *Fig. 2*.

In view of the fact that the majority of bearing rings will unavoidably be somewhat out-of-round and eccentric, however slightly, it is obvious that the measurement described above indicates neither true eccentricity nor true out-of-round but a summation of the two quantities. Hence the measurement is more correctly termed *radial runout*.

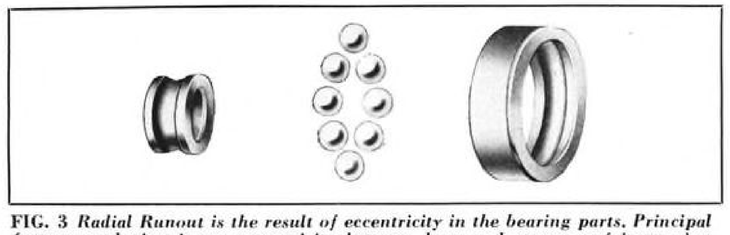

FIG. 3 *Radial Runout is the result of eccentricity in the bearing parts. Principal factors producing it are eccentricity between bore and raceway of inner ring (left) and between raceway and outer diameter of outer ring (right). Out-of-round balls offer negligible effect, since effect tends to cancel out as balls roll.*

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"Exotic" Fuels Carry Performance Bonus

By David A. Anderton

New York—Spectacular performance gains for aircraft and missile powerplants are promised by new families of fuels synthesized in chemical plants.

These specific improvements can be expected in airframes and engines using "exotic" fuels.

- **Engine power** and aircraft range can be increased markedly. Current calculations indicate that turbojet performance could be bettered by at least 50%.
- **Fuel weight** and tank volume can be reduced. Most of the fuels are lighter than conventional hydrocarbons, gasoline and JP-4, and still show more energy available per cubic foot or per gallon than the now-standard fuels.
- **Engine length** and weight can be reduced because of reductions in the length of the combustion process. This design refinement is possible because the new fuels have better flame holding and propagation characteristics during combustion.

Fuel Comparisons

Fuel	Specific gravity	Heat of combustion	
		Btu/lb.	Btu/cu. ft.
Acetylene	0.6208	20,734	803,556
Aluminum	2.702	13,309	2,244,979
Beryllium	1.85	29,140	3,365,447
Boron	2.3	25,100	3,603,986
Carbon (graphite)	2.25	14,087	1,978,712
Diborane	0.447	31,370	875,394
Hydrogen	0.070	51,571	225,364
Lithium	0.534	18,460	615,396
Lithium hydride	0.82	17,760	909,156
Magnesium	1.74	10,639	1,155,664
Pentaborane	0.61	29,127	1,109,193
Silicon	2.4	13,170	1,973,234
Silane	0.68	17,160	728,463
Titanium	4.5	8,187	2,299,952
Gasoline	.678	18,800	790,000
Kerosene	.820	18,492	946,600

Growing List

Spurred by requirements for maximum performance of powerplants for military aircraft and missiles, fuels chemists have developed dozens of new compounds and reinvestigated some old ones. The brief list of available fuels for turbojets, ramjets and rockets has suddenly blossomed with scores of new names strange to the aeronautical engineer.

Predominant among them are the light-metal hydrides in which hydrogen atoms are tied to atoms of boron or lithium, and slurries of magnesium or aluminum powder suspended in a hydrocarbon fuel.

A few years ago these were laboratory curiosities, made in tiny quantities to assess physical and chemical properties. One or two were put into pilot-plant production and made available for limited tests in full-scale powerplants.

Now a multi-million dollar industry has sprung out of these first plants, with expansion of or construction for new chemical fuel facilities scheduled for half-a-dozen different locations around the country.

The recent re-evaluation of the chemically fueled WS-110A bomber delivery system reflects the tangible progress made in the production and application of the exotic fuels. There is confident prediction that chemical fuel production will soon become a billion-dollar business.

Probably the greatest impetus to the production of chemical fuels has been the peculiar requirements of liquid-propellant rocket engines. For years limited to a handful of propellant combinations, all with about the same performance, rocket engineers dreamed of the day when they could produce a quantum jump in powerplant performance. They studied chemical propellants, calculated their performances, and then began to promote the cause.

Today indications are that there will be a fuel to fit every condition, that chemical fuels can be tailored to match a mission in much the same fashion as an airplane is built around the job. The problems of production and logistics have been studied and seem solvable.

Fuel Variety

Tomorrow, turbojet and afterburner, ramjet and rocket motor applications can be expected to call for a variety of propellants drawn from the vastly expanded fuels spectrum.

Increased performance is the single reason for the choice of a new fuel, or for that matter, any new item for an aircraft. The demands of high-speed flight, particularly over intercontinental distance, have made the powerplant and its installation almost the controlling factor in an airframe design.

During World War II, the emphasis was on carrying useful load, and the amount carried in the bomb bay was often more than the fuel carried in the wings. Now the proportions are reversed.

Fuel and powerplant weight is a major fraction of the overall gross weight of the aircraft, and the weapon to be carried has shrunk considerably.

Factor In Cost

But more than weight enters; economics is a definite factor. Cost of fuel for a typical military mission is a small part of the total. Doubling or tripling the price of the fuel would be little noticed, particularly if it brought a discernible improvement in performance of the mission. This is especially true in the case of expendable missiles.

Consequently the military services are willing to pay for fuels that can promise performance increase, either in increased power and range, or reduced weight and tank volume.

There's a secondary reason why some of these new fuels could not be used before. Ramjet and rocket engines, and turbojet afterburners are not sensitive to solid or liquid exhaust products. A turbojet engine has to be fueled with a refined propellant that won't leave gummy or solid deposits on the turbine blades and fuel nozzles. The other engines don't have that worry. Consequently it is entirely possible to burn a slurry of magnesium and octene in a

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French Anti-Sub Plane Flies

Breguet 1050 Alize anti-submarine aircraft, has made its initial flight. French navy, which has ordered 100, has added an order for 20 more. Powered by a Rolls-Royce Dart 7 turboprop engine. Alize carries a crew of three and is designed for carrier operation.

ramjet engine and almost impossible to use it as the prime fuel in a turbojet.

Comparison of Fuels

Easiest way to evaluate fuels is to look at the heat of combustion, generally stated in terms of British thermal units (Btu) per pound of fuel. Sometimes where tank space is going to be at a premium as in the case of a short-range interceptor aircraft, the criterion should be calculated in Btu per cubic foot of tankage. This is one of the reasons why the Germans liked heavy fuel oil for their turbojet aircraft. Forced to use more of it because of the damage done to refineries, the German designers found that the heavy oil had between 10 and 15% more available energy per cubic foot of tank space. This paid off in range or endurance. But this simple comparison only holds true at low fuel-air ratios, comparable to those obtained in routine operations of a turbojet, where there is an excess of air. Once the process goes toward a higher fuel-air ratio, and particularly where it approaches the stoichiometric (where there is no excess air at all), this comparison is invalidated.

For those conditions, fuels can be compared on the basis of their specific impulses, which are measures of the thrust produced by burning unit weights of the fuel. Specific impulse can be thought of as the reciprocal of specific fuel consumption; it defines the number of pounds of thrust produced by burning one pound of fuel in a second. Since the dimensions of these units produce a final dimension of lb./lb./sec., the specific impulse unit is expressed in seconds.

Two kinds of specific impulses are used to evaluate fuels and engine performance:

• **Fuel specific impulse,** which expresses the impulse in terms of unit weights of fuel, and is generally the parameter used in rocket engine performance.

• **Air specific impulse,** which relates the thrust to unit weights of air, and is therefore used to compare air-breathing engines such as the turbojet, turbojet afterburner and the ramjet.

Fuel Characteristics

Favorite choice among chemical fuels is pentaborane, a liquid hydride of the light metal boron. Lighter than gasoline by 10% and with a heating value about 54% higher, pentaborane is probably the chemical fuel for the near future for turbojets and ramjets. In all probability it has been specified for the WS-110A bomber system.

Based on tank volume, pentaborane shows about a 17% improvement over kerosene and a 40% gain over gasoline in Btu/cu. ft.

Enough work has been done in production development of the pentaborane to get the cost down to a reasonable level, although pound for pound, it is well above gasoline. By eliminating the majority of the steps in refining the fuel, some processors speak of cost below one dollar per pound.

Pentaborane has another valuable characteristic in its high flame propagation speed, several times that of hydrocarbons. This advantage shows up in combustion chamber design where the flame generally starts at a point source and spreads out along a conical front to fill the chamber. The vortex angle of the flame front is determined by the local flow speed and the flame propagation rate.

With pentaborane the flame front angle gets very large so that complete combustion is obtained in much shorter distances than with hydrocarbons. This means that a shorter com-

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The Gerotor is a form of internal gear pump consisting of only two moving parts: an inner toothed element and an outer, meshing toothed element. The inner element has one less tooth than the outer and the "missing tooth" provides a chamber to move the fluid from the inlet port to the outlet. (See Figure 1). Pump capacity is measured by the volume of the "missing tooth" multiplied by the number of driver teeth and RPM.

FIG. 1

▸ **The designer** thus has the advantage of several variables to secure a given capacity within his space limitations: *Gerotor diameter* – which governs the area of the pumping chamber–*Gerotor thickness* which, taken with area, determines chamber volume – *Gerotor RPM*, since this is a positive displacement pump. Thus, it is possible to vary the diameter, the length and the speed of the pump within certain overall limits to secure the wanted capacity.

▸ **Unlike conventional** gear pumps the Gerotor needs only a *single shaft* – both elements are substantially concentric to it. These are mated to provide continuous, fluid-tight engagement without the crescent structure necessary in other internal gear pumps. Further, Gerotor elements can be stacked along a single shaft and mounted on a single AN pad to perform multiple pump functions: lube, scavenge, boost, etc. (See Figure 2). Such compactness allows the pump to be "submerged" in a gear box or sump and frequently the sump may be part of the pump housing.

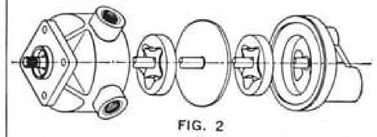

FIG. 2

▸ **Gerotor pumps** are lightweight, valveless, provide high volumetric and mechanical efficiency and offer exceptional performance at high altitudes.

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bustion chambers can be used, which in turn means a shorter and lighter engine. This is extremely important in a ramjet engine, where combustion chamber length is a major portion of overall length.

The higher flame propagation rate also pays off in the flameholding process. Burning can take place at a higher local air speed, which means that the subsonic diffuser portion of a ramjet need not be as long as previously required.

Theoretical Example

A quick and simple calculation shows the potential of pentaborane as a fuel in a turbojet. Assume a single-engine airplane with a 10,000-lb. thrust engine and JP-4 fuel for one hour's endurance at full throttle. Assume that the engine specific -fuel consumption is 0.8 lb./lb./hr. Thus the airplane burns 8,000 lb. of JP-4 per hour. Its tank volume is approximately 160 cu. ft.

Now replace the JP-4 fuel with pentaborane, making the assumption that the engine remains the same. This is not necessarily true, but is close enough. Then calculate the advantage, considering two operating conditions for the comparison: constant engine thrust, letting fuel rate vary, and constant endurance, letting the thrust vary.

The fighter airplane burning pentaborane will be able to increase its endurance at full throttle almost 20%, still using 10,000 lb. thrust. It would be able to increase its thrust to 11,900 lb. for the constant-endurance condition.

These rough approximations to real performance point up the great advantage of pentaborane as a fuel. Comparable calculations could be made for ramjet and rocket engines.

Metal Slurries

Solid fuels for powerplants have been tried with varying degrees of success. Rocket and ramjet tests have been made as far back as World War II with coal, magnesium and peat in briquet and powdered forms. The attendant difficulties have presented real problems.

One way around the difficulties of fuel feed and injection is by making a suspension of the solid fuel in a hydrocarbon. This approach seems to minimize the difficulties of handling and moving the fuel.

Magnesium has some advantages over other solid fuels that make it worth investigating. For example, it has a higher rate of combustion, and it is more reactive chemically. Furthermore, it can be obtained commercially in a finely divided state that is ideal for slurry use.

Tests have been made of a magnesium slurry in octene-1, which is comparable to gasoline. They show that for a slurry of half-and-half magnesium and octene, the potential thrust of a powerplant using the com-

Navy R&D Head

Rear Adm. William A. Schoech, who is assistant BuAer chief for research and development, heads the reorganized Navy R&D system which utilizes Weapon Systems Concept.

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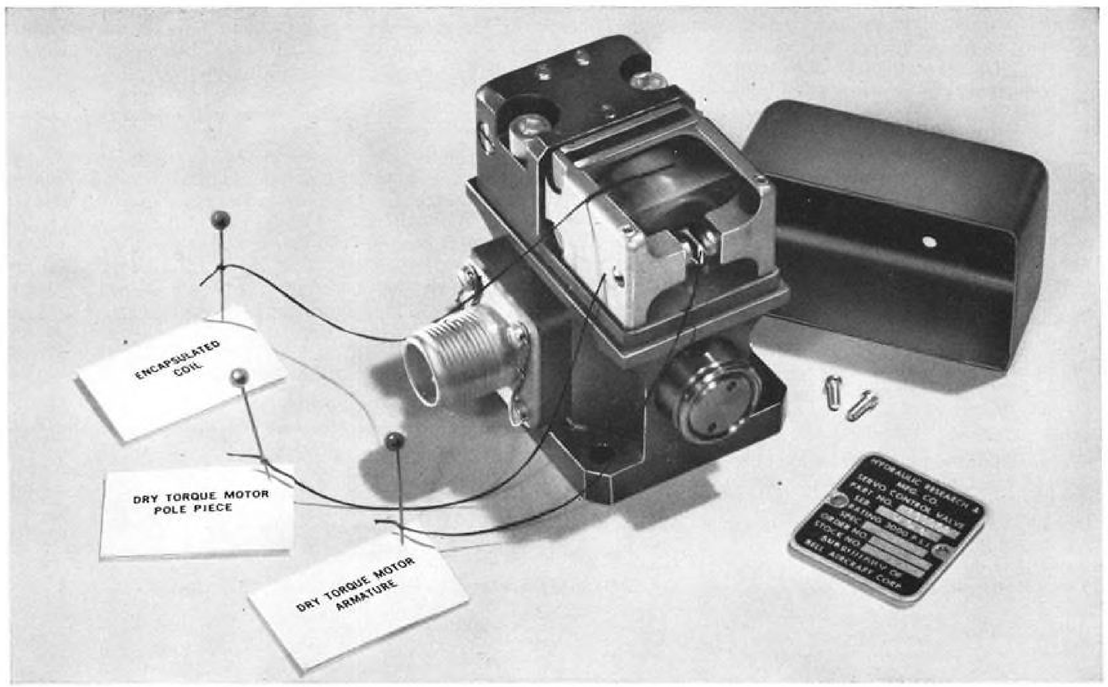

DRY COIL TORQUE MOTOR BOOSTS SERVO VALVE LIFE AND RELIABILITY

Unique isolation diaphragm in the Hydraulic Research Servo Valve acts as a fluid barrier to keep coil and torque motor completely dry. Because coil and magnetic gap are not immersed in the operating fluid, build up of magnetic particles in the flux gap of the torque motor is impossible. The high increase in valve life and reliability is immeasurable.

As further protection the coil is completely encapsulated to resist all atmospheric moisture, salt spray, fungus and corrosion. Encapsulation permits coil to function at elevated temperatures not possible with ordinary coils.

Torque motor and nozzles are symmetrically arranged about the center line of the torque arm to minimize null shift at both low and elevated operating temperatures.

Power stage is a unitized control assembly with stainless steel spool and null adjustments. This, plus triple filtration adds precision hydraulic operation to the dependability of dry coil construction.

The Hydraulic Research Dry Coil Servo Valve is in current use in military and commercial flight control and stabilization systems. It is in production and available in quantity. **WRITE FOR ADDITIONAL ENGINEERING INFORMATION.**

CHALLENGING ENGINEERING POSITIONS OPEN

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PRECISION HYDRAULIC VALVES AND COMPONENTS FOR FLIGHT CONTROL SINCE 1943

WS-110A: Supersonic Dash Over Target

WS-110A requirements call for a weapon delivery system with supersonic dash performance over the target.

Such performance could be obtained in two ways: new powerplants could be developed operating only on chemical fuel, or current powerplants could be adapted to burn chemical fuel in afterburners only.

The latter technique is sooner achieved and presents less complication.

Boeing and North American proposals for the WS-110A could show a bomber of contemporary layout, using powerplants either available now or in the near future.

The WS-110A would be able to maintain high subsonic cruise speed from takeoff until the start of the bomb or missile-release run.

Once headed in to the target, the pilot could cut in the afterburners and obtain tremendous thrust increase for the dash.

Practical test results of this technique in engine runs, plus advances in the chemical production of exotic fuels and particularly pentaborane, may have been the major factors behind the recent re-evaluation of the WS-110A and the decision to carry its development along.

bination is increased more than 50% over the thrust with octene-1 alone.

These two sets of examples begin to indicate the tremendous potential of new chemical fuels. Problems will be many. For example, performance with pentaborane, as with most of the chemical fuels, depends on higher combustion temperatures. The values of temperature are going to be higher enough than current ones to make redesign of the combustion chambers a necessity.

This will in turn call for metallurgical developments to produce new alloys, or perhaps will force the swing to ceramic-coated or all-ceramic combustion chambers.

But regardless of the problems, the next big jump in powerplant performance is going to grow directly out of the use of these new and exotic propellants.

Rem-Cru Titanium Buys Research Laboratory Site

Rem-Cru Titanium, Inc., jointly owned by Remington Arms Co. and Crucible Steel Co. of America, purchased 262 acres in Beaver County, Pa.; five miles northeast of present plant as a possible site for their new research laboratory and administration offices.

All-weather performance of the F-102A at supersonic speeds demands perfection in every vital plane part. That's why Camloc's SPF (Stressed Panel Fastener) is used to secure highly stressed access panels... SPF's have continuous thread engagement, no cross threading, long torque life.

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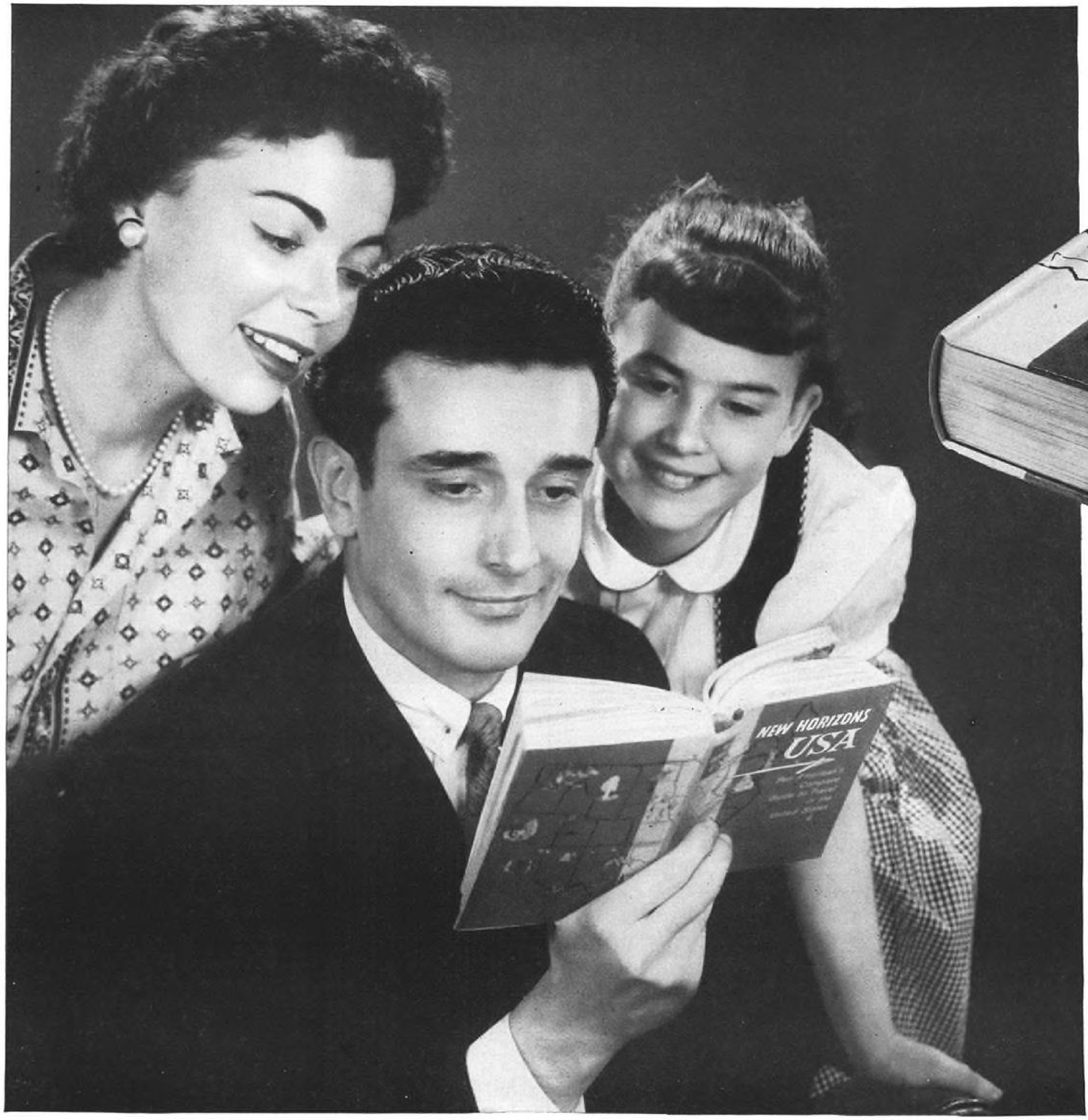

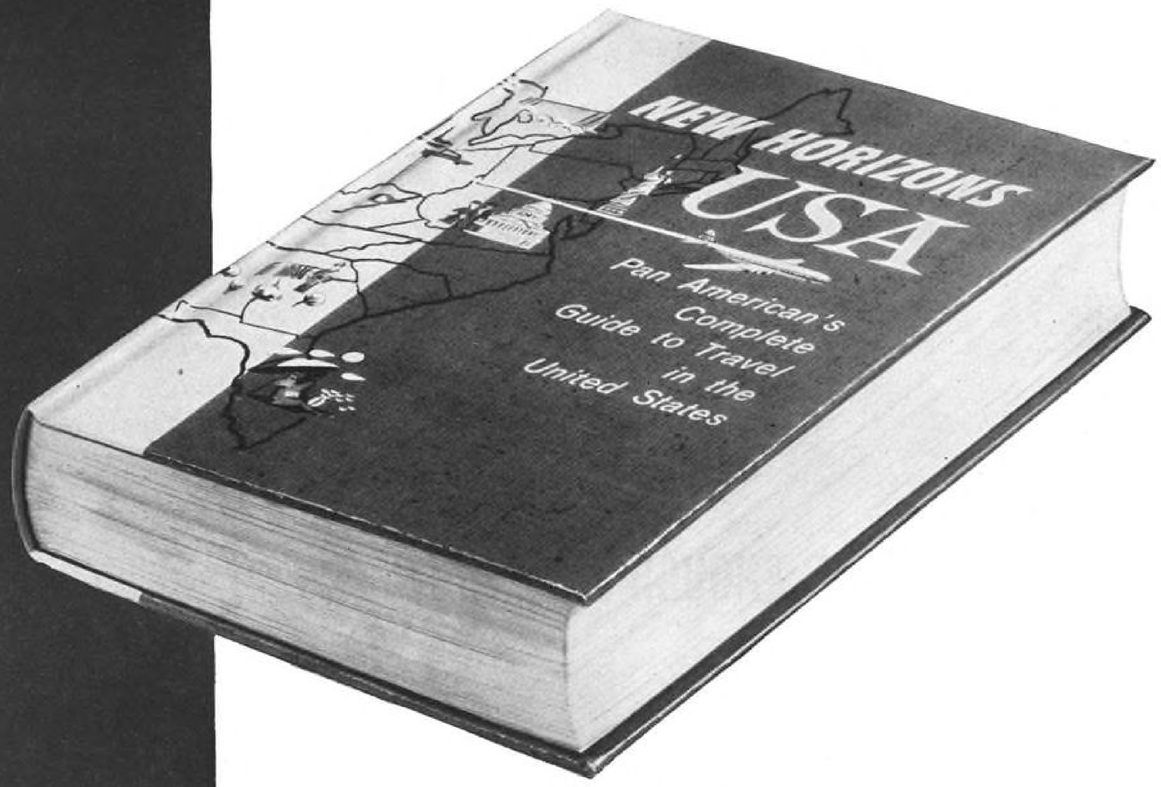

"What's America really like?" "Where's the biggest zoo located in America?" "Do they actually let tourists go *under* Niagara Falls?"

These are some of the many questions every American abroad has been asked. People want to travel in America. This is why Pan Am is publishing another travel encyclopedia: *New Horizons, U.S.A.*

This informative 510-page hard-cover book is designed to encourage tourism in America by presenting the most complete picture possible to the foreign traveler, and to native Americans as well.

Compiled with the help of American Airlines and local Chambers of Commerce and information offices, *New Horizons, U.S.A.* presents comprehensive suggestions on what to eat and where, lodgings and prices, points of unusual and historical interest, what to wear, regional sports, good buys in local products and helpful hints on American regional customs and habits.

New Horizons, U.S.A. is in the same interesting format as Pan Am's best-selling *New Horizons*®, *The Guide To World Travel* (more than half a million copies sold to date). The success of *New Horizons* in stimulating world travel has prompted Pan Am to tell America's travel story, too.

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COOL ENOUGH FOR YOU?

Fenwal's new Cooling Effect Detector rides high in North American F-100F Super Sabre . . . Answers question: Is cooling air cool enough?

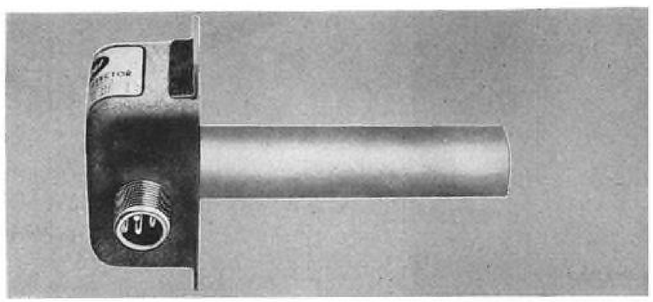
The Aircraft Industry, the most weight-conscious industry of all, has good news from Fenwal Incorporated — good news in a half-pound package. Fenwal engineers have packed a complete, accurate Cooling Effect Detector into a package that light.

North American has sent the feather-weight detector aloft in the F-100F, where it warns the pilot the instant cooling air for vital electronic equipment fails to cool enough.

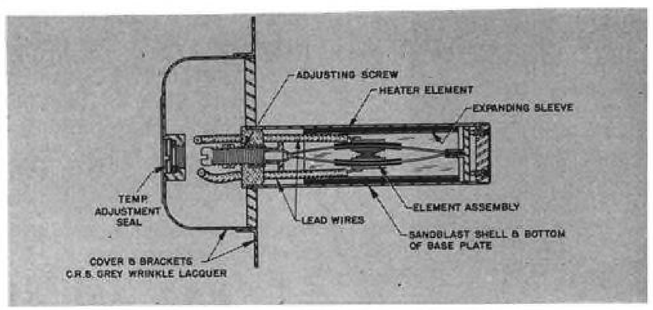
The detector, known as the #18801, is not only light but versatile. It can be used wherever cooling air protects vital equipment.

Though simple, it takes into account every variable in air-cooling effect — ambient temperature, air flow, air density, humidity, and others. When the total cooling effect is inadequate, the detector closes a circuit. Depending on the circuitry, an alarm is sounded, an indicator is actuated, or automatic remedial action is taken.

If you are looking for a compact, light detector of inadequate air cooling, the 18801 could easily be your answer. Write for complete data — or, better still, tell us your problem and let us suggest the right answer. **Fenwal Incorporated, Aviation Products Division, 1211 Pleasant St., Ashland, Mass.**

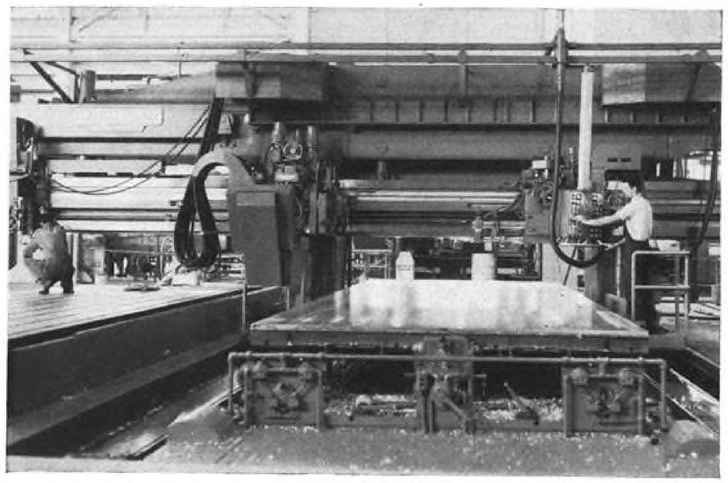


ALL IN A HALF-POUND STAINLESS STEEL PACKAGE — here is Fenwal's #18801 Cooling Effect Detector. Inside is a hermetically-sealed THERMOSWITCH® unit with a heater element. Characteristics of a 22 ohm heater element rated at 32 volts D.C. — optimum adjustment range, 500—10,000 lbs./hr./ft² of air flow; exposure limits —65°F to 160°F under "no-flow" conditions. Characteristics vary with other heater element ratings.

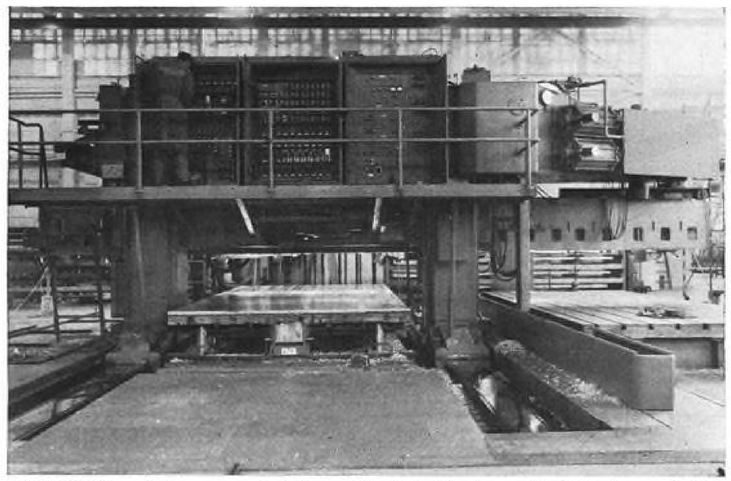


INSIDE STORY — Exposed probe shell is the sensing element. Changes in the rate of heat dissipation cause shell to expand almost at once, actuating internal switch. Switch is surrounded by a heating element. Thus, detector signals its own overheat and, simultaneously, overheat of the protected equipment.

Fenwal Controls Temperature . . . Precisely



WORKTABLE (center) and template table (left) of Avro's 200-ton skin mill are shown.



ELECTRONIC controls are mounted above. Two-inch aluminum slab is fitted to worktable.

Large Skin Mill Used for CF-105

Toronto—Largest skin milling machine in operation in Canada has begun work at the Avro Aircraft Ltd. factory near Toronto, to make wing sections for the new delta-wing supersonic fighter CF-105 being built for the Royal Canadian Air Force.

The skin mill was built for Avro Aircraft to its specifications by Kearney and Trecker, Milwaukee, Wis., at a cost of $825,000. The manufacturers are reported to have spent over a million dollars on its design, and now are producing these machines at a cost of $600,000 for other industrial plants.

Versatile Machine

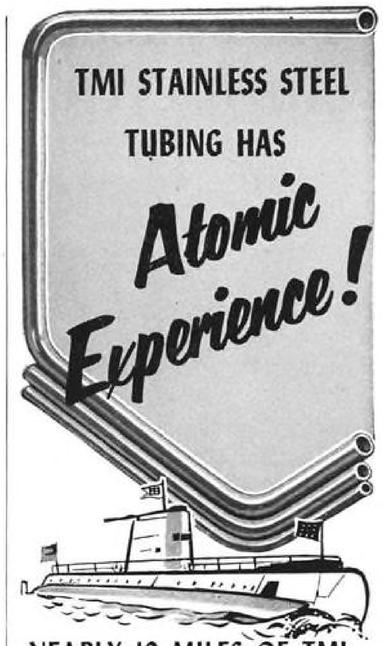
The skin mill is one of several new machines installed at Avro Aircraft for the manufacture of the CF-105. It is considered the most versatile in its field and capable of carrying out any skin milling work on aircraft designs of the foreseeable future.

How It Operates

Basically this is how Avro's new mill operates:

Alongside the 28 x 9-ft. work table is another table on which the metal pattern template is placed. A stylus is guided by the operator along the contours of the template. This stylus, under eight ounces of pressure, transmits its readings to an electronic center which sends out the pattern to the large traveling head of the machine.

As the 70-ton head and gantry starts to move, the tool attached to it begins to trace the same pattern on a solid billet of aluminum, ripping the chips out at high speed. During test runs a



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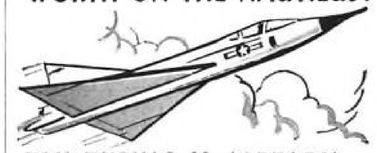

TMI TUBING IS ALREADY UNDER ACTIVE TEST FOR APPLICATIONS IN THE AIR!

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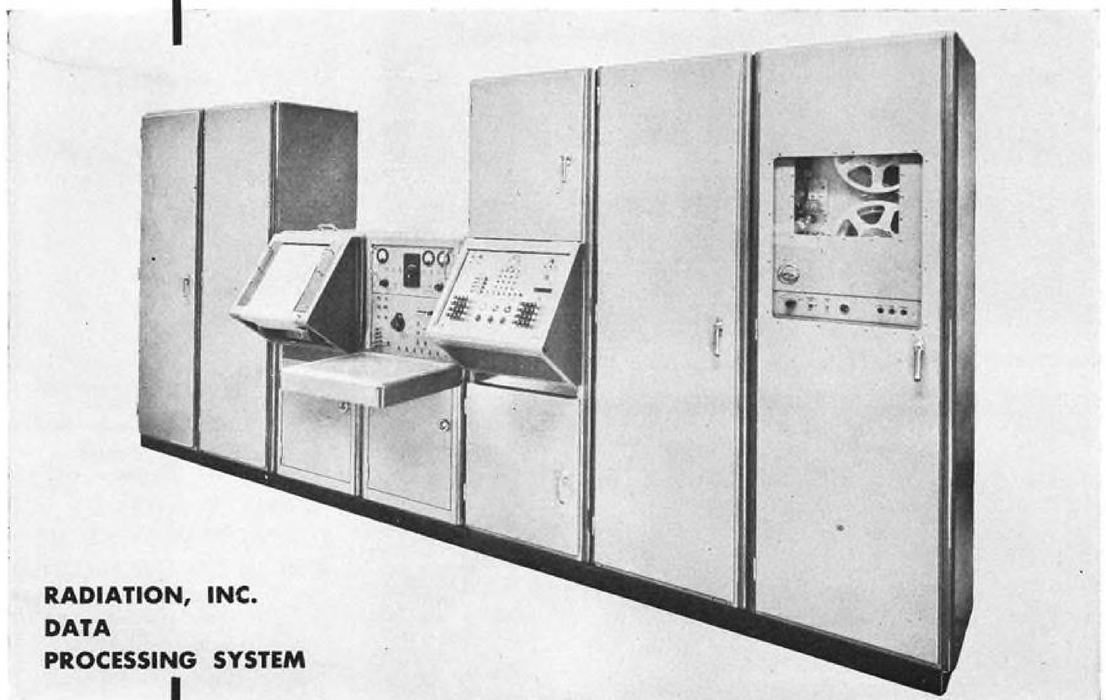

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tool taking a cut 2¾ in. wide by 1¾ in. deep chewed through the metal at about nine feet a minute.

To keep the cutter cool while running at these speeds, a flood coolant system provides 75 gal./min.

On a typical skin job the machine will start with a 3,300 lb. billet of aluminum and in short order end up with a finished product weighing under 300 lb., having milled out 90% of the weight in chips. To keep the machine from burying itself in chips, the chips are fed onto a conveyor belt, which in turn feeds them into mobile scrap bins.

Tilt and Swivel

The large slabs of aluminum are held in position on the work table by vacuum, and the tool can be tilted and swiveled to facilitate the cutting of tapered skins and converging ribs. There are 30 motors in various parts of the machine.

The mill is also foolproof safety-wise. If the vacuum holding the work drops below a certain minimum, the tool stops cutting and retracts. The same thing happens if the tool begins to overheat. To prevent any danger of a tool cutting too deep and into the harder metal of the work table, a two-inch slab of aluminum is permanently fitted over the whole table area and the work rests on this. First cutting job for the mill was to take a fine shaving off the whole of this aluminum slab to ensure its complete alignment with the traveling head.

The mill weighs 200 tons and rests on 150 cu. yd. of reinforced concrete which was laid in one integral pour. Base of the foundation is four feet thick.

Electronics Controls Spar Milling Machine

The first 90-ton universal spar milling machine controlled by an electronic tracer system has been completed for the USAF's Air Materiel Command.

Manufacturer of the unit is the Onsrud Machine Works, Inc. Control system was developed by General Electric Co.'s Specialty Dept.

Onsrud's tests on the machine have shown that it is capable of making repeat cuts to an accuracy of 0.002 in. at a carriage feed rate as high as 300 in. per min. and a head feed of 30 in. per min.

The miller can make from 1-12 simultaneous or separate cutter-feed motions, controlled by the integrated selsyn-type tracer system.

Major use of the machine will be in manufacturing wing spars, ribs and skins. Thus the cutter control has to be able to produce simultaneous vertical, transverse and rotational motions. Four spindles, each with three motions, are controlled by the system. Two of the spindles are horizontal and two are vertical to give variety of cuts, but the operation is common to each unit.

Twelve tracer control systems have been integrated into a single machine control, probably the largest of its type ever built. Each of the dozen systems uses a selsyn-type one-dimension tracer to direct a single machine feed.

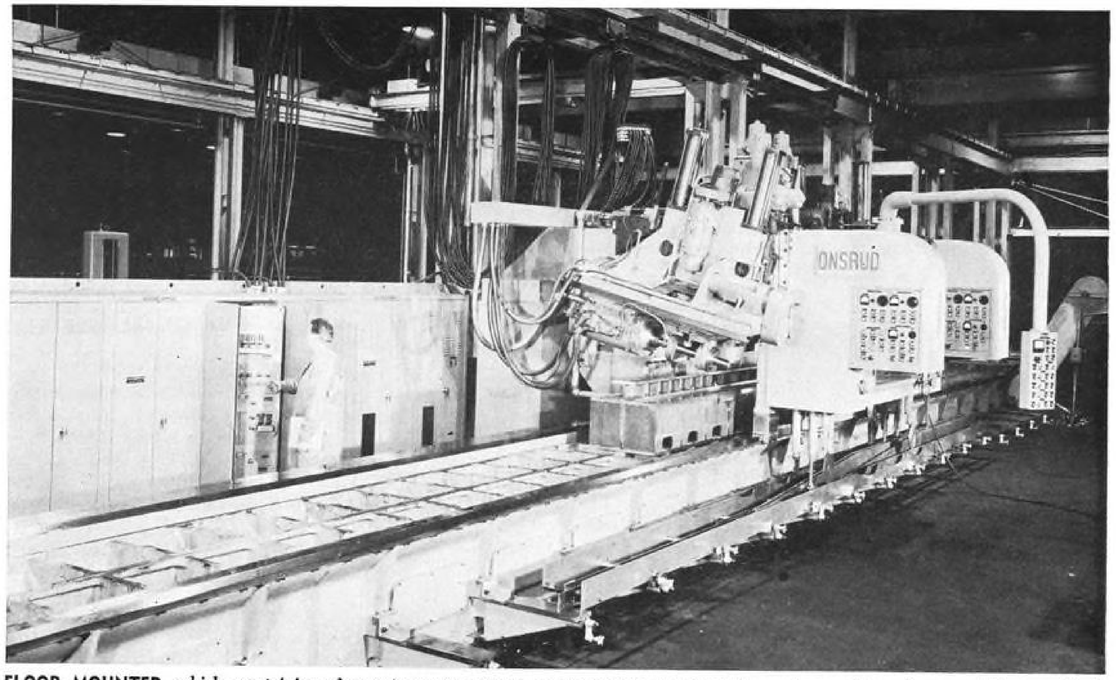
Integration of the control system makes it possible to operate from 1-12 feeds simultaneously.

Onsrud has previously built smaller capacity but similarly operated machines, and the company has found that in actual production, two of these millers have done the work planned for four of the manually controlled type.

One prime advantage of the control system is that there is only an electrical connection between the template follower and the machine feed.

To align the follower and the cutting head the operator simply turns a differential selsyn at his control station.

GE says the miller is capable of accurate and economical production of duplicate parts, including those that are too complicated for a machinist to turn out manually even at very slow speeds.



FLOOR MOUNTED cubicle containing electronic tracer control equipment is examined by engineer. One of spar milling machine's four spindles is mounted horizontally at center. Two machine mounted operator control stations and pendant station are at right. Selsyn tracing heads follow template mounted parallel to workbed along machine base.

Force Gages Measure Controls

Two sizes of spring-actuated force gages are being used by Republic Aviation Corp. to measure stick and rudder pedal break-away and maximum deflection forces of the hydraulically-powered flight control systems of its latest jet fighters.

Purpose is to determine whether or not the proper force-deflection gradient has been built into an aircraft's control system to give the pilot a realistic "feed."

The gages, similar to precision-made fish scales, but which can measure both in tension and compression, are made by the Hunter Spring Co., Lansdale, Pa.

Rudder pedal forces are measured with a Model D-100A indicator with a 100 lb. capacity and an accuracy of ±1.0 lb.

The instrument was especially designed and built by Hunter for Republic for this job. The unit incorporates three 6 in. extension rods which provides an 18 in. extension for the gage's compression head. This allows the inspector to read the dial without having to crouch in an uncomfortable position in the cramped fighter cockpit. Detachable handles fit on the insides of the gage to allow the operator to exert sufficient force on rudder pedals.

INSPECTOR reads force resisting rudder pedal depression with Hunter D-100A force gage. Extension measuring 18 in. allows comfort in cockpit.

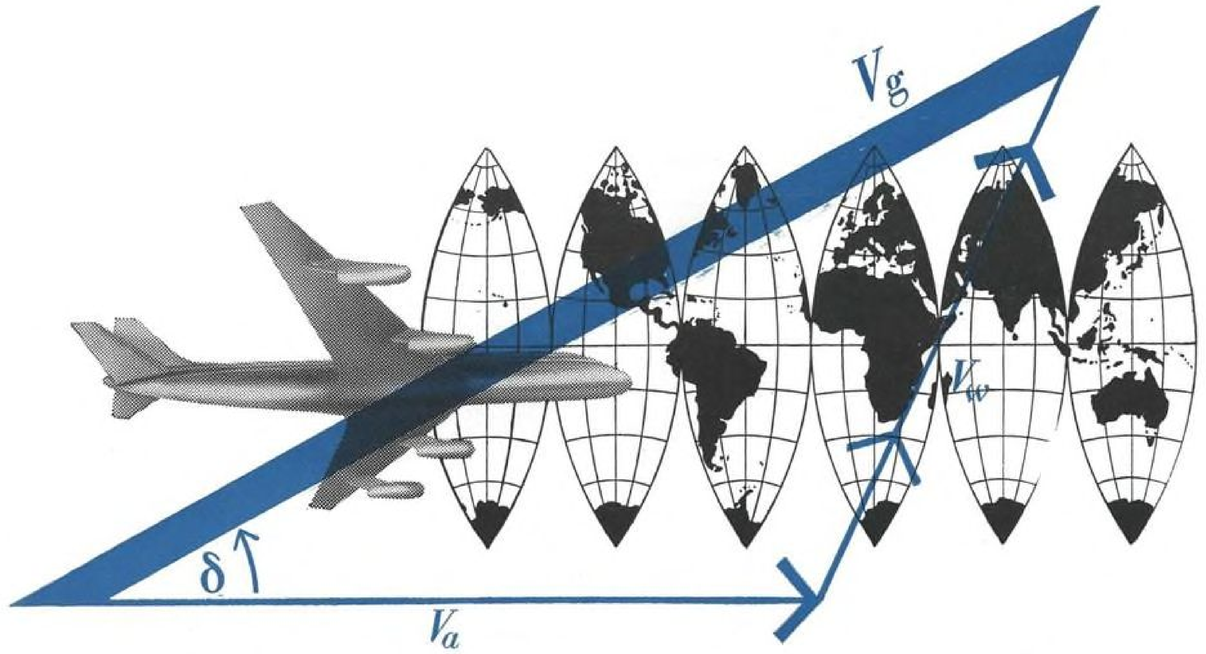
MODEL L-30 force gage is used in tension to check F-84F stick nose-up. Compression head is shown at end of gage (right).

Fore-and-aft and side-to-side stick forces are measured with a standard Model L-30 gage, modified to meet Republic's needs, which has a 30 lb. capacity and an accuracy of ±.3 lb.

All measurements are made with the instrument's compression head except the nose-up, stick-back movement. This is done by looping a wire around the stick's grip and attaching it to the gauge's hook and using the device in tension.

A variety of standard end attachment fittings are provided to simplify performing a large variety of tests.

Hunter makes a line of 18 different force gages, ranging in capacity from 1 lb. to 200 lb. All incorporate individually calibrated, compensated spring systems which actuate jeweled dial mechanisms.



a navigation system that solves jets' problems

The navigational needs of high-speed, fuel-hungry jet aircraft—civilian and military alike—were anticipated long in advance by the Air Force and General Precision Laboratory. Almost nine years ago, GPL began research on this problem in conjunction with Wright Air Development Center, ARDC. As a result, GPL has had in actual production for the Air Force for more than a year the most advanced air navigation system in operational use.

This GPL System guides an airplane to its destination under any conceivable conditions, anywhere in the world. It reports continuously and automatically — and with unprecedented accuracy—where the plane is and the distance to its destination, together with the direction the plane must fly to reach it. Completely self-contained within the plane, it needs no ground guidance, no search radar, no optical observations. In millions of flight miles in Air Force and Navy bombers, transports, patrol craft and hurricane hunters, this GPL Doppler System and its variations have demonstrated the best systems accuracies ever achieved by global navigators. When adapted to civilian use, they will be guiding commercial jet planes to the remote corners of the world and make far-reaching contributions to fuel economy, passenger convenience, safety, and efficient use of limited air space.

HOW GPL'S DOPPLER NAVIGATION SYSTEMS WORK

GPL's Doppler Systems required the harnessing of the physical phenomenon known as the Doppler effect—the apparent shift in the frequency of sound or electronic waves transmitted from a moving object to a stationary one. They bounce radar waves off the earth's surface beneath the aircraft and measure the frequency shift in the echoes. From this shift the ground speed and drift angle are accurately determined. These data are combined, in conjunction with a compass, to constantly compute the plane's latitude and longitude, from which the system figures the course and distance to whatever destination is manually inserted, providing a steering signal for the pilot or autopilot. Four other GPE Companies took part with GPL in accomplishing this engineering achievement.

Though you may have no need for a highly accurate navigational system, you may well have use for the scientific facilities and technological resources that made these GPL systems possible. For information, write:

ENGINEERS—Join the group whose creativity is responsible for this outstanding achievement. Send resumé to Personnel Manager.

GPL **General Precision Laboratory Incorporated**
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Solar builds both the Mars 50 hp and the Jupiter 500 hp gas turbine engines. The Mars is now in use on the Lockheed C-121C, Douglas C-124C, Convair C-131B and the Boeing KC-97 tanker. The Jupiter is being produced as a compressor pack and in variable and constant speed versions for other applications.

The proven dependability of Solar gas turbines is the result of nearly three decades of experience in engineering and fabricating precision products of alloy steels for severe service. Can this experience help you solve a complex engineering or manufacturing problem? For information write Dept. C-96, Solar Aircraft Company, San Diego 12, California.

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Tank Test Table Design Progresses

A 20,000 lb. slosh and vibration table for environmental testing of fuel cells and tanks at Wright Air Development Center has passed the preliminary design stage.

Work was done by Century Engineers of Burbank, Calif.

The sloshing motion is imparted to a tilting reaction block by a throw crank and connecting rod driven by a 20 hp. electric motor through a variable speed unit and an 87.5 to 1 reduction. The specimen table is mounted on the reaction block and vibrated vertically relative to it by four eccentric mass generators each of which will generate a peak force of 60,000 lb.

All four units are driven from a single hydraulic motor mounted on the reaction block. Its supply pump is driven by a 100 hp. electric motor. Sixteen flexures limit movement of the table relative to the reaction block to vertical and prevent horizontal translation and rotation.

Vibration capabilities are:
- **Frequency**—20-50 cps.
- **Double amplitude**—.050 in.
- **Peak acceleration**—7.7 G.
- **Specimen weight**—20,000 lb.

Slosh capabilities are:
- **Frequency**—10-20 cpm.
- **Double amplitude**—16-30 deg.
- **Specimen inertia**—50,000 lb. ft. sec.
- **Specimen C.G. location**—48 in. above table.

General Electric Buys Cincinnati Land

General Electric Co. acquired a 108-acre plot adjacent to the company's jet engine plant at Evendale, Ohio, near Cincinnati. The purchase added to GE's present area will make 269.7 acres all told encompassing the GE facility.

J. S. Parker, general manager of the company's Aircraft Gas Turbine Division, said the additional land will allow greater flexibility for future planning.

Navy Re-Orders Radar Super Constellations

Los Angeles—Receipt of a $50 million re-order from Navy for WV-2 Super Constellation radar planes increased total military contracts awarded Lockheed Aircraft's California Division nearly $140 million, the company reported.

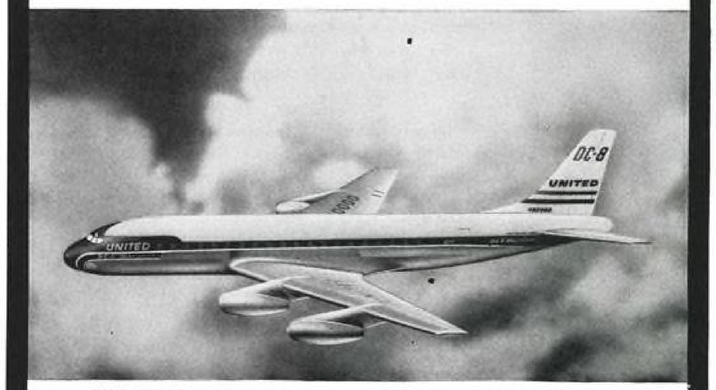
The WV-2 order, the fifth placed by the Navy, will extend deliveries of the electronic early warning airplanes through 1958. Exact quantities are not disclosed.

United specifies Skydrol for entire new jet fleet

In one of the largest commercial jet orders ever placed with one manufacturer, United Air Lines recently purchased thirty Douglas DC-8s for delivery starting in 1959. To help assure maximum operating safety and efficiency for these jets, United specified a fire-resistant Skydrol fluid *for the hydraulic system* (Skydrol 500).

The same advantages that make Skydrol the preferred fire-resistant synthetic hydraulic fluid in piston engine aircraft, also make it superior for use in jets. Skydrol is the only *fire-resistant fluid* approved by the C. A. A. — outlasts, *outperforms* petroleum fluids . . . providing higher lubricity for longer hydraulic component life.

Whatever your needs in hydraulic fluids, there's a Skydrol to do the job best. For more facts, write: Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Box SKD-5, St. Louis, Missouri.



THE DOUGLAS DC-8, powered by four P&W J-57 engines, will carry 112-140 passengers and 7000 lbs. of freight over 3000 miles non-stop at speeds up to 575 m.p.h. Seat-mile costs of operating these jets may even be less than latest piston types.

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The "bogeys" never had it so bad. Successful infiltration of our skies by their manned aircraft is slimming away to the point of no return—thanks to Navy F4D Skyray fleet interceptors.

The sleek, supersonic Skyray has a new stinger—Westinghouse Aero 13 armament control system. Aero 13 employs search-track radar to find the target. The computer calculates the best attack course and firing information. The rest is wreckage! Weather and moonless night make no difference. The "bogeys" can run, but they can't hide.

The Aero 13 armament control system is another example of Westinghouse creative engineering to solve today's problems—and tomorrow's applications, as well. Information and engineering assistance in specific fields of airborne electronic systems are available to you from Westinghouse Electric Corporation, Air Arm Division, Friendship International Airport, Baltimore 27, Maryland. J-91050-X

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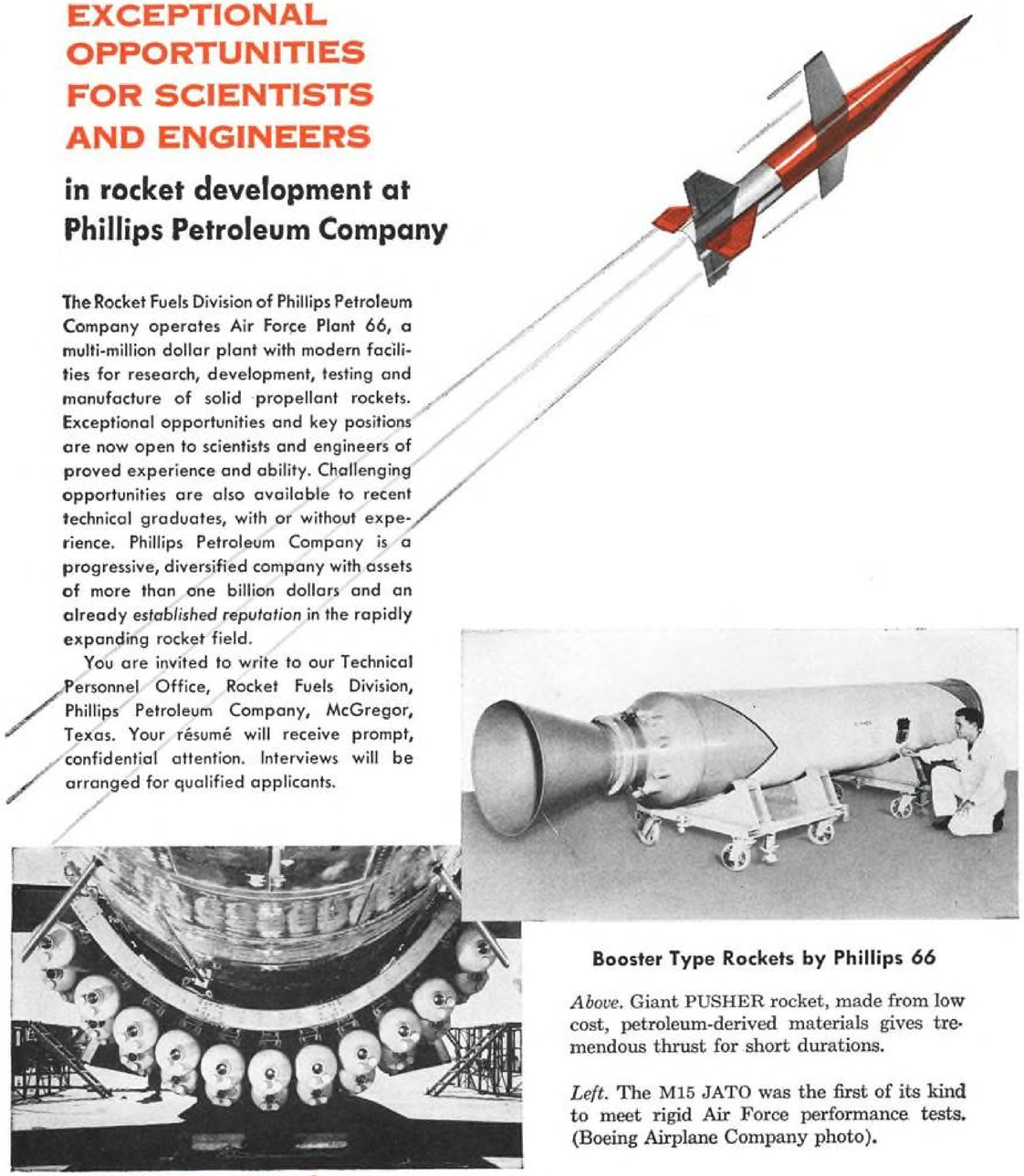
EXCEPTIONAL OPPORTUNITIES FOR SCIENTISTS AND ENGINEERS

in rocket development at Phillips Petroleum Company

The Rocket Fuels Division of Phillips Petroleum Company operates Air Force Plant 66, a multi-million dollar plant with modern facilities for research, development, testing and manufacture of solid propellant rockets. Exceptional opportunities and key positions are now open to scientists and engineers of proved experience and ability. Challenging opportunities are also available to recent technical graduates, with or without experience. Phillips Petroleum Company is a progressive, diversified company with assets of more than one billion dollars and an already *established reputation* in the rapidly expanding rocket field.

You are invited to write to our Technical Personnel Office, Rocket Fuels Division, Phillips Petroleum Company, McGregor, Texas. Your résumé will receive prompt, confidential attention. Interviews will be arranged for qualified applicants.



Booster Type Rockets by Phillips 66

Above. Giant PUSHER rocket, made from low cost, petroleum-derived materials gives tremendous thrust for short durations.

Left. The M15 JATO was the first of its kind to meet rigid Air Force performance tests. (Boeing Airplane Company photo).

Phillips 66

Rocket Fuels Division

PHILLIPS PETROLEUM COMPANY

McGregor, Texas

HUMAN FACTORS

Rocket-Tube Ejector Adds to Escape Margin for Jet Pilots

By Robert Cushman

New York—Rocket-tube pilot emergency escape catapult is being readied for the Convair F-106 by the Talco Engineering Corp., Hamden, Conn. The new ejector uses a canted rocket inside a tube to give added ejection height at low altitudes and to counteract the air-blast deceleration at high speeds.

Standard Catapult

Standard USAF M3 telescoping tube seat catapult is not considered safe for high speed ejects from supersonic aircraft (even those it is currently used on) and never was anything but marginal for "on-the-deck" ejects, according to experts at the Equipment Laboratory, Wright Air Development Center and in the escape device sections of advanced aircraft projects.

In the rocket-tube catapult, the ¼ lb. first charge ignites when the pilot pushes the eject button and expands in the lower tube, pushing the rocket (which is attached to the seat) out piston fashion as in the M3. Once the pilot and seat are lifted clear of the guide rails in the cockpit, the 5 lb. rocket grain is fired.

The rocket thrust, directed through the pilot-seat center of gravity continues to separate the pilot from his disabled ship.

Because it is directed through the pilot-seat center of gravity, there is no unbalanced torque to aggravate tumbling.

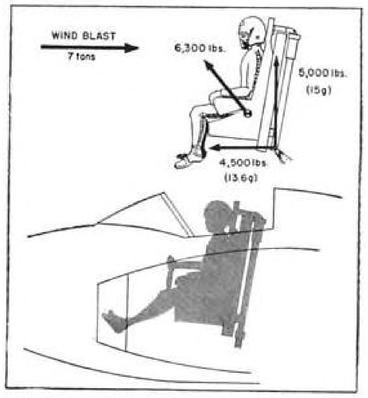
Furthermore, the canted rocket thrust has a forward component which can soften the rearward jolt which occurs when the pilot is catapulted abruptly into the slipstream.

Actually it is this split-second stopping of the aerodynamically "duty" pilot in the sudden departure from the airframe carrying him at high speeds which does the greatest physical damage.

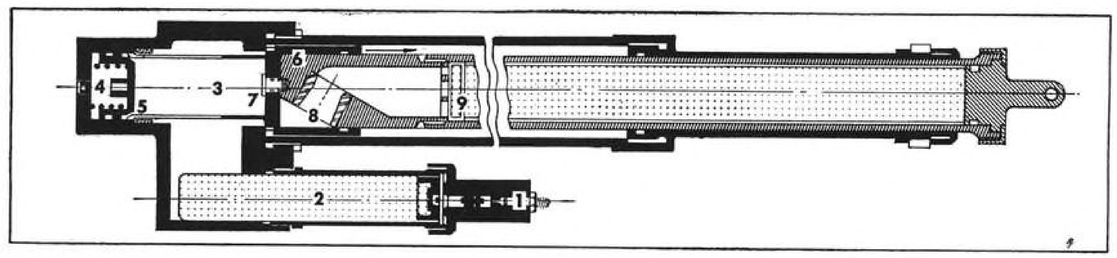
Deceleration Force

At speeds over Mach 1 and even in the less dense air of altitudes over 30,000 ft. the total air load on the pilot may easily be as great as seven tons and the resulting decelerations as high as 40G—exceeding the pilot's 35G tolerance limit in the horizontal direction. His vertical ejection limit is 20G.

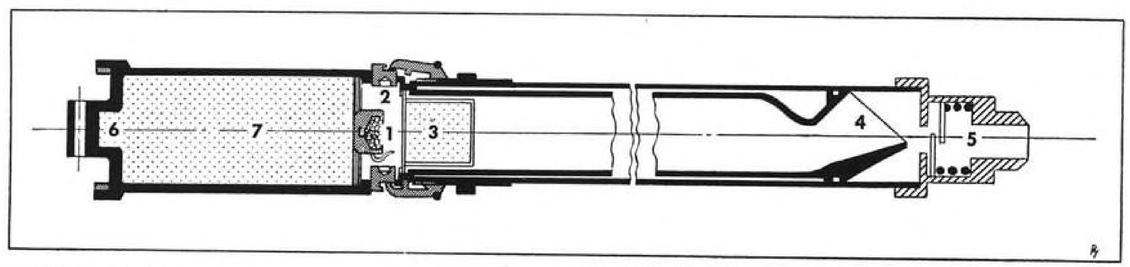
Talco currently has taken a lead in this new field so far as hardware is concerned. But David Fulton, Bernardsville, N. J., who recently formed his own catapult firm, was one of the first to put the concept down on paper. In May, 1954, when he was with Reaction Motors Inc., Denville, N. J., Fulton ap-



FORCE vectors in ejection explain use of canted rocket nozzle. The 4,500 lb. forward component counteracts seven ton slipstream force. The 5,000 lb. upward component provides twice the height of present ejectors.



PRELIMINARY version of Talco's rocket-tube catapult is shown in centerline slice. Outer container is anchored to airframe (left), and rocket assembly is at right. Firing pin (1) actuated by pilot's eject button ignites tube grain (2). Gasses fill chamber (3) and push back lock (4) allowing grips (5) to spring in and the intermediate sleeve assembly (6) to move upwards (to right). When intermediate sleeve (6) slams against restraint on end of outer container, jolt causes thin rim of plug (7) to shear off and gasses from chamber (3) to enter nozzle (8) and ignite rocket grain (9).



FULTON'S ejector (facing opposite way) uses electrical squib-fired ignitor charge (1) to push locking levers (2) out and fire the tube grain (3). Gasses expand out nozzle (4) and work against barrier (1) to start seat moving (to left). Vent valve (5) is for grain overburning on hot day. Seat movement actuates microswitch (not shown), fires rocket charge ignitor (6), sets off main rocket charge (7). Main rocket charge destroys barrier (1) and reaches canted nozzle (4).

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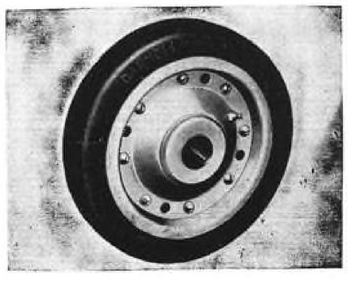

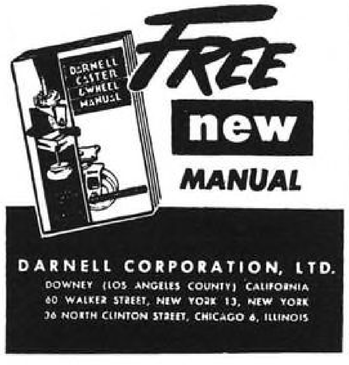

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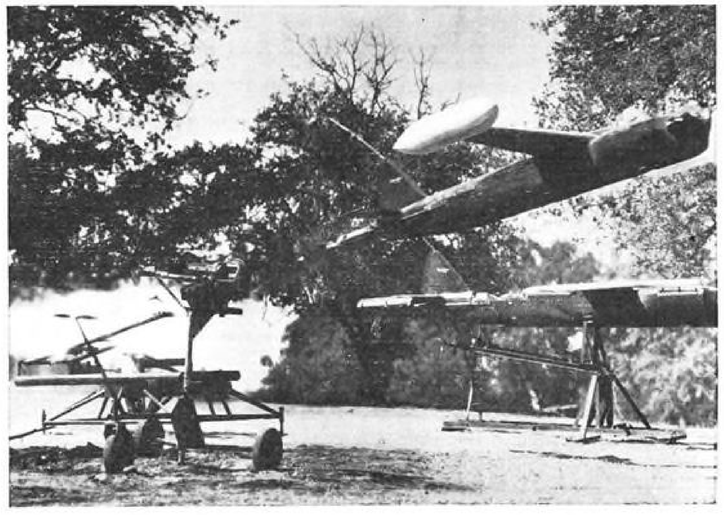
Rato Launches Drone Types

Radioplane RP-77 target drone (above) blasts off zero-length launcher on thrust from main powerplant and two small Rato rockets. Launcher was recently developed by company. RP-77 is recoverable by parachute. Photographic reconnaissance of a battlefield area is the mission for Radioplane RP-71 modified drone aircraft (below). Plane is in service with Signal Corps for tactical remote reconnaissance. Launching is by Rato rockets.



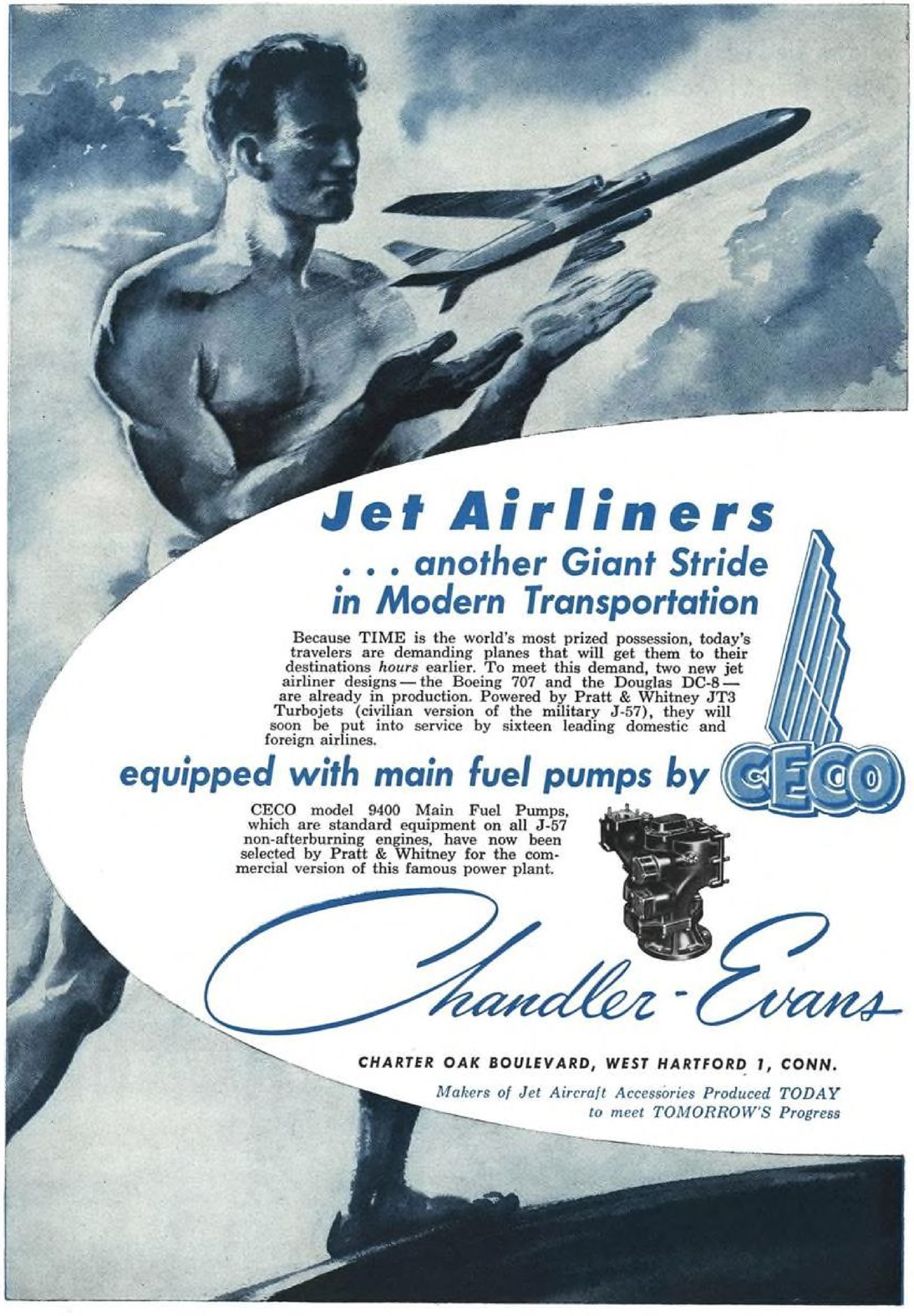
plied for a patent on the combination principle and presented the combined rocket-tube ejector to the Frankfort Arsenal.

Last month two dummies were ejected from a side-by-side TF-102 cockpit on the high-speed sled at Edwards Air Force Base, one dummy by a seat equipped with the standard M3 double-tube catapult and the other by one of Talco's new rocket-tube combinations. Convair observers reported that the Talco equipped dummy went from half again to twice as high as the M3 ejected dummy. In addition, the Talco dummy had ample time for the parachute to open.

Since this test was made at Mach .3, it only represents the new system's ability to increase take-off and landing survival, situations which nevertheless cause a large percentage of ejection fatalities.

Landed Ahead

The effect of the forward component of the rocket was to cause the Talco rocket seat to land 100 yd. farther down the track in the direction of the sled's motion. At Mach .3 neither dummy tumbled much, but at higher or lower speeds the fact that the Talco system's rocket thrust line is directed through the pilot-seat center of gravity is ex-



Jet Airliners
. . . another Giant Stride in Modern Transportation

Because TIME is the world's most prized possession, today's travelers are demanding planes that will get them to their destinations *hours* earlier. To meet this demand, two new jet airliner designs — the Boeing 707 and the Douglas DC-8 — are already in production. Powered by Pratt & Whitney JT3 Turbojets (civilian version of the military J-57), they will soon be put into service by sixteen leading domestic and foreign airlines.

equipped with main fuel pumps by CECO

CECO model 9400 Main Fuel Pumps, which are standard equipment on all J-57 non-afterburning engines, have now been selected by Pratt & Whitney for the commercial version of this famous power plant.

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These internally restrained stainless steel assemblies are used to control the growth of thermal loads in pneumatic ducting systems by angular deflection. Two kinds are available: a center link type and a double link bar type. The first anchors the ends of the bellows at a single point along the bellows center line; the double pivot type employs two pivot points on the bellows center line. In a tension system these tie-rods reduce the bending moments, reduce the column loading and reaction loads at the mounting flanges.

A complete line of aircraft quality stainless steel bellows and ducting components are manufactured by Arrowhead. Other products include pressure compensating chambers, braided-bellows and flexible rubber-fiberglass ducting. Bellows are made in all diameters from 1″ to 15″.

For additional information, write

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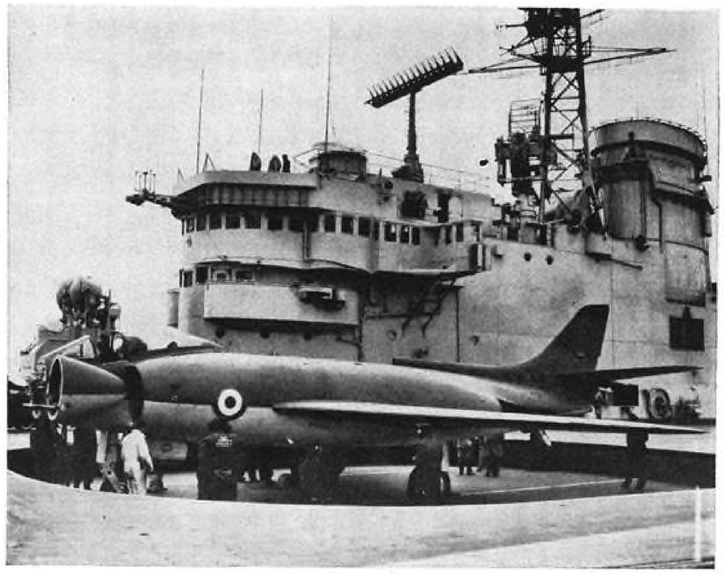

Supermarine N.113

Vickers Armstrongs Ltd. Supermarine N.113 on deck elevator of British carrier, HMS Ark Royal. Note out-folding radar-carrying nose. Plane is powered by two Rolls-Royce Avons.

pected to prevent pilot nausea due to gyrations.

The Talco seat was fired slightly ahead of the other to check the effect of the rocket exhaust gasses on the remaining dummy. Observations indicated that the rocket gasses did not start streaming until the Talco seat was clear of the cockpit and the thermocouples located on the remaining dummy indicated there was no objectionable temperature rise.

Design Details

The illustrations (p. 71) show preliminary versions of both designs. Main difference between the Talco and the Fulton systems is in their methods of keying off the second grain for the rocket blast at the proper time and distance along the stroke.

Fulton intends to use a microswitch located by tests at the proper place along the guide rails. Jerry Hurt, Talco's designer (formerly with the Frankfort Arsenal), uses the force of an intermediate sleeve as it slams against a travel stop on the outer container (which is anchored to the airframe) to shear off the retaining head of a small plug dividing the tube chamber from the rocket chamber. The hot gasses then blow through the nozzle into the rocket chamber and ignite the rocket charge grain.

The sizing and timing of the rocket blast is the greatest single problem, Hurt said. If it fires too soon it may fill the cockpit with fumes and give the pilot too great a jolt; too late and deceleration due to air blast may kill him. The amount of charge must tie in with the timing.

As an embellishment upon the standard M3 catapult first action, Fulton has added a simple spring loaded valve

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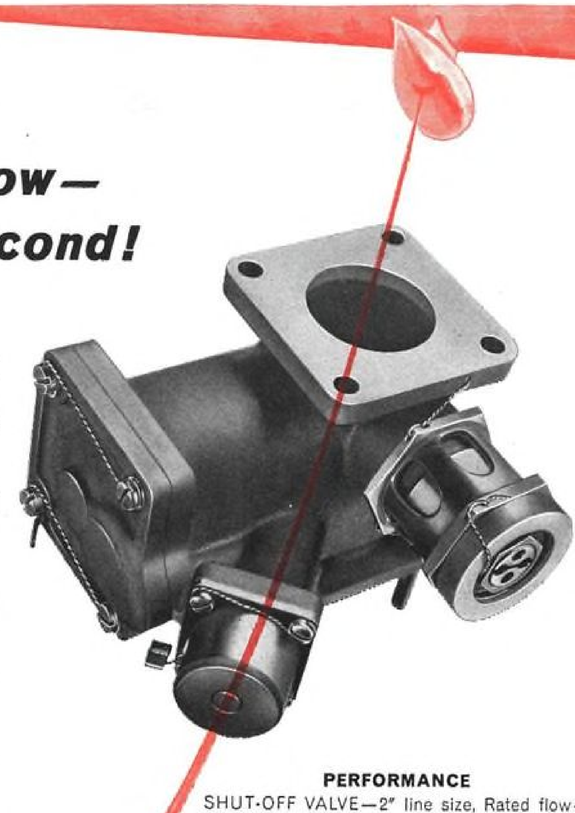


Here is the highly efficient new fueling shut-off valve, designed by Whittaker to solve the problems involved in shutting off the high velocity, high pressure flows during in-flight and ground fueling operations.

The shut-off valve is a pilot actuated, piston powered flapper type. This design provides rapid shut-off by utilizing the dynamic energy in the flow stream to augment the force obtained from the line pressure on the actuating piston.

A surge relief valve, consisting of a co-axial pilot and main valve assembly, is provided to limit surge pressures to 125% of line pressure.

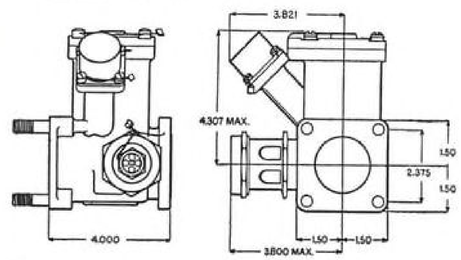
The valve is designed to be installed in the fueling line and within the fuel tank. The pilot bleed and surge control fuel is vented into the tank, making it possible to shut off a 200 GPM flow in 250 milliseconds with an overshoot through the fueling line of only .75 gallons.

NOTE: Flapper shut-off forces are balanced by the actuating piston to enable the flapper to be opened against the maximum line pressure. The surge relief valve employs a co-axial pilot assembly to obtain minimum pressure loss and accurate control of both cracking and reseat pressures.

PERFORMANCE

SHUT-OFF VALVE—2″ line size, Rated flow—200 GPM at 1 PSI pressure drop, Rated pressure—110 PSI, Actuation time—250 milliseconds at 200 GPM and 110 PSI, Pilot valve—18 to 30 Volts D.C., 1.2 Amps maximum at 30 Volts.

RELIEF VALVE—Cracking pressure—125 PSI, Full relief flow (200 GPM)—135 PSI.



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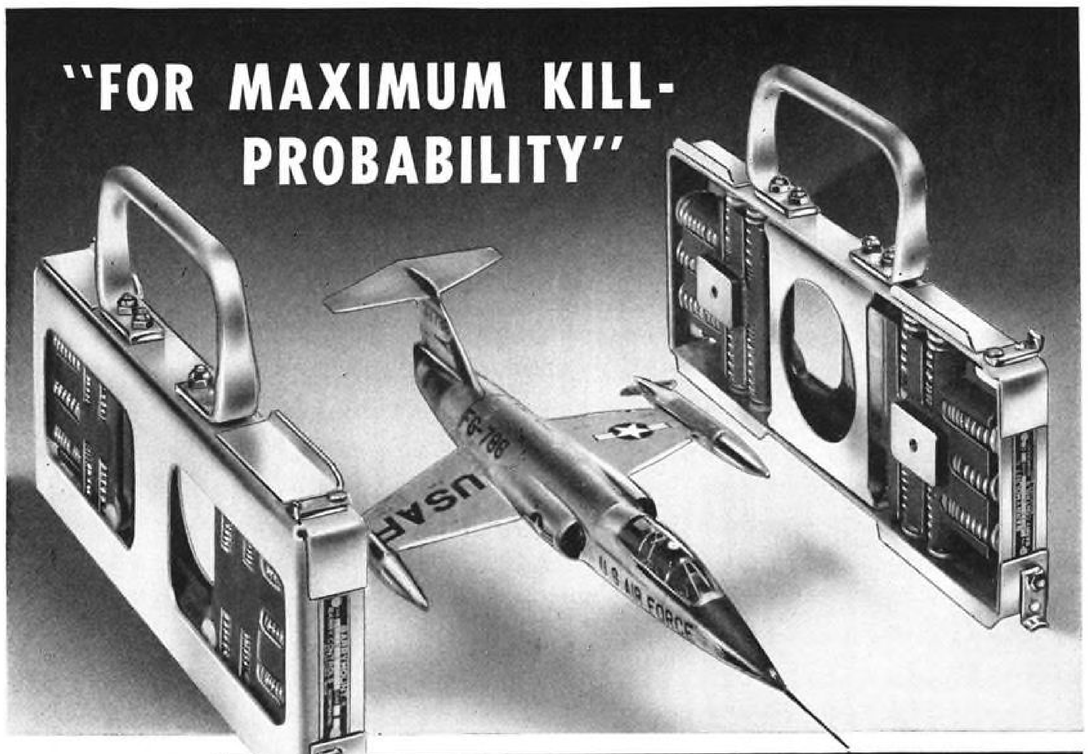


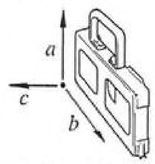
Starfighters' Fire-control Radars Use Barry's NEW Integral* Mounting Systems

In the most advanced airplane of its type ever developed — Lockheed's F-104A Starfighter — Barry's new Integral* Mounting Systems are solving the toughest combination of shock, vibration, and sustained-acceleration problems ever posed by jet aircraft. Literally a "missile with a man in it", the F-104A demands that equipment mounts give superior performance, in less space, and at lighter weight than ever before.

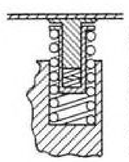
Here's how Barry's Integral* Mounting Systems are meeting this demand in the production models of the Starfighter.

In a space only 12¾ x 5⅜ x 1-13/32" on each side of a 150-pound load . . . a pair of units weighing less than three pounds each . . . provides adequate vibration isolation at 4g sustained acceleration in all radial directions . . . passes all shock-test requirements of this supersonic fighter . . . performs reliably through wide temperature and altitude ranges . . . and provides positive, quick-release attachment to the airframe to satisfy Lockheed's requirements for "plug-in" electronics-system components.

Here's the way this system works.



Helical springs designed to function in their axial direction only are grouped about the load attachment points so as to provide controlled resistance to movement along the *a* and *b* axes. For the *c* axis, resistance is provided by the slightly tapered side flanges of the mounting frame working against the displacement of all the load-carrying springs.



Damping adjustments (see diagram), completely independent of the stiffness of the load-carrying springs, provide design flexibility for obtaining desired natural frequency, transmissibility at resonance, and degree of vibration and shock isolation.

Write for THO-5 containing a full exposition of this All-Angl Integral* Mounting System.

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to the bottom of his tube chamber. This valve allows the temperature sensitive solid propellant grain to be designed for adequate kick in cold temperatures but vents the excess when the grain is warm and burning too rapidly.

Source of Danger

As with so many of the safety devices heaped upon modern aircraft, the improved system also intensifies its own built-in hazard in case of malfunction.

The rocket demands an increased weight of solid propellant located close to the pilot. Though most authorities tend to discount the possibility that this will be set off in combat by enemy action, they do agree there is an increased possibility that rough handling, hard landings and aging may add to the danger of an involuntary or erratic firing.

The combined system does not have as large a charge as a pure rocket type would (such as Aerojet General once proposed and Atlantic Research, Alexandria, Va. is now working on), but it still has to have 5 lb. of grain in addition to the ¾ lb. primary tube action charge.

The pure tube type needs only ¾ lb. total grain.

As for cost, both Fulton and Talco are confident that the combined system need cost little more, if any, than the older M3s. For one thing the new ejector will be made competitively by private industry rather than exclusively by the government operated Frankfort Arsenal.

Other aircraft projects which may utilize the combined system are: Douglas RB-66, Martin P6M SeaMaster and North American F-107. Goodyear Aircraft is considering the principle for its pilot escape capsule.

New Company to Make Chemical Propellants

Development of gas-generating devices for aircraft will be one major objective of Propellex Chemical Corp., a recent entry into the chemical propellant field.

Founder of Propellex is Dr. Robert A. Cooley, formerly with Olin Mathieson Chemical Corp.

The company will work in the areas of propellant and explosive research, development and manufacture. In the aircraft field, the company proposes to emphasize gas generators as jet engine starters, aircraft and missile auxiliary power units and safety devices, as ejection systems. Propellants are being developed around fertilizer-grade ammonium nitrate to reduce the cost of solid fuels.

Now...

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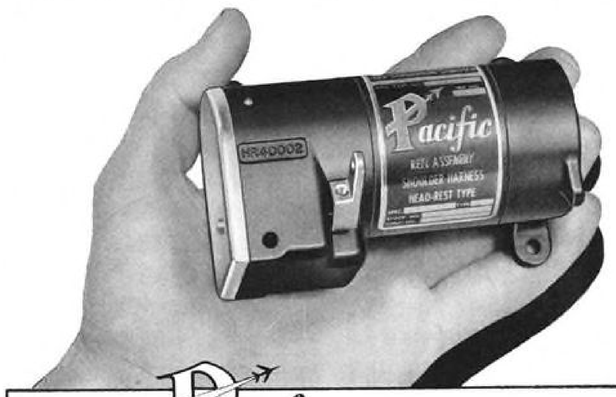
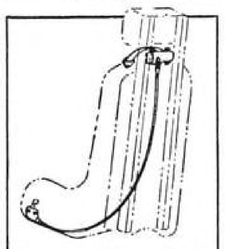


with *Pacific*'s fully automatic multi-directional protection!

Here's the most advanced design in personnel protection—the Pacific HR-40 Shoulder Harness Reel! Based on the same principle of operation as the now standard HR-30, this new reel works against any force which tends to throw the user from his seat – *in any direction!* It permits full mobility and freedom to perform all duties, yet, when an emergency does occur, it locks instantly and automatically to hold the seat occupant safely in place!

Made to the absolute minimum weight, the reel alone is only one pound, and is the smallest overall package available. It is designed especially to put the shoulder harness reel logically out of the way of ejection seat mechanisms and other equipment, by its convenient location on the seat head rest. It permits easy initial installation, fast harness attachment and can be used with integral suit harnesses when they are available.



A typical head rest installation showing the reel, manual reset lever and cable.

Fully self-contained, the HR-40 needs no electrical, hydraulic, or other external accessories to operate, and is absolutely unaffected by temperature, vibration or the position of the aircraft. The entire reel is fully tested and built to conform to Air Force Specifications MIL-R-8236, type MA-6.

For more complete information, contact your nearest Pacific office or representative, or write for the latest bulletin on the HR-40!

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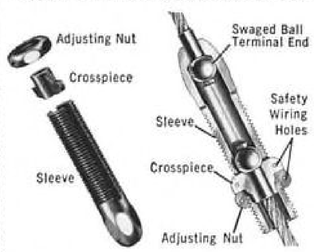
Already in use by many major aircraft manufacturers, the CABUCKLE answers the problem of more efficient cable tensioning and adjustment. CABUCKLE'S many unique design features offer unusual flexibility of application, yet provide absolute dependability. This new accessory is available in a wide choice of standard sizes or special types to your specifications. Write for complete catalog information.

Here's How the CABUCKLE Works



CABUCKLE consists of three parts: a threaded sleeve, a crosspiece and an adjusting nut. Use of a wrench on the adjusting nut provides accurate cable tension. Available in most materials.

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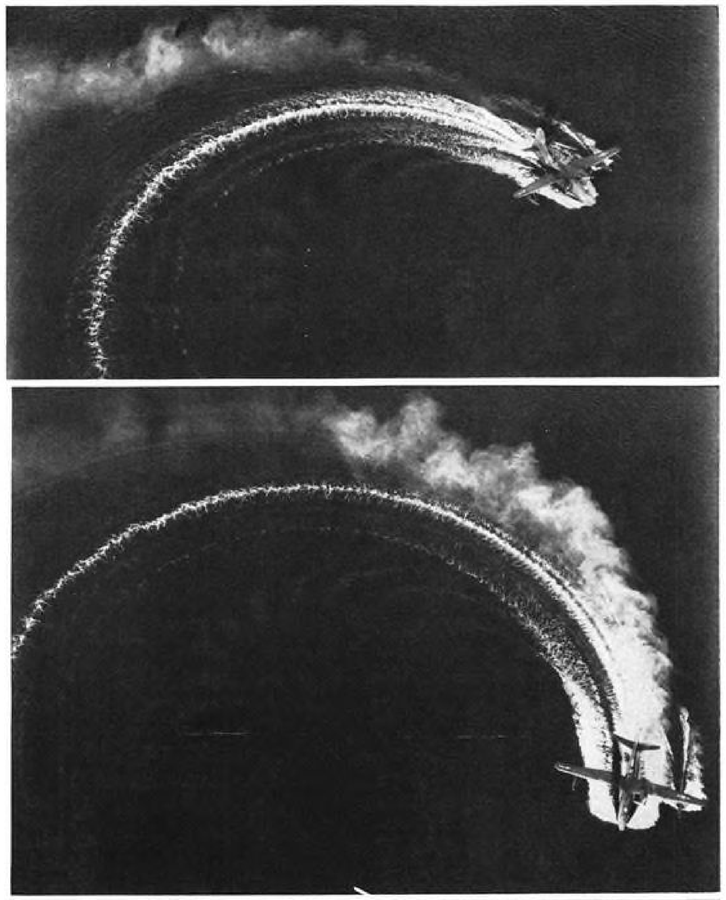

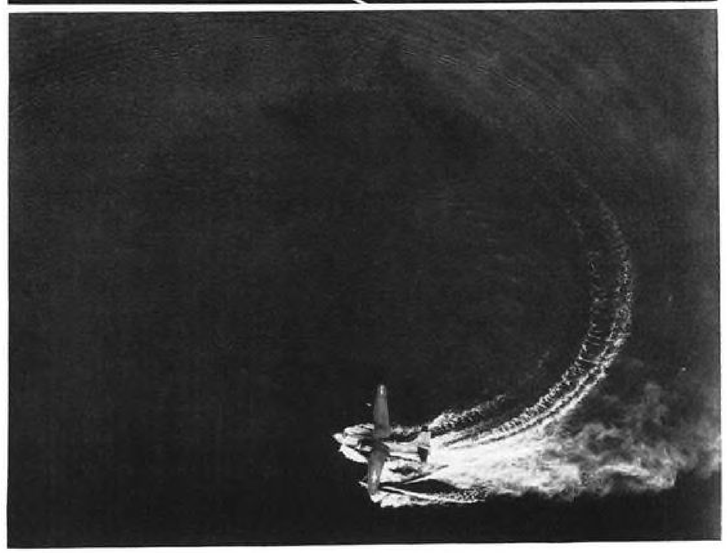

Martin Maneuvers

Martin P5M demonstrates water maneuverability with Martin-developed hydroflaps. Flaps on both sides of rear hull can be used individually as rudders or as brake when opened together. Devices also can be used as mine doors.

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

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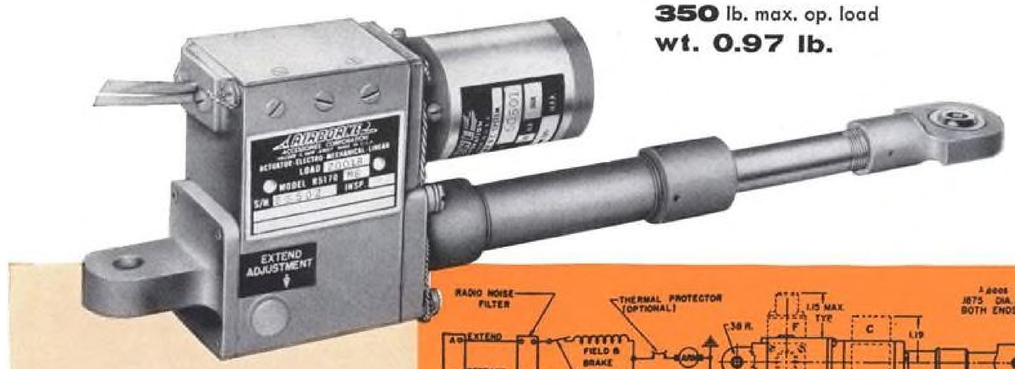
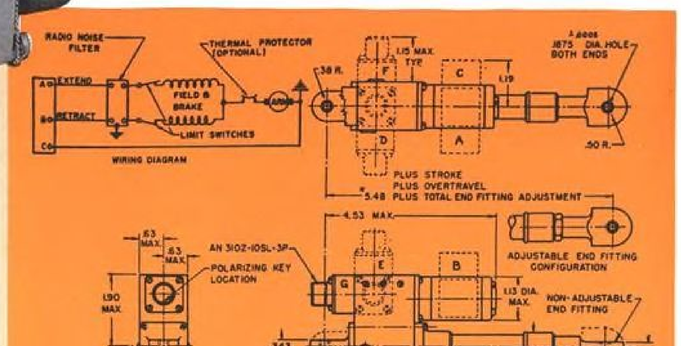
350 lb. max. op. load
wt. 0.97 lb.



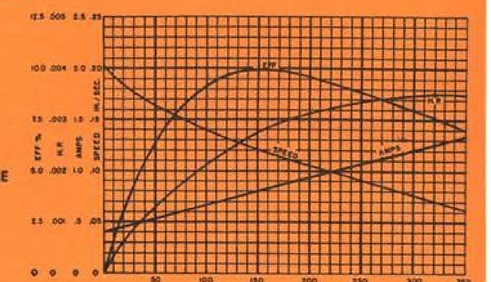
GENERAL
ENGINEERING DATA:

1. 26 volt dc split field, series wound reversible, intermittent duty motor with magnetic brake. Available with thermal overload protector.
2. Unit includes limit switches externally adjustable through entire length of stroke, positive overtravel stops, overload clutch, and anti-rotation device.
3. Maximum operating load—350 lb. Ultimate static load—1000 lb. for 12 inches maximum extended length.
4. Weight 0.97 lb. Plus 0.03 lb. x stroke in inches. Plus 0.04 lb. for thermal overload protector.
5. Maximum dimensional tolerance ±.03 in. unless otherwise specified.
6. Dimensions given are minimum lengths for zero stroke. To determine minimum length for required stroke, add stroke plus stroke overtravel plus total end fitting adjustment.



OPTIONAL LOCATIONS	
THERMAL PROTECTOR	CONNECTOR
A	D
B	E
C	F
	G

TYPICAL PERFORMANCE 26 v dc



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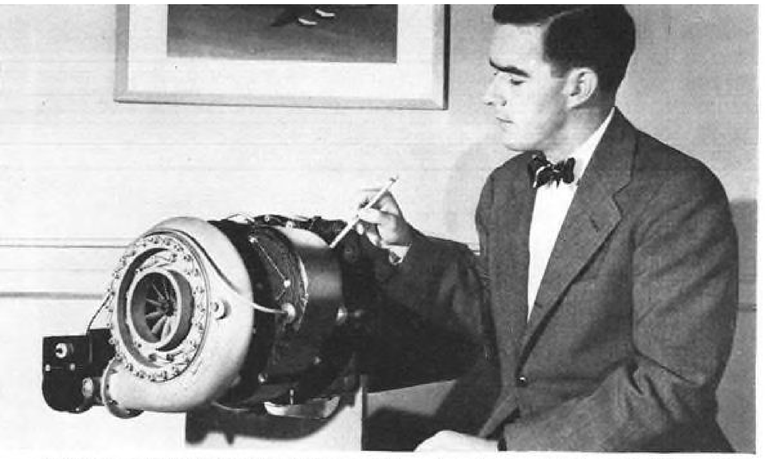
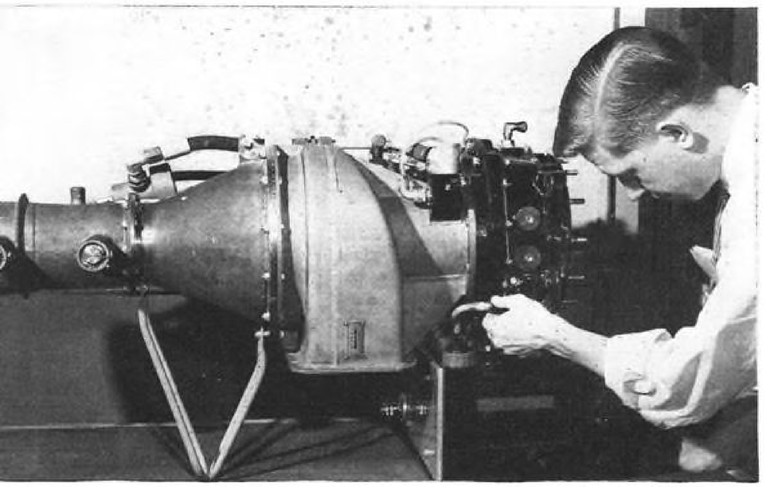


G-E TURBOPUMPS ON THE B-52 are driven by air ducted from the jet engines. These units supply the hydraulic power necessary to operate the bomber's steering, empennage surfaces, landing gear, bomb-bay doors, and wing spoilers.



G-E TURBODRIVES ON THE B-52 also operate on air ducted from the engines. These constant-speed drives each turn a 60-kva, 400-cps alternator which produces electricity for the B-52's radar, lighting, armament, and control panels.

THE B-52—first aircraft in history to use pneumatic-driven power equipment for operating its entire accessory system.

New General Electric Air-turbine Drives Save Weight, Permit Increased B-52 Performance

The Boeing B-52 Stratofortress, newest Air Force jet bomber, uses General Electric turbopumps and turbodrives to help supply its hydraulic and electric power. Chalking up more than 100,000 hours operating time, these weight-saving power packs have helped to make the giant bomber one of the most advanced aircraft in the world today.

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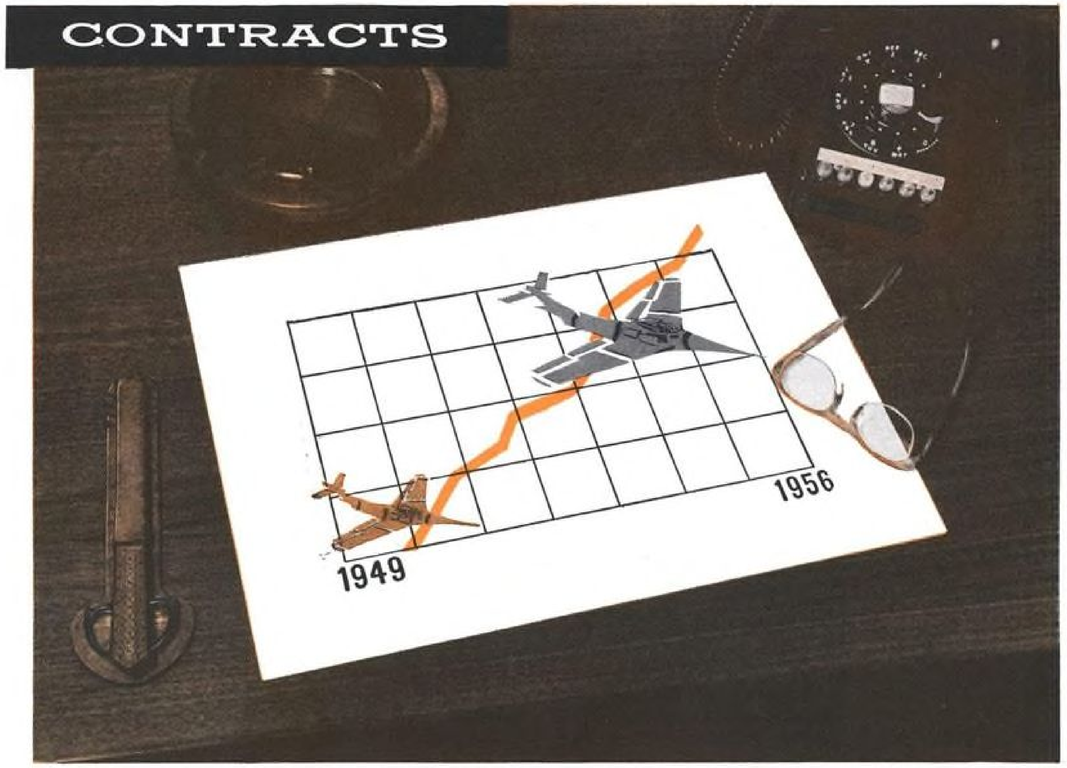
CONTRACTS



At Temco GROWTH tells the story

Growth — in contracts earned, for example, tells the Temco success story.

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ENGINEERS: *For complete details of the Temco story of unusual opportunities in all phases of engineering, write: Joe Russell, Engineering Personnel, Room 10-B, Temco Aircraft Corporation, Dallas, Texas.*

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Datamation: Third Hand for Controller

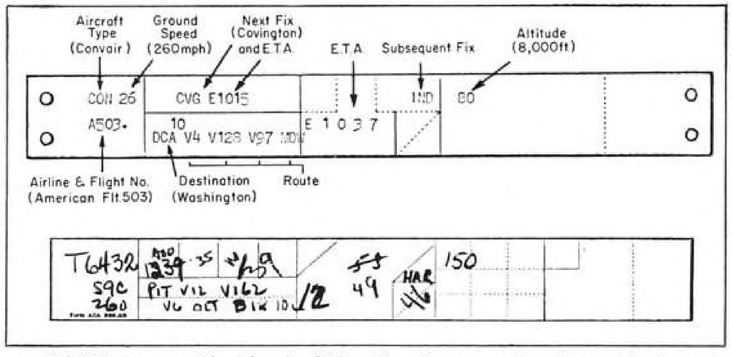
By Philip J. Klass

Indianapolis—Semi-automatic air traffic control coordinating system which will use electronic data processing (datamation) technique to relieve, but not replace, the over-burdened traffic controller is under development at Civil Aeronautics Administration's Technical Development Center (TDC).

Details of this new research and development program were reported here during the recent Fall Assembly Meeting of the Radio Technical Commission for Aeronautics by G. E. Fenimore, chief of TDC's Air Traffic Control Equipment Branch.

TDC is taking an evolutionary rather than revolutionary approach to automation of the existing traffic control system. This will permit piecemeal introduction of improvements and simplify the transition. Much of the program is sponsored by the Air Navigation Development Board.

FLIGHT plan data stored on magnetic drum can be up-dated by controller to correspond to new position report. System will automatically compute fix ETA and print out . . .



. . . **FLIGHT** progress strip (above) which will replace manually written strip (bottom).

Automation Barrier

Biggest barrier to the use of electronic data processing techniques is that Air Route Traffic Control Centers now receive aircraft flight plan information in void form—a form computers cannot accept.

When this flight plan information is telephoned into an ARTC Center from an airline office, military operations center, or Interstate Airways Communication Station (INSACS), an assistant flight controller must prepare several flight progress strips, one for each of the sectors through which the airplane will pass. (Photo, lower right.)

These strips show airplane identity, altitude, speed, destination, route, as well as estimated time of arrival over each radio fix. This has to be calculated by the assistant controller, and must be revised on each flight progress strip in event of en route delays.

Flight Strips

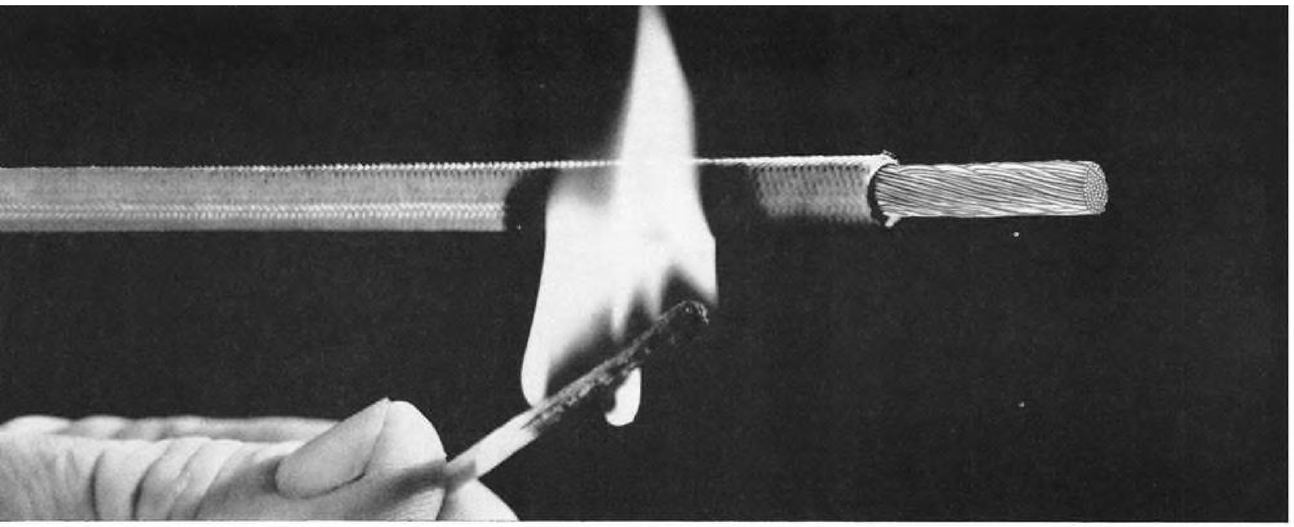
When the airplane destination lies outside the local ARTC control area, the controller must call the adjoining ARTC center, and orally transmit information on the flight to an assistant controller there. Once again flight progress strips must be manually prepared and estimated time over fixes must be calculated.

The first phase of TDC's program calls for the development of a system which will permit all flight plan data to be transmitted to ARTC Centers, and between centers, over conventional teletype circuits. Local airline, INSACS, or military operations offices will file their flight plans by means of a push-button handset, or by means of punched cards or perforated tape, Fenimore said. The device might resemble the present airline reservations computer handset. Suitable means will be included for checking the format of the flight plan message.

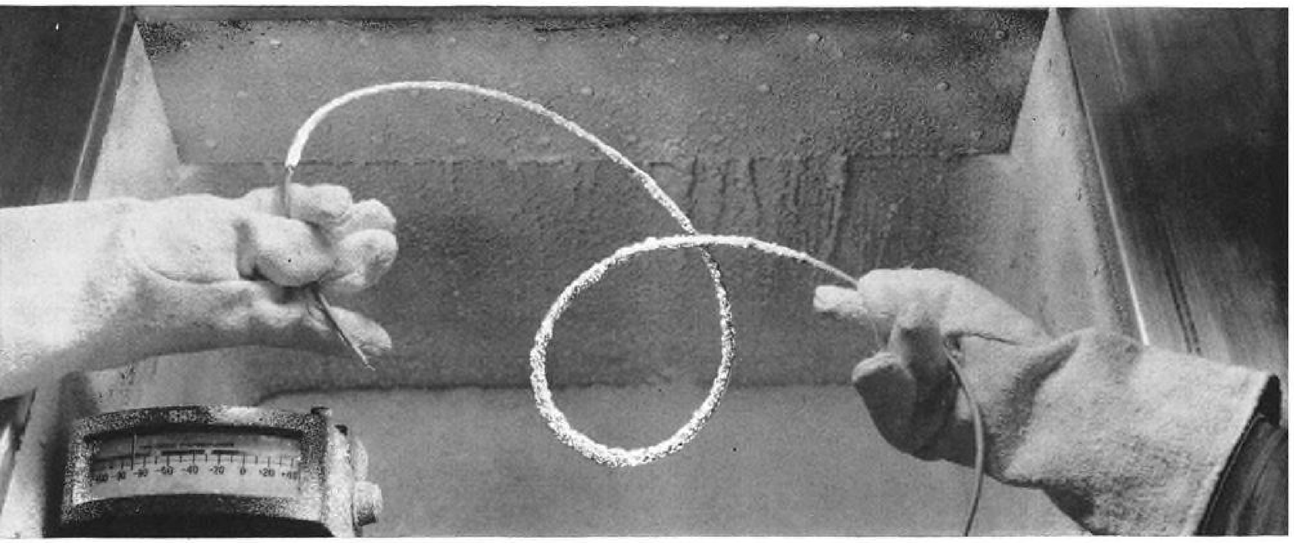
Automatic teletype switching centers will route the message into the proper ARTC Center. Here it will feed into a digital computer and magnetic storage drum. The computer will determine how many flight progress strips are required for the particular flight and what time the aircraft is estimated to arrive over each radio fix. Teletype printers within the Center will then print out the required number of flight progress strips for each sector and these will be manually inserted in the strip holders. (See top photo.)

Revised ETA

If an aircraft is flying into an adjoining ARTC control area, its flight plan must be transmitted to the new ARTC Center about 20-30 min. before the aircraft comes under new control. The proposed computer will automatically transmit this flight plan data to an adjacent ARTC Center computer and magnetic storage where the same procedure of computing fix ETAs and printing out flight progress strips will be



PACKARD ELECTRIC / *Heat at 500° F. doesn't harm it!*



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Packard PE-400 will withstand prolonged operating temperatures up to 500° F. Flame will not destroy its effectiveness. It is not affected by any of the fuels or chemicals used in aircraft operation.

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accomplished. If radio/interphone reports from the pilot indicate a change in flight plan, the controller will use a push-button handset to set these revisions into the stored flight plan data before it is transmitted to the adjoining center.

TDC intends to investigate the operational feasibility of printing revised flight progress strips whenever an aircraft fix report (made by voice radio or interphone) indicates a change in ETA. This would require the traffic controller to enter the new data into the computer by means of the push-button handset, enabling it to recalculate and print out revised flight strips.

It may prove easier for flight controllers merely to cross out and write in the new flight data rather than punch in the data on the handset and then replace old flight strips with new ones, Fenimore said.

However, in the second phase of TDC's program, such semi-automatic periodic revision of flight data will certainly become feasible.

Phase II

In the second phase of TDC's development program, the long-used flight progress strips will be replaced by electronic displays using special cathode ray tubes such as the Convair Charactron or Hughes Typotron. These probably will display information in much the same fashion as present flight strips do.

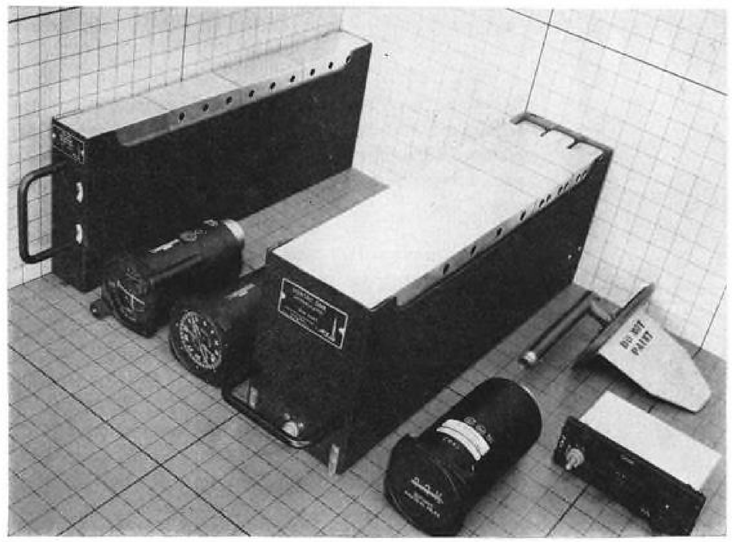
However, each flight automatically will be displayed in the proper time sequence in the order of its estimated ETA over a reporting fix. When a position report is received by radio or interphone, the controller will use a suitable handset to correct the flight data displayed and this will automatically feed the revised data into magnetic storage.

Warning Light

The computer will then recalculate ETA estimates over all subsequent fixes and automatically transmit this revised flight data to the displays of adjoining sector traffic controllers. When such data revisions are made, a light will flash to alert the controller of the change and continue flashing until the controller acknowledges that he is aware of the change by pushing a button.

Because flight data on all controlled flights is stored in the computer, and periodically up-dated by the controllers based on radio/interphone reports, the computer will be able to determine roughly whether suitable separations are being maintained. The computer will also be able to look ahead for possible conflicts, and warn the controller by means of flashing lights.

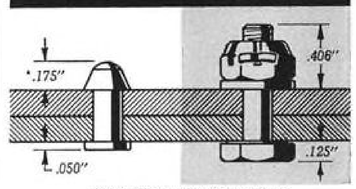
Growing use of peripheral (remote) VHF stations that permit direct radio contact between ARTC controllers and the aircraft they are controlling instead



Prototype Vortac DME

Vortac DME, first equipment to be developed following recent resolution of Tacan controversy, is shown in prototype model weighing 35 lb. and occupying ½ ATR size case (center). Unit was developed by Federal Telecommunication Laboratories and produced by its affiliate, Federal Telephone & Radio Co. Vortac DME obtains distance information from ground Tacan stations to be installed at VOR sites. Small ¼ ATR size unit (far left) is bearing adapter which can be added to Vortac DME to provide Tacan bearing information. DME is suction cooled from a central cooling system or with its own air blowers.

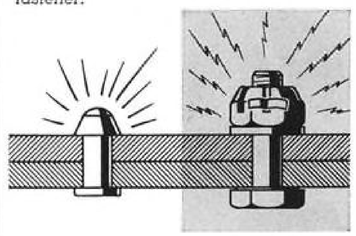
3 *hi-shear* FACTS THAT COUNT!



*PROTRUSION SHOWN FOR MAXIMUM GRIP CONDITION

minimum protrusion

HI-SHEAR rivets have the smallest "headed ends" of any high strength fastener.



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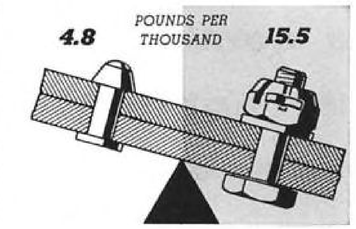
The smooth spherical rivet end eliminates chafing of adjacent fuel cells or other equipment. HI-SHEARS eliminate hazards in aircraft areas which are accessible to the flight or maintenance crews, passengers and cargo.



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HI-SHEAR rivets are the lightest, standard high strength fasteners in the aircraft industry.

Installed fastener size and weight shown above are based on HI-SHEAR HS52P-6-5 pin and HS15-6 collar compared to AN3-5 bolt, AN310-3 nut and AN960-10 washer.

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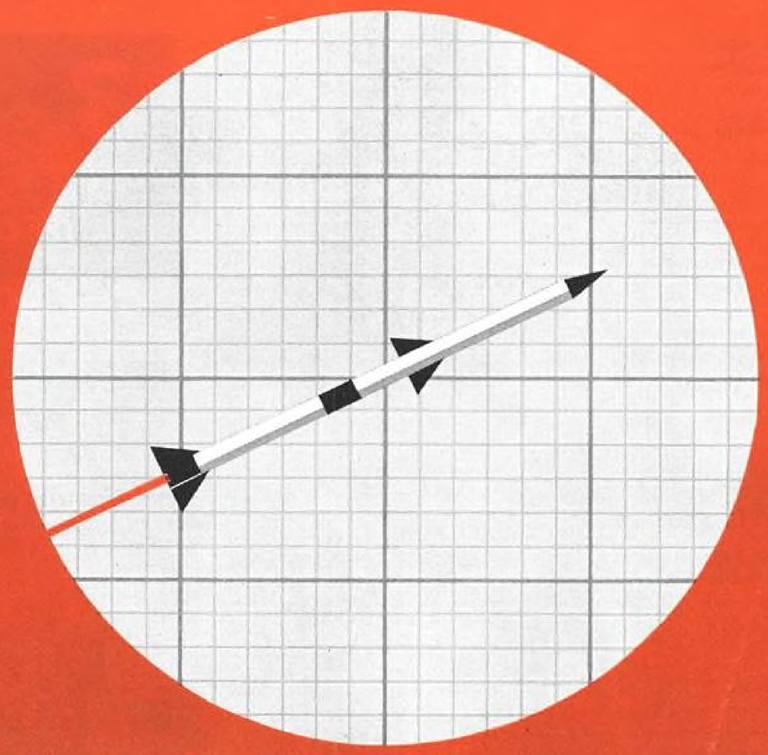

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Looking to future expansion, Burroughs invites inquiries from qualified engineers.

of working through airline radio stations has made it more difficult for airline dispatchers to keep track of flights. When the second phase of the system is operative, airlines will be able to interrogate the ARTC Center magnetic storage drum and obtain instantaneously information on the ETA of their aircraft.

The system also may be tied in with the air defense SAGE system to permit the interchange of information on the position of civil-military aircraft.

Phase III

The final phase of the program calls for the use of "fine-grain" position data such as that obtainable from air-ground data link (transmitting aircraft bearing, distance and altitude), and from ground radar when aircraft are equipped with transponder beacons that provide positive aircraft identification.

This precise aircraft position data will be available on practically a continuous basis compared to the present infrequent voice-radio position reports. This automatically derived position data will be fed into the computer and magnetic storage drum, permitting more accurate control and resolution of conflict than possible in Phase II where infrequent voice-radio position reports are the only source of information. Phase III also will provide controllers with a pictorial display of aircraft position as well as the electronic flight progress strip type display.

TDC hopes to obtain a Sperry Rand Univac File Computer next spring and to have its Phase I system in operation by the summer of 1958, Fenimore said. From this prototype system TDC expects to determine how much storage and computer capacity is required, and work out computer programming problems.

Military Liaison

TDC group located in the Boston area is working closely with Lincoln Laboratories and Air Force Cambridge Research Center to obtain information on the latest military developments in electronic display techniques for application to Phase II and Phase III of TDC's program. If sufficient funds are made available, Fenimore hopes that an experimental Phase II system will be in operation at TDC by late 1959.

Barring a major increase in the program's pace, this indicates that the earliest implementation of the Phase I system in the nation's 31 ARTC Centers is probably around 1960-61, with Phase II implementation 18-24 months after.

However, TDC also is investigating an interim measure which might provide more immediate relief, if it proves operationally feasible. TDC will soon

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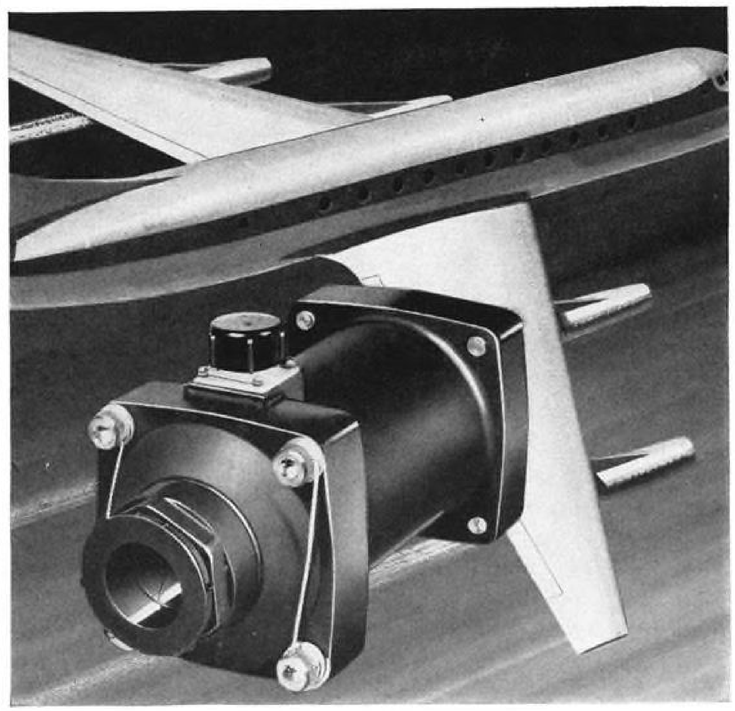

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The accuracy of the Single-Turbine Type Mass Fuel Flow Transmitter is *within 1% of actual flow*, regardless of flow rate, type of fuel, or environmental conditions. The new, single turbine is responsible for this greater accuracy because of its reduced friction, reduced fluid coupling, and insensitivity to aircraft accelerations.

The simplified design and fewer parts of this Bendix angular momentum transmitter also make possible longer, more trouble-free service life, and *its use to measure flow in either direction*.

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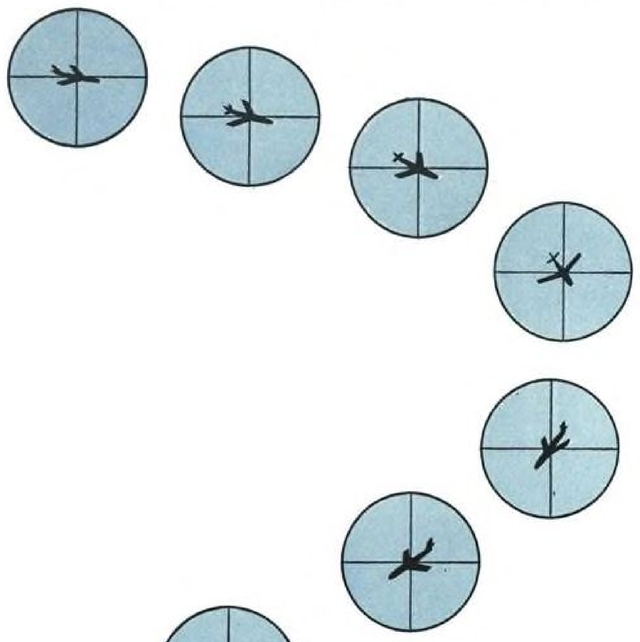

The "eyes" are on...

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take delivery of an IBM 650 computer which will be programmed to compute estimated time of arrival over a radio fix and produce printed flight progress strips.

When flight plans are received by voice, the data will be taken down in pencil, then used to prepare a punch card. When the punched card is introduced into the computer's card reader input device, the computer will calculate fix ETA's and produce printed flight strips for each sector, similar to the one shown on p. 83.

This will eliminate some of the workload from the assistant controller, but will involve the additional step of converting written flight plan data into punched card form.

Major Gain

However, TDC is pinning its hopes on the more sophisticated Phase I system. "If provision can be made for encoding flight data properly, and introducing and storing this flight data in an electronic memory, a major breakthrough will have been accomplished toward the ultimate semi-automatic system," Fenimore told the RTCA Assembly.

FILTER CENTER

(Editor's note: The following items are highlights of reports of Radio Technical Commission for Aeronautics' special committees given during the Fall Assembly meeting in Indianapolis.)

► **ATC Beacon System (SC-64):** Studies are underway to determine whether the number of ATC transponder reply codes can be increased from the originally authorized 10 to the 64 codes which are inherently possible. Civil Aeronautics Administration says it can make effective operational use of 64 codes. Final decision is up to Defense Department.

► **Jet Aircraft-High Altitude Operational Requirements (SC-76):** Committee investigations indicate that jet airliners will probably operate at altitudes of 20,000-25,000 ft. rather than at altitudes above 40,000 ft., according to Chairman Capt. J. D. Smith of the Air Line Pilot's Assn. In such event jetliners and prop-driven airliners will be operating at the same altitudes, raising serious overtaking problems, Smith said.

► **TV Interference in UHF Band (SC-68):** Tests indicate that UHF television stations will not interfere with DME equipment, providing the station is equipped with 85-90 db. of harmonic suppression. Tests were run

OSTUCO NP-60 TUBING HAS DONE IT AGAIN!

This time, with a 24% production increase for Standard Locknut and Lockwasher, Inc., Indianapolis, Indiana. Tubing experts from OSTUCO recently recommended a switch to NP-60 Tubing specially processed for machineability for Standard's locknut and lockwasher line used in ball and roller bearing applications.

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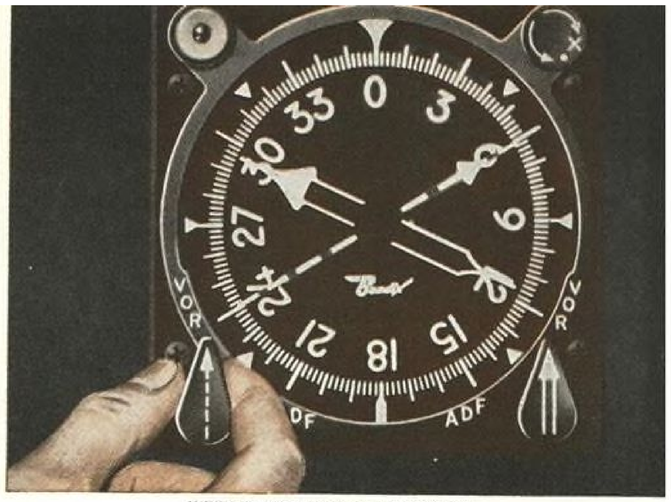
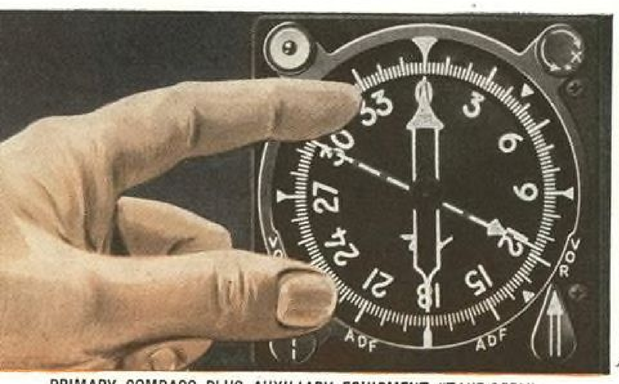
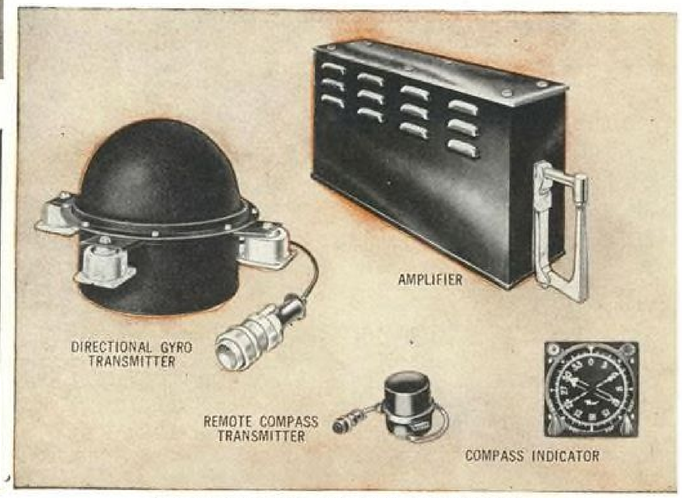


INTEGRAL VOR AND ADF SWITCHING



PRIMARY COMPASS PLUS AUXILIARY EQUIPMENT "TAKE-OFFS"



NEW SYSTEM SMALL, COMPACT, YET COMPLETE

NEW, LIGHTWEIGHT BENDIX CONTINENTAL COMPASS SYSTEM OFFERS BIG SYSTEM ADVANTAGES AT MODERATE COST

Here, for transport, executive, and private aircraft, are all the stability and accuracy of famed Polar Path* plus the lower cost and simplified design of a compass system for use in non-polar areas.

The new Bendix Continental Compass System offers many advantages never before available at such a modest price. For example:

- *Both magnetic accuracy and gyro stability.* This results from slaving 1° random-drift, directional gyro transmitter to a magnetic-sensing, remote compass transmitter.
- *RMI and primary compass combined.* A single indicator provides the functions of a conventional RMI and a master direction indicator, as well as "take-offs" for operating repeaters, an autopilot, or other navigational equipment.
- *Integral VOR-ADF switching.* Pointers may be switched to VOR or ADF by individual, self-contained selectors instead of the usual remote switching arrangement.
- *Transistorized, modularly constructed amplifier.* The use of transistors and same "card-type" advanced packaging technique as the Bendix PB-20 Automatic Flight Control System affords greater operating dependability and simplified maintenance.

In these, and many other ways this Continental version of Bendix Polar Path conforms to every modern navigational requirement. Get full particulars. ECLIPSE-PIONEER DIVISION, BENDIX AVIATION CORPORATION, TETERBORO, NEW JERSEY.

*REGISTERED TRADEMARK BENDIX AVIATION CORPORATION

District Offices: Burbank, Calif., Dayton, Ohio, and Seattle, Wash.
Export Sales and Service: Bendix International Division, 205 E. 42nd St., New York 17, N. Y.

Eclipse-Pioneer Division

Bendix
AVIATION CORPORATION

Portable Radar

Lightweight portable radar, weighing 25 lb., substitutes audio signal for conventional cathode ray tube display. Developed by Sperry Gyroscope Co. for Army Ground Forces use, the AN/PPS-4 can distinguish between fixed and moving objects at ranges up to three miles. This suggests the equipment could be installed near end of airport runway and its signal remoted to a distant control tower to enable tower personnel to determine whether runway is clear of traffic.

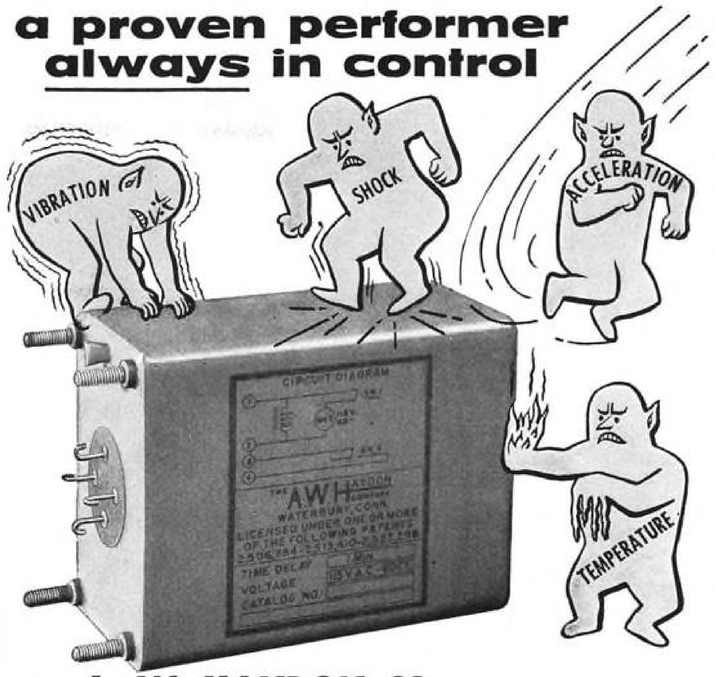
using civil DME. Committee is now studying new Vortac DME but does not anticipate any interference problem.

► **Radio Teletype Circuit Monitoring (SC-71):** Committee will soon issue report recommending a relatively simple, inexpensive monitoring system that will check circuit continuity and fidelity of reception. Check will be made automatically every second during idle circuit conditions and at 15-180 second intervals during transmission. Teletype machines will be monitored at both ends of the line for mechanical or electrical failures.

► **Altimetry (SC-70):** Earlier committee recommendation that a standard 29.92 altimeter pressure setting be used at altitudes of 29,000 ft. and above has been adopted and is expected to go into nation-wide use in November. Committee is studying methods of using standard altimeter settings at lower altitudes to better assure aircraft altitude separation. Committee may recommend use of automatic flight control during level flight to assure greater precision in maintaining assigned altitude.

► **Radio Equipment Standards for Small Aircraft (SC-75):** Problem of

a proven performer always in control



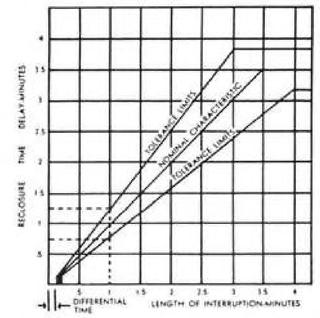
the A. W. HAYDON CO. delayed reset time delay relays

Protect power tubes in expensive transmitting, receiving or control equipment two ways:

1. On initial application of line voltage, the timer operates as a standard Time Delay Relay providing the delay equipment required to get up to correct operating temperature. Therefore, you can throw your load right across the line, and plate voltage will not be applied until filaments or heaters warm up. This eliminates the need for estimating warm-up time, preventing premature tube failures.
2. If line voltage fails, an escapement in the timer operates to provide a Reset Rate which can be calibrated to the cooling characteristic of the equipment. "Down time" is kept to a minimum, and equipment is back in operation as soon as practical after line voltage is restored. This automatic system takes all the "guess" out of operation. You know that no time is wasted — no tube life sacrificed by operator error.

Do you have another application where a Delayed Reset is necessary? These timers will undoubtedly solve your problems too!

Shown in the chart is a typical characteristic. In this case the Reset Rate is equal to the Time Delay.



SPECIFICATIONS

1. Operating temperature range: −65°F to 160°F.
2. Vibration: 5-55 CPS with 10g maximum acceleration.
3. Shock: 30g (11ms duration)
4. Hermetically sealed units meet military requirements for fungus, humidity, and salt spray.

Write for Bulletin AWH TD402 describing 6400 Series DC, 11400 Series AC, 24300 Series 400 Cycle.

PREFERRED WHERE PERFORMANCE IS PARAMOUNT.

See us at the Automation Show, Booth 330, Nov. 26-30

The A.W. HAYDON Company
222 NORTH ELM STREET, WATERBURY 20, CONNECTICUT
Design and Manufacture of Electro-Mechanical Timing Devices

OUT OF THIS WORLD

in the SATELLITE

Hundreds of miles out in space a rocket burns out . . . and back on earth, optic and electronic instruments begin tracking the first unmanned Satellite as it is launched into its orbit.

Speeding into outer space is perhaps the most rigorous test of components that man has ever devised.

Martin, Baltimore, prime contractor on Project Vanguard, has specified A-MP Terminals and Connectors for the Project because of their proven dependability and enduring quality. Aircraft-Marine products have always been designed to be ahead of the present and abreast of the future.

A-MP

AIRCRAFT-MARINE PRODUCTS, INC.

General Office: Harrisburg, Pa.

A-MP of Canada, Ltd., Toronto, Canada
A-MP—Holland N.V., 's-Hertogenbosch, Holland
Aircraft-Marine Products (G.B.) Ltd., London, England
Societe A-MP de France, Courbevoie, Seine, France

providing adequate communications equipment for small single-engine aircraft is acute because of the cost ($2,000) and weight (30-40 lb.), according to Committee Chairman H. F. Tanke. Committee is seeking to establish industry-wide standards which will make it more attractive for small aircraft owners to install VHF equipment with sufficient channels to meet air traffic control needs. This objective is stymied by fact that present lightplane radio equipment often is tailored to each aircraft manufacturer's cockpit.

► **Audio Response of Air-Ground Communications (SC-72):** Presently available data indicates that an audio spectrum of about 400-3,000 cps. is optimum for ground-air communications, but the optimum spectrum for ground-to-air may differ from that for air-to-ground. Automatic volume control to compensate for different human mike techniques might provide at least 5 db. gain, according to Committee Chairman J. A. Parrott. Data on USAF-conducted articulation studies, which may shed further light on the problem, is expected to become available this month.

Expansions, Changes In Avionics Industry

Granger Associates is name of new company headed by Dr. John V. N. Granger, former assistant director of engineering and head of the Radio Systems Laboratory at Stanford Research Institute. New firm will specialize in radio and radar systems for the Military Services and commercial airlines. Company has temporary offices at 801 El Camino Real, Menlo Park, Calif.

Other recently announced avionics industry changes and expansions include:

• **International Business Machines Corp.** has opened a new computer research laboratory in Zurich, Switzerland. Present staff of 33 persons, mostly Swiss, is headed by Dr. Ambrose P. Speiser, associate professor at the Swiss Federal Institute of Technology.

• **Reeves Instrument Corp.**, New York, has opened new West Coast office at 1216 Fifth St., Santa Monica, Calif. New office is headed by Robert T. Franzel.

• **U. S. Dynamics Corp.**, Boston, has moved into new 20,000 sq. ft. facility at 1250 Columbus Ave. Firm produces transistors and other semiconductors.

• **DeJur-Amsco Corp.** has opened new regional branch office in Beverly Hills, Cailf. to handle its Continental connector line. Address: 405 North Maple Drive.

• **Technitrol Engineering Co.**, Philadelphia, manufacturer of electronic components and computers, has moved to new 92,000 sq. ft. plant at 1952 E. Allegheny Ave.

• **Servomechanisms' Western Division** has leased 18,000 sq. ft. of additional area at 8825 Sepulveda Blvd., Los Angeles, to house its engineering, accounting, and administrative personnel.

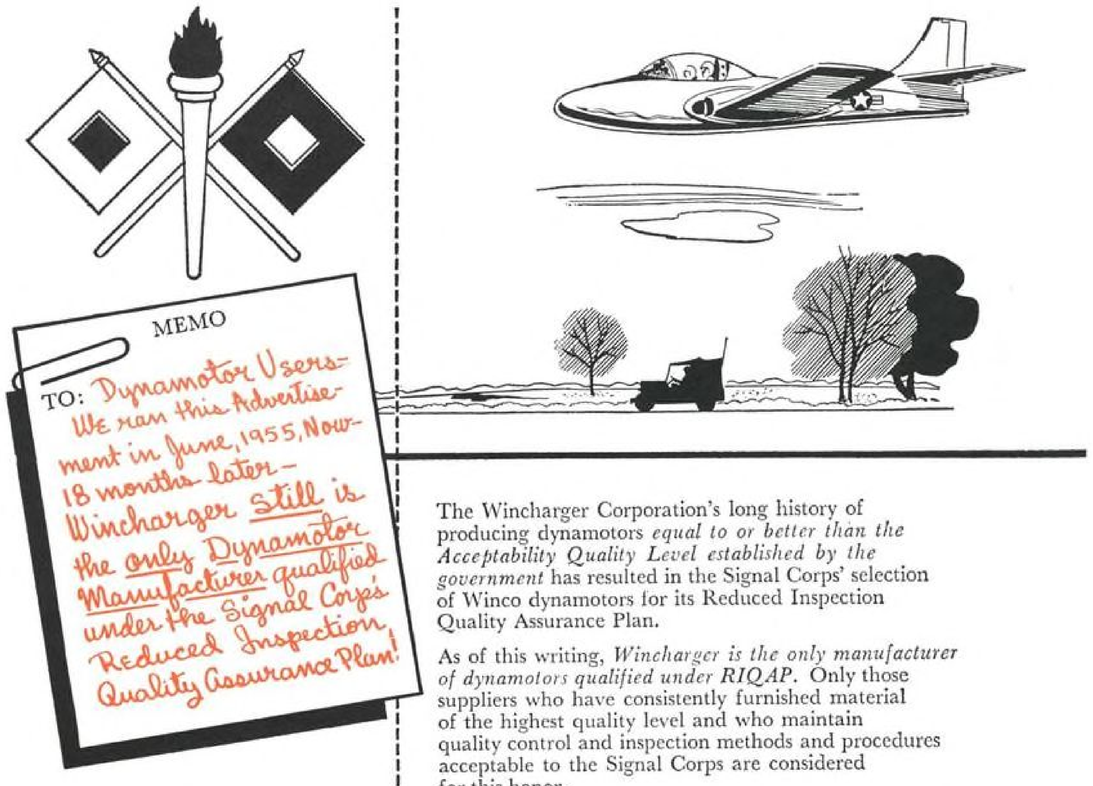
• **General Precision Laboratory** has started construction of new 22,000 sq. ft. engineering building at Pleasantville, N. Y., the second major addition to its engineering facilities in the past two years. Completion is scheduled for July, 1957.

• **G. H. Leland, Inc.**, Dayton, Ohio, has leased four-story building providing 30,000 sq. ft. of additional facilities, a 50% increase in company floor space. New plant is near firm's present main plant.

• **U. S. Engineering Co., Inc.**, division of Litton Industries, has moved to larger quarters at 5873 Rodeo Road, Los Angeles 16, Calif.

Winco dynamotors qualify

for Signal Corps Reduced Inspection Plan



The Wincharger Corporation's long history of producing dynamotors *equal to or better than the Acceptability Quality Level established by the government* has resulted in the Signal Corps' selection of Winco dynamotors for its Reduced Inspection Quality Assurance Plan.

As of this writing, *Wincharger is the only manufacturer of dynamotors qualified under RIQAP.* Only those suppliers who have consistently furnished material of the highest quality level and who maintain quality control and inspection methods and procedures acceptable to the Signal Corps are considered for this honor.

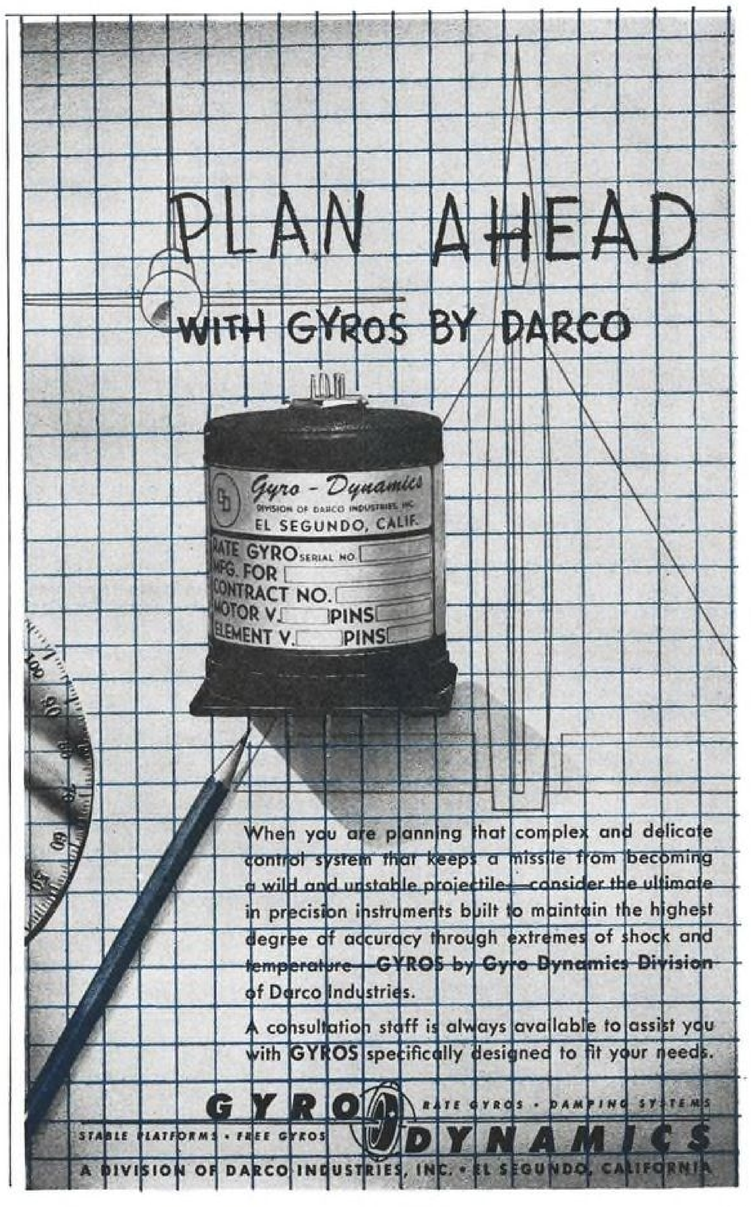
This new Signal Corps plan places more responsibility for maintenance of quality on the manufacturer by reducing the amount of government inspection. It is an honor inspection program.

What does Wincharger qualification for RIQAP mean to you — further evidence that you can depend on Winco Products.

WINCHARGER CORPORATION
Sioux City 2, Iowa
Subsidiary of Zenith Radio Corporation

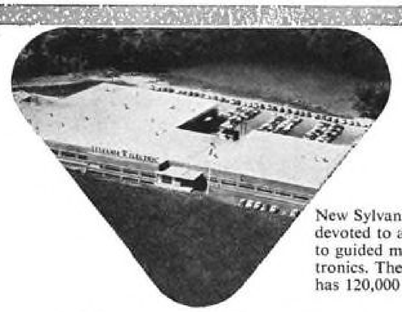
WINCO®

Power for the nation's mobile communications



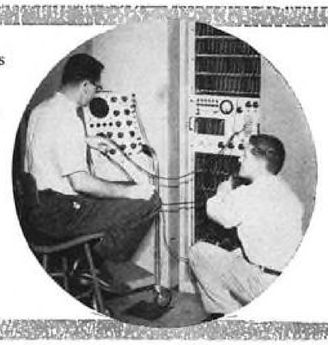
With UDOFT circuitry drawings as background, computer systems engineers at Sylvania's Avionics Laboratory discuss design of an extremely high-speed magnetic core memory. From left: J. J. Wargo, F. M. Bosch, and John Terzian.

The right people with the right facilities produce the right solutions



Computer development engineers E. L. Perry (left) and A. F. Gianino perform final test runs on engineering model of special-purpose large-scale digital computing system at the Waltham Laboratories.

New Sylvania Waltham Laboratories, devoted to advanced projects related to guided missiles and aviation electronics. The air-conditioned building has 120,000 square feet of floor space.



UDOFT

—new electronic "brain" to train jet pilots

UDOFT—the first Universal Digital Operational Flight Trainer—will use a new electronic "brain" to simulate flight and combat conditions of a wide variety of jet aircraft for training pilots.

A Navy-sponsored project of Sylvania's Avionics Laboratory, the UDOFT system is centered around a new digital computer of great flexibility, speed, and accuracy which is being developed to take the place of numerous special-purpose analog computers currently being used in Operational Flight Trainers.

Highly advanced electronics projects of many kinds—each aimed at a practical, *producible* solution for a specific problem—are constantly being carried out by the scientists and engineers of Sylvania's Electronic Systems Division, of which the Avionics Laboratory is a vital part.

In all of Sylvania's Electronic Systems Division installations, the right people work with the right facilities, within a sound managerial environment. That is why they have produced right solutions to a variety of problems, and have made many important contributions in the fields of aviation electronics, guided missiles, countermeasures, communications, radar, computers, and control systems. Whether the problem is military or industrial, Sylvania's business is to come up with solutions that are producible.

Facilities of the Electronic Systems Division include its manufacturing plant and engineering laboratory at Buffalo, New York; the Avionics Laboratory, Missile Systems Laboratory, and Applied Research Laboratory at Waltham, Massachusetts; the Electronic Defense Laboratory, Microwave Tube Laboratory, and Microwave Physics Laboratory at Mountain View, California. All of these facilities are staffed with top-ranking scientists and engineers, backed with Sylvania's extensive resources in the electronics field.

SYLVANIA IS LOOKING FOR ENTERPRISING ENGINEERS

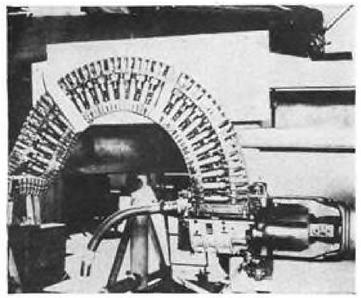
Sylvania has many opportunities in a wide range of defense projects. If you are not now engaged in defense work, you are invited to contact Edward W. Doty, Manager of Personnel, Electronic Systems Division, Sylvania Electric Products Inc., 100 First Avenue, Waltham 54, Mass.

SYLVANIA

SYLVANIA ELECTRIC PRODUCTS INC.

LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY

NEW AVIATION PRODUCTS



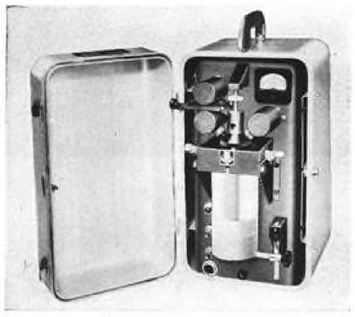
Light Ammunition Chute

Lightweight, flexible ammunition chute is assembled without tools and is constructed of self-interlocking parts without welds, rivets or mechanical fasteners. Especially adapted to high rate of fire, it cuts weight about 50% from conventional chuting. It will be available in aluminum, titanium, stainless and mild steel. Immediate production is planned for 20 mm. and 30 mm. ammunition chutes. Production for other calibers may follow.

Armamet Componets, Inc., Santa Ana, Calif.

Airborne Dew Point Meter

Small self-contained electronic dew point hygrometer measures over range from −50C to +18C with accuracy of ±1C at pressure of ±½ atmosphere with flow rate from 500 cc. to 2,000 cc. per minute. Two photocells and light source analyze fog density on a first surface mirror cooled by CO_2 acetone bath and heated by in-



duction coil. Amplified photocell output balances cooling and heating at the desired mirror temperature and provides indicator signal. Hygrometer is intended as airborne unit, may be purchased to use 60 or 400 cycle 115 volt source.

It weighs 24 lb. Dimensions are 7 x 8 x 16 in.

Burton Mfg. Co., Santa Monica, Calif.

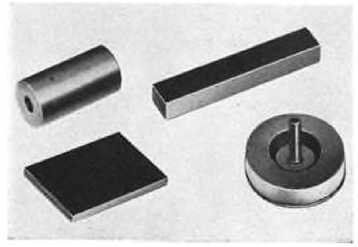
Hydraulic Jacks

Line of hand powered hydraulic jacks designed especially for rescue operations on crashed vehicles and other collapsed structures is available. Porto-Power kits are made in 4-50 ton ratings. They can be used to push, pull, spread or clamp. Power is transmitted from the pump to the ram by a long flexible hose for the safety of the rescuer. In aircraft crashes the units may be used to spread collapsed exits or lift debris from pinned survivors.

Blackhawk Mfg. Co., Dept. RE, 5325 W. Rogers St., Milwaukee 46, Wis.

Molded Radiation Shielding

Lead-plastic compound, called Lead-cast, may be precision molded to a tolerance of ± .0005 in. as radiation shielding. Containing 95% lead, it is harder and more rigid than pure lead and when molded around a structural member has excellent bonding characteristics. Hardness can be controlled

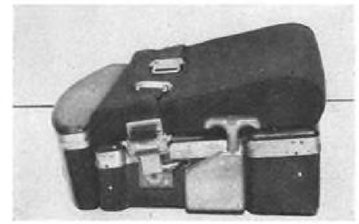


from rubber-like consistency to that of cast aluminum by varying lead content. Upper limit of lead content is 95% by weight. For selective absorption of radiation or increased shielding any metal, mixture or compound may replace lead. Small or large runs may be molded at low tooling costs.

Telectro Industries Corp., 35-18 37th St., Long Island City 1, N. Y.

Survival Kit

Fibreglas global survival kit developed for USAF's Aero-Medical Laboratory supplies oxygen and pressure for high altitude escape. The 70 cu. in. of oxygen carried is adequate for 20 min. When survivor reaches altitude low enough for breathing of outside air, disconnect lever is pulled and oxygen mechanism breaks away as the kit drops to the end of a 12 ft. line. Kit then opens, life raft inflates and kit drops another 25 ft. to slow survivor's descent as kit floats and chute is relieved of its weight. Once in the water, survivor can pull in kit and board raft



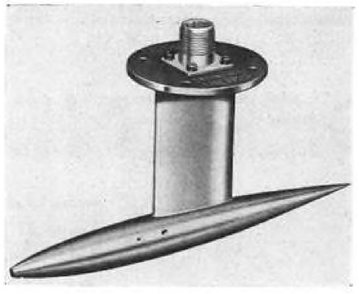
in 10 sec. Equipment vacuum-packed in kit includes radio, radar and sun reflector, rifle, fishing gear, water purifier, sleeping bag, food, first aid kit, etc.

H. Koch & Sons, Corte Madera, Calif.

Strain Gage

Weldable high temperature strain gage has dynamic test range to 1,600F. Gage can be spot welded to flat or curved surface and ready to operate in less than five minutes. Tests show that in most cases spot welding installation causes no significant alteration of the structure being tested. Available gages have nominal resistance of 120 ohms and gage factor of 1.80. Length and width of two types available are 1.250 X .125 in. and .750 X .250 in.

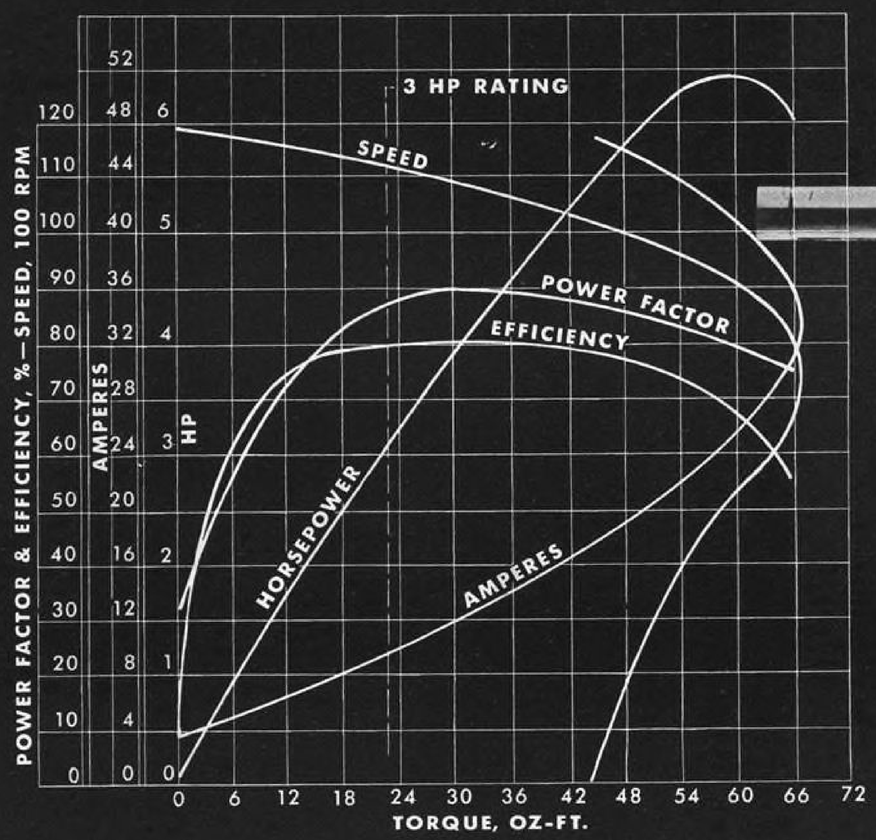
Micro-Test, Inc., 657 N. Spaulding Ave., Los Angeles 36, Calif.

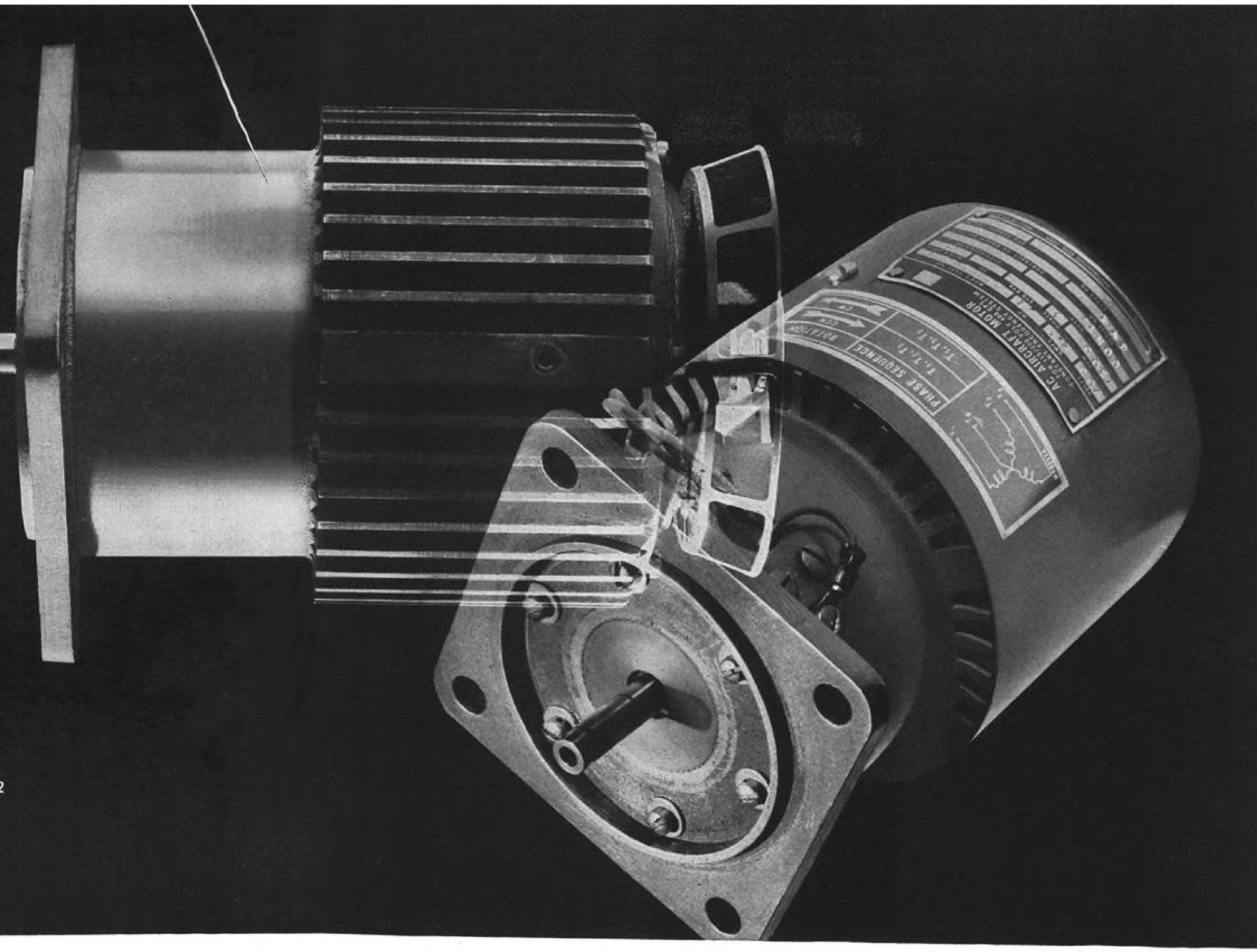


Temperature Probe

Adiabatic temperature probe measures airstream stagnation temperatures in aircraft and missiles. Designed for telemetering and control and for sens-

TOMORROW'S AIRCRAFT: *One step closer*





DEPENDABLE POWER

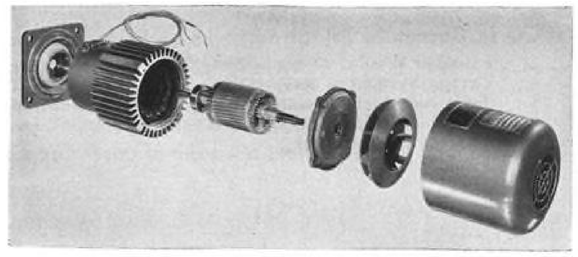
from sea level to stratosphere

Dependable drive power . . . from sea level up. That's what you get with the new line of Westinghouse 400-cycle, a-c motors. Ranging from 1/30 hp to 30 hp, the power-to-weight ratio of these motors is unequaled by any on the market. *A 4-inch-diameter frame delivers 3 hp at continuous duty and weighs only 10½ pounds!* Unique design keeps temperature rise extremely low in spite of the small size.

These new a-c motors meet the general requirements of MIL-M-7969A. They are designed to drive aircraft-type fans, pumps, compressors, blowers and actuators. They are totally-enclosed or through-ventilated, self-cooled and explosion-proof. Locked bearing construction gives longer bearing life when subjected to shock and vibration. Simplicity of design permits easy maintenance.

Westinghouse engineering and experience is available to you now to solve your motor problems. For complete information call your Westinghouse sales engineer or write: Westinghouse Electric Corporation, Aircraft Equipment Dept., Lima, Ohio.

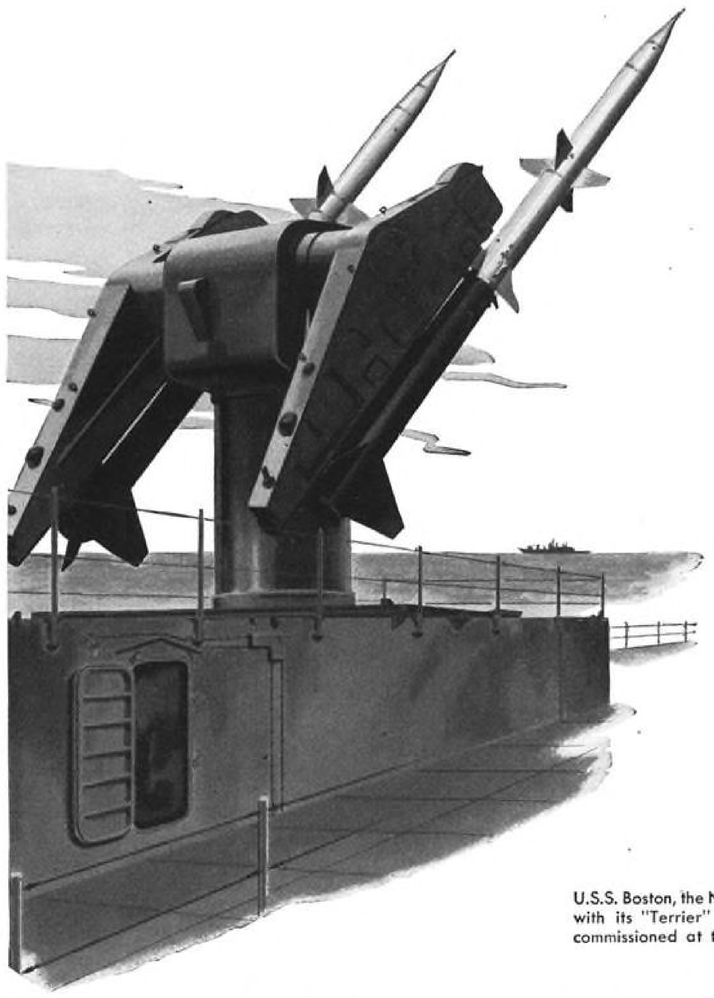
J-05032



YOU CAN BE **SURE**...IF IT'S

Westinghouse

"TERRIER" -ready for action!



ONE OF THE MOST potent defense weapons now in use by our Navy is a supersonic, rocket-propelled, guided-missile called the "Terrier". Well named, the job of this electronically-controlled "watchdog" is to track down an enemy and put him out of action *before* he can strike.

Working in close cooperation with the Armed Services on this guided-missile, Philco research, engineering and production have made important contributions to its development. This has been particularly true in connection with the proximity fuse, the mechanism which extends the effective target range and enables the "Terrier" to demolish an aircraft the moment it gets in the *vicinity* of the marauder.

From the first sketch to the final, super-accurate mechanism, Philco pioneered and completed this assignment in cooperation with the Navy. Philco's world famous scientific knowledge and skill is a continuing factor in the development of tomorrow's defense for your protection . . . tomorrow's quality products for better peacetime living throughout the world.

U.S.S. Boston, the Navy's first guided-missile ship with its "Terrier" ready for action, as it was commissioned at the Philadelphia Navy Yard.

PHILCO is Currently Engaged in Long Range Industrial and Diverse Military Engineering Fields

• Guided Missiles • Radar • TRANSAC Digital Computers • Underwater Ordnance • Bombing and Fire Control Systems • Servo-Mechanisms • Microwave Communication Systems • Infra-Red Devices • Transistor Circuit Application • Multiplex Equipment • Television Relay Systems • Industrial TV • Color Broadcast Equipment • Forward Scatter Communications • Fire Control Systems • REDAP

Philco offers a wealth of career opportunities for qualified engineers

PHILCO CORPORATION

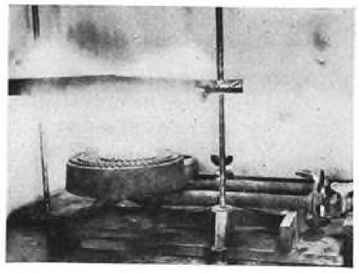
Government and Industrial Division, Philadelphia 44, Pennsylvania

ing of temperature data in airborne systems, it offers a recovery factor of 0.985 with response time of 0.25 sec. or less and repeatability within 0.5%. Housing is of stainless steel highly polished to minimize emissivity and reduce aerodynamic friction. Low drag body gives superior performance over velocity range from Mach 0.3 through Mach 2.0 at altitudes up to 60,000 ft. Two fast response temperature elements are available to provide a voltage or resistance output proportional to airstream stagnation temperature.

G. M. Giannini & Co., Inc., 918 E. Green St., Pasadena 1, Calif.

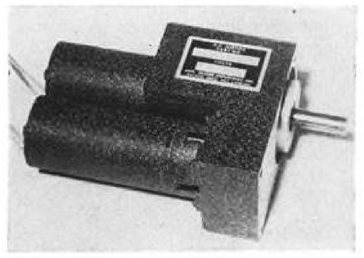
Resinous Insulation

Resinous compound insulates metal surface against reaching 1,000F for 30 minutes while subjected to 2,000F flame. Heavy-bodied black mastic fire retardant can be sprayed or trowelled to a thickness of $\frac{1}{4}$-$\frac{3}{8}$ in. on metal, wood, fibreboard and other materials. Does not run, drip, or burn. It also



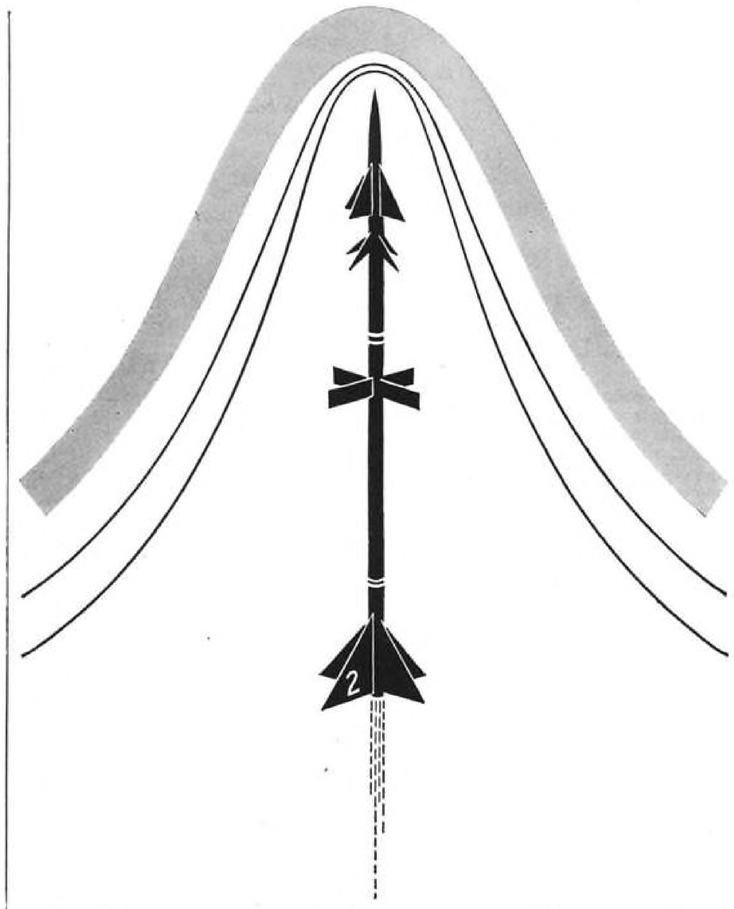
reduces condensation, rust and weathering in the temperature range from −20 to 250F. The mastic withstands acid and alkali fumes and splash and will not support mildew.

Insul-Mastic Corp. of America, Dept. A-9, 7750 W. 61st Pl., Summit, Ill.



Miniature Differential

Miniature differential is adaptation of small planetary gear reducer. Resultant speed of the output shaft is difference between speed of input and that of the independently driven internal gear. Holding one power input constant and varying the other produces output speeds ranging from 5 rpm. in one direction to 5 rpm. in reverse. Load ca-



now magnesium castings for high temperature applications

Now you can enjoy the high strength-weight ratio of magnesium at high temperatures. Alloys now being cast by Rolle have the tensile strength and creep resistance modern jets and missiles demand . . . even at temperatures above 600F.

Developed by Magnesium Elektron Ltd., these rare-earth magnesium alloys were pioneered in this country by Rolle personnel. And in the hands of Rolle foundry engineers, the published specifications of the alloys are being realized to the utmost in casting after casting.

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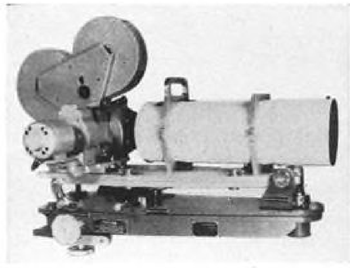

Powerad Co., 1170 Broadway, New York 1, N. Y.

Plotter for Chart #3071

Navigation plotter, designated #3071, has nautical mile distance scales matching scale of revised edition of North Atlantic Plotting Chart #3071 (1:6,250,000). Upper distance scale measures from zero to 500 nautical miles in both directions from center hole to facilitate direct plotting of lines of position. Scales for interpreting distances between Loran lines are on ends of plotter. Plotter also has conversion scale using increments of longitude against conversion angle to convert true courses to grid courses. It is same shape and size as standard Weems Mark II plotter. Revised Plotting Chart #3071 by U. S. Coast and Geodetic Survey is now in standard use by transatlantic airlines. Projection is changed from Mercator to Lambert Conformal. All radio aids, weather ships, ADIZ, and other aids to navigation are plotted. It also contains grid north lines and enables user to navigate crossing on one chart.

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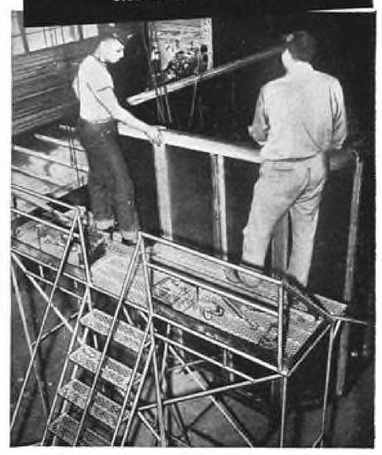

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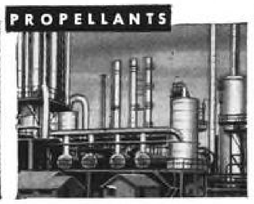

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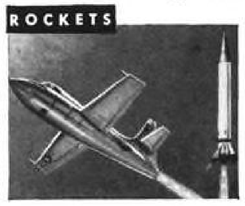

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ments is 5.0 gpm. at 4,200 rpm., 5 psi. discharge pressure, and lube element is 2.0 gpm., 60 psi. discharge pressure; rated capacity is based upon pumping MIL-L-7808 oil at 350F. Nominal input is 1.0 hp. Displacement of scavenge elements is 0.372 cu. in. per revolution per element; lube element is 0.139 cu. in.—Lear-Romec Division. Lear, Inc., Elyria, Ohio.

Electric motor driven hydraulic power package for guided missiles and supersonic aircraft incorporates electric motor, hydraulic pump, valves and reservoir. Units permit wide latitude in systems design.—Adel Precision Products, a Division of General Metals Corp., Burbank, Calif.

Fuel control units for use on turbine type auxiliary power units and guided missiles are mechanical type governors with single or dual valve systems incorporated into the design. Single valve units control flow of one fuel; dual valve system controls and proportions flow of two fuels ranging from JP-4 through red foaming nitric acid.—Pierce Governor Company, Inc., Aircraft Accessories Division, Anderson, Ind.

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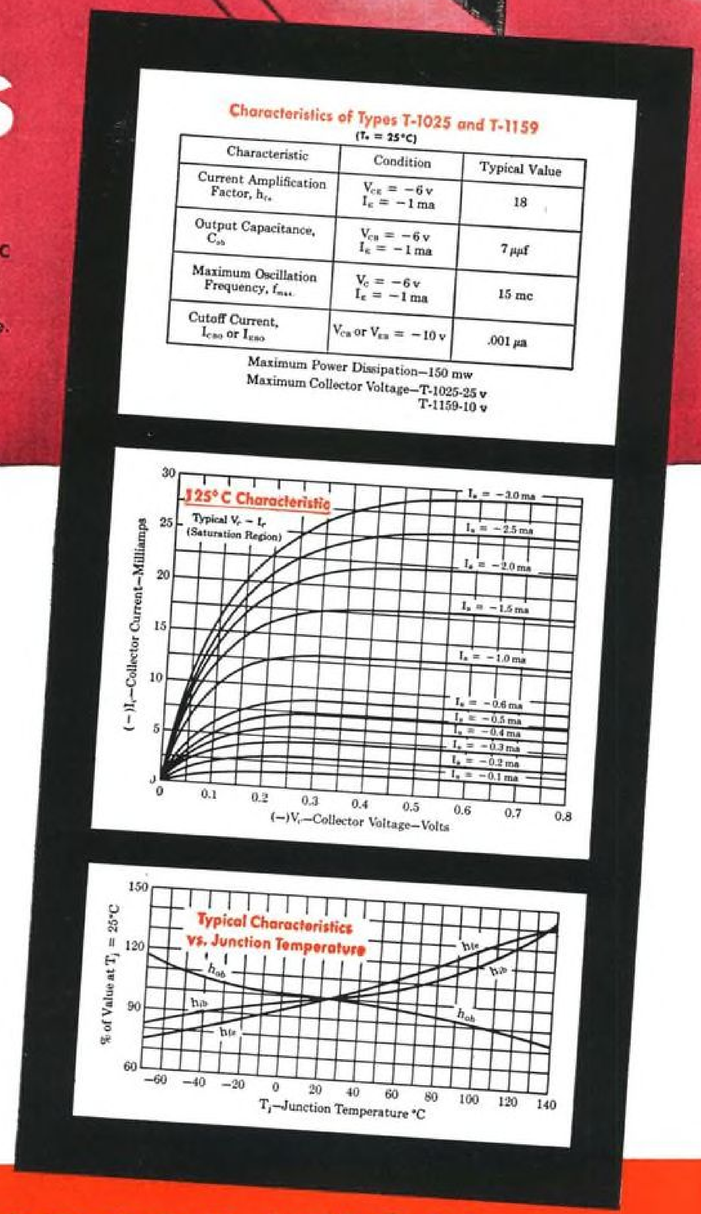

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Lockheed Interest Foreshadows Jet Era

By Erwin J. Bulban

Miami—Exploration of the market for a new small executive transport with "spectacularly high performance" is being undertaken by Lockheed Aircraft Corp., Sales Engineer Frank Davis told participants at National Business Aircraft Assn.'s 9th annual meeting and forum here recently.

Davis indicated that the new Lockheed business transport would be based on an entry the company is readying to meet Air Materiel Command's request for an off-the-shelf jet-powered utility aircraft (AW Aug. 27, p. 29). He said that the company could have a prototype flying by the end of next year. Lockheed believes that there will be a good market for this airplane, Davis said.

ROYAL GULL SUPER 200 five-place amphibian with supercharged 340-hp. Lycomings was one of the few new business planes shown during NBAA meeting. It has top speed of 208 mph.

Membership Application

Lockheed's application for associate membership in NBAA is a clue to the company's intentions to become active in business flying, explained Davis, who is a member of Lockheed's new corporate commercial sales department. He noted that the company's identification with this segment of the industry was established in the 1920s when it supplied Lockheed Vegas to executive fliers. This relationship has been maintained and enhanced by Lockheed Aircraft Service, one of the major maintenance bases in the U.S. serving business plane operators, he added.

Lockheed's revelation accented an atmosphere of realization that business fliers are rapidly approaching their era of jet operation. Fairchild pointed out that it is offering two new planes, the turboprop F.27 Friendship and the jet-powered M-185, both of which have been ordered by Continental Can Co. Cost of the four-jet M-185 will not exceed $800,000 minus cabin interior and plug-in radio equipment, the company reported.

Beech reported that the Morane-Saulnier MS-760 four-seat jet, for which it has a manufacturing option (AW June 27, 1955, p. 44), is now in the process of being licensed for approval under Civil Aeronautics Administration Part 03. The MS-760 is not now an all-weather airplane, but this capability could be developed rapidly, Beech said.

NEW RCA AVQ-50 lightweight radar for business planes (components marked 2) shows marked size reduction compared to RCA AVQ-10 (1). Initial deliveries of AVQ-50 are expected to begin next spring at price of about $8,000 plus $5,000 for installation.

Small Jet Need

Need for a new small jet transport, not only for time-pressed industry top management but also for important military leaders was underscored by Air Force Assn. Executive Director James H. Straubel, who stated that both of these groups continue to fly ". . . vehicles obsolete in terms of the times.

"The other day, a good friend of mine—a major general in the Air Force—had business to accomplish across the country from his station in Washington," Straubel said. "His flight schedule called for a 20-hour elapsed time to destination. If an executive's time is worth thousands of dollars an hour—then we taxpayers have a reason to question his multi-thousand dollar hike from coast-to-coast. His aircraft was that wonderful old clunker known to the military as a C-47 . . . I have noted that the C-47, or DC-3, is a mainstay of the business fleet."

Straubel pointed out that the requirement for a high speed jet transport by the military and businessmen is responsible for AMC's proposal that industry develop such a vehicle with the expressed willingness to waive any specific military requirement to obtain CAA certification. USAF requirements include a relief-type lightweight autopilot for the twin-engine type and a fully

DEMONSTRATING possible commercial use, Kaman HOK-1 drops equipment, three-man rescue crew at crash scene. Rotor downwash protects advancing firemen.

operational autopilot with approach coupler for the four-engine configuration, automatic anti-icing for the complete engine air induction system, single-point ground refueling, all-weather capability, and jet reverser to cut landing roll.

If utility jets are included in the next Air Force budget, civilian counterparts will be available to executives by about 1960, he stated.

As for maintenance, few outstanding problems are anticipated, except perhaps on accessories. Airport operators serving the business air fleet will have to accent cleanliness on runways, taxiways and ramps. USAF experience has shown in one campaign against engine removal because of foreign object damage, that in 60 days prior to the cleanup 22 jet engines were taken down; in the second 60 days, only nine were removed. In cleaning up runways, 2,000 lb. of debris was picked up, including razor blades, cups, spoons and enough tools to equip two mechanics.

Performance Rise

Operationally, business pilots flying jets will be faced with handling rates of climb increased three or four fold compared with their present equipment, operating altitudes increased in some cases by a factor of two and low-altitude fuel consumption increased by as much as factor of eight.

General aviation, including business flying, poses the greatest difficulties in attempting to predict future facilities needed, NBAA was told by Edward P. Curtis, special assistant to President Eisenhower for aviation facilities planning. He urged that business flyers continue their support of the General Aviation Facilities Planning Group program to gather accurate data on current business, private and agricultural aircraft activities.

Business flying was called the fastest growing segment of our fastest growing form of transportation by Louis S. Rothschild, Undersecretary of Commerce for Transportation. Rothschild noted that one of the important objectives of installation of Vortac, radar and direct communications is all-airspace traffic at the higher altitudes, an area concept long advocated by NBAA.

Rothschild predicted "remarkable" growth for business flying in the years ahead. From the 3.9 million hours of business flying in 1954, he said, there will be a 46% climb to 5.7 million hours by 1960. By 1965 the total should hit 7.8 million hours, he said, a 0.6 million hour increase over CAA's previous forecast for this period. For 1970 he envisioned a peak of 9.9 million hours. CAA believes that by 1965, business pilots will be recording more than 50% of all hours flown in general aviation activities, compared to the 11% they totaled in 1946. Business pilots already achieved 45% of all general aviation flying hours in 1955.

CAA is studying regulations affecting business pilots, with a view toward updating requirements to meet today's and tomorrow's requirements, NBAA was told by W. Buril Barclay, Flight Operations Specialist, General Operations Branch. Some of the things being considered are inclusion of instrument instruction along with primary training, periodic pilot proficiency checks, particularly in instrument flying and also to gage the pilot's capability in handling emergencies. Also on CAA's agenda are a look at minimum crew requirements, maximum pilot flight duty hours.

CAA has recently set up at Oklahoma City a course for safety agents who have heavy concentrations of business flying in their areas as an aid for them to be of more assistance to executive plane operators.

Pilots and airport operators will benefit from a Radio Technical Commission for Aeronautics recommendation that Federal Communications Commission initiate rule making to authorize air-to-ground transmission of special messages from business planes to assist them in fast turnarounds on arrival. The new ruling will authorize transmission of operational special service messages on 122.8 m.c. to airports not having control towers.

In this case one airport operator will obtain a license to operate on this frequency; other business plane service facilities will tie-in to his station.

Channel 123.0

Channel 123.0 will be additionally authorized for airports with towers for aeronautical advisory use with its function limited to transmission of special service messages air-to-ground. Notice of the proposed FCC rule making will be publicized in several weeks for industry comments. If there are no unfavorable comments, it will probably become part of FCC regulations.

Liveliest debate during the forums came during a discussion on radio and communications when CAA representatives told pilots about its proposal to inaugurate duplex channelling for en route communications, which they said was aimed at alleviating the present jamup caused by everyone using 126.7 m.c. Under the new system, which is to begin about June 30, transmissions air-to-ground would be made on 126.7, ground stations would use 120.7 m.c. to talk to aircraft.

Several pilots protested strongly against inauguration of the system, maintaining that this would require them to install a standby receiver to monitor communications so as to maintain a picture of area traffic. They estimated that this extra equipment would require an extra expenditure of approximately $5,000 per aircraft.

Turnout for NBAA's latest forum is estimated by association officials to have exceed 600 persons, the largest attendance yet. Registration by company affiliation totaled over 200, roughly half of these were equipment vendors and various service organizations.

Next year's meeting is scheduled for Denver, NBAA officials stated. No new president was named during the meeting, contrary to usual practice. This was due to election of two additional members on the NBAA board, bringing it to 11. Current president Henry W. Boggess, Sinclair Refining Co., who will retain the top office until the new chief executive is elected, stated that the elec-

Helicopter Demonstrates Firefighting Tactics

RESCUER pulls dummy pilot from cockpit. Rescue times have averaged under 45 sec. Equipment, made by Ansul Chemical Co., includes two Ansul 300-lb. capacity dry chemical tanks, each with 100-ft. of hose, and rescue tools. Package is carried on HOK's external cargo hook. Fire was simulated at Kaman plant, Bloomfield, Conn., with 400 gal. of gasoline, jet fuel. Bell Aircraft Corp. also has demonstrated helicopter effectiveness in fire and crash rescue. Commercial model 47J was used.

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The B-58, America's first supersonic bomber, and the first U. S. aircraft to be built under the new "weapons-system" concept, will soon graduate into the production stage. Even now, many of the engineers and scientists at CONVAIR-FORT WORTH are delving into newer and more challenging projects in connection with the nearly half-a-hundred Air Force contracts now on hand.

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tion had been held off to allow the additional board members to participate.

New aircraft displays were noticeably lacking; the number of new conversions of the business fleet workhorses, such as the DC-3, Ventura and Beech 18 appeared to outnumber current new models.

Cessna flew its new four-engine pressurized 620 from Wichita to Miami International Airport with a stop at New Orleans with no attempts to break any records. Pilot Dale Westfall and Project Engineer Ralph Harmon told AVIATION WEEK that the flight was primarily an excercise in trying various cruise control procedures. Most of the flight was made at 14,000 ft.

The company also took advantage of the meeting's distant location from Wichita to make a practical demonstration of how the installation of its new auxiliary fuel system in the Model 310 stretches the light twin's range. The 310 flew 1,100 nautical miles nonstop from Wichita to Newark Airport, N. J. at an average ground speed of 153 kt. at an average fuel consumption of 16.6 gal./hr., using maximum lean condition from the surface up. Cylinder head temperatures average 330-340 deg. The plane arrived at Newark with 34 min. usable fuel aboard. Takeoff was at gross weight.

Next leg, from New York International Airport to West Palm Beach, 1,046 nautical miles, was made nonstop with an average fuel consumption of 17.2 gal./hr. and average ground speed worked out to 155 kt. The flight was initially intended to land at Miami International, but thunderstorm activity in the vicinity of the airport resulted in the pilot putting down at West Palm Beach, having 49 minutes of fuel remaining at cruise power.

Among other aircraft shown at the meeting was the latest model Royal Gull Super 200 P. 136-L2 having supercharged Lycoming engines rated at 340 hp. each on takeoff. Cruise speed for this five-place amphibian is given as 190 mph. at 70% power at 13,500 ft. and top speed is 208 mph. at 12,000 ft.

The Bell 47J four-place executive/utility helicopter provided shuttles for registrants to the airport from near the meeting.

Awards Go to Business Pilots

Miami—Safety awards were given at the 9th annual meeting and forum here to 29 pilot members of National Business Aircraft Assn. who have flown more than 1 million accident and injury free miles. Also cited were 59 pilot members who have flown more than 500,000 accident and injury free miles, and 26 corporation members whose aircraft have completed a total of 47,036,788 mi. without accident or injury. The million and half-million miler pilots represented a total of 74,871,265 safe plane-miles.

Safety Award

Also honored were Jesse W. Stonecipher, University of Illinois chief flight instructor, who received the Women's Aeronautical Association of Kansas annual business flight safety award for "developing the 180-deg. turn procedure, his articles published on weather flying and for his implementation of a flight training procedure at the University of Illinois that has trained thousands of pilots who have proven to have an above average flight safety record."

Capt. E. V. Rickenbacker, board chairman of Eastern Air Lines, received NBAA's merit award for 1956.

The award was given "in recognition and acknowledgement of his bravery and substantial contributions of immeasurable and enduring value to the defense of our country and the progress of aviation in the field of air transportation."

Pilot recipients of NBAA's awards for having flown 1 million or more consecutive accident and injury free business plane miles are:

R. F. Allen, Frankfort Oil Co., 1,488,379 mi.; Raoul Castro, International Harvester Co., 1,153,039; L. P. Cornwall, Chrysler Corp., 1,075,000; W. R. Dotter, International Harvester Co., 1,141,216; A. Eager, Crane Co., 1,071,000; E. W. Estelle, Esso Shipping Co., 1,516,250; Harvey H. Glass, Texas-Illinois Natural Gas Pipeline Co., 1,296,000; R. L. Hansen, Kroehler Mfg. Co., 1,800,000; W. P. Hobson, Hercules Powder Co., 1,161,299; J. C. Jones, Fairbanks, Morse & Co., 1,800,000; J. E. Kidd, Anchor Hocking Glass Corp., 1,034,600; L. D. Kirby, Universal Moulded Products Corp., 1,046,544.

A. C. Korb, Westinghouse Electric Corp., 1,000,000; Robert J. Kusse, Fruehauf Trailer Co., 1,013,308; J. S. Lewis, Thatcher Glass Mfg. Co., 1,108,000; C. J. Lund, International Paper Co., 1,131,700; S. M. Maxwell, Burlington Industries, Inc., 1,107,915; B. O. Mayfield, Hercules Powder Co., 1,370,619; G. E. Meyers, Monsanto Chemical Co., 1,150,000; N. L. Mitchell, Minneapolis Star & Tribune, 1,156,750; R. E. Piper, Monsanto Chemical Co., 1,152,000; G. P. Rider, Delta Drilling Co., 1,044,000.

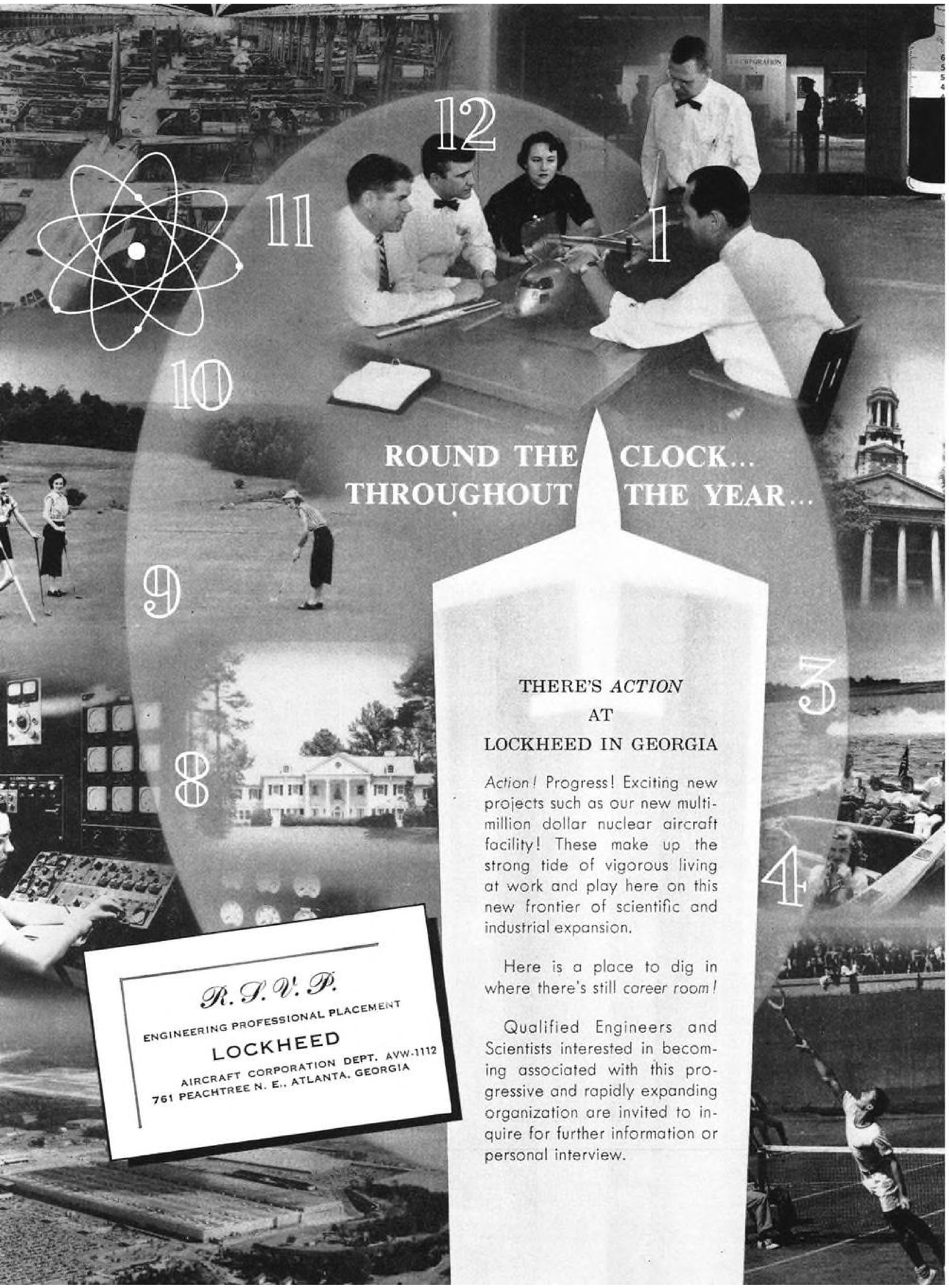
N. U. Rokes, Procter & Gamble Co., 2,800,608; T. J. Schuetz, International Harvester Co., 1,140,969; G. W. Sherwood, Briggs Mfg. Co., 1,182,060; O. E. Sparks, Holley Carburetor Co., 1,019,024; D. M. Teel, U. S. Steel Corp., 1,017,000; R. N. Thurston, Monsanto Chemical Co., 1,226,048; C. H. von Hollen, Union Bag-Camp Paper Corp., 1,200,000 mi.

Half-Million Milers

Those NBAA member pilots who have flown 500,000 mi. or more accident and injury free are:

W. D. Adams, Procter & Gamble Co., 670,680; H. E. Ahrns, Ohio Oil Co., 829,-

Engineers: write for opportunities with an industry leader in an ideal California locale.
HILLER HELICOPTERS
PALO ALTO, CALIFORNIA



420; W. E. Ames, Hercules Powder Co., 562,719; J. E. Basso, Columbia Geneva Steel, 507,955; E. W. Bauer, Ohio Oil Co., 655,260; R. K. Bennett, Sangamo Electric Co., 647,500; R. W. Bryson, Anchor Hocking Glass Co., 510,000; D. H. Bishop, Sinclair Refining Co., $33,230; J. A. Boutelier, Jr., Service Pipe Line Co., 950,187; J. Boomsa, J. I. Case Co., 520,000; W. G. Davenport, Service Pipeline Co., 975,617; C. E. Dillahunty, Shell Oil Co., 700,500; J. M. Grogan, Pillsbury Mills, 810,000; N. A. Grele, Fruehauf Trailer Co., 500,160.

J. G. Guess, Burlington Industries, 911,-275; B. N. Haddock, Falstaff Brewing Corp., 866,526; L. Hartwell, Essex Wire Corp., 525,000; A. Hinkle, Minnesota Mining & Mfg. Co., 572,220; K. F. Horton, Jr., Sinclair Refining Co., 727,860; D. W. Hubbard, Tobin Map Co., 565,950; W. A. Ivey, Southern Natural Gas Co., 640,397; H. K. Kaiser, Walker Mfg. Co. of Wisconsin, 611,-290; C. S. Kincaid, Service Pipeline Co., 810,958; C. R. King, Esso Shipping Co., 754,730.

C. R. Kinney, Burlington Industries, 628,-900; J. L. Lacey, Sinclair Refining Co., 730,000; M. C. Lora, Ohio Oil Co., 807,260; G. C. Lowe, Ohio Oil Co., 531,417; R. A. McArdle, Service Pipe Line Co., 625,682; T. R. McFarland, Ohio Oil Co., 513,055; C. F. Martin, Potlatch Forests, 503,404; S. H. Massey, Hercules Powder Co., 575,-979; R. Matthews, Jr., Sawhill Tubular Products, 864,380; A. F. Minich, Sinclair Refining Co., 643,500; R. H. Murphey, Service Pipe Line Co., 916,244; S. H. Murphey, Esso Shipping Co., 750,400; C. B. Nichols, Service Pipe Line Co., 794,225; W. C. Pague, Armco Steel Corp., 917,340; R. E. Parrott, Fuller Brush Co., 961,250.

D. E. Phillips, Ohio Oil Co., 737,340; A. L. Rainwater, Service Pipe Line Co., 844,-600; R. Rammel, Ohio Oil Co., 618,480; D. T. Richardson, Minnesota Mining & Mfg. Co., 600,440; J. M. Richter, Columbia Geneva Steel, 816,261; R. R. Rigg, Owens-Illinois Glass Co., 650,273; R. H. Rollo, Columbia Geneva Steel Co., 863,505; H. L. Sefton, Ohio Oil Co., 653,000; W. W. Shepherd, Shepherd Machinery Co., 581,250; S. C. Smith, N. Y. Wire Cloth Co., 520,560.

A. E. Spotswood, Monsanto Chemical Co., 912,070; E. L. Springer, Service Pipe Line Co., 567,335; F. J. Thera, Jr., Minnesota Mining & Mfg., 529,550; P. Van Treuren, Dairypak, Inc., 835,000; W. F. Underwood, Sinclair Refining Co., 726,000; J. D. Wallace, Procter & Gamble, 502,920; J. M. Wolfe, Service Pipe Line Co., 529,424; W. E. Wormald, Fuller Brush Co., 625,000; P. E. Wynn, Service Pipe Line Co., 598,678; R. A. Yoakam, Ohio Oil Co., 631,130.

NBAA member firms, whose aircraft have flown 1 million miles or more in business aircraft consecutively without accident or injury:

Anchor Hocking Glass Corp., 1,430,000; Armco Steel Corp., 1,174,248; Burlington Industries, 3,596,701; Champion Spark Plug Co., 1,037,540; Cluett, Peabody & Co., 1,597,500; Columbia-Geneva Steel, 2,632,-885; Delta Drilling Co., 1,044,000; Essex Wire Corp., 1,267,000; Esso Shipping Co., 3,556,895; S. J. Groves & Sons, 1,110,000; Hercules Powder Co., 2,292,112; Holley Carburetor Co., 1,286,852.

International Harvester Co., 1,937,250; International Paper Co., 1,897,557; Kroehler Mfg. Co., 1,752,200; Minneapolis-Honeywell Regulator Co., 1,635,000; Minnesota Mining & Mfg. Co., 1,421,969; Monsanto Chemical Co., 4,272,894; Owens-Illinois Glass Co., 1,816,265; Procter & Gamble Co., 1,584,754; Southern Natural Gas Co., 2,493,862; Texas Gas Transmission Corp., 1,100,000; Texas-Illinois Natural Gas Pipeline Co., 1,397,520; Thompson Products, 1,370,000; U. S. Steel Corp., 1,285,240; Universal Moulded Products Corp., 1,046,-544.

Narco Expects to Triple Volume in 10 Years

Philadelphia, Pa.—National Aeronautical Corp. (Narco) expects to triple its business volume in the next 10 years. Officials of the business aircraft communications and navigation equipment manufacturer said during the firm's annual sales meeting that the electronics industry during that time expects a doubling of volume.

Narco sales in the first nine months of 1956 have topped by 50% the dollar volume of all of last year. Company

Portable TV Aloft

Small Admiral TV, shown in Krochler Manufacturing Co.'s executive Lodestar, permits following programs during entire cross-country flight.

Airport Space and Facilities

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Five thousand acres isolated from populous regions. Four long runways, which can be readily expanded. Large parking aprons. Operational buildings & hangars.

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SCOTT AVIATION CORP.
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EXPORT: SOUTHERN OXYGEN CO., 15 WEST 57th STREET, NEW YORK 19, NEW YORK

officials estimate that by the end of this year total sales will approximate $2.75 million. The company currently is shipping $200,000 worth of avionics equipment monthly. The business aircraft market "from the light twins down is our bread and butter," sales manager Gil Quinby stated.

He stated that more Narco equipment is installed in business aircraft than any other make of competitive types, and that the company leads in factory installations on new aircraft. There are 16,500 omni equipments of all makes currently installed in civil aircraft. Of these Narco has delivered between 6,500 and 7,000 units. In peak months it is delivering about 500 omni receivers.

As a "sign of its maturity", the company established a "million-dollar roundtable" for distributors whose sales have reached or exceeded that mark. Initial awards went to the Eastern Division of Van Dusen Aircraft Supplies, Teterboro, N. J., represented by George Galipeau, and the Chicago (Ill.) branch of Air Associates, represented by William Carolla.

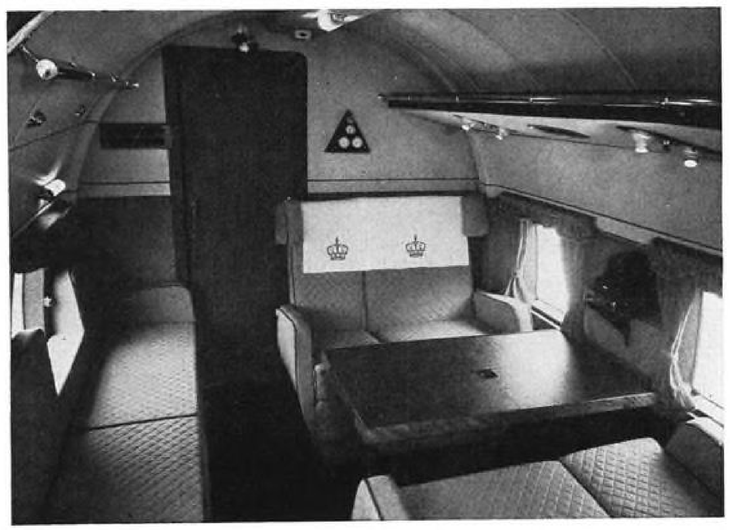
Among the new products shown distributors was a preliminary engineering model of a VTA-3 "pancake" 27 channel transmitter using power supply from Narco's Omnigator, Simplexer, or independent power source. The wide-band transmitter has a five-megacycle spread, measures approximately 1¼-in. deep.

The recently dedicated 25,000-sq.-ft. Narco plant at Ft. Washington, Pa., currently has a daily production of about 10 VTR-1 Omnigators, 12 VHT-2 Superhomers, 13 LFR-3 and LFR-3L range and broadcast receivers, 15 V12MP-2 power suppliers and about one 360-channel 1016 communications set.

Production on the latter is expected to go to five a day soon; backlog is currently over 200 units.

Jordan's Rulers Get Executive Transport

Luxurious conversion of a former RAF Vickers Varsity bombardier trainer to an official transport plane for King Hussein of Jordan and the Queen is shown at Eagle Aircraft Services' Blackbushe Airport conversion base, England, prior to delivery. Among the extensive modifications was deletion of the bombardier's compartment under the belly. Photo below shows the royal couple's private compartment with intercom phone (between windows, right). A separate compartment for the entourage seats nine.



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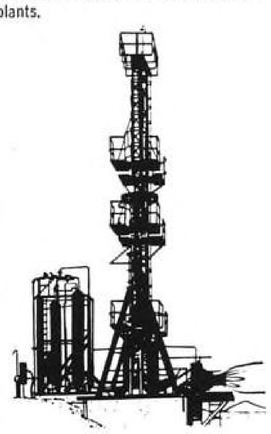
In piloted aircraft, missiles, and upper-atmosphere research vehicles, Aerojet-General liquid-propellant rockets have proven unexcelled for assisted takeoff, superperformance, and as prime powerplants.



Whether your interest lies in Vanguard or valves, Aerojet-General offers a variety of challenging assignments for:

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Electrical Engineers
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s'Gravesande's Stoomwagen

s'Gravesande's Steam Reaction Car

In 1721 Jacob Willem s'Gravesande of Delft, stimulated by the recently enunciated Third Law of Motion, astounded the Royal Society by constructing a practical steam reaction car. The vehicle actually moved several times its own length, a distance of about two meters.

In 1956 the goal is no longer meters, but hundreds, and even thousands, of miles. Aerojet-General Corporation, leader in American rocket propulsion for more than a decade, is proud to participate in man's first assault on the frontiers of outer space—Project Vanguard.

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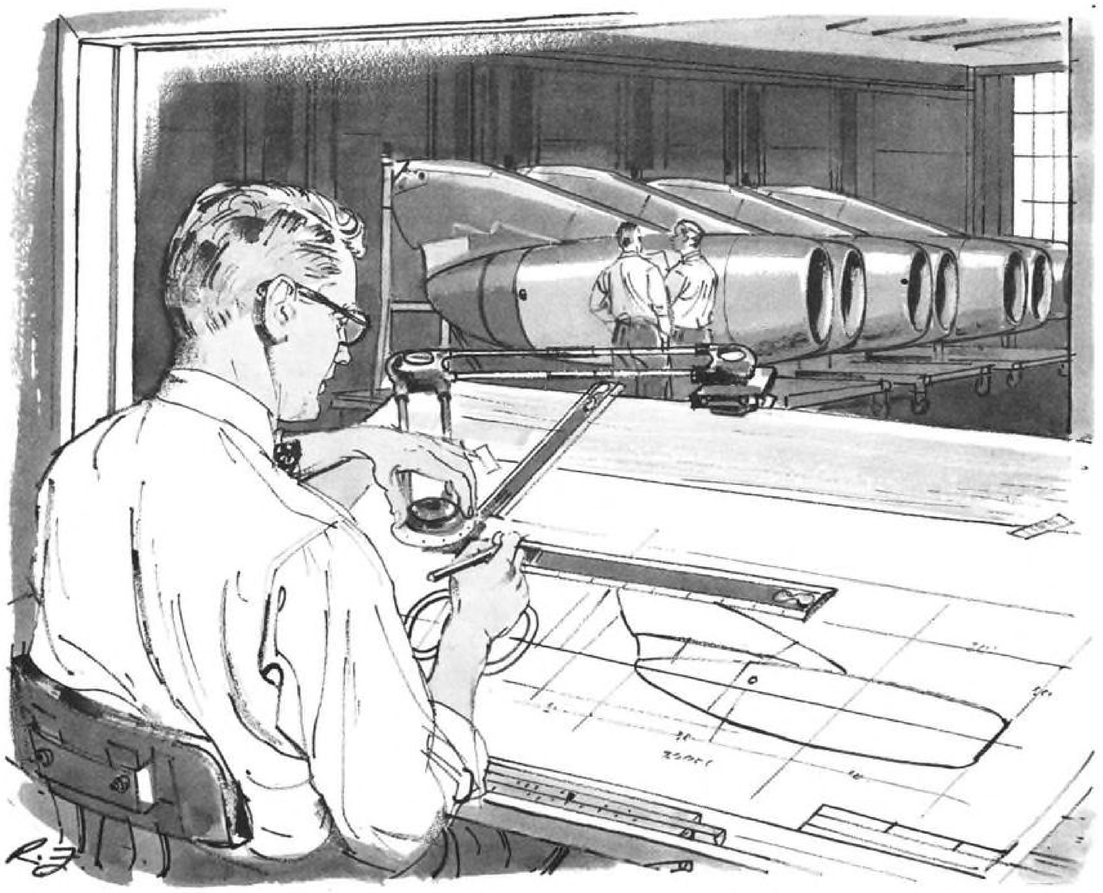
Aerojet-General invites scientists and engineers—men of imagination and vision—to join the attack on the most significant research, development and production problems of our time.



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Please enclose full resume and we will answer at once. J. L. Hobel, Industrial Relations Manager, Rohr Aircraft Corporation, Chula Vista, California, Dept. 33A.

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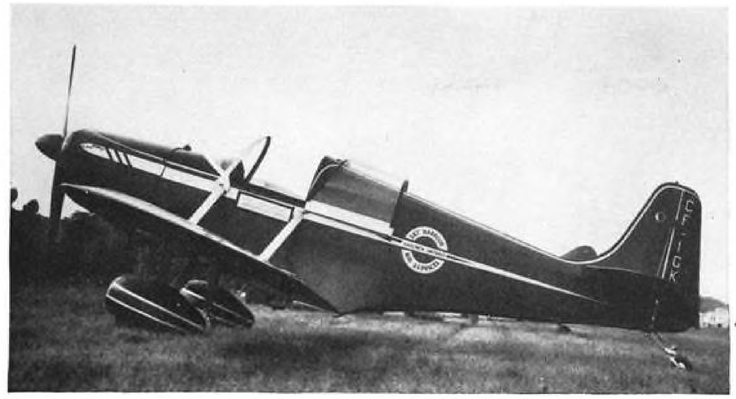

Private Fliers Build Their Own

Two examples of the trend in homebuilt sport planes are the Stits Playboy (above), made in Canada by Keith Hopkinson, Sky Harbor Air Services, Goderich, Ont. and the Doodlebug (below), designed and built by Lawrence Heuberger, El Paso, Tex., who is a flight engineer with Continental Air Lines. The Playboy, powered by an 85-hp. Continental, cruises at approximately 135 mph. It is reported to be the first homebuilt sportplane to be made in Canada under the dominion's new regulations allowing amateur construction of aircraft, and it will serve as a test case on development of the ruling. The Doodlebug, powered by a 90-hp. Continental, cruises at 170 mph. and has a range of over 700 mi., according to the builder. Tiny wingtip fuel tanks each hold 6.4 gal., main tank in the fuselage contains 12.5 gal. Construction is all metal except for fibrous-glass tip tanks and wheel pants.

PRIVATE LINES

Exhibitor at recent National Safety Congress & Exposition, Chicago, chartered a helicopter to transport personnel and customers between Hilton Hotel roof and firm's plant to avoid hazards and congestion of highway travel. Runs took about 20 min. each way by helicopter against 70-90 min. by road.

Uranium exploration by air will be carried on in three areas in Australia. Two localities about 175 mi. square southeast of the Adelaide River and another area of about 9,000 sq. mi. in the Northern Territory will be surveyed by scientists from the Bureau of Mineral Resources from an Auster lightplane.

Alabama is developing cross-state patterns of fields with paved runways to allow transient business and private pilots to over-fly and avoid congested major airports when operating through the state.

Japanese version of Beech T-34A, designated LM-1, is being delivered to Ground Self Defense Force. Last of 24 ordered is expected to be operational next March.

100th civil Bell helicopter sale and delivery of 1956 was made to Mid-States Aviation, Northbrook, Ill. which will lease its new 47G-2 to corporations. The sale boosted Bell's commercial helicopter business for the first nine months of 1956 30% over the same 1955 period.

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3-TOOLS-IN-1 . . pliers-cutters-twisters. Side-cutting, oil-tempered head. Permanent bronze bearing. No adjustments. Jaws lock on wire, can't slip off. Perfect, uniform twist every time.

12" —for assembly line safety wiring, 15 oz. **$21.50**

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Payload for F-101A

Load carrying ability at supersonic speeds of McDonnell F-101A Voodoo is demonstrated. External test shape simulates either fuel or bomb carrying capacity. F-101 went into operational status this fall with Strategic Air Command.

USAF Contracts

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

McCLELLAN AIR FORCE BASE, Calif., Sacramento Air Materiel Area.

D. Zelinsky and Sons, 165 Grove Street, San Francisco, Calif., paint interiors as specified, 3 units, (P/R 5133), $25197.

RCA Service Company, Incorporated, Government Service Department, 420 Taylor Street, San Francisco 2, Calif., accomplishing engineering and preparing installation specifications, drawings, special instructions and bills of material for twenty-four (24) fixed communications and electronic facilities P/R 356, job, $44860.

Pesce Brothers, 5901 S Street, Sacramento, Calif., install government-furnished coolers as follows: bldgs 51, 50 and 65, P/R 5136, $62236.

Howard S. Markwart, 4801 24th Street Road, Sacramento, Cal., modification of bldg 73, cell 1 for jet engine testing over 10,000 lbs thrust P/R 5137, job, $46078.

Avien, Incorporated, 58-15 Northern Blvd., Woodside 77, N. Y., kit, group B, temperature indicature and recording system, quantity, 2248, P/R 6674, $2336571.

A. Teichert & Son, Incorporated, 1931 Stockton Blvd., Sacramento, Calif., demolition and removal of PCC pavement, P/R 5149, $91618.

DEPARTMENT OF THE AIR FORCE, Headquarters U. S. Air Force, Air Force Academy Construction Agency, P. O. Box 1670, Colorado Springs, Colo.

Colorado Constructors, Inc., 725 W. 39th Ave., Denver 16, Colo., grading, roads and parking—services and supply area, (IFB 05-613-56-9), job, $319413.

Heating and Plumbing Engineers, Inc., 318 N. Tejon St., Colorado Springs, Colo., heating system installation in four houses on Academy Site, (IFB 05-613-56-25), job, $3245.

AMC, Wright-Patterson Air Force Base, Ohio.

Crosley Division, Avco Mfg. Corp., 2630 Glendale-Milford Road, Cincinnati, Ohio, licensee-licensor agreement with General Electric (licensor) to furnish proprietary info and tech assist on radar comp for MD-9 FCS, (PR 709895), $76000.

American Bosch Arma Corp., Arma Division, Roosevelt Field, Garden City, Long Island, N. Y., MD-9 bomber fire control system, 60 ea, spare components, spare parts (PR 709935), $8000000.

Johnke Mfg Co., 3109 Thirty-fifth Avenue, Long Island City 6, N. Y., printer, photographic, PH 649, 44 ea, literature, tabular list of parts (MIPR R55-3023-SC-SMD-24 and Amd #2), $33230.

E. I. DuPont De Nemours & Co., Wilmington 98, Del., squib, electric, 6 gain w/24 inch copper lead wire, 26250; cap, blasting electric, w/24 & 6 inch copper lead wire, 1450; (PR WR 407984, -1, -2, -3, and -4), $31703.

Stratford Pen Corp., 44 West 28th St., New York, N. Y., control panel C-695/AIC, 1384 ea (PR 642909), $25576.

Pioneer-Central Div., Bendix Aviation Corp. Davenport, Iowa, transmitter, rate of fuel flow type J-5, 424 ea (PR 635914), $80560.

The Leland Electric Company, Division of American Machine & Foundry Company, Dayton, Ohio, inverters, class A, 750 VA, 593 ea (PR PE635679 "Q") $197340.

A and Z Engineering Company, 4th and Court Street, Covington, Ky., photographic print straightener, 101 ea (PR MO736893), $30765.

Aerosonic Instrument Corp. 528 Reading Road, Cincinnati, Ohio, indicator, cabin air pressure, type MA-1, 992 ea., data table 250 (PR 635955), $27130.

Radio Corporation of America, Camden, N. J., amplifier AM-843/AIC-10, 1200 ea., eng & maint data (PR 642813 & 642913-1), $227002.

Airtron, Inc., Linden, N. J., cable and lead assemblies, (PR SA-611362 and SA-611391 "Q"), $80783.

Andrea Radio Corporation, 27-01 Bridge Plaza North, Long Island City, N. Y., control panel C-824/AIC-10, 3761 ea., dynamotor DY-77/AIC-10, 503 ea., relay RE-94/AIC-10, 637 ea (PR 692008 & Amd #1, 642915, 704752, 689254, 670770, 628553 & Amd #1, MIPR R56-290-10 Aer), $1227577.

General Electric Co., Dayton, Ohio, type E-34 tachometer indicators, 1793 ea (PR 635992) & 662651), $139127.

United States Guage Division, American Machine & Metals, Inc., Sellersville, Pennsylvania, type A-9 torque pressure indicators, 1795 ea (PR 635996), $181259.

Curtis Laboratories, Inc., 2718 Griffith Park Blvd., Los Angeles 27, California, 7" & 10 ft periscope for radar recording camera, 200 ea., focusing microscope & data, 25 ea (MIPR 56-2416-149-Aer & Amend. #1, $158633.

Eclipse-Pioneer, Bendix Aviation Corporation, Teterboro, N. J., control-roll and pitch for E-4, E-5, and #-6 fire control system, 864 ea., (PR 407830), $797860.

The Lewis Engineering Company, 339 Church Street, Naugatuck, Conn., type MS28008-1 temperature indicators, 3166 ea., (PR 63000, 692002, 692002-1), $84468.

Boeing Airplane Company, Wichita, Kansas, trainers (R PH-669501), $58886.

Solar Aircraft Company, 2200 Pacific Highway, San Diego 12, Calif., gas turbine compressor type MA-2(GFE for MA-3 MPSU) 90 ea (PR 154386-1-2-3-4), $3-923848.

Loewy Construction Co. Div., Hydropress, Inc., 350 Fifth Avenue, New York 1, N. Y., services and materials necessary to design, manufacture, install and test automatic-program speed control system for 35,000 ton press. (PR 148974), $90766.

Continental Motors Corporation, 205 Market Street, Muskegon, Mich., engine packette, 320 ea, (PR 533274).

Pastushin Aviation Corporation, 5651 West Century Blvd., Los Angeles 45, Calif., plyon assemblies, parts 420 ea. (PR 672014), $347240.

MPO productions, Inc., 15 E. 53rd St., New York, N. Y., production of motion picture project 19162, 1 ea (PR670138), $89016.

Navy Contracts

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

DISTRICT PUBLIC WORKS OFFICE, Third Naval District, Room 633, 90 Church St., New York 7, N. Y.

S. Puma, 5518 18th Ave., Brooklyn, N. Y., sound laboratory, U. S. Naval Training Device Center, Sands Point, Port Washington, Long Island (IFB NOy-90340), job, $29884.

DISTRICT PUBLIC WORKS OFFICE, Eleventh Naval Dist., San Diego 32, Cal.

L. C. Anderson Co. and Oliver Construction Co., 3040 Hancock St., San Diego 10, Cal., construction of U. S. Naval Facility and project aircraft maintenance building, San Nicolas Island, Naval Air Missile Test Center, Point Mugu, Cal., contract NBy-4108 (IFB 4108-56B), job, $165204.

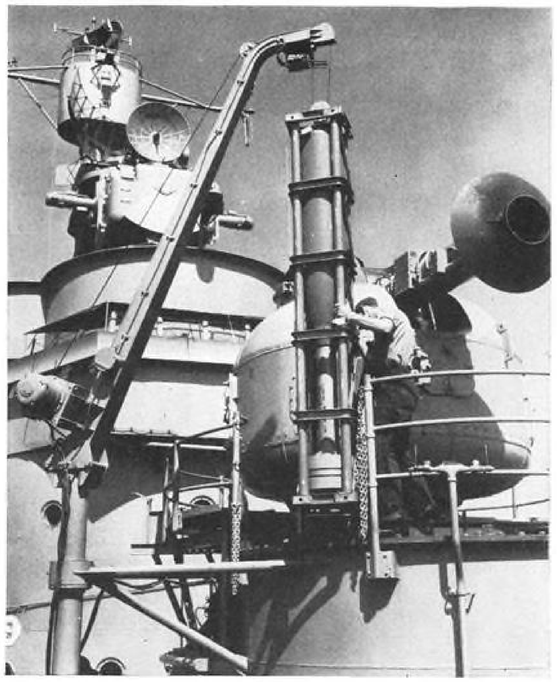
Alco Co., 5423 Flemish Lane, Los Angeles 29, Cal., BOQ and mess, Naval Air Missile Test Center, Point Mugu, Cal., contract NBy-5434 (IFB 5434-56B), job, $384378.

OFFICER IN CHARGE OF CONSTRUCTION, District Public Works Office, Fifth Naval District, Norfolk 11, Va.

Va-Carolina Electrical Works, Inc., 1007 E. Main St., Norfolk, Va., communications facilities, Naval Air Station, Norfolk, Va. (IFB NOy-89486), contract, $498700.

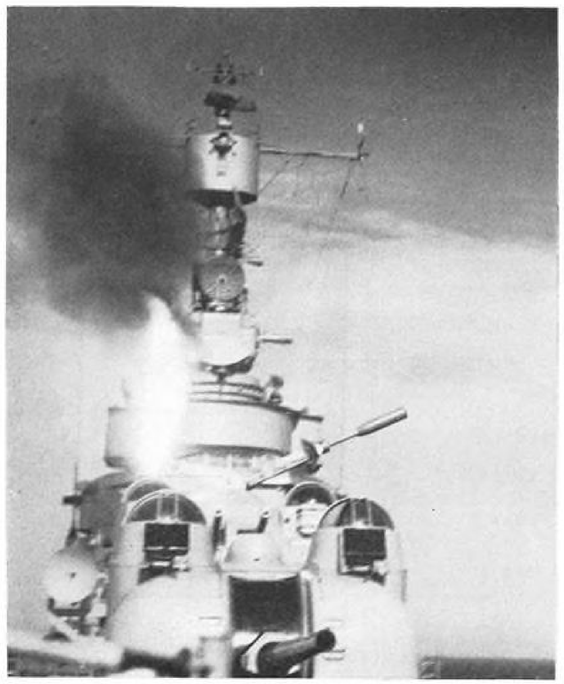
T. A. Loving and Co., Goldsboro, N. C., radar air traffic control center, Marine Corps Air Station, Cherry Point, N. C. (IFB NOy-85858), contract, $815945.

Coggins Const. Co., Box 1508, Raleigh,



Navy's Rocket Launched Depth Charge

Anti-submarine weapon is ready for loading into launcher on destroyer Wilkinson (above). Crew member is removing tompion (right) from launcher, which has flash shield at mouth to protect deck. The weapon, being fired below, weighs approximately 500 lb. Its explosive weight is approximately equal to that of conventional depth charge. Launcher can be rotated to fire in almost full 360-deg., thus eliminating time needed to maneuver ship to firing position using conventional depth charges. Missile sinks rapidly and covers larger water area than depth charge.



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N. C., relocation of H. E. Magazines, Marine Corps Air Station, Cherry Point, N. C. (IFB NOy-91329), contract, $94780.

Dale Benz Inc., Contr., Phoenix, Ariz., repairs to Airship Dock II, Naval Air Facility, Weeksville, N. C. (IFB NBy-676), contract, $809000.

Construction Engineering and Development Co., Inc., P. O. Box 33, Portsmouth, Va., building for explosive decompression chamber, Naval Air Station, Norfolk, Va. (IFB NOy-91346), contract, $66000.

U. S. NAVAL AIR STATION, Pensacola, Fla.

Moore Service, Inc., P. O. Box 1487, El Paso, Tex., refueling and defueling services during fiscal year 1947 N204s-31979 (IFB 204-180-56), misc. units, $150333 est.

NAVY PURCHASING OFFICE, Washington, D. C., 4th & Independence Ave., S.W., Washington, D. C.

United Aircraft Corp., Hamilton Standard Div., Windsor Locks, Conn., air turbine starter, model A-19 (N600(A)42112) (IFB 600-1625-56) spec MIL-S-7848, 865 ea, $475800.

NAVY DEPARTMENT, BUREAU OF SHIPS, Washington 25, D. C.

Bendix Aviation Corp., Friez Instrument Div., 1400 Taylor Ave., near Loch Raven Blvd., Towson, Baltimore, Md., services to survey and record characteristics of wind speed direction on the flight deck of a CVA type aircraft carrier, contract nobs-72137 (inv. no. 565-2314Q), $49736.

Gilfillian Bros., Inc., 1815 Venice Blvd., Los Angeles, Calif., develop a multicolor plan position indicator, contract nobsr-72571 (inv. no. 882-66139Q), $82500.

NAVY DEPARTMENT, BUREAU OF AERONAUTICS, Washington 25, D. C.

Metal Hydrides, Inc., 12-23 Congress Street, Beverly, Mass., design, develop, acquire, construct, assemble and install equipment for production of sodium borohydride, noas 56-384-c (Aer-34-2080-56 and 2147-56), $4388290.

The Garrett Corp. (AiResearch Mfg. Co. Div.) 9851-9951 Sepulveda Blvd., Los Angeles, Calif., redesign GTP79-10 compressor wheel, noas 56-507-c(PP-32-2110-56), $69551.

The Garrett Corp. (AiResearch Mfg. Co. of Arizona Div.), 402 South 36th Street, Phoenix, Ariz., design, fabricate, test and furnish light-weight air starters, model XA-23 and XA-24, noas 56-570-c(PP-32-2117-56), 2, $118106.

Pinsecki Aircraft Corp., Island Road, Philadelphia International Airport, Philadelphia 42, Pa., design and construct a ground test stand, consisting of a ring-wing propeller combination, construct a wind tunnel model, noas 56-834-c(AD-32-4299-56), $94331.

Vertol Aircraft Corp., Morton, Pa., prepare and furnish rough draft copy of a design handbook for engine cooling system and duct systems, reproducible copy and reproduction copies, noas 56-880-f(PP-31-2070-56), 30, $40651.

NAVAL SUPPLY DEPOT, Great Lakes, Ill.

Ford Instrument Co., Division of Sperry Rand Corp., 31-10 Thomson Ave., Long Island City, N. Y., servo amplifier per BuOrd drawing 87707 (no revision) LD 296726 alteration #4 using spec OS 5651 and OS 5655 with contractor's measurement values as of the date of this contract, (N128(419)8637, 100 ea, $83076.

Army Contracts

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

LOS ANGELES ORDNANCE DISTRICT, 55 S. Grand Ave., Pasadena, Calif.

University of Utah, Salt Lake City, Utah, studies of ionization created by fast moving objects, job, $25000.

Coleman Engineering Co., Inc., 6040 W. Jefferson Blvd., Los Angeles 16, Calif., cinetheodolite angle viewer, job, $25204.

Gilfillan Bros., Inc., 1815 Venice Blvd.,

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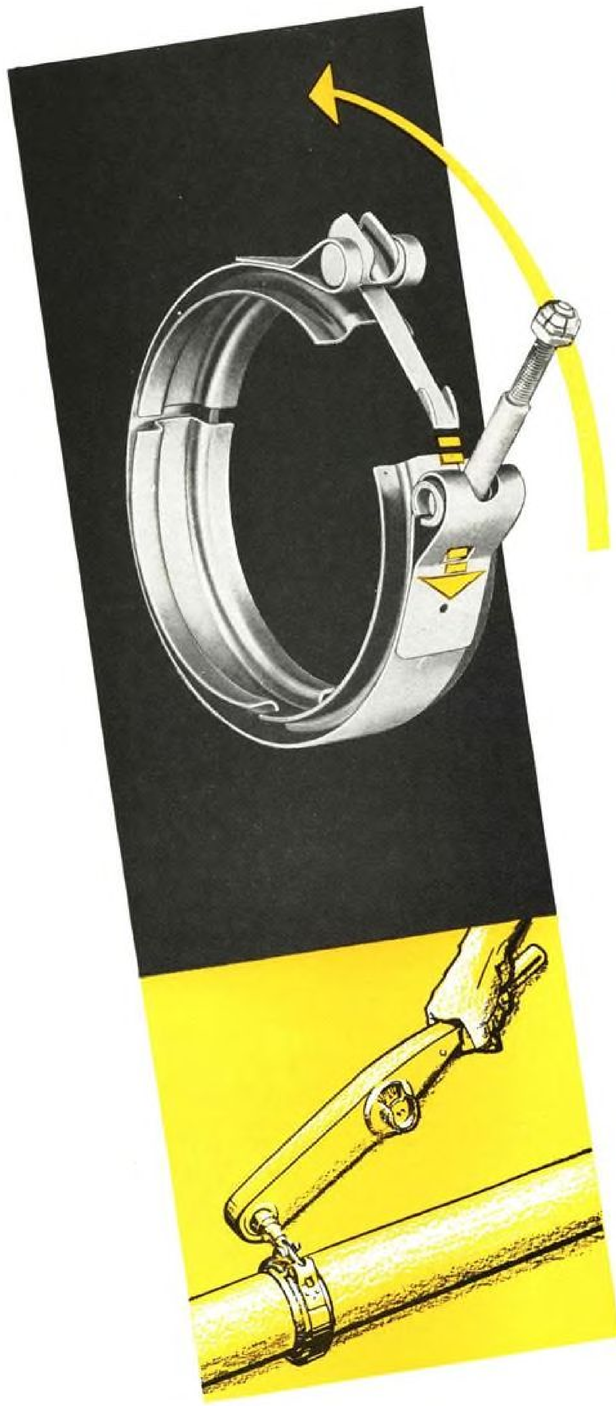

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Los Angeles, Calif., Corporal replenishment spares, job, $39000.

REDSTONE ARSENAL, Huntsville, Ala.
The Ralph M. Parsons Co., 617 S. Olive St., Los Angeles 14, Cal., study to determine the optimum requirements for facilities to produce and test large solid propellant power plants (PR CS-335-56), job, $95485.

BIRMINGHAM ORDNANCE DISTRICT, 2120 Seventh Ave. N., Birmingham 3, Ala.
J. A. Jones Construction Co., Cape Canaveral Air Force Base, P. O. Box 1175, Cocoa, Fla., installation of air conditioning system in ABMA assembly & checkout facility at Missile Firing Laboratory, FMTR, Cape Canaveral Air Force Base, Fla., contract DA-01-009-ORD-406 (BRM-AB-A1), job, $33187.

NEW YORK ORDNANCE DISTRICT, 180 Varick St., New York 14, N. Y.
Federal Telecommunication Lab., Division of International Telephone & Telegraph Corp., 500 Washington Ave., Nutley, N. J., precision pulse ranging investigation, DA-30-069-ORD-1800, job, $66811.

CORPS OF ENGINEERS, Jacksonville District, Jacksonville, Fla.
The Duval Engineering & Contracting Co., 1746 E. Adams St., Jacksonville, Fla., widening missile skid strip, AFMTC, Patrick AFB, Fla. (req.) for (quotation ENG—08-123-(neg.-56-12), job, $121867.
R. E. Clarson, Inc., and Ewell Engineering & Contr. Co., P. O. Box 387, St. Petersburgh, Fla., construction of launching complex no. 26, missile bldgs. R and S, and groups I and II G/M tracking facilities, AFMTC, Patrick Air Force Base, Fla., (ENG-08-123-(neg.-56-10), job, $5403361.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill., furnishing twenty-five 30 KW two 50 KW and three 75KW generator units with diesel engines and misc. switchgear and accessories, AFMTC, Patrick Air Force Base, Fla. (inv. ENG-08-123-56-62), job, $267030.

CORPS OF ENGINEERS, New England Division, Boston 15, Mass.
Edward R. Marden Corp., 233 Harvard St., Brookline, Mass. Sub-Contracting: Prime Contractor requires assistance in all lines of sub-contracting, construction of Nike battery 40, Boston Defense Area, Quincy, Mass. (IFB ENG-19-016-56-149B), job, $379674.

CORPS OF ENGINEERS, Office of the District Engineer, Mobile District, 2301 Grant St., Mobile, Ala.
Burns & Roe, Inc., New York, N. Y., contract DA-01-076-ENG-3445, architect-engineer services for design of IM-70 OST facility at Eglin AFB, Fla., (negotiated) job,
J. Gordon Turnbull, Inc., Cleveland, Ohio, contract DA-01-076-ENG-3346, architect-engineer services for design of IM-99 OST facility at Elgin AFB, Fla., negotiated, job, $17,500.
Insche's Mechanical Contractors, Birmingham, Ala., mechanical modifications and additions to existing facilities at Redstone Arsenal, Ala., (IFB ENG-01-076-56-85), job, $39991.

RESEARCH CONTRACTING DIVISION, TRADCOM, Fort Eustis, Va.
Municipal University of Wichita, Engineering Research Department, Wichita 14, Kan., evaluation of the performance, stability and control of the Hello Courier airplane, contract DA-44-177-TC-369, job, $43404.

CORPS OF ENGINEERS, U. S. ARMY, NEW ENGLAND DIVISION, 150 Causeway St., Boston 15, Mass.
A. A. Salerno, 41 Relyea Place, New Rochelle, N. Y., construction of additional buildings, Nike battery no. 67, Hartford Defense Area, Plainville, Conn. (IFB ENG-19-016-56-120B), job, $399822.

PICATINNY ARSENAL, Dover, N. J.
The Glenwal Co., P. O. Box 26, Saddle Brook township, Rochelle Park, N. J., construction, utilities & facilities for loading biding for project Jackstraw at Picatinny Arsenal, (IFB ORD-28-017-56-150), job, $106300.

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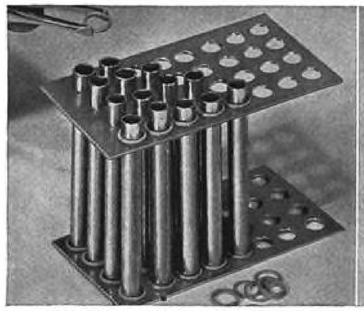

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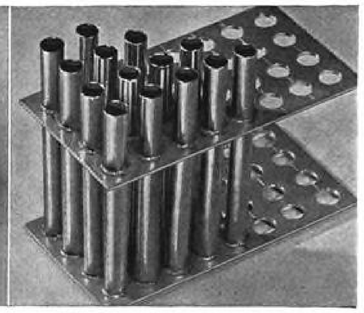

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CAB Accident Investigation Report:

Broken Runway Lights Misled Pilot

At 2204,[1] Mar. 29, 1956, Northeast Airlines' Flight 124, a Convair 240, N 90659, landed in deep snow to the left of runway 20 at the Portland, Me., Municipal Airport. The nose gear folded back resulting in major damage to the aircraft and minor injuries to five of the 32 passengers. The crew was uninjured.

FLIGHT HISTORY

Northeast Airlines' Flight 124 of Mar. 29 was scheduled between La Guardia Field, New York, and Bangor, Me., with several intermediate stops including Boston, Mass., and Portland. The flight utilized the aircraft and flight crew of Trip 117 which terminated at La Guardia to originate as Flight 124. Capt. Ayres R. Chaves, Capt. Robert A. Lebewohl, acting as first officer, and Stewardess Jean L. Anderson comprised the crew.

Other than traffic delays which made the flight late, Flight 124 originated in a routine manner. Gross weight of the aircraft at takeoff was 38,318 lb. and the maximum allowable was 38,393 lb. The load was properly distributed.

The first segment to Boston was uneventful and Flight 124, after a short ground time there, departed for Portland at 2120. The flight was conducted in instrument weather conditions and in accordance with an IFR (Instrument Flight Rules) flight plan.

At 2147, after a routine flight to the vicinity of Portland, Trip 124 was cleared by ARTC (Air Route Traffic Control) to descend from its assigned cruising altitude of 3,000 ft. to 2,000 ft. and thereafter make an instrument approach to the Portland Airport.

Shortly thereafter tower personnel observed the aircraft over the airport and below the overcast as it circled left to land on runway 20, which was available and selected by Capt. Chaves. The aircraft disappeared momentarily in the limited visibility, reported as 1¼ mi. in light snow, while it was flying on the downwind leg.

It was then seen, landing lights on, apparently aligned with the runway and descending normally on the final approach. Seconds later the aircraft touched down, seemed to roll a few hundred feet, then went up on its nose and stopped abruptly. Tower personnel promptly dispatched emergency equipment and personnel to the scene.

INVESTIGATION

Evacuation was through the front door, the most accessible exit because of the tail-high position of the aircraft. It was orderly but slow because several passengers were reluctant to leave without their personal belongings or, despite Capt. Chaves' objections, insisted on retrieving them.

Weather conditions reported at the airport at the time of the accident were: scattered clouds, 400 ft.; precipitation ceiling, 900 ft.; sky obscured; visibility 1¼ mi.; light snow; temperature 32; dewpoint 31; wind south-southwest 8; altimeter setting 29.99.

Investigation at the accident scene showed that the aircraft landed parallel to and off of runway 20 to the left and continued about 450 ft. before it stopped.

The touchdown position was approximately midway laterally between the left[2] row of white runway lights which border the left side of the runway and a parallel row of white lights marking the left boundary of the field. The area was covered by packed snow 18-24 in. in depth. Lateral distance between the left row of runway lights and the boundary lights is about 168 ft. The runway is 150 ft. wide with its two rows of runway lights 160 ft. apart.

Rearward Forces

As the aircraft moved forward parallel to the runway, rearward forces fractured the nose gear drag link and permitted the nose gear to fold back. The main landing gears remained extended and locked. Therefore, the aircraft came to a stop resting on the nose section and main landing gear. Before stopping, the sliding action caused extensive abrasive and impact damage to the lower nose section of the fuselage.

Both engines stayed in place; however, the nose section of each engine with its respective propeller was torn off. These components were located apart from the main aircraft showing that they had been separated as the aircraft slid forward.

An extensive examination was made of the aircraft structure, equipment, controls, and its engines and propellers. This examination, as well as confirming statements of the pilots, revealed there was no malfunction or failure of the aircraft prior to impact. It also indicated that performance of the powerplants and aircraft equipment was normal in all respects before the accident.

An examination of the runway lights was conducted shortly after the accident. Ten of the lights along the right edge of runway 20 were inoperative for mechanical reasons, broken, or covered by snow. Eight of the 10 were consecutive, beginning at the approach end and extending down the runway in the landing direction. One was partially obscured by snow and considered dull as compared to normal brilliance.

The broken lights were the result of being struck by snowplows during several snow-removal operations and appeared to have been broken for a considerable period. The distance covered along the runway by the broken, inoperative, or obscured lights was about one-half of the runway total length of 4,260 ft.

At the time of the accident the three rows of lights (the row of boundary lights and the two parallel rows of runway lights) were white in color with the boundary lights somewhat brighter than the ones for the runway. The latter were set for maximum intensity. The runway fixtures were flush mounted, and the fixtures for the boundary units extended 24 in. above the ground, or a few inches above the snow cover.

The approach end of runway 20 is marked normally by three green threshold lights. Inspection of these, after the accident, disclosed they varied in brilliance and that the green glass cover of one was broken. The left light, as viewed from the approach area, was bright, the middle one was dull, and the cover for the right light was broken.

At the time, the policy of the city of Portland in connection with inspection of the airport lighting was to contact the control tower personnel daily for any lighting irregularities reported to them during the previous night. If required, action was taken by the city to make corrections before the next night.

Also, the policy required a complete inspection of the lighting system once each month by an electrician employed by the city to detect any unreported faults.

It was the policy during the snow season not to replace each broken light as it was reported or discovered unless complaints by pilots showed too many lights were broken. In this season repairs were deferred until spring.

Tower personnel, on the day of the accident, reported no irregularities had been brought to their attention and so indicated in the daily report to the city. These personnel stated that they were unaware of the broken lights and that existing snowbanks precluded them from seeing the area where the broken lights were located.

Electrician's Report

Investigation disclosed that the electrician's report of Feb. 13 indicated all lights were repaired. Thereafter, his report of Mar. 12 did not indicate any broken lights.

Records also showed that there were eight snow-removal operations during the month of March and the last one preceding the accident was on Mar. 25. Further, investigation showed that there were no current Notams (Notices to Airmen) issued relative to the Portland Municipal Airport except that runway 10-28 was closed during the winter months.

Northeast Airlines company procedures require that the company ground personnel at Portland submit a periodic field condition report to the Boston operations office. This report is required three times daily. Among other pertinent items, the condition of the airport lighting is included as follows:

"Remarks as to lighting conditions. Will

[1] All times herein are Eastern Standard and based on the 24-hr. clock. Altitudes are mean sea level unless otherwise indicated.

[2] Left and right are used as viewed from the cockpit while approaching runway 20.

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specify if boundary contact or runway lights are operating, and if any are out when expected to be replaced and if smoke pots will be used to replace any inoperative lights, etc."

A message in compliance with the above instruction was sent Mar. 29, the day of the accident, at 0518. With respect to lighting the message stated:

"Lites Normal."

A second message sent as the noon field report repeated:

"Lites Normal."

The station manager responsible for the message indicated that his understanding was to reflect the lighting condition as outlined in the policy of the city of Portland for the snow season. The snow season policy was the basis on which "lites normal" was reported.

Instrument Weather

Captains Chaves and Lebewohl stated that the flight to the vicinity of Portland was uneventful but in instrument weather conditions.

In accordance with their clearance, they proceeded to the Portland low frequency range station at 2,000 ft. and stated that when over this facility were briefly able to see the airport. The instrument approach procedure was then executed precisely and completely. According to the pilots, during the final approach to runway 15, the instrument runway, visual reference was established at approximately 1,000 ft. above the ground.

This permitted a circling approach for landing on runway 20.

Clearance was then obtained by the flight for the circling approach to land on runway 20. Capt. Chaves chose this runway because of its length, grade, and the existing winds. The aircraft was therefore flown across the airport and a left circling turn made to align the airplane on the final approach with the runway.

The captain stated that while turning onto the final approach he was able to pick out the runway lights and instructed Capt. Lebewohl to complete the landing checklist. During the final approach Capt. Chevas stated that he noted landmarks below which were familiar to the final approach path. Landing flaps were extended and landing lights turned on.

Capt. Chaves recalled that what he assumed to be the runway, during the approach, was white and without wheel tracks; because of light to moderate falling snow this seemed normal. Approach speed and altitude were good. Alignment seemed good.

The pilots said that at touchdown the aircraft decelerated very rapidly, nosing down as the nose gear collapsed and stopping after a short slide. Both pilots were completely amazed when they learned that the landing had been to the left of runway 20.

ANALYSIS

Based on all the available evidence, it appears that Flight 124 was conducted as a routine instrument flight and was normal in all respects until it was positioned on the final approach for landing on runway 20 at the Portland Municipal Airport.

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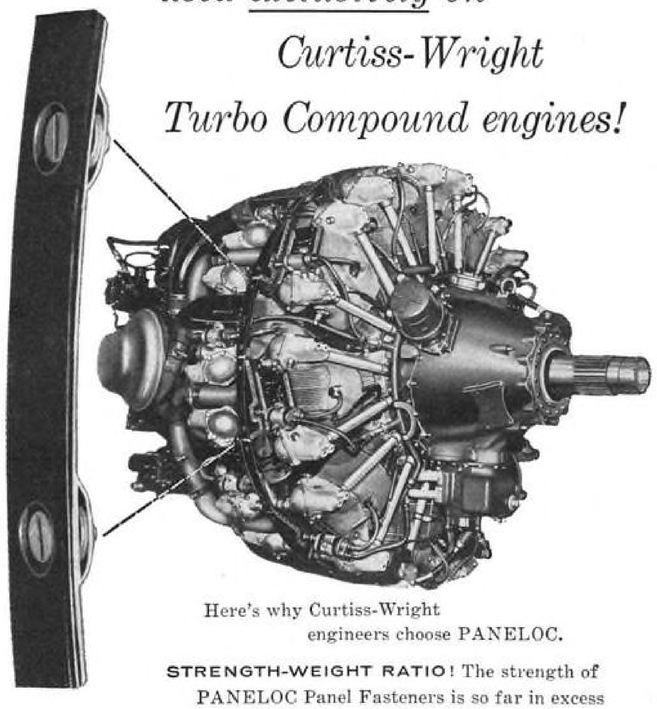

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way lights were obscured or inoperative along the right side of the runway. As the final approach was made the pilots saw a row of field boundary lights and the left row of runway lights. This undoubtedly appeared to the pilots as the left and right rows of runway lights and created an illusory runway to the left of and parallel to runway 20.

Considering the nearly equal distance between the boundary lights and the left row of runway lights as compared to the distance between the left and right rows of runway lights, their same color and comparable spacing, the appearance of an actual runway is even more apparent. These factors considered together with the existing weather conditions make Capt. Chaves' off-runway landing understandable.

With moderate falling snow to restrict flight visibility and the normal tendency to concentrate on the landing area of the runway (the first one-third) during the final approach, it is not difficult to understand why the pilots did not see the operating lights of the right row located along the far one-half of the runway. Further, these lights, when normally viewed during the final approach, would probably have been near the limit of forward flight visibility.

Reporting Requirements

According to company procedures, a field condition report was required which included a section on the field lighting. In accordance with the reporting requirements, the field lighting was stated as "lites normal" on the day of the accident. This being a report to the operations branch of the airline and principally for pilot information, the Board does not understand the report or the reason for indicating that the lights were normal. It is believed that the detailed field condition report procedure was definite and clear but complied with inadequately.

It is further believed that the policy of the city of Portland was not adequate for the maintenance of its airport lighting. Although it is recognized that the maintaining of field lighting in northern areas is difficult because of the many snows and resulting snow-plowing operations, it is believed that the maintenance of lighting should be geared to this situation.

The responsibility for adequate lighting and the detection of irregularities rests properly with the airport management.

It is believed that sufficient inspections should be made by airport and company employes to ensure an accurate knowledge of the condition of the lighting facilities and that the condition be reported so that users of the airport be on notice of the condition.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The carrier, aircraft, and crew were properly certificated.
2. The aircraft was loaded to a gross weight less than the maximum allowable.
3. The flight was cleared according to Instrument Flight Rules to Portland, a scheduled stop.
4. The flight was routine in instrument weather conditions and normal in all re-

Engineers

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Compact and lightweight, this highly reliable temperature control uses only standard electro-mechanical components—no electronic equipment. Its design simplicity eliminates costly maintenance training. The instrument's checkout procedure is familiar to any electrician.

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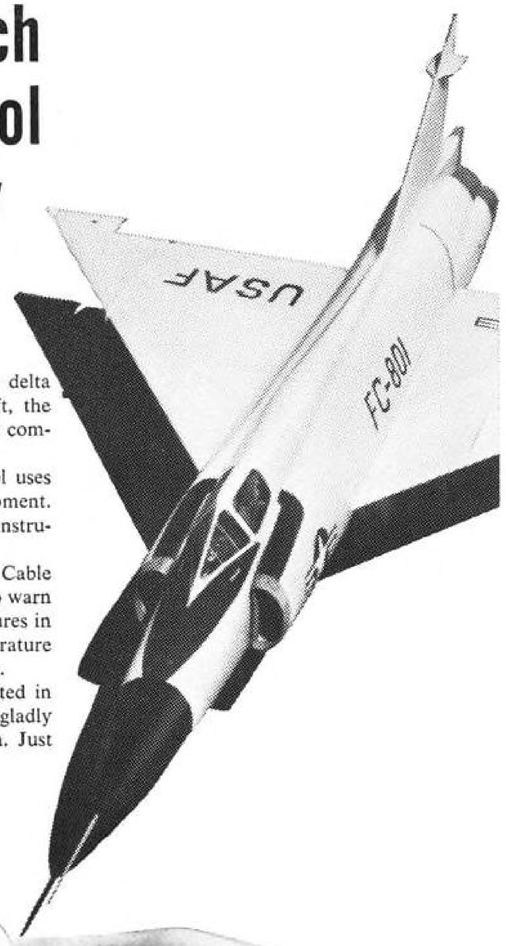

SAFETY

spects until it was positioned for landing on the final approach to runway 20.

5. Eight consecutive runway lights were inoperative or obscured along the right side of this runway.

6. Under the existing weather condition, airport boundary lights paralleling the left row of runway lights created the illusion of runway 20 being to the left of its actual position.

7. Capt. Chaves understandably landed to the left of and off runway 20 in the area which appeared to be the runway.

8. The lighting condition was reported incorrectly to the airline operations office by company employes as "lites normal."

9. The procedure for detecting and reporting lighting irregularities by the airport management was inadequate.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was inadequate maintenance of runway lights and incorrect reporting of their condition resulting in an illusionary position of the runway under conditions of low visibility.

By The Civil Aeronautics Board:

James R. Durfee
Harmer D. Denny
G. Joseph Minetti

(Adams, vice chairman, and Gurney, member, did not participate in the adoption of this report.)

SUPPLEMENTAL DATA

The Civil Aeronautics Board was notified of this accident shortly after its occurrence on Mar. 29, 1956. An investigation was immediately initiated in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. There was no public hearing held in connection with the accident.

Air Carrier

Northeast Airlines, Inc., is a Massachusetts corporation with its principal offices located in Boston. The company is engaged in the transportation by air of persons, property, and mail under a currently effective certificate of public convenience and necessity issued by the Civil Aeronautics Board and an air carrier operating certificate issued by the Civil Aeronautics Administration. The company conducts scheduled operations over the route involved.

Flight Personnel

Capt. Ayres R. Chaves, age 43, on Mar. 29, 1956, held CAA Airman Certificate No. 21316 with an airline transport rating and rating for the Convair 240. He became a first officer with the company June 1, 1939, and captain April 22, 1941. He had accumulated 5,568 flying hours in the Convair 240. The last instrument proficiency check of Capt. Chaves was satisfactorily passed Nov. 21, 1955. His medical certificate was current.

Capt. Robert A. Lebewohl, age 39, was acting first officer on the subject flight. He held CAA Airman Certificate No. 94014 with an airline transport rating and rating for the Convair 240. Capt. Lebewohl became a first officer with the company July 1, 1946, and was promoted to captain on Aug. 11, 1953. He had accumulated 2,437 flying hours in the Convair 240. The last

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instrument proficiency check of Capt. Lebewohl was successfully accomplished Nov. 17, 1955. His first-class medical certificate was currently effective.

The stewardess on Flight 124 of Mar. 29, 1956, was Miss Jean L. Anderson of North Quincy, Mass.

N 90659, a Convair 240, serial number 34, was manufactured during May, 1948, and acquired from the original owner by Northeast Airlines, Inc., on Mar. 8, 1954. Total time on the aircraft when the accident occurred was 12,478 flying hours, 43 of which were accumulated since major overhaul. The aircraft was powered by Pratt and Whitney R-2800-CB3 engines which were equipped with Hamilton Standard 43E60/6895E-R propellers.

Certificates of Necessity

The Office of Defense Mobilization has awarded Douglas Aircraft Co. Inc., two certificates of necessity for accelerated tax amortization totaling $3,008,874 with 65% of the amount allowed at the rapid rate. Both certificates are for military aircraft facilities. Other certificates awarded are:

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American Machine and Foundry Co., Boston, Mass., electronics equipment, $25,624 certified with 65% allowed.

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Pheoll Manufacturing Co., Chicago, Ill., titanium fasteners for military aircraft, $995,000 certified with 65% allowed.

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Motorola Inc., Phoenix, Ariz., research and development, $1,200,000 certified with 65% allowed.

United Aircraft Corp., Hamilton Standard Division, Windsor Locks, Conn., research and development, $1,200,000 certified with 65% allowed.

Sperry Gyroscope Co., Div. of Sperry Rand Corp., Salt Lake City, Utah, research and development, $444,000 certified with 40% allowed.

H. G. Machine & Tool Co., Long Island City, N. Y., electronic equipment, $4,732 certified with 70% allowed.

Television Associates, Inc., Michigan City, Ind., aircraft engine components, $100,000 certified with 50% allowed.

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(D) DATA REDUCTION & ANALYSIS ENGINEERS. Experience required: General planning for Data Processing, including estimating and scheduling; specification of data transcription equipment and techniques; preparation of computational requirements, procedures, and knowledge of machine programming; mathematical studies, equation formulation, digital smoothing and filtering techniques; data reduction equipment, functional design and project engineering.

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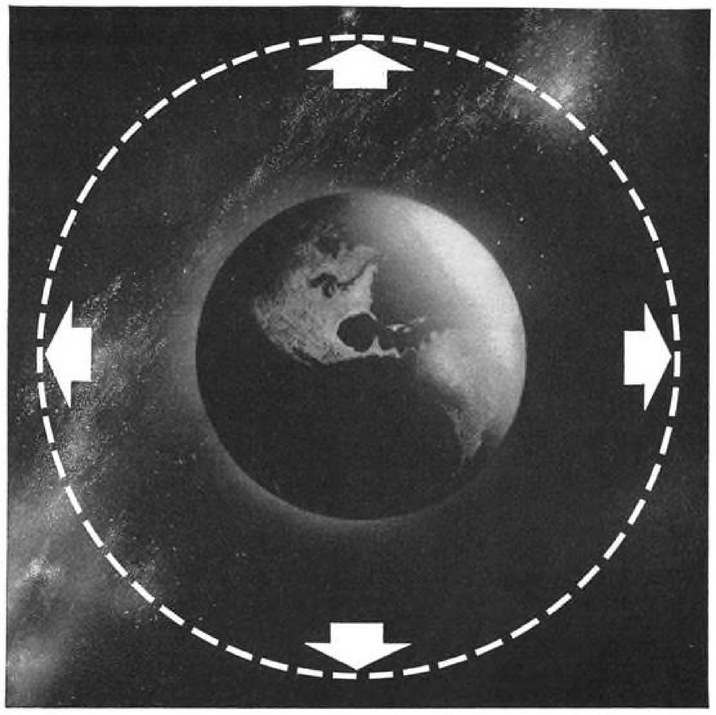

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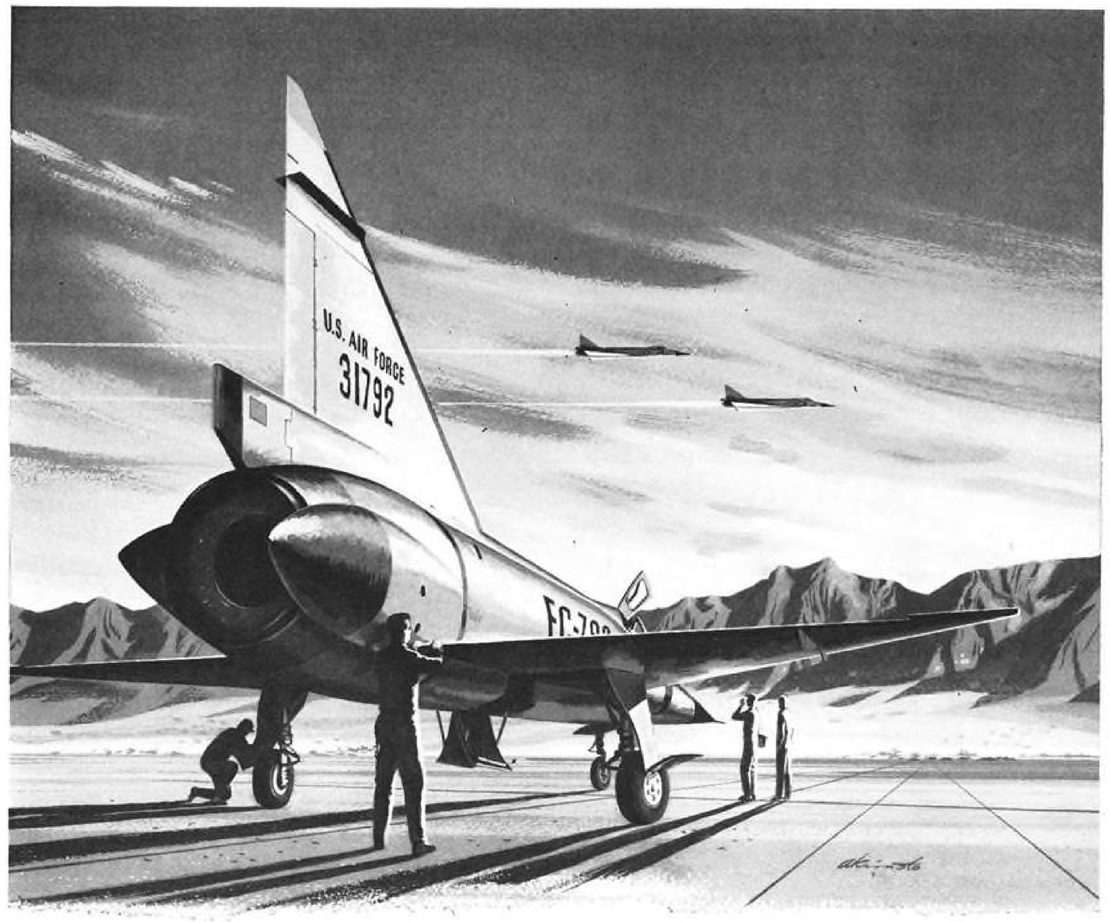

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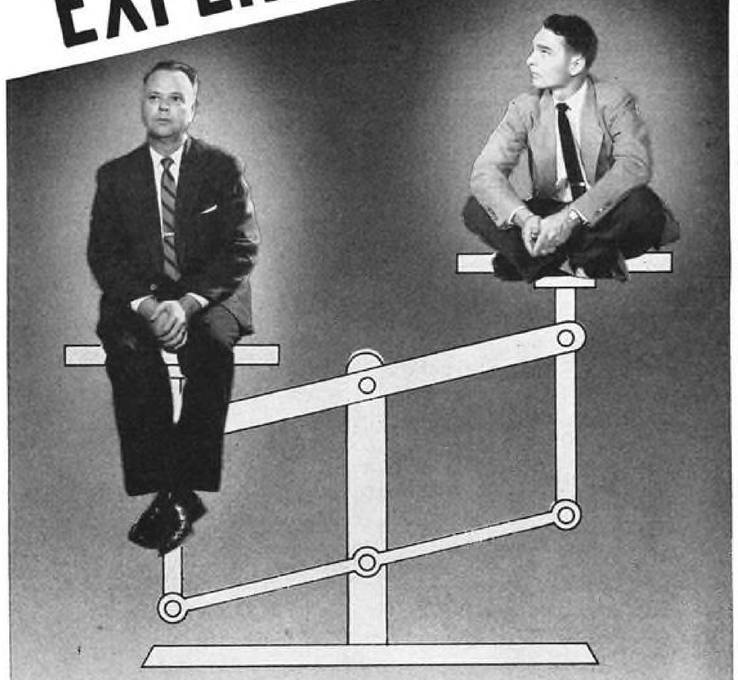

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Pilot ATR written, all land ratings. 5500 hrs. diversified flying, extensive IFR, 3500 Multi-Eng., incl. Twin-Beach., B-25, C-46; 2400. hrs. DC-3, 2½ yrs. sched. airline. 4 yrs. college engrg. Age 36, family. Desire permanency. Resume on request. PW-3401, Aviation Week.

Field Service: 19 yrs. diversified aircraft experience including 10 yrs. field service jet and conventional powerplants; widely travelled foreign, domestic, USAF and commercial airline contacts; excellent correspondent; commercial pilot; college. Seeks position greater responsibility and growth potential, preferably field service administration and supervision. PW-3374, Aviation Week.

Pilot ATR 6000 hrs. DC-4, DC-3, C-46 age 32, college grad. PW-3400, Aviation Week.

10,000 hrs. as Airline Captain 3,000 hrs. as executive 1st. pilot. Douglas DC-3, DC-4, DC-6. ATR Lockheed Lodestar-Accident free Married, age 41. Managment ability. PW-3391, Aviation Week.

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Manufacturers Agent twenty years as engineer and sales manager in aircraft and automotive fields wants new lines for aircraft, missile and industrial accounts in Ohio and Michigan. RA-3263, Aviation Week.

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AND
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Familiar with low voltage DC aircraft equipment such as generators, starters, regulators, navigation and communication systems, and their installation. Experience in custom installations of such equipment on a variety of executive aircraft desirable.

Contact
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PIPER AIRCRAFT CORPORATION
LOCK HAVEN, PA.
Phone Lock Haven 6711
Ext. 259

DIARIES

...from the stratosphere

Telemetry today enables aircraft and missiles to write their own flight test autobiographies. These remote transcriptions make significant reading for anyone probing the barriers of speed and space. They are especially absorbing to the electronic and electrical engineers who develop telemetry and data processing systems. A leader in this field, Chance Vought is a mecca for engineers who seek new capabilities for remote instrumentation. Here, these men staff a department designed exclusively for flight test research. Their own instrumentation laboratory includes environmental test equipment, machine tools and shop technicians. And their informal organization allows each engineer freedom to envision, build up and field-test his own designs. Small wonder that this department has secured important patents on telemetric refinements. It follows, too, that here are outstanding opportunities for electronics engineers to enter instrumentation research. You can find out your qualifications in a few days' time. Just mail a resume of your background to:

Mr. J. W. Larson, Asst. Chief Engineer
Dept. 11-3A, Engineering Personnel

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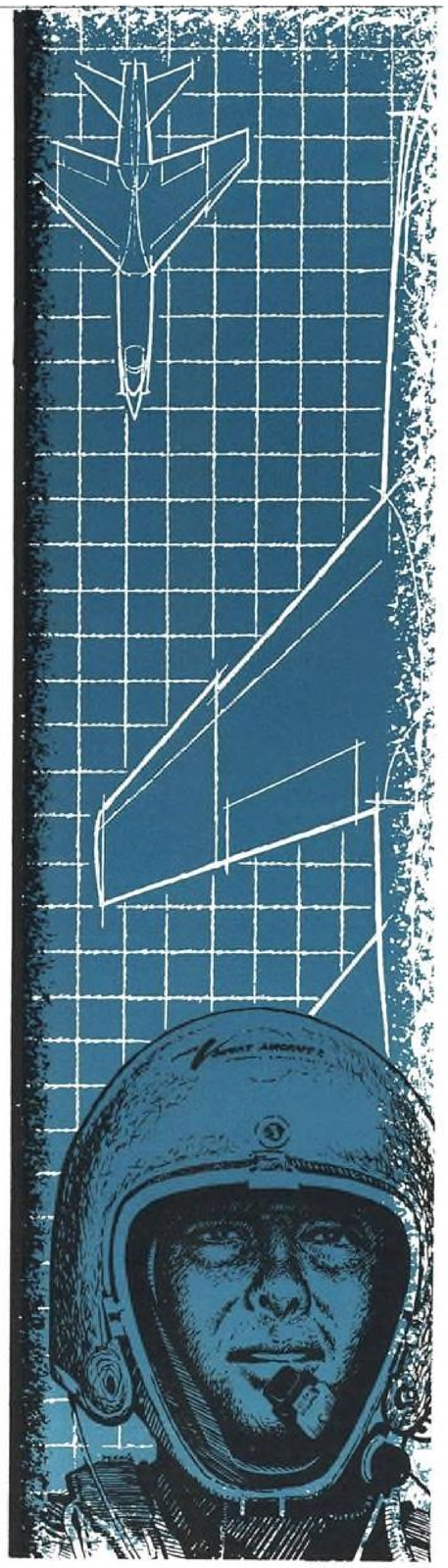

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- Executive management experience necessary in initiating and administering sales programs.
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- Must develop and administer a spare parts merchandising program.
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This is straight salaried position with starting rate dependent on your background.

Interviews will be arranged at our expense.

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P-3361, Aviation Week
520 N. Michigan Ave., Chicago 11, Ill.

Engineers

Check This List of Professional Skills

- ☐ *aerodynamics*
- ☐ *thermodynamics*
- ☐ *fluid mechanics*
- ☐ *fluid dynamics*
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P-3190 Aviation Week, Class. Adv. Div.

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Sikorsky S-55
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ROTOR-AIDS, INC.
P. O. Box 1850 Ventura, California

ENGINEERS

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...AT REPUBLIC AVIATION

In a recent newspaper statement, Mundy I. Peale, President of Republic Aviation Corporation, stressed the increasing need in the aviation and missile industry for "men whose minds can really range the universe in complete intellectual freedom . . . what might be called 'Tomorrow Thinkers'."

The emphasis, of course, has always been on NEW IDEAS at Republic. For a quarter of a century this company has been in the forefront of aviation design, developing and building such planes as the most advanced supersonic fighter-bomber in the U. S. Air Force, the new F-105 Thunderchief—newest of the famous family of Thunder-Craft.

The pace of invention and discovery must be stepped up, in line with national necessities. Breaking the sound barrier—so tremendous an achievement only yesterday—is taken for granted today. Now the urgent need faced by Republic's designers of aircraft and missiles is to conquer the thermal barrier and the fantastic problems of hypersonic flight—and tomorrow, what new urgencies will confront us?

Practical engineering, important as it is, is not enough. We need an increasing number of engineers and scientists of inventive capacity, who are able to produce totally new theories in many fields, breaking the bonds of traditional thought. In short: "TOMORROW THINKERS."

We have many engineers and scientists with bold creative minds at Republic...and we need MORE men of this calibre. Company activities and scientific challenges are *both* expanding.

We invite professional men at all levels of experience, who feel qualified to contribute to the future of aviation, to a friendly interview...and we promise the men selected a professional working climate in which their ideas can thrive.

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Farmingdale, Long Island, N. Y.

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$11,000

Coordinate and direct activities of trained engineers in the design of military equipment. Requires a broad engineering background in radar, communications, countermeasures and a familiarity with tactical weapons systems problems.

This opportunity is with Light Military Electronic Equipment Department of General Electric in Utica, N. Y.

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LIGHT MILITARY ELECTRONIC EQUIPMENT DEPT.
GENERAL ELECTRIC
French Road Utica, N. Y.

ENGINEER, AE ME
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Cincinnati, Ohio

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P. O. Box 535
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GENERAL ELECTRIC

NEW ADVERTISEMENTS

Received by Nov. 15 will appear in the Nov. 26 issue subject to limitations of space available.

CLASSIFIED ADVERTISING DIVISION
AVIATION WEEK
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Now open at **General Electric's**
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AIRCRAFT PRODUCTS FIELD

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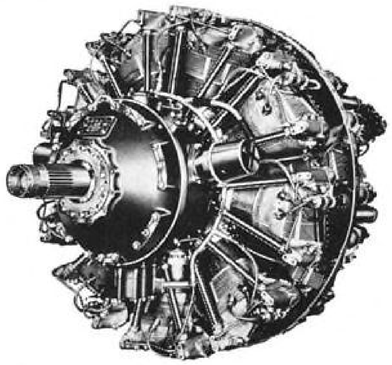

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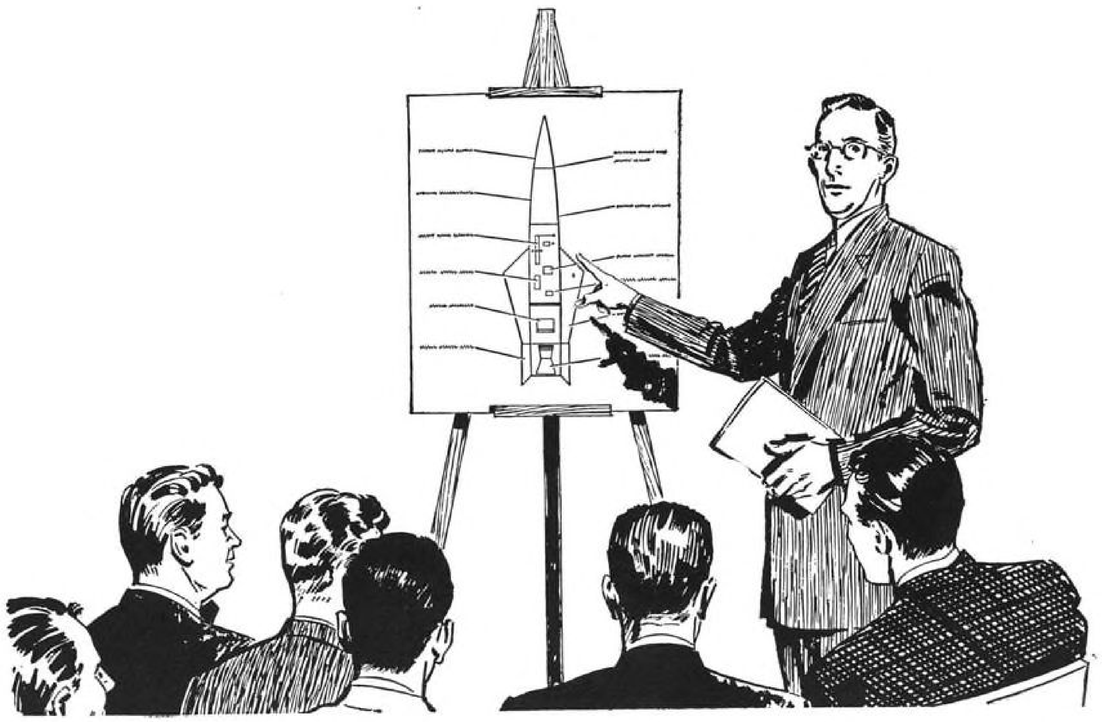

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LETTERS

Simple, Common-Sense

No thinking pilot could help but support the philosophy expressed by Capt. Kriloff in AVIATION WEEK of July 30 (p. 102). He is quite correct in pointing out that the accident does not indicate the need for tremendous expenditures for radar, proximity warning devices, or a complex airways system overburdensome to the ordinary taxpayer. What it does indicate is the continuing need for adherence to simple, common-sense safety practices, for it is still true that, "Aviation, like the sea, is not inherently dangerous, but is terribly unforgiving of any carelessness or neglect."

Any experienced aviation practitioner knows only too well that the means to avoid the June 30 tragedy were in the possession of the airlines themselves, and a candid observer might be tempted to add that the pilots also had similar power. The general inadequacy of visibility out of current air carrier aircraft has been far too widely discussed to require reiteration here, nor is there any question of the statistics that show no accidents have occurred between aircraft which had been properly cleared and were operating under instrument flight conditions. Yet history shows that commercial considerations have, from time to time, delayed the adoption of the day-to-day safety practices which time proves necessary to any business of manufacturing or transportation.

A refreshing note in this regard was contained in a New York Times editorial of Aug. 1, which read in part as follows: "To the credit of the trucking industry, many of the reforms called for by the Governor originated with labor and management representatives. Their enlightened self-interest in combating highway hazards would seem to assure full cooperation in the program. . . . If the new truck licensing rules save only a single life, they will be a worthwhile reform." The rules referred to will be a burden to the trucking industry, but here we seem to have different feelings from those on display during the current airspace quarrel. Instead of enlightened self-interest, in aviation we find a situation paralleling a hypothetical one in which the trucking and bus industry would be actively engaged in a violent campaign to preempt the highways for their exclusive use or a single chain of broadcast stations would be clamoring for the entire radio broadcast spectrum.

From first hand technical knowledge—quite apart from considerations of cost—it can be pointed out that this country cannot build and maintain a radar and computer system capable of holding every cubic foot of airspace inviolate. People who strongly advocate such a solution are either wholly ignorant of the facts of life with respect to electronics and technical manpower or they hope by their demagoguery to create hysteria and chaos, out of which will come some fundamentally unsound solution favoring their own interests. The truly repugnant aspect of this whole business is the impression which one readily gains that some segments of aviation are intent upon using the deaths of the unfortunate people in the June 30 accident as a stepping-stone from which to achieve just such a solution —regardless of the technical validity of their claims.

For a long time the air transportation industry has shown a cost per seat-mile which has run steadily counter to the trend of costs in all other types of transportation. Increased productivity undoubtedly accounts for much of this effect. Yet, in the absence of a thoroughly objective analysis of this price phenomena, there remains the suspicion that this differential may have been in part supported through such short cuts as flight planning direct through uncontrolled airspace. Transportation media, from canal boats to high-speed trains, have been forced to institute certain changes and somewhat more extensive practices, either through public reaction, statutory regulation, or enlightened self-interest. By what providential dispensation should the air carrier industry feel free of such strictures?

It is to be hoped that once the sound and fury has died down greater objectivity and better understanding will characterize the public utterances on this subject. Despite the regrettable sinking of the Andrea Doria, there has been no clamor for a Coast Guard picket boat on every wave or a line of Texas Towers to guide all traffic in our coastal waters. Any movement, be it of men or material, has its hazards, and a little discipline will replace many taxpayer dollars —and with probably greater ultimate safety.

T. O. MCCLURE, Paoli, Pa.

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.

Tacan/DME History

In your report (AW Sept. 10, p. 39) on the resolution of the Tacan/DME question, you include this statement, "The VOR/DME system was jointly planned and developed by both civil and military airspace users as a common system shortly after World War II."

I was surprised to see that view, so often made during the past year, repeated. All are glad that a controversy has finally been settled, but in the interest of historical truth I call to your attention the facts that in the common system plan that you mention VOR was only intended as an interim element. DME was to be of a type that could be multiplexed with a 1,000 mc bearing system to replace the VOR, and the common system was to satisfy requirements of both civil and military users. (Tacan, developed by the military, fulfills these specifications of the common system plan.)

In support of the point I am making, I refer you to reports on the common system plan published at the time of its adoption and appearing in these old issues of AVIATION WEEK itself: Mar. 1, 1948, p. 14-15 and Nov. 22, 1948, p. 14-15.

And then there is the RTCA document itself, paper 27-48/DO-12, May 12, 1948.

ROBERT I. COLIN, Nutley, N. J.

CAA's 'Unsung Heros'

Who are the "forgotten men of the airways"? After reading so many stories recently about the "unsung heros" in Air Traffic Control I don't think you can say they are unsung any longer. Not after hearing the third and fourth chorus.

But don't get me wrong. I think they are doing a fine job. I have no bone to pick here. It's just that CAA fortunately has many fine groups of people, and if I had to single out any one group for outstanding service my vote would go to the Airways Flight Inspectors. I haven't heard a word or any songs about them yet.

Being an airline pilot myself with quite a few years service, I've known some of these men personally, and the work they are doing. They are the guys who fly CAA's small fleet of flight inspection aircraft. I've watched them progress from old single engine planes to the DC-3, and now to Convairs and jets. I've watched them pioneer radar, ILS, and FIDO to name only a few. I've seen them take off and land when even the birds were crawling, and I've flown through thunderstorms and icing conditions and heard these same men battling the elements right out there with me to prove the airways safe. It's not easy flying. These men are constantly looking, listening, and searching for discrepancies as they maintain patrol of the skyways. Out west a DC-3 on a mountain peak marks the spot where some of these brave men gave their lives to the cause.

The inspector approves or disapproves all airway aids to navigation. He is the guy who certifies them as safe for all users of the common system. The safety of all-weather flight rests heavily on his shoulders. His decisions are final, and the right decision can save thousands of dollars in installation costs, and in operational costs to the airlines and other users of the airways.

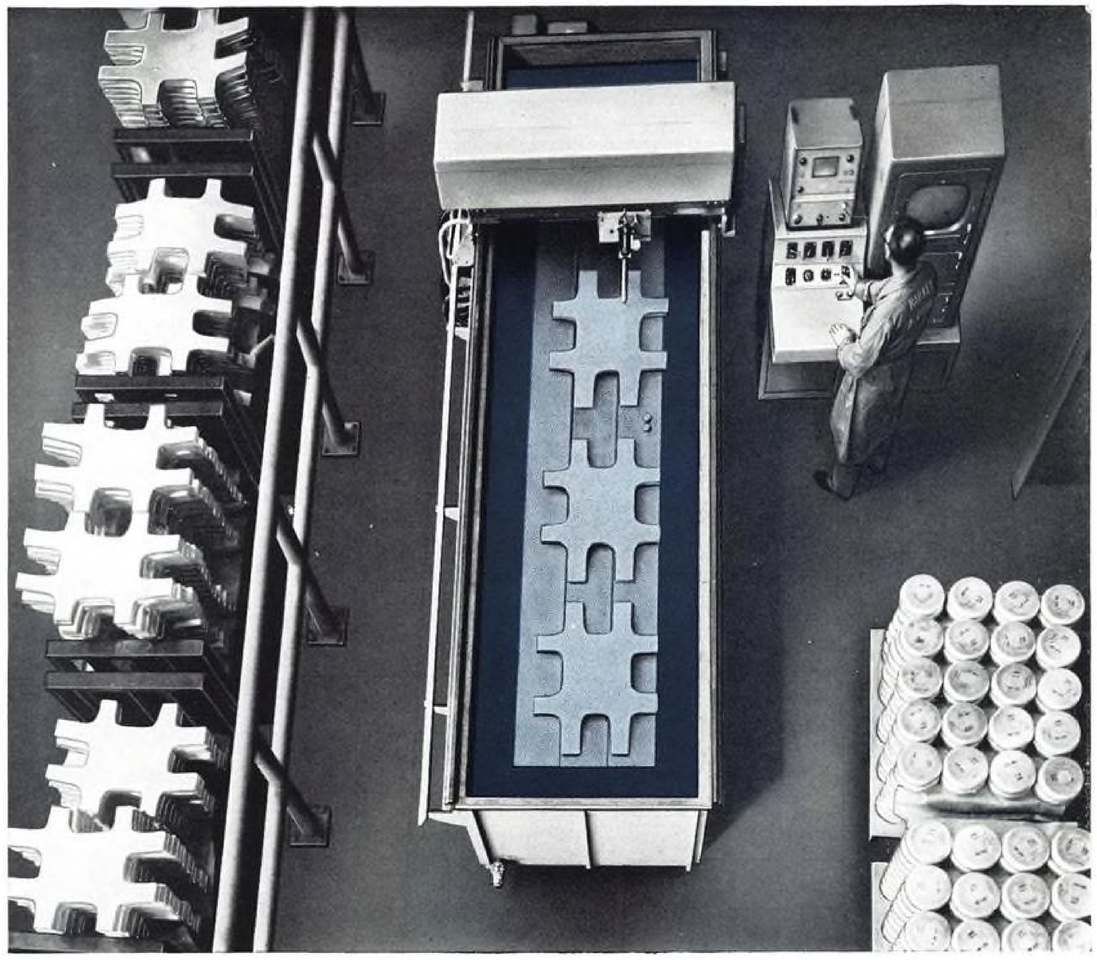
The pay? I understand the job, unlike most others in CAA, hasn't been upgraded since 1940 in spite of the greater complexity and responsibility of the job. But the pay isn't the answer. These men are doing what they like best. The job pays off in a feeling of accomplishment.

To me I am glad to see a breed of government employes who willingly put in more than the required eight hours a day, who don't insist on air conditioned offices, who aren't afraid to pre-flight their plane and take off in a snow storm, or get their hands dirty and make necessary repairs to their plane.

Most of all I am happy to know that someone in CAA is still looking at the airway system from the cockpit, and not the armchair.

My vote with hats off goes to these fine men. Keep up the good work!

ROBERT E. JOHNSON, Los Angeles, Calif.



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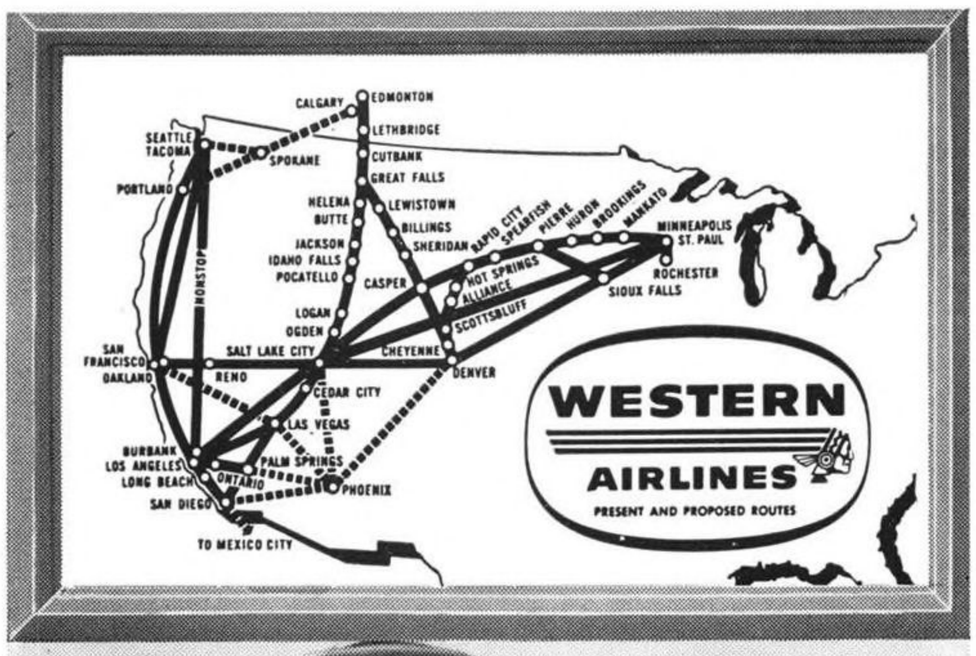

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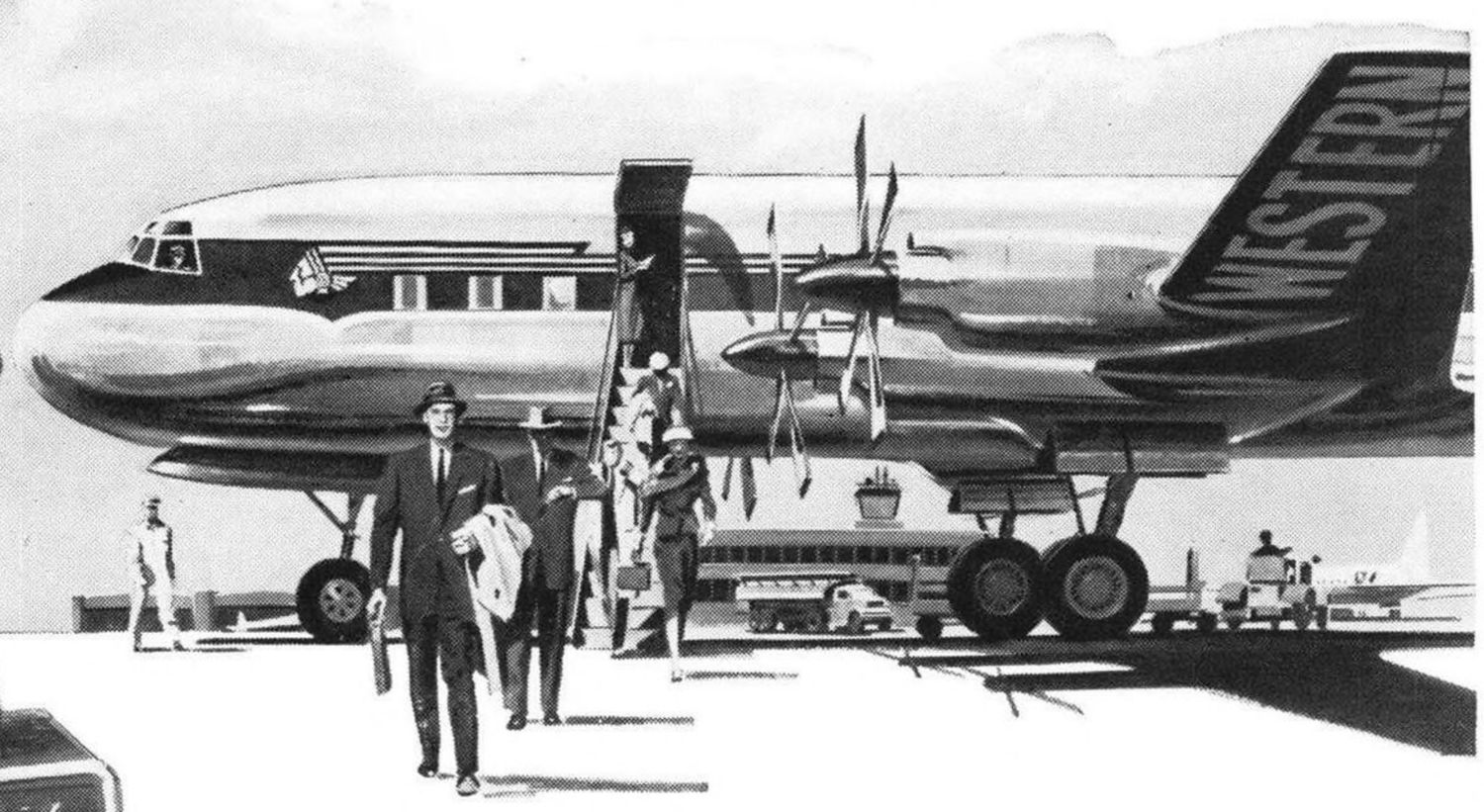

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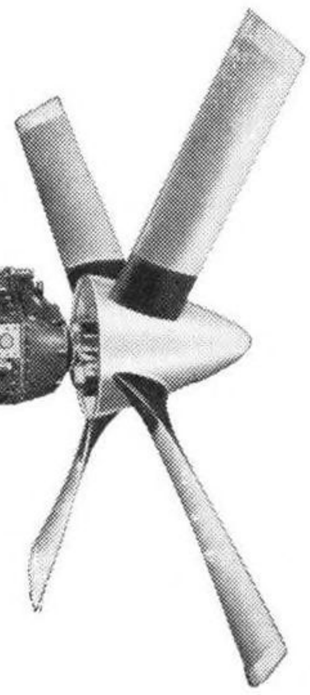

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