

AVIATION WEEK

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APRIL 11, 1955

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Around these *top-drawer* developments at Convair, the men who plan the defense of our nation are building entirely new concepts of military strategy. Only Convair has designed and produced all basic types of aircraft—fighter, interceptor, transport, bomber, and water-based. And now, Convair has attained leadership in producing guided missiles that meet the most exacting military requirements.

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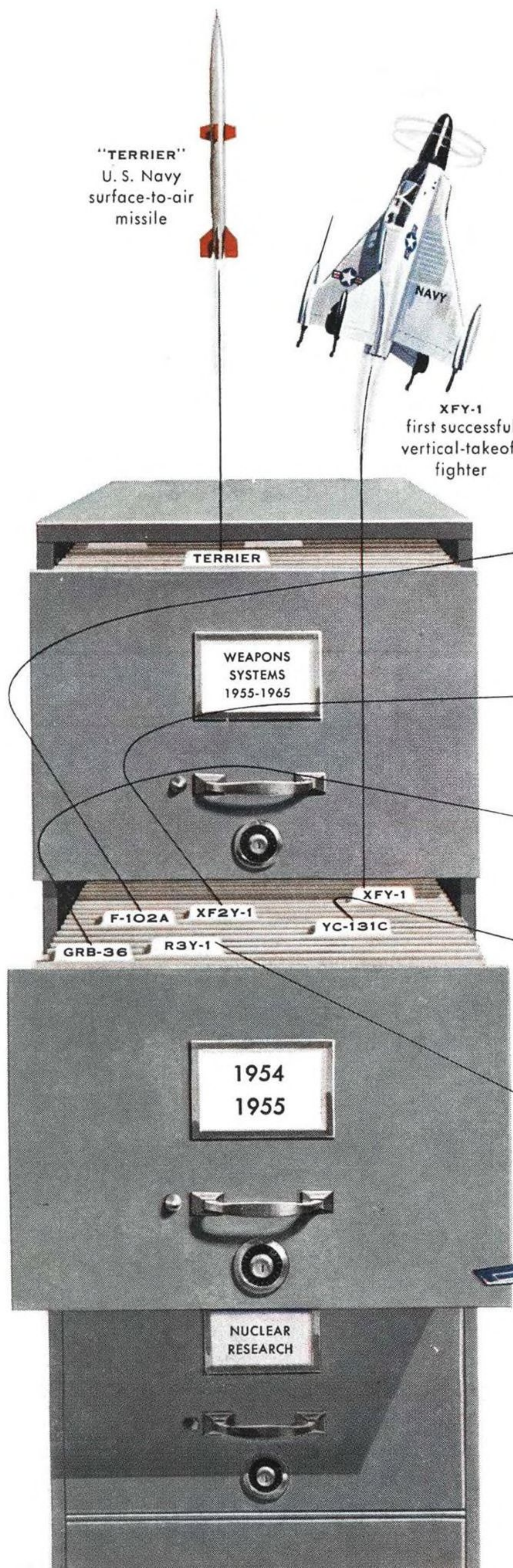
GRB-36 "AIRCRAFT CARRIER" — launches
and retrieves fighters in flight

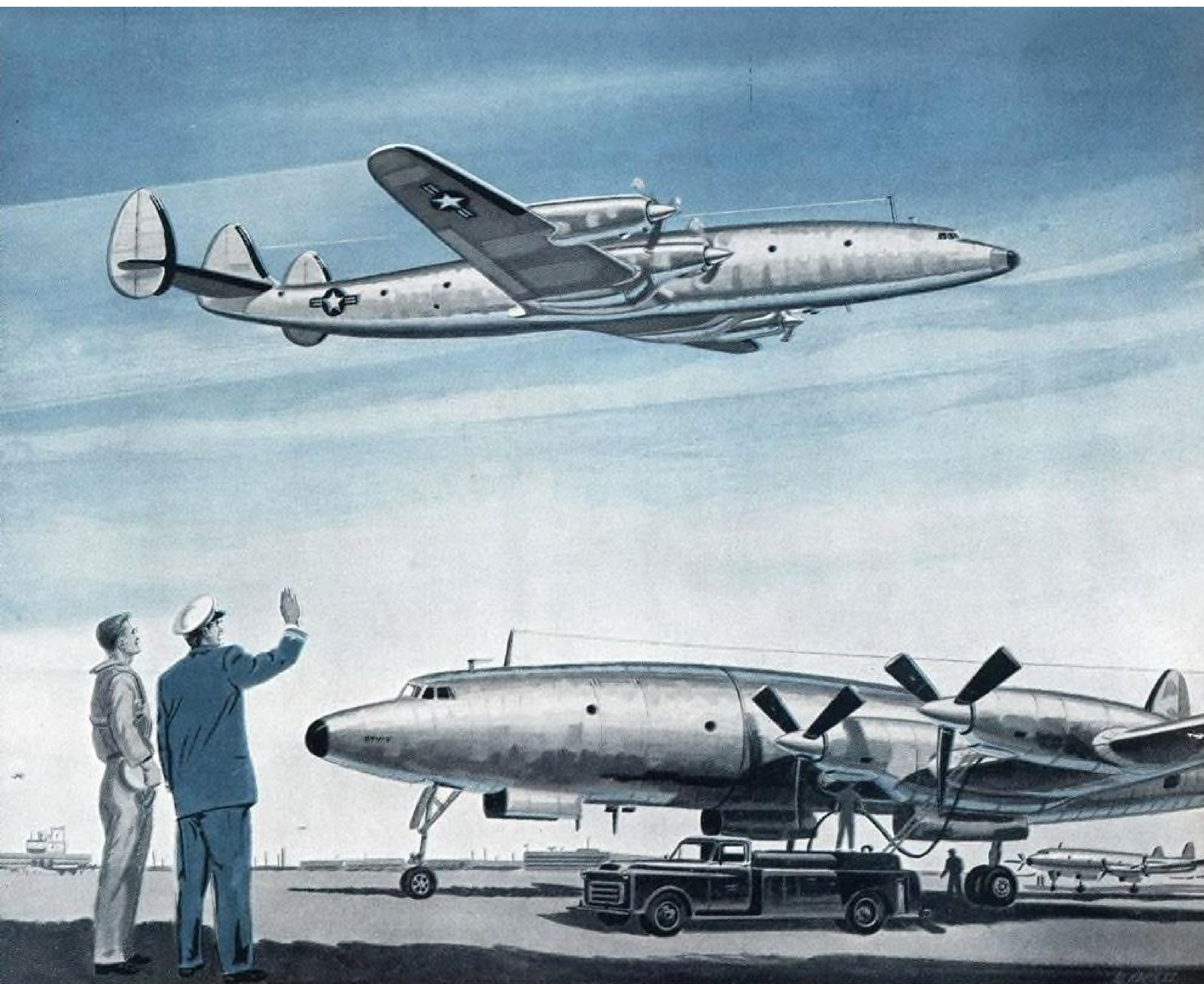


YC-131C
USAF turboprop
transport



R3Y-1 "TRADEWIND"
water-based
turboprop transport





New Holley turboprop power control installed in Lockheed R7V-2

One hundred and six passengers or 36,000 pounds of cargo cruise at speeds up to 440-miles-per-hour in the Navy's new Lockheed R7V-2 turboprop Super Constellation. Four Pratt & Whitney Aircraft axial flow T-34 propeller turbine engines develop a total of 22,000 horsepower for take-off. Each of the four is automatically controlled by a new Holley gas turbine power control.

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and research engineers

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APRIL 11, 1955

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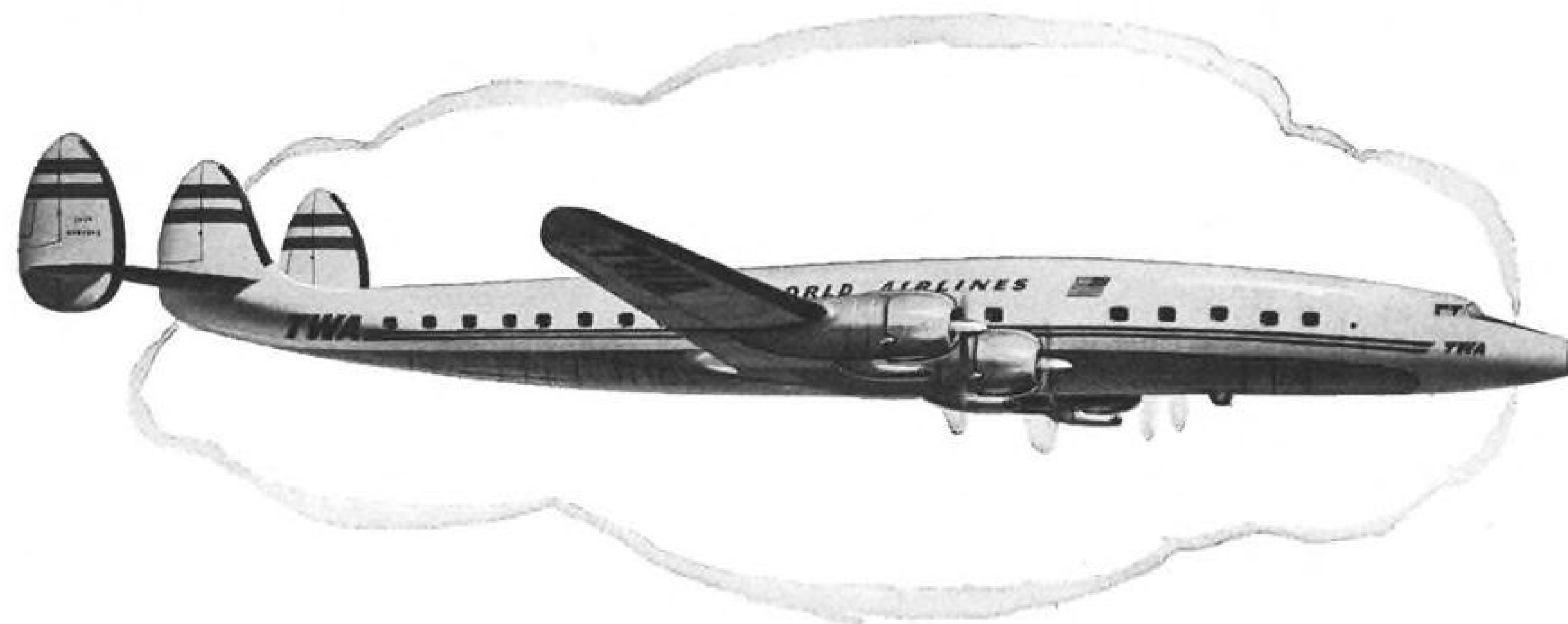


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In April, Trans World Airlines inaugurates coast-to-coast non-stop flights, in both directions, between New York and Los Angeles, with their new Super-G Constellations.

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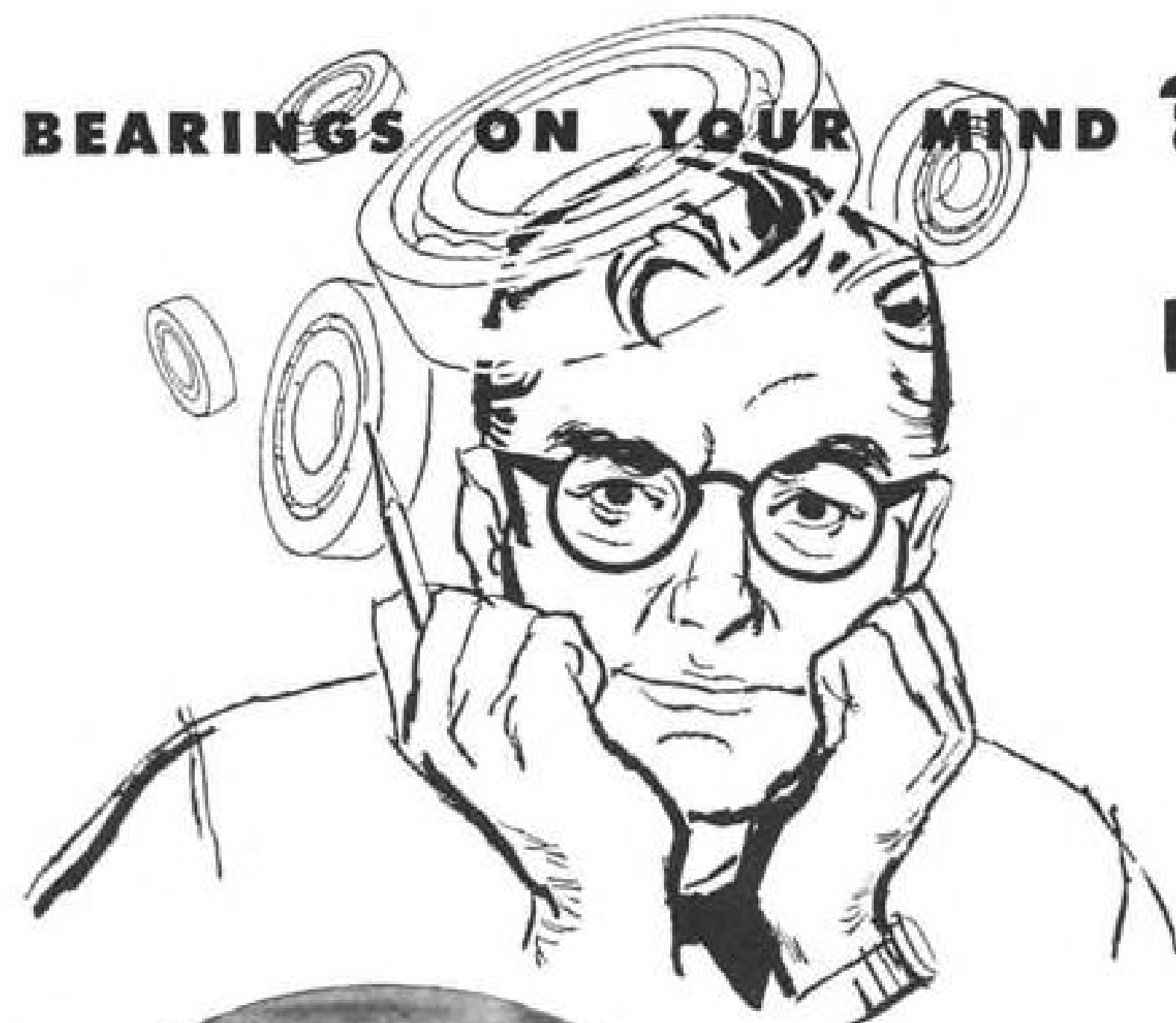
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NEWS DIGEST

Domestic

Atomic warhead on an air-to-air guided missile was exploded over Nevada Apr. 6 in the first test of this type. The nuclear weapon was launched from a Convair B-36 at a pattern of smoke trails laid down at 30,000 ft. by six North American F-86s. Atomic Energy Commission and the Defense Department said the nuclear-armed missile is capable of destroying a fleet of bombers without a direct hit (AW Apr. 4 p. 16).

Initial flight of North American Aviation's first production FJ-4 Fury was made last week, five months after the prototype was flown. The Navy carrier-based fighter, powered by a Wright J65 turbojet, is capable of speeds in excess of 690 mph.

First delivery of Fairchild Engine & Airplane Corp.'s C-123 assault transport will be made in May to the 463rd Troop Carrier Wing at Ardmore AFB, Okla. Fairchild has an Air Force contract to build more than 150 C-123s.

New York Supreme Court instructed the Port of New York Authority to refrain from making further space allocation at Idlewild International Airport's \$60-million terminal until a decision is reached on motions filed Apr. 5 by National Airlines and PNYA. NAL asked for a temporary injunction halting the terminal's construction. The Port Authority requested a summary judgment.

Pastushin Aviation Corp. received a \$1.9-million contract from Douglas Aircraft Co. for 300-gal. jettisonable fuel tanks that can be installed on such aircraft as Navy's F4D-1 and the AD series. The Los Angeles equipment manufacturer also received a \$250,000 contract from Lockheed Aircraft Corp. for ejector pylons.

Trans-U. S. jet mark of 3 hr. 46 min. 33 sec., set by Lt. Col. Robert R. Scott in a Republic F-84F flight from Los Angeles to New York Mar. 9, was recognized by the National Aeronautic Assn. as the official transcontinental speed record. Scott clipped more than 20 min. off the previous official mark set in a North American F-86F last year by Col. Willard W. Millikan, Jr. His adjusted time and speed also bettered the unofficial record set in 1954 by a flight of Grumman F9F-6s.

Piasecki Helicopter Corp., Morton, Pa., granted an average wage increase of 5.8 cents Apr. 4 to 2,915 hourly rated employees.



Convair VTOL Flies on the Level

Convair XFV-1 Navy fighter levels into horizontal flight after a vertical takeoff near San Diego, Calif. Portions of the VTOL plane's fuselage, wings and tail are fitted with tufts for airflow studies. Added instrumentation is being fitted on the experimental fighter at Convair San Diego plant. XFV-1 is powered by an Allison T-40.

P2V-7 Neptune anti-submarine patrol bomber powered by two Wright Turbo Compound piston engines and twin Westinghouse J34 turbojets, is being delivered to the Navy in quantity by Lockheed Aircraft Corp.

Douglas Aircraft Co. is preparing to demonstrate application of closed-circuit television to optical tooling used in DC-7C production.

Aircraft Products Division of Kawneer Co., Niles, Mich., received a contract to produce spoilers and inboard ailerons for Boeing Airplane Co.'s KC-135 jet tanker.

Financial

Braniff Airways plans to sell \$6 million in common stock and negotiate a \$15-million long-term institutional loan to defray the cost of seven DC-7Cs ordered from Douglas Aircraft Co.

Glenn L. Martin Co. will ask stockholders Apr. 25 to approve an increase in authorized capital stock from 3 million to 6 million shares of \$1 par value.

Beech Aircraft Corp., Wichita, declared a 30-cent dividend on common stock, payable Apr. 26 to holders of record Apr. 14.

International

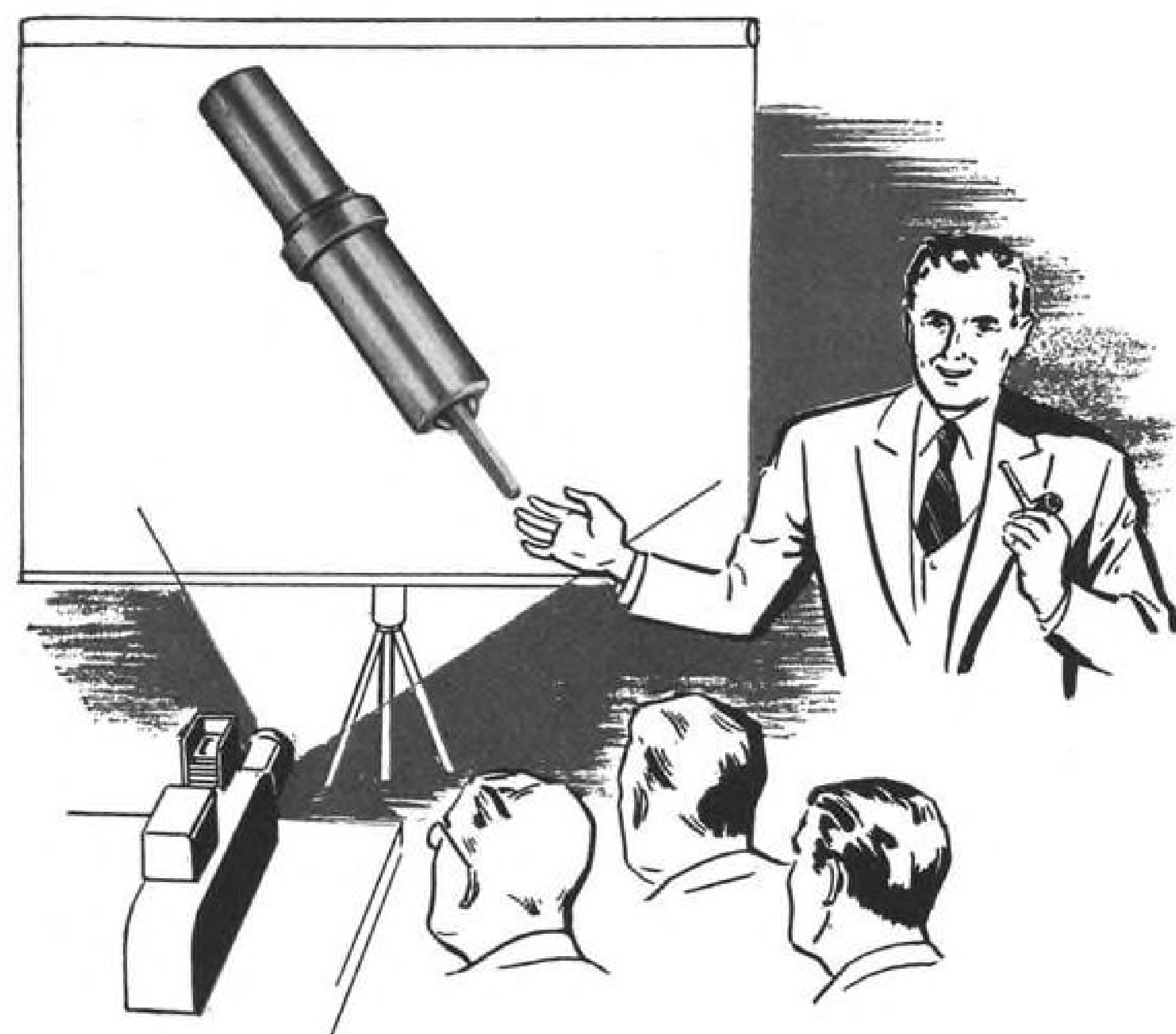
East Germany plans to start rebuilding its aircraft plants next year under the Soviet satellite's second five-year plan, deputy premier Walter Ulbricht announced last week. Factories in East Germany include the Junkers plant at Dessau and the Heinkel works near Rostock. In West Germany, about 200 aircraft parts manufacturers hope to resume production after June 1.

KLM Royal Dutch Airlines ordered 10 DC-7Cs from Douglas Aircraft Co. for intercontinental service. Deliveries of KLM's Seven Seas will begin in the spring of 1957. Approximate value of the order, including spares: \$30 million.

Vickers Viscount was ordered by the Pakistan government for the country's governor general, bringing Vickers-Armstrongs' total orders for the turboprop transport to 180.

French Air Force purchased four twin-engine Super 18 transports from Beech Aircraft Corp., increasing its fleet of Beechcraft planes to about 44.

British European Airways reports the 500,000th passenger to fly in the airline's Vickers Viscounts boarded a turboprop-powered transport Apr. 6 at London.



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WHO'S WHERE

In the Front Office

David B. Thurston, former preliminary design engineer for propeller-driven planes at Grumman Aircraft Engineering Corp., became president of Colonial Aircraft Corp., Deer Park, N. Y. Herbert P. Lindblad resigned as project structural design engineer at Republic Aviation Corp. to join Colonial as vice president-chief engineer.

Victor T. Koozin moved up in Century Engineers, Inc., Burbank, Calif., from division manager for aircraft structures design to vice president-contracts.

G. K. Griffin resigned as vice president-personnel of American Airlines.

Philip B. Keller, onetime airframe fabricating specialist for North American Aviation, was appointed vice president-engineering of Stillman Rubber Co., Culver City, Calif.

Martin Goland, associate engineering director at Midwest Research Institute in Kansas City and consultant for the aeronautical research laboratory at Wright Air Development Center, will become vice president of Southwest Research Institute at San Antonio May 1.

William Taylor is new assistant to the president of Detroit Bevel Gear Co., Detroit, Mich.

Changes

Edward Benham is new public relations manager at United Aircraft Corp.'s Pratt & Whitney Aircraft Division. He is being succeeded at UAC's Sikorsky Aircraft Division by William Kilpatrick.

Howard E. Roberts was promoted to general manager of the American Helicopter Division of Fairchild Engine & Airplane Corp. at Manhattan Beach, Calif.

G. A. Fitzpatrick moved up in Lockheed Aircraft Corp. to assistant general manager of the California Division at Burbank. Other changes: John A. White, assistant materiel director; H. A. Caldwell, manufacturing manager; Charles A. Wagner, production manager; W. A. Pulver, chief manufacturing engineer; Robert F. Hurt, chief tool engineer; W. G. Kibre, chief project planner, and R. W. Harker, manager of outside manufacturing.

Fernand J. Martens, former general manager in North America for Sabena Belgian Airlines, was appointed director of operations and sales in Scandinavian countries. Guillaume Van Antwerpen becomes acting general manager for Sabena in North America.

John H. Kinkade, former member of the helicopter panel of IATA's Technical Committee and onetime engineering and technical director for Philippine Air Lines, joined Lockheed Aircraft Service's Planning Division, Burbank.

Honors and Elections

Dr. Theodore Von Karman received USAF's Exceptional Service Award for "contributions to the achievement of the advanced weapons systems" while chairman of the Scientific Advisory Board.

INDUSTRY OBSERVER

► Lockheed's X-7 flying test bed and the Marquardt 20 in. supersonic ramjet have performed so well together that Lockheed is now using the X-7 for further missile development. Marquardt ramjets power the Boeing Bomarc anti-aircraft missile and are earmarked for the North American Navaho intercontinental bombardment missile. X-7 now uses a recovery system combining a parachute for descent with a nose spear to engage the ground without damage to the airframe.

► Convair XB-58 Hustler supersonic delta wing bomber uses stainless steel honeycomb construction in about 15% of its outer surface including rear of engine pods, pod struts, some underwing areas and ailerons. Companies that may figure in development of this all-metal honeycomb structure include Ryan, Rohr, Goodyear, Solar and Twigg Industries Inc.

► Rolls-Royce Ltd. will give its RB-109 the first test stand run as a complete engine during April. The 4,000 eshp. RB-109 will be flight tested in an Avro Ashton turbojet-powered flying test bed. Rolls is now flight testing the Conway by-pass turbofan engine in an Ashton rig. Westinghouse is considering U.S. manufacture of the RB-109 if a military and commercial market develops.

► Orenda Engines Ltd. of Canada has its PS-113 Super Orenda running on the test stand. It is aimed at a power-weight ratio of 6 to 1 and incorporates considerable amount of titanium alloys. Basic engine power will be boosted from about 18,000 lb. static thrust to 25,000 lb. thrust by a Marquardt lightweight afterburner developed specially for the Super Orenda. The engine is being developed for Avro's C-105 Mach 2 delta interceptor but early versions of the fighter will be powered by Pratt & Whitney J57s.

► Allison has logged more than 7,000 hr. of test stand running on its T56 turboprop including 13 standard USAF 150-hr. qualification runs on production type engines. One T56 successfully completed four 150-hr. runs. T56 flight testing is being done with installation in nose of a B-17. Engine has operated successfully at altitudes up to 35,000 ft. The twin power sectioned T40 turboprop has passed the 1,000 hr. mark in flight time logged in five Convair R3Y Tradewind seaplanes.

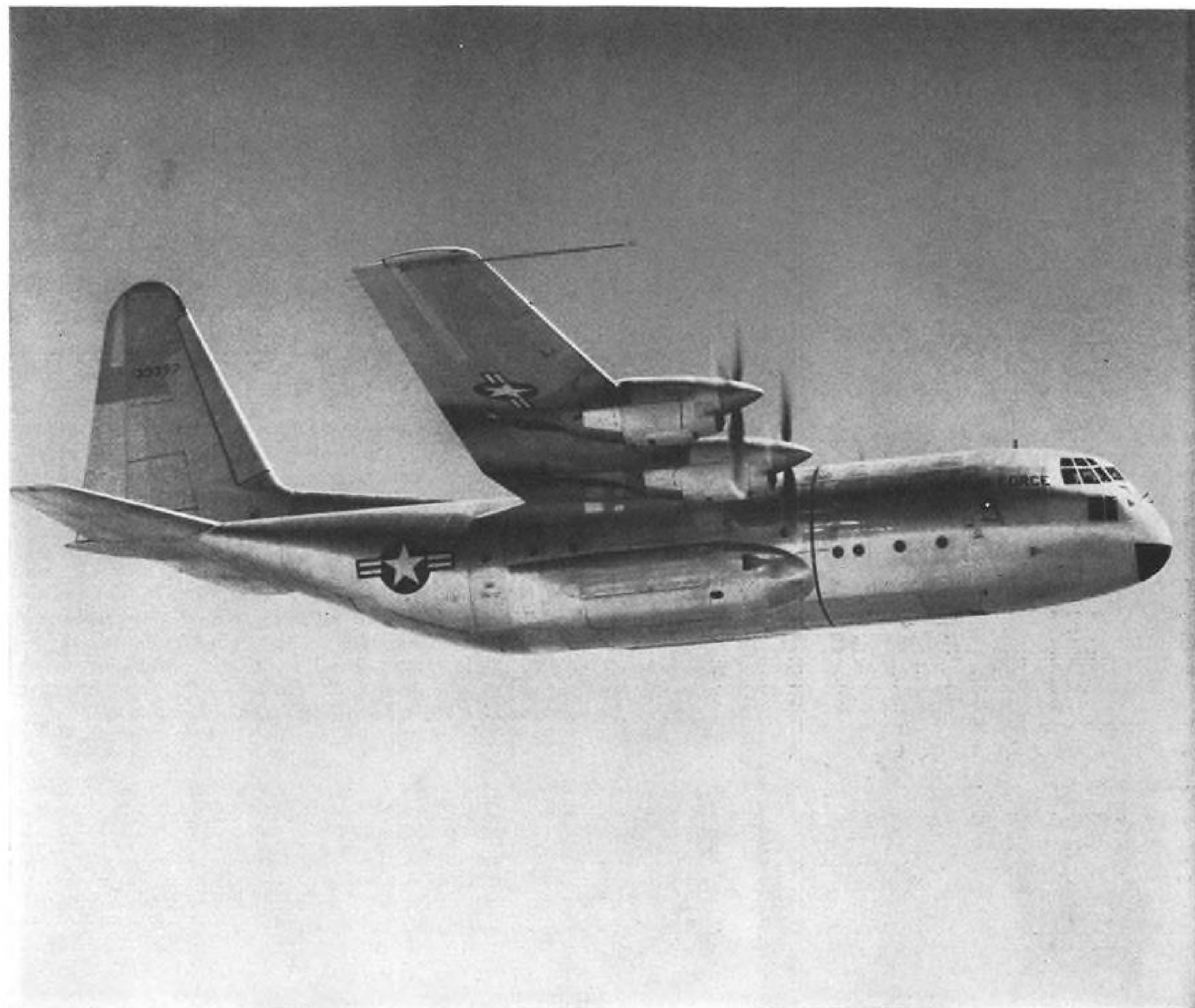
► Convair F-102 delta all-weather interceptor will have an extremely long ferry range utilizing missile-bay fuel tanks and extra tanks in space just aft of cockpit.

► Navy's Talos supersonic anti-aircraft missile built by Bendix at Mishawaka, Ind., is powered by a ramjet engine manufactured by McDonnell Aircraft Corp.

► Lockheed Aircraft's first production model of the C-130 turboprop transport, which rolled off the line at Marietta, Ga., last month, made its initial test flight last week, a month ahead of schedule.

► United Air Lines has placed a \$2.5-million order with Radio Corp. of America for airborne C-band storm-warning radar, following hot competition with Bendix Radio which earlier was named the winner in a premature news release, later called back. UAL becomes first U.S. airline to order radar for fleetwide use, at an estimated cost of \$4 million including installation. Initial installation will go into UAL Convairs, starting in May.

► Production of the CF-100 all-weather jet fighter will be cut in half at Avro Aircraft Ltd., Toronto, following a second lay-off of 1,000 workers. The cutbacks in production are intended to regulate the flow of aircraft and maintain even employment until the new C-105 jet fighter goes into production. The lay-off is effective in June and the production cut-back will occur in September. This will stretch out production of the CF-100 until 1958, when it is expected the C-105 will be in production. Prototype of C-105 is now being built at the suburban Toronto plant. Of the 1,100 men laid off in January about a third have been rehired on the C-105 development contract.



TITANIUM helps lift the C-130 higher and faster...with heavier payloads

Titanium is an *essential* material for high-performance aircraft. On the new Lockheed designed Air Force C-130 turbo-prop medium combat transport, titanium's high strength-weight ratio... exceptional resistance to corrosion... and freedom from stress corrosion cracking, play a vital role.

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Washington Roundup

Mail Rate Plan

Domestic trunkline mail rates have been fixed in a new multi-rate formula plan agreed upon by the airlines and the Post Office Department which is supposed to save the Post Office more than \$5,300,000 a year. The agreement was reached after long negotiations, and after hearings had been started by the Civil Aeronautics Board.

The plan is similar to one proposed by CAB last September designed to save \$3,250,000 a year. It is based on a rate plan which splits mail pay on an 80-20 basis between line haul and terminal charges. Last year the airlines got \$33,000,000 in service mail pay based on rates ranging from 45 to 75 cents a ton-mile. Under the new rate, pay for the same period will be \$27,700,000 at a rate that averages 38.56 cents a ton-mile.

The trunkline rate has been open for more than a year, and the new rate will be retroactive to that date. This will mean a sizeable amount will be due the Post Office from the carriers, since they have been paid under the higher rate. Rebates will amount to a substantial percentage of the \$5,300,000 to be saved.

Hardest hit by the plan will be the Big Four (American, Eastern, United and Trans World) whose mail pay will drop 18% because of their long haul routes. Pay will drop for all carriers but Northeast Airlines, which will get a slight increase.

Fiat for NATO Fighter?

Latest rumor on the NATO lightweight fighter competition is that Italy's Fiat factory at Turin will get contract for test quality of aircraft, but Pentagon spokesmen insist the decision is not final, that there still are unsettled issues. Paris report says USAF, which has controlling voice because purchase will be financed by American money through offshore procurement program, is firm in its opposition to Fiat deal. USAF takes this position despite the fact that the Fiat entry is strongly supported by Gen. Lauris Norstadt, Air Deputy, Supreme Allied Commander, Europe.

ARDC: Round Two

Watch for hot protests from Maryland's congressional delegation over USAF decision to move Air Research and Development Command headquarters from Baltimore to Dayton. So far, neither the congressmen nor the press have been able to uncover Secretary of Air Force Harold E. Talbott's reasons for the shift (AW Mar. 21, p. 13). In letters to congressmen, Secretary Talbott says the move will be made in 1956, that it is for reasons of economy and that the decision was made after "an independent study and review by a firm of industrial engineers."

Maryland congressmen suspect reason is largely political, possibly linked to the struggle between ARDC and Air Materiel Command for controls with move designed to bring the Baltimore operation closer to the procurement center. Senators and representatives will enter debate over authorization of funds for the shift to Dayton armed with a four-year-old report of a committee headed by Lt. Gen. James H. Doolittle. This document lists the reasons why Baltimore is a good site, and is signed by scientists Carl Overhage, Mervin J. Kelly, Louis N. Ridenour and A. E. Lombard, Jr., in addition to

Gen. Doolittle and three USAF colonels.

House Committee on Government Operations has been asked to rush study of situation and the Maryland delegation seeks a chance to appear before the appropriations committee. Big stake to politicians: 1,900 jobs in Baltimore, with payroll near \$1 million a month.

ATA Search Continues

Air Transport Assn.'s search for a successor to Earl D. Johnson as president has been intensified. Johnson is now set to leave the \$42,500-a-year post Apr. 30 to join General Dynamics as vice president. He originally hoped to stay with the ATA job until his successor had been selected but after four months of waiting Johnson can no longer delay his move.

Difficulty of ATA's board in locating the right man for the top executive post is two-fold: lack of unanimity on any one prospect and setting their sights too high. It was three years before they agreed on Johnson. He turned down a contract and men of his caliber who are now being approached also refuse a long term contract.

Praise for Talbott

The most enthusiastic praise from Senate appropriations committeemen went to Secretary of Air Force Harold Talbott—out of the top echelon of defense officials and officers participating in briefing sessions before the group (see p. 14). Praise came from Sen. Margaret Chase Smith, who thought Talbott was "a very human person," and from Sen. John Stennis who remarked on "the splendid job" he has done as USAF head.

Although there have been initial differences of opinion between USAF's military and civilian commands, Talbott told the committee that "there has never been a time when we (Talbott and USAF Chief of Staff Gen. Nathan Twining) did not agree on procedure when the smoke cleared away."

New NACA Facility: Where?

There are some indications that the \$4.8 million facility for testing the effects of radiation on aircraft materials and components may become entangled in a tug-of-war as to where it is to be located.

NACA wants it situated near the Lewis Flight Propulsion Laboratory in Cleveland, Ohio, to eliminate the housekeeping apparatus of a new station. A consulting firm is now making a survey of possible sites in the area.

But Idaho's Sen. Herman Welker objects that Cleveland is a key strategic target and that the project should be situated in a non-strategic area—such as a site in Idaho.

MATS Report Response

Hoover Commission's report on the Military Air Transport Service was enthusiastically received by both the domestic and international scheduled airlines (AW Apr. 4, p. 14). Industry reaction was centered on the recommendation that the government make greater use of available commercial air services. The emphasis is to eliminate government competition with private enterprise by assigning commercial-type air traffic for the military establishment to the commercial airlines and restricting MATS' operations in that category.

—Washington staff

Defense Compromises in Tacan Dispute

Secret agreement with Commerce Dept. to head off Congress' investigations may set off new inquests

By Preble Staver

A secret compromise agreement between Department of Defense and Department of Commerce, AVIATION WEEK has learned, may upset two months of congressional efforts to resolve the civil-military differences over a common system of air navigation (AW Apr. 4, p. 13).

The dispute was raised by the Air Navigation and Development Board's recommendation in favor of the military's Tacan over civil VOR/DME for the common air navigation system.

The military, which had made a strong case for its position on Tacan, suddenly decided to back down. The action seemingly would satisfy Tacan's opponents, but probably will create a more explosive situation. It would provide for side-by-side continuance of two expensive and conflicting systems, putting off the decision on a single system for another five years. Congress is determined to settle the issue now.

The Defense Department's goal is to head off a joint congressional investigation of Tacan. The action will probably result in a full-scale investigation.

► **Congressional Study**—Congress has under way two investigations aimed at producing a final decision through its fund appropriating powers. Reaction of Congress to additional confusion isn't certain, but there is no question that Congress does not intend to continue financing two systems.

The ANDB decision gave the legislators a starting point for the first time in five years. Once the matter was brought into the open, the legislative committees closely studied the Tacan-VOR/DME dispute.

Failure of the executive branch to consult the legislative and appropriations committees at this time may be disastrous. At least one group, the transportation subcommittee of the House Commerce Committee, is near a decision after an exhaustive study of the matter.

► **Compromise Program**—Apparently ignorant of the nearness of a congressional solution, the military began a series of maneuvers designed to produce a compromise and escape further investigation. A five-point program to

modify the ANDB position was evolved:

- **Continue the operation of civil DME** until June 30, 1960, implementing the ground installation of DME to such limited degree as this period of operation would justify.

- **Limit DME** to fewer than the full channel complement, if this is found to be feasible.

- **Permit purchasers** of airborne DME equipment to write off the cost within five years and seek legislation to this effect if necessary.

- **Obtain backing** of interested government agencies for this modified program and work in good faith toward the implementation of the common system along these lines at the earliest date consistent with resolution of present uncertainties, completion of the devel-

opment of the equipment, and availability of equipment for common system use.

- As a corollary to the third point, DME operations will be discontinued June 30, 1960, if required by standardization of Tacan. All purchasers of DME equipment should be on notice of the likelihood of this action.

This proposal makes no change in the decision to proceed with full development of Tacan for eventual adoption as the common system but would extend the "experimental" period for DME by five years.

Actions by Congress and Air Coordinating Committee due this week on the controversy are:

- House appropriations subcommittee starts hearings on the Civil Aeronautics Administration's budget for fiscal 1956, which includes a program for 55 additional DME ground stations.

- House commerce subcommittee is scheduled to hear Max Karant, assistant general manager of the Aircraft Owners and Pilots Assn. Karant has supported continuance of civil DME.

- Air Coordinating Committee will receive a report from its Navigation Panel, which was instructed to review the ANDB recommendations and approve them or in event of disapproval to suggest alternatives.

Another Study

Radio Technical Commission for Aeronautics has formed Special Committee 73 to study "channeling" requirements for short distance navigation aid systems, the latest group to become involved in the common system controversy.

Problem is one of conflict in the assigned frequency spectrum. Number of channels needed for Tacan has not been determined because the operational requirements are not fully known. At present there are only some 47 clear, non-interfering channels for Tacan. It is not possible for both DME and Tacan to be fully implemented because of lack of channel space.

The industry-government group is composed of 17 members and will concentrate on the suitability of Tacan to provide sufficient channels.

The group has not held its first meeting. The delay has been attributed to obtaining necessary security clearances for each member. Chairman of SC-73 is Ellery E. Estes, Civil Aeronautics Administration frequency expert, with other members drawn from Air Transport Assn., Army, Navy, Air Force, Airborne Instruments Laboratory, National Aeronautical Radio Corp., Federal Telephone and Radio, Hazeltine-Bendix, and Stromberg-Carlson.

Military Plane Fund Balance \$8.8 Billion

With new orders totalling only \$3.7 billion during the first eight months of fiscal 1955, Air Force and Navy had an unobligated balance Mar. 1 for aircraft and related procurement of more than \$8.8 billion.

USAF obligated \$3.1 billion during the eight-month period; the Navy, \$623 million. The unobligated balance, as of Mar. 1, was divided: USAF, \$6.4 billion; Navy, \$2.4 billion.

The unexpended balance of funds for aircraft and related procurement of the two services on that date was \$21.2 billion: USAF, \$14.1 billion; Navy, \$7.1 billion.

Expenditures of \$5.8 billion during the first eight months of Fiscal 1955 was slightly less than the \$6 billion expended for the same Fiscal 1954 period. The \$200 million difference was due to reduced spending by the Navy.

Red China Gets Jet Fuel

(McGraw-Hill World News)

Hong Kong—Communist China is getting kerosene fuel for its Russian-built MiG jet fighters through the black market and tanker shipments from Soviet satellites.

Authorities here report buyers from Red China are purchasing black-market kerosene at prices ranging from 10% to 15% more than the regular United States cost of 25 cents per gallon.

The Hong Kong Standard says the Polish tanker Karpaty recently unloaded a cargo of about 10,000 tons of jet fuel and petroleum—enough for more than 3,200 MiG sorties against Taiwan—at Whampoa Harbor near Canton.

Four Communist tankers formerly were running regularly from Constanza, Roumania, to Lap Sap Mei and Whampoa Harbor, the newspaper says. Two of the tankers were seized by Nationalist China last year.

According to a United Press report from Taipei, the China News claims an unidentified Polish tanker landed 8,000 tons of jet fuel at Whampoa Mar. 25.

Evaluation Proves Tacan Accuracy, ANDB Chief Tells Avionics Group

By William Coughlin

Los Angeles—Engineering changes in Tacan, the military short-range navigation system, have shown it will fulfill its early promise, according to Col. J. Francis Taylor, Jr., director of the Air Navigation Development Board. Col. Taylor told the meeting of the Radio Technical Commission for Aeronautics here that the evaluation tests were made at Caldwell and Nutley, N. J.

Taylor defined Tacan as being slightly less accurate in distance than the common system DME and considerably more accurate in bearing than VOR. Part of the increased accuracy of the bearing system is inherent in the equipment and part because Tacan can be located so as to be free from site effects. ► **Easy Comparison**—The engineering evaluation at Caldwell used modified URN-3 ground and ARN-21 airborne equipment. The Caldwell site is in the immediate vicinity of a commissioned VOR facility, making it possible to compare Tacan error data with similar data taken on the VOR.

Taylor summarized the small-radius orbit data as follows:

- **The average Tacan error data** showed a spread that varied from 0.6 deg. to 1.4 deg. for elevation angles from 3.1 deg. to 6.8 deg. Corresponding VOR data for the lower part of this elevation-angle range showed a spread of from 3.4 deg. to 4.4 deg.

- **No serious scalloping** was observed at any elevation angle with the Tacan equipment. The average random variation spread of indicated bearing was about 0.4-deg. The maximum variation showed a spread of about 1.5 deg. Corresponding VOR data showed scalloping spreads of from about 3 deg. to over 7 deg.

Large-radius orbit data for the Caldwell Tacan equipment showed an increase in the error spread over that of the small-radius orbits, Taylor said. He attributed increased spread, in part, to decreased signal level and to increased error in determining actual bearing.

An aggregate error spread of 2.4 deg. was observed on the 17-mi. orbit and 1.6 deg. on the 26-mi. orbit. The corresponding large-radius orbit data for the Caldwell VOR equipment showed an aggregate error spread of 3.5 deg. to 5.1 deg., Taylor reported.

He said Tacan is less critical in its requirements for siting than is VOR. Taylor said bearing accuracy in the presence of reflecting objects appears to be less critical, the height of the antenna for ground equipment is less critical, and the over-water performance of ground equipment is less critical.

Taylor also reported:

- Prior to any widespread use of Tacan, a study should be made to assure that it can provide the total number of interference-free channels required for common system operations.

- VOR, for basic technical reasons, cannot provide satisfactory service when installed on Navy carriers.

- VOR/DME does not meet military needs for equipment which can be easily sited in military theaters of operation.

- **Declassification Soon**—Declassification of the disputed military Tacan navigational system will take place very soon, Col. Taylor said.

"Action is proceeding at a reasonably rapid rate and although details cannot yet be announced, I am entitled to say that there is apparently nothing in the way of declassification except the complexity of the procedure itself," he said.

"We hope an early announcement

can be made concerning the few engineering details which are still under wraps.

Taylor emphasized that security surrounding development of Tacan was due entirely to military requirements.

"It was not, as someone has suggested, developed in secrecy because it was competitive to the VOR/DME," he said. "It was definitely not realized in the beginning, as others have suggested, that it would be offered for common system use."

"There was no thought in the military that I have been able to discover or that I was aware of at that time through personal knowledge of Air Force plans, that Tacan would ever be considered for common system use. On the contrary, it was to be a 'tactical system' to be used in fleet operations or, in the case of the Air Force, in tactical situations which historically occurred outside the United States. Both Air Force and Navy had the idea that their flights within the limits of the United States would be conducted with common system equipment."

► **Designed for Military**—"The tactical system was therefore developed in accordance with the military's own special requirements in which the security aspect was vital," he explained.

Realization that the United States might be the battlefield in the next air war changed the military concept, Taylor told the group.

"It now became apparent, and this is one of the most significant events in Tacan's history, that the tactical navigation requirement for the military was no longer restricted to overseas operations but involved the United States as well."

"The result of these two changes in concept," Taylor said, "was that the Air Navigation Development Board was advised by the military that Tacan appeared to satisfy the SC-31 requirement for an ultimate navigation aid to the common civil/military system and suggested it be put to this use. This offer was based again on the military realization that only one navigation system can exist and be operated in the United States and that it had to meet at least the minimum requirements of its most exacting users, the military."

New Rocket Test Site

Aerojet-General Corp. will operate a new rocket engine test facility to be built by the Air Force at Fort Crowder, an Army base 25 mi from Joplin, Mo.

Survey and site preparation already is under way and construction of the plant will be started later this year.

Selection of the Fort Crowder site conforms to the policy of dispersing installations of this type.

Twining Supports Army Program For Increased Military Airlift

By Katherine Johnsen

Army Chief of Staff Gen. Matthew Ridgway "shortly" will present to the Joint Chiefs of Staff a program to increase substantially the military airlift capability.

This was disclosed by Air Force Chief of Staff Gen. Nathan Twining at briefing sessions of top Defense Department officers and officials before the Senate Appropriations Committee on the Fiscal 1956 military budget.

Indicating that an increase in planned airlift would have USAF support, which would mean majority support on JCS, Twining told senators that Air Force considered this mission very important and is ready to implement an expansion "as soon as we are given the green light."

► **Airlift Pledge**—Sen. John Stennis, who has voiced skepticism as to the adequacy of USAF airlift for Army ground troops, said: "A few weeks ago I was told the same thing—that the plan for an increase would be submitted shortly to the joint chiefs."

Meanwhile, in a speech on the Senate floor, Sen. Stuart Symington, former Air Force secretary, declared that "if war should be forced upon us, this country, despite all its continuous boasting about its superior airpower, cannot as of today lift and properly support a single Army division. And this despite the fact that we have formally pledged our allies to support them on the ground as well as in the air."

Under the Eisenhower Administration's 137-wing program for the Air Force, the number of troop carrier wings was reduced by six from the 17

planned under the Truman Administration's 143-wing program.

► **Intelligence Problem**—Stipulating that there "is not nearly enough information" on military developments behind the Iron Curtain, although "everything humanly possible" is being done to improve intelligence, Twining highlighted these points in his report to the Senate committee:

- The new Russian Type 39 medium jet bombers which "have been openly displayed in numbers which indicate that they may be in quantity production, are comparable in size, design, and estimated performance to our own B-47s."

- The new Type 37 long-range Russian jet bomber, comparable in size to the B-52, "is aimed squarely in our direction."

- "The Soviets are now producing large numbers of an improved fighter with better performance than the MiG-15," he said. The MiG-15 is a first rate airplane, Twining said, and the superior skill and aggressiveness of U.S. pilots were the main reasons for our margin of air victories in Korean operations.

- Russian contributions to an airpower build-up of Red China, including many jet aircraft, is particularly significant in the light of the present Far East tension.

"A potentially greater danger," Twining added, "is their expanding system of air bases. This increased base system gives the Communists the ability to move in aircraft rapidly from the Soviet Union. We cannot ignore their capability to double or triple their air strength in the Far East overnight."

- USAF is placing the very highest pri-

ority on development of an intercontinental ballistic missile as the best defense against such a weapon. "We know the Soviets are at work on an intercontinental ballistic missile," Twining declared. "We must assume their goal with this weapon is sufficient range to destroy targets in the U. S. Ballistic missiles with intercontinental ranges present a defense problem more difficult than any ever faced in history. They will fly at speeds above 10,000 mph. They can be launched from widely dispersed, isolated, well-hidden firing sites. They would be difficult to find and destroy."

- USAF is making good progress in development of intercontinental ballistic missile Atlas. "It will be powered by rocket motors and develop speeds of several thousands miles per hour," Twining reported.

- Observing that aerial refueling is only a partial answer to real endurance in the air, Twining reported "good progress toward our goal of unlimited range—the nuclear-powered airplane."

Air Defense

- USAF will begin to equip interceptor squadrons with its first air-to-air missile, the Falcon, in the near future (AW Mar. 21, p. 10).

- USAF's surface-to-air missile, the Bomarc, designed to increase the intercept and destruction range beyond the capability of the Army's Nike, is now undergoing test and "we are pleased with the results so far," Twining said.

- Conversion of medium bomber units from B-29s and B-50s to jet B-47s will be completed by early 1956. This year USAF will begin to replace B-36s with B-52s in heavy bomber units.

► **Retaliation**—Chairman of the Joint Chiefs of Staff Adm. Arthur Radford gave full backing to the administration's defense policy of giving "priority in all planning to our offensive capabilities with emphasis on our capacity to guarantee instant and overwhelming counter-offensive blows to any enemy who might attack us."

Challenge

Sen. Symington, a leading advocate of the atomic-retaliation concept when he served as Secretary of the Air Force, challenged Radford's position in a floor speech. He said: "That position was logical during the past decade, when we had a monopoly on such weapons—but that monopoly is now over. Unless we reverse this trend on relying predominantly on nuclear weapons, we will create a military force capable of defending the free world in no other type war but nuclear war . . . if the Communist armies start to move, say in the Middle East, or in Asia, what do we do? Do we start a nuclear war? . . . In reducing

steadily our ability to fight on the ground . . . we may well be committing ourselves to a path from which there can be no turning back—world devastation resulting from the use of the hydrogen bomb."

Observing that U. S. security is inextricably bound with that of other nations, Radford maintained that these countries "can most efficiently provide in their own and adjacent countries the bulk of the defensive ground forces and local naval air power." The most effective contribution the U. S. can make to mutual security, he said, consists of complex technical weapons and equipment, modern air and naval power, and highly mobile offensive combat foundations.

He observed that "we have reached a state where atomic weapons are now conventional and their use is being fully integrated into our strategy and tactics."

Chief of Naval Operations Adm. Robert Carney reported that, in addition to a new Forrestal-class carrier, the Navy's Fiscal 1956 shipbuilding program also includes: construction of one conventional-powered submarine and three frigates with guided missile capabilities; installation of angled decks on six carriers to gain improved performance from jet aircraft; conversion of one light cruiser and one destroyer to give them guided missile capabilities; conversion of 12 escort vessels and four Liberty hull cargo vessels into radar picket ships in support of continental defense.

AEC Easing Industry Access to Atomic Data

Recognition of industry's growing interest in possible applications of atomic energy has resulted in liberalization of Atomic Energy Commission controls over information on the subject.

It now is possible to get what amounts to a library card, granting access to restricted data that would be useful in peaceful applications of the new sources of power. Formal title of the permit, granted on a "reasonable need-to-know basis," is "access agreement."

Policy changes, disclosed by Charles G. Manly, acting chief of the Industrial Liaison Branch of AEC's Reactor Development Commission:

- Pure commercial interest is sufficient "need-to-know" as long as there is reason to believe there is ability to use the information.

- AEC now realizes that service industries, such as research, finance and insurance organizations and trade associations, may need access to restricted data.



TRAINER FLIGHT compares configuration of new T2V-1 (foreground) over earlier TV-2.

T2V Uses Boundary Layer Control

Burbank, Calif.—Lockheed Aircraft Corp. took the wraps off its new two-place T2V-1 jet trainer last week revealing that a boundary layer control system will be standard equipment. The Navy aircraft now is going into production at the California Division.

The T2V-1 will be the first two-place jet trainer assigned to pilot training aboard aircraft carriers. It is an up-to-date version of the TV-2 (USAF T-33).

► **Boundary Layer Tests**—Installation of boundary layer control on the T2V-1 follows tests of a similar system on a Grumman F9F-4 Panther jet fighter. The F9F-4 test vehicle first flew with boundary layer control some two years ago. It was designed by Bureau of Aeronautics, Allison Division of General Motors Corp. and Grumman Aircraft Engineering Corp.

Test pilots A. W. Levier and Ray Crandall now are testing the T2V-1 prototype at Lockheed's Palmdale facility.

► **Greater Lift**—Purpose of the boundary layer system is to improve wing efficiency and provide greater lift. Compressed air from the T2V-1's Allison J33 engine is diverted into a tube inside the trailing edge of the wing. It then is blown at high speed over the wing flap and aileron.

By forcing the boundary layer flow over the wing to hug the skin surface more closely, the effect increases lift and delays stall—making possible reduced landing speeds and shorter take-off runs necessary for carrier operation.

Lockheed reports that landing speed of the 600-mph. T2V-1 is 97-mph.

► **Engine, Airframe**—Provisions are made for both Allison's J33-A-22 jet engine with 6,100-lb. thrust and the Pratt

& Whitney J48-P-8 with 7,250 lb. thrust. Production T2V-1s will be powered by the Allison engine.

The aircraft is equipped with leading-edge slats that move over a 17-deg. arc. Horizontal stabilizer has been raised 20 in. and increased 12 in. in span for maximum spin control.

T2V-1 landing gear can absorb four times more energy on takeoffs and landings than previous gear on Lockheed trainers, the company reports. Nose landing gear can be lengthened hydraulically while in the down position to raise the nose for faster climbs on catapult takeoffs.

► **Navaid's Cockpit**—Navigational equipment in the T2V-1 includes radio and ADF installations, glide path receiver and VOR-localizer attitude gyro, a combination gyro compass and homing device.

Cockpit safety features include an "inside windscreen" made of two sheets of laminated aluminum anchored with steel coils. If the canopy is jettisoned, the screen pops up automatically as wind-blast protection.

Rear seat of the T2V-1 is 6 in. higher than the front seat to improve visibility. Two-in-one instruments have been used on the instrument panel so that the pilot, by flipping switches, can use one gage to read several navigational devices.

► **Range, Dimensions**—The aircraft is equipped with 230-gal. tip tanks that are nonjettisonable. Provision is made for rapid inflight fuel dumping, however.

Approximate dimensions of the T2V-1: length, 38 ft.; height, 13 ft.; wing span (including tip tanks), 42 ft. Gross takeoff weight is approximately 16,400 lb., and total fuel capacity 760 gal. Range is approximately 900 mi.

Funds Outlook: USAF Stable, Navy Up

Air Force's requests for funds to finance new aircraft and related procurement will remain stable at the present level, but Navy's requests will increase sharply, according to testimony before Senate Appropriations Committee.

Secretary of Air Force Harold Talbott said: "it appears that the USAF requirements to maintain a modern, up-to-date air force will remain stable at the \$6.1 billion figure requested for Fiscal 1956." New money appropriated for Fiscal 1955 totalled only \$2.7 billion, but there was an unobligated carry-over from previous appropriations of more than \$4.6 billion available. Talbott said that now that the level-off stage for the long pull has been achieved "the best manufacturers, those who do the job cheapest are the ones who are going to get the business."

Secretary of Navy Charles Thomas said: "Beginning in Fiscal 1957, greatly increased obligating authority will be required in order to insure that we receive in the future the aircraft necessary to keep our Navy and Marine Corps aviation units modern." The \$750 million asked by the Navy for new aircraft and related procurement for Fiscal 1956 compares with \$1.9 billion for Fiscal 1955. It will provide for delivery of 1,600 aircraft, starting in calendar 1957. During calendar 1955 plane deliveries will average 200 a month, or an annual rate of 2,400. The Navy considers this rate required to support its present force-level.

Bell Aircraft Reports Record Net Profit

Annual reports for 1954 continue to reflect general prosperity in the aircraft industry. Latest figures are provided by Bell Aircraft Corp., Piasecki Helicopter Corp., and Borg-Warner Corp.

Bell

Highest earnings in the company's history are reported for 1954 by Bell Aircraft Corp., Buffalo, N. Y. Net income after taxes was \$6,404,243, an increase of 84.8% over the 1953 net income of \$3,465,423.

Sales volume was fourth largest in the Bell record, \$185,646,114, compared with \$145,967,100 in 1953. Increased sales, reduced taxes and budget controls were credited for the earning increase.

During 1954, stockholders' equity increased from \$22,870,002 to \$34,398,302 and working capital from \$11,160,096 to \$19,500,786. Stockholders were paid \$3,233,249 in dividends.

Highlights from the report:

- Two new subsidiaries were added during the year: American Wheelabrator & Equipment Corp., Mishawaka, Ind., and Hydraulic Research & Manufacturing Co., Burbank, Calif.
- Diversification was widened and president Lawrence D. Bell anticipates further "realignment of emphasis" as required by the national defense program.
- The Bell VTOL, jet-propelled vertically-rising airplane, can "turn in almost the width of its wing span."

Piasecki

Piasecki Helicopter Corp., Morton, Pa., reports 1954 net earnings of \$1,360,241. This was only slightly lower than 1953 earnings of \$1,410,345, despite the fact that sales dropped sharply from \$86,726,430 in 1953 to \$48,745,708 last year. Earnings per share were off from \$3.75 to \$3.24.

The company's annual report implied that the lower sales were due to technical difficulties that forced a slowdown in helicopter production and said that the problem has been largely surmounted. This was borne out last week in an announcement that the Air Force has authorized resumption of normal production of the H-21 Work Horse. Laid-off employees are being recalled.

Backlog at the end of the year was \$100 million, compared with \$130 million at the end of 1953. But the company last week said it had a new H-21 contract for helicopters and spare parts with a value of about \$36 million. At year's end Piasecki's contracts were 85% fixed-price incentive agreements.

Other highlights:

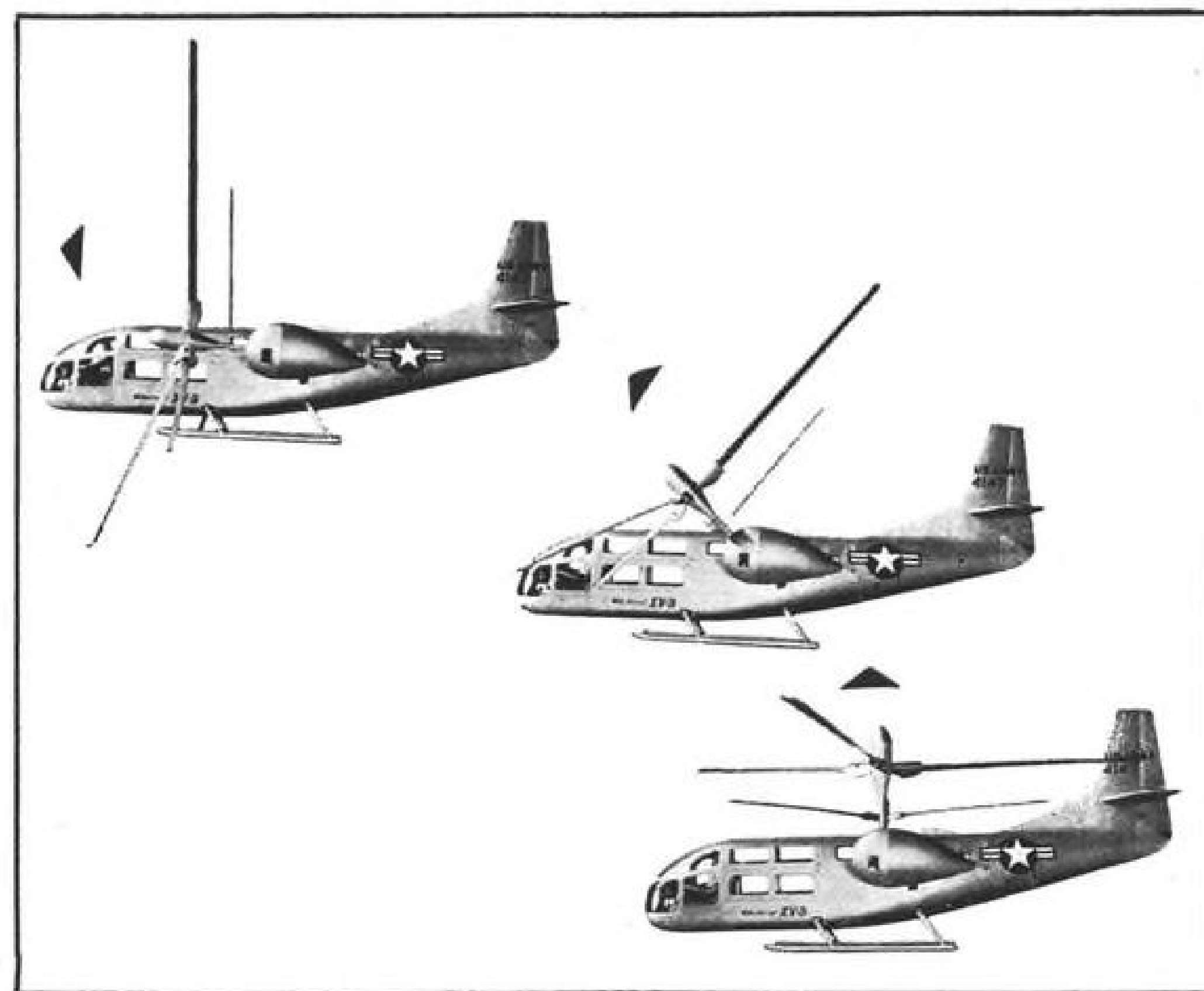
Piasecki's net worth, working capital

and general financial strength improved. Stockholder's equity increased 35% from \$4,090,228 in 1953 to \$5,541,353 for 1954. Working capital of \$4,056,000 an increase of \$1,029,000.

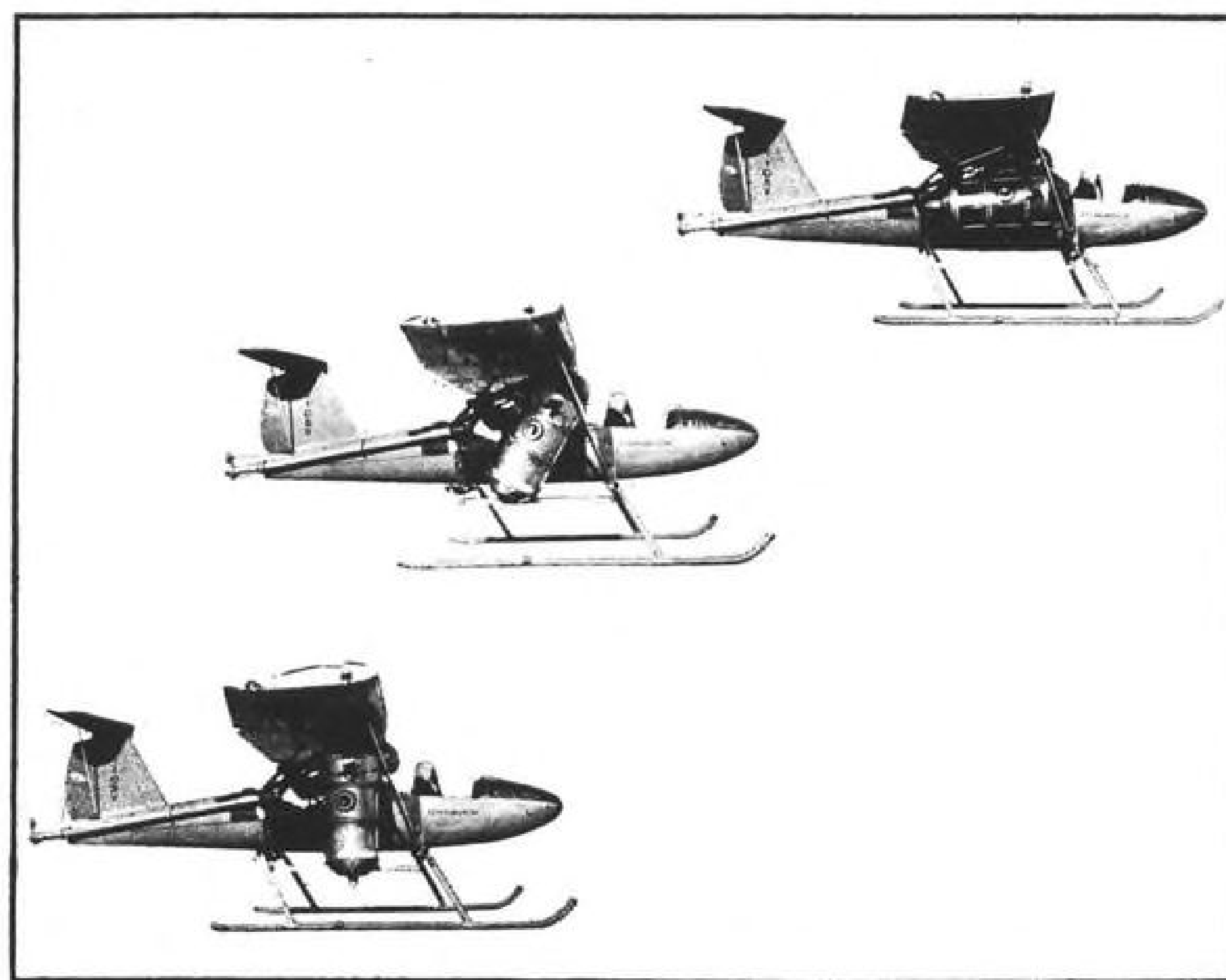
• Deliveries of the HUP-type helicopter have been completed and a high-powered version is under development for

the Navy. Total sales to Army, Navy and foreign countries were 339 aircraft.

• The YH-16B is "programmed for production." This is a 40-passenger helicopter that will result from replacement of the reciprocating engines in the YH-16—now in flight test—by Allison T56 shaft turbine engines. The devel-



ARMY XV-3 convertiplane makes transition as its tilting rotors complete 90-degree arc.



BELL VTOL converts from vertical to horizontal flight with rotating turbojet engines.

opment will be carried out under an Army contract.

• Commercial deliveries of the H-21 Work Horse are expected in 1956.

Borg-Warner

Borg-Warner Corp., Chicago, Ill., manufacturers of aircraft components, reported sales of \$380,317,341 in 1954, down from \$407,379,000 in 1953. Net earnings, however, increased from \$23,978,000 to \$24,460,075.

Sales of defense products accounted for 16.5% of the total sales volume in 1954. Items produced by Borg-Warner divisions include pumps for aircraft, power controls, airframe sections, and other components. In all, 9.09% of the sales were in aviation, a reduction from the 10.25% figure of 1953.

CAA Forms Aviation Safety Study Group

A four-man committee has been formed by Civil Aeronautics Administration to study safety responsibilities of industry and CAA's Office of Aviation Safety.

The special group will submit a report by May 1 to A. S. Koch, director of CAA's Office of Aviation Safety, outlining concrete proposals on:

- OAS activities for which the primary responsibility should be transferred to industry or private parties, including some now handled by delegation.
- OAS activities which should be delegated.
- OAS activities that should be eliminated or substantially reduced.
- Basic changes in the direction, management, approach and manner of execution of OAS activities which would improve efficiency and economy.

These proposals will be used as a basis for a joint industry-government planning meeting sometime after July 1. The joint meeting hinges on Congressional approval of a budget request of \$40,000 to finance the project.

Hearings are scheduled to start next week on the appropriation request.

► **Industry Suggestion**—Koch has advised industry associations of the formation of the committee and suggested that they might find it advisable to secure similar preliminary opinions.

Members of the CAA committee are: chairman, W. H. Weeks, chief, Aircraft Engineering Division; E. B. Franklin, chief, Air Carrier Safety Division; E. W. Hudlow, chief, General Safety Division; W. R. Stovall, chief, Medical Division.

Idea for the project came from President Eisenhower's Jan. 17 budget message calling for a substantial reduction in the federal government's safety promotion and enforcement activities.

AMC Responsible for Management Methods in Weapons Manufacture

Growing importance of new materials, fabricating techniques and complex weapon systems components is recognized in a new Air Force Procurement regulation giving Air Materiel Command direct responsibility and control over manufacturing methods projects.

Manufacturing methods projects result from a situation where producibility of an aircraft or components can be improved in the interest of economy or where introduction of a new material or technique requires that the manufacturing method be worked out in advance of production.

► **Problems**—USAF interest in the subject has been growing as weapon systems become more complex. In addition, new thermal problems, the emphasis on miniaturization, the development of new adhesives and bonding processes all are contributing to the producibility problems that must be met by procurement officers.

Improvements that will cut the man-hours and machine-hours, resulting in economy in fabrication, frequently justify studies to improve manufacturing methods. An example of this is the case of a cast landing gear door which in its original design required 65 pieces of aluminum and more than 600 fasteners. It now is made of a single piece of magnesium.

New USAF procurement regulation AFR 78-18 says manufacturing methods projects can be started with these objectives:

- To insure quality-quantity production.
- To reduce unit production costs.
- To improve fabricating efficiency and techniques.
- To improve product reliability, particularly in the avionics field.

In the past, much of the improvement in manufacturing methods has been provided by Air Force contractors on their own initiative or stimulated by AMC's interest in general economy. There always have been some projects financed through special contracts.

USAF spokesmen said they do not anticipate any increase in the number of contracts for manufacturing methods projects. Purpose of the regulation, they said, is to provide better control over the program by centralizing it in AMC and insure a proper limit on the number of projects in work. At the same time, it was clear from their comments and the text of the regulation that the program is becoming more important with the radical changes and complexity of modern weapons.

► **Who is Responsible**—Jurisdiction of the Air Research and Development

Command is recognized in the new regulation with the policy statement that ARDC's recommendations must be reflected in "production refinement projects for electronic component parts and new materials" under these circumstances:

• When production refinement is necessary prior to the development of the end item, or when the material or part has wide impact across weapon and support systems.

• When specific requirements cannot be developed.

However, AMC is given full responsibility for seeing to it that policies and criteria are being met and that the projects are "technically feasible."

Among other policies governing program development:

• Projects will be reviewed and approved annually in a group, not individually.

• Manufacturing methods funds may be used when the financial risk is beyond what can be reasonably expected of a given group of manufacturers and there is little possibility of conflict with other industry efforts.

• Once a method is proved and used by industry, further application will be on a normal basis through supply contracts.

• Priority will be given to projects with specific deficiencies vital to the military.

• Projects must avoid inhibiting or discouraging normal competition. Normally, proposals will be obtained from two or more contractors.

► **Criteria for Approval**—Among the criteria that will be applied before a manufacturing methods project is approved are:

• If an item is in the R&D stage it must be sufficiently advanced to assume

QEA-BOAC Freight

(McGraw-Hill World News)

Melbourne—Qantas Empire Airways and British Overseas Airways Corp. hope to increase their combined air cargo capacity this year between Sydney and London to 120 tons a month.

By the end of 1955, the two airlines expect to operate daily freighter service in each direction.

Qantas purchased a special DC-4 airfreighter in the United States, bringing the airline's Skymaster fleet to six. Able to lift a 15,000-lb. payload, the transport will be the first air cargo plane to operate from Australia on overseas routes.

that procurement will follow.

- If it is in the "grey" area between research and development and production, justification will be on lead time.
- The item must be acceptable for USAF use if the project involves building pilot machines for production.
- If the project involves development of machine tools and tooling a responsible aircraft or aeronautical manufacturer must be the prime contractor.

CAB Seeks Economic Violation Penalties

Civil Aeronautics Board is renewing its drive for legislation authorizing civil penalties for economic violations. Both the scheduled and non-scheduled airlines have successfully opposed such action in previous sessions of Congress.

The industry is apprehensive that repeated impositions of minor penalties would not only increase red-tape but also could build up to a major burden.

Pointing out that criminal penalties provided in 1938 Civil Aeronautics Act are effective for "serious cases involving knowing and willful violations," CAB Chairman Ross Rizley declared:

"It is in acting upon the less serious but more numerous violations that the Board believes it could avail itself of the remedy of civil penalties in a constructive manner toward improving the enforcement program."

He added that this would permit the Board "to attack violations speedily and avoid situations such as have existed in the past where offenders have been able to persist in violations during the time required to prosecute a formal proceeding or court action."

USAF Assignments

Retirement this spring of Lt. Gen. Laurence C. Craigie, Commander of Allied Air Forces in Southern Europe, and new assignments for six other general officers were reported by USAF.

Maj. Gen. Patrick W. Timberlake, Commander, Air Proving Ground Command, will replace Gen. Craigie and Maj. Gen. Robert W. Burns, USAF Assistant Vice Chief of Staff, succeeds Gen. Timberlake at APGC.

Maj. Gen. Jacob E. Smart, Deputy for Operations at Far East Air Forces, will replace Gen. Burns and Maj. Gen. Hunter Harris, Jr., Deputy Director of Plans for the Deputy Chief of Staff, Operations, takes Gen. Smart's post FEAF assignment.

Brig. Gen. Harvey T. Alness, Chief of War Plans Division for the DCS/O, will become the new Deputy Director of Plans, DCS/O and Brig. Gen. Charles H. Pottenger, Deputy Air Member, Joint Strategic Plans Committee, DCS/O, will replace Gen. Alness.

Civil Uses Feature AHS Agenda

Commercial rather than military applications will be emphasized in technical sessions of the 11th annual forum of the American Helicopter Society to be held in Washington, Apr. 28-29.

Helicopter operators and engineers from six foreign countries are included in the list of speakers scheduled for the two-day meeting. More than 900 representatives of the industry, the military services and related fields are expected to attend.

In addition to the technical papers, there will be an exhibit at the hotel of products of helicopter manufacturers and subcontractors. There will be a display of helicopters at Anacostia Naval Air Station Apr. 30.

The society's annual honors night dinner, featuring awards for distinguished contributions to rotary-wing science, will be held Apr. 28.

Chairmen of the technical sessions will be David Plumb, Sikorsky Aircraft; Bartram Kelley, Bell Aircraft; Clarence Belinn, Los Angeles Airways and Byron A. Moe, Allegheny Airlines.

Papers to be delivered:

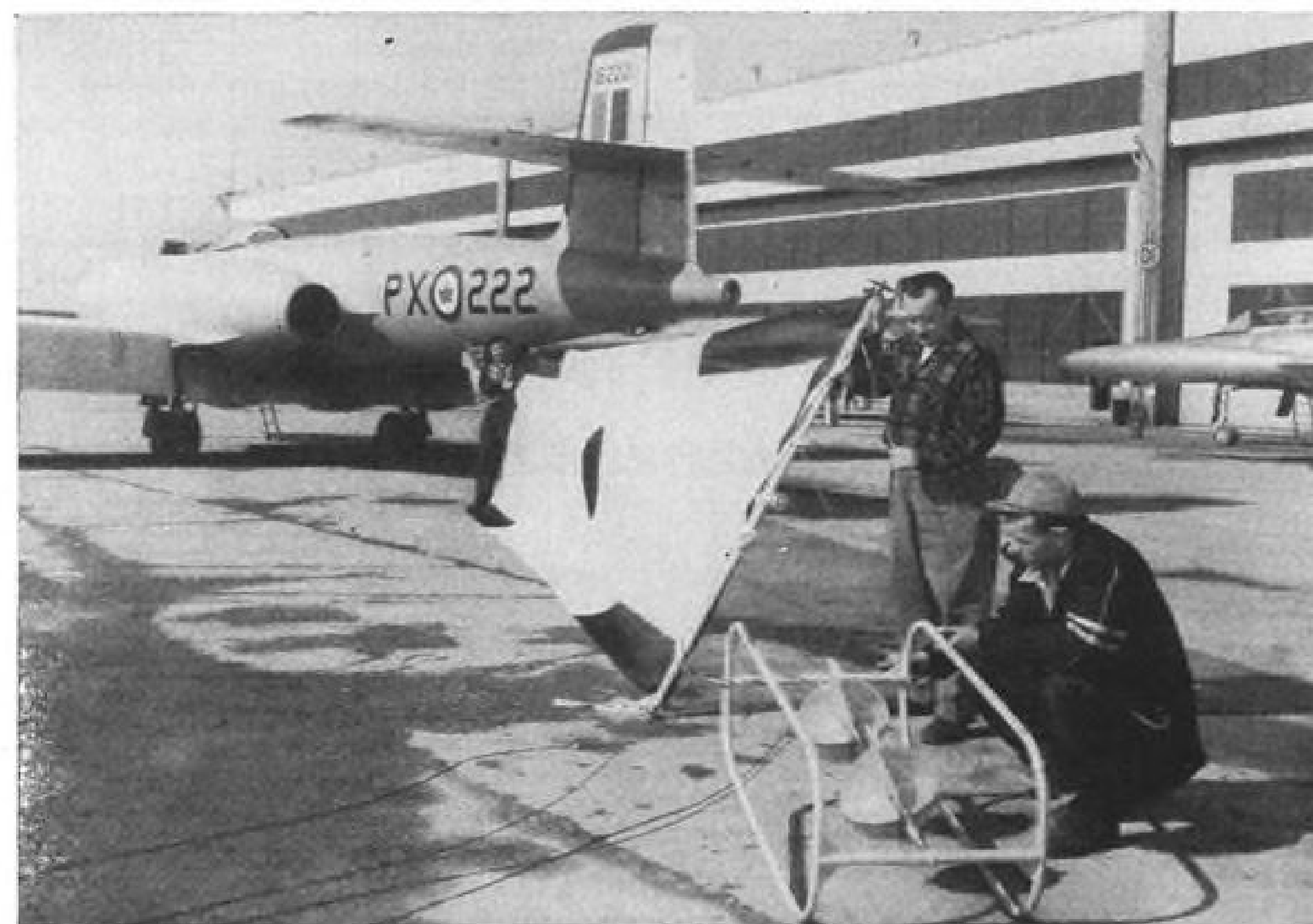
Whirling-Arm Study of Wing-Helicopters—Wesley L. Cresap and George Galerstein, Bell Aircraft Corp. Remarks on the Unloaded Rotor Type of Convertiplane—Kurt

H. Hohenemser, McDonnell Aircraft Corp. The Bristol Type 173—Design, Development and Experiences—Raoul Hafner, chief helicopter designer, Bristol Aircraft Co., Ltd., England. Development of the Cessna CH-1 Helicopter—Charles M. Seibel, Cessna Aircraft Co. Rotor Speed Control for Free Turbine Engines in Multi-Engine Helicopters—R. H. Rosenberg and R. L. Paquette.

Application of Helicopter Flight Simulators for Training and Research Purposes—Peter DeGullenchmidt, managing director, Gibravions Dorand, Paris. Contact Flight Simulator—Thomas R. Harriman, Bell Aircraft Corp. Preliminary Investigation of the Karman-Yuan Helicopter Rotor System—Dr. S. W. Yuan, Polytechnic Institute of Brooklyn. Effect of Blade Stalling and Drag Divergence on Power Required by a Helicopter Rotor at High Forward Speed—Kenneth B. Amer, Hughes Tool Co.

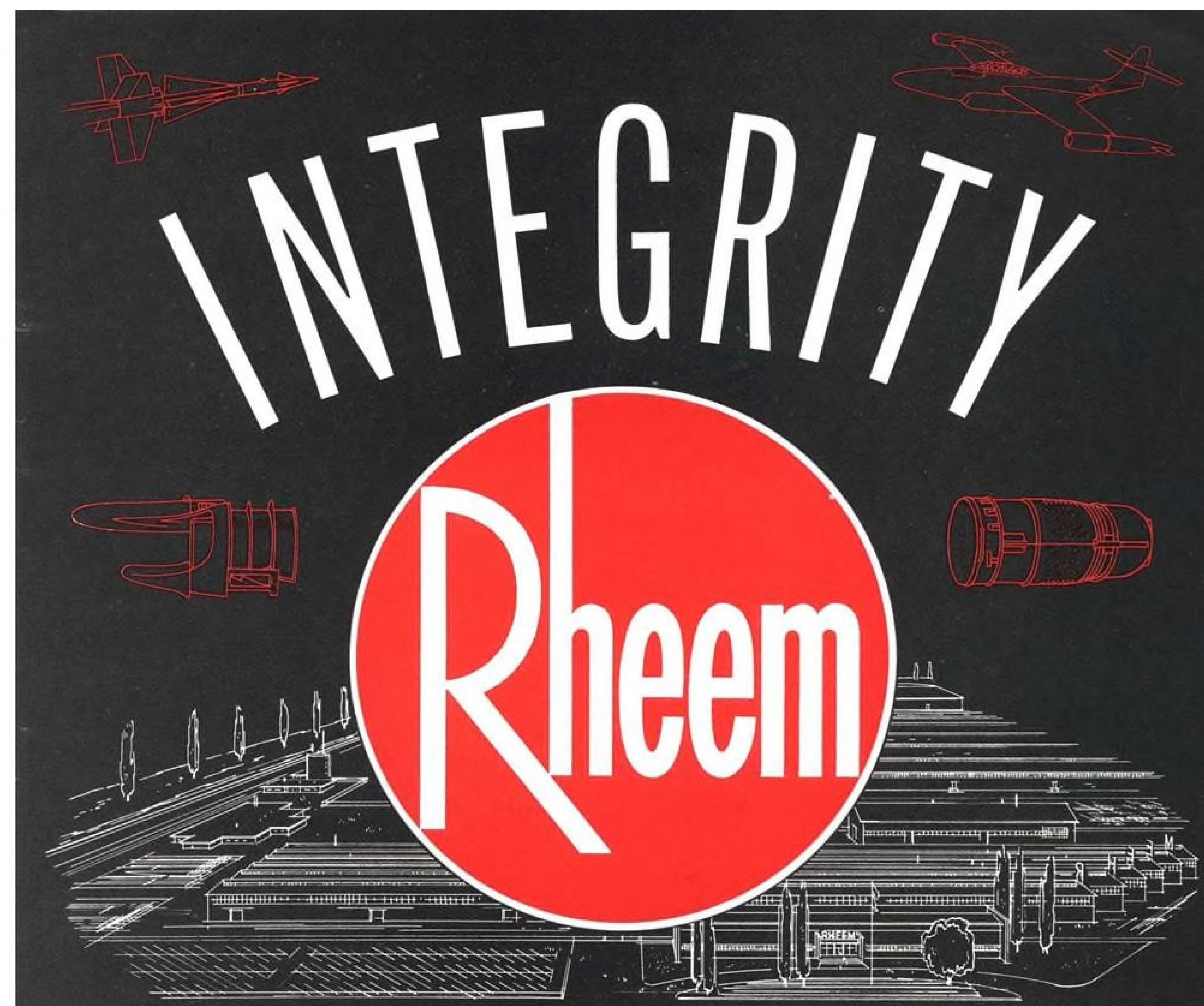
Helicopter Activities of BEA—R. A. C. Brie, director helicopter operations, British European Airways, England. Design Requirements for Transport Type Helicopters—Jack E. Gallagher, New York Airways. Helicopter Operations of Sabena—Anselme V. J. Vernieuwe, vice president of operations, Sabena-Belgian Airlines, Belgium. The Operation of Okanagan Helicopters Ltd.—Carlyle C. Agar, chief executive, Okanagan Helicopters Ltd., Canada.

The Regulatory Aspects of Helicopter Operations—K. S. Cooper, Civil Aeronautics Administration. The Helicopter Takeoff Problem—Ralph B. Lightfoot, Sikorsky Aircraft. Equipment for Blind Approaches—G. S. Hislop, chief designer, helicopters, Fairey Aviation Company, Ltd., England. Future Helicopter—M. A. Warskow, Port of New York Authority. Helicopter Navigation—Cmdr. W. W. Bush, ANDB, Civil Aeronautics Administration. Instrumentation for Helicopter Navigation—Dr. D. G. C. Luck, Radio Corp. of America.



RCAF Practices Highspeed Radar Interception

CF-100 twin-jet fighters have been modified as highspeed tugs by Avro Aircraft, Ltd., Malton, Ont., in response to RCAF's request for a fast towing vehicle to provide practice in modern one-pass, radar-controlled, collision attack techniques. In foreground is fluorescent-red-painted target attached by 12,000 ft. of armored cable to the CF-100 tugs. Sled-like metal frame contains a metal spinner for providing radar response to attacking plane's interception and fire-control equipment. Target imposes 2,500-lb. drag force on the tow plane when it is flying at top speed. Higher speeds and drags are limited by cable's strength. When the tow pilot wants to release the target, he sends a "butterfly" cutting device down the cable, which parts the line just ahead of the target. The CF-100's hydraulic winch then can reel in the lightened cable.



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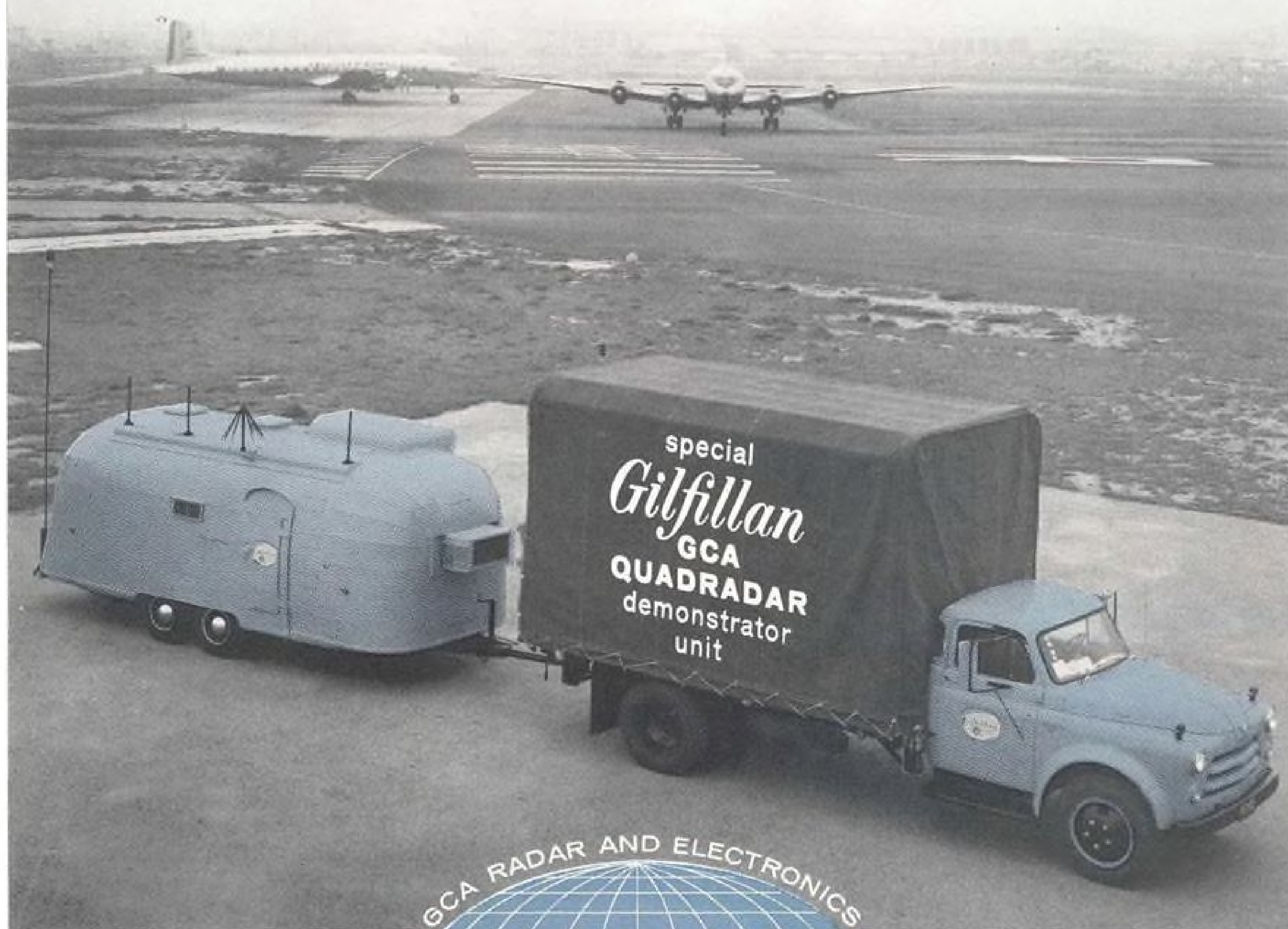
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A compact "auditorium on wheels" is now touring military and civil air bases throughout the United States to demonstrate the Gilfillan GCA Quadradar. Inside this streamlined, air-conditioned truck and trailer unit is seating capacity for 12 visitors, as well as the lightweight 4-in-1 Quadradar, a communications system, power unit, motion picture projection equipment and the new Gilfillan radar trainer.



Airports Get Set for Traffic Jump

Major airports in the United States are spending more than \$100 million to expand and change the face of their facilities.

The design trend is toward a faster, smoother flow of passengers, baggage and cargo to and from aircraft.

But improvements now under construction are only a step toward solving the big problem of developing an airport system capable of handling growing air traffic. America's air terminals last year processed more than 30 million domestic airline passengers plus additional millions for international air carriers, business aircraft, military planes and private craft.

By 1964, annual passenger traffic is expected to increase to 60 million.

► **\$300-million Program**—To handle this flow, Air Transport Assn. says the U.S. needs a national airport development program of at least \$200 million—preferably \$300 million. This means the federal government would put up from \$100 million to \$150 million a year, to be equaled by local matching funds on a 50-50 basis.

Federal appropriations have fallen far short of this goal. Airport aid was suspended in 1954, and Congress approved only \$22 million for 1955. The Eisenhower Administration has cut funds for fiscal 1956 even more, requesting a lean \$11 million.

Local government sponsors of airport projects, however, have indicated to Civil Aeronautics Administration that they are prepared to put up more than \$100 million—if it is matched by federal funds.

Total funds that have been available provided no more than enough for year-to-year improvements. The improvements now under construction are only a step toward solving the big problem of developing an airport system capable of handling growing air traffic.

Needed projects include new terminals, development of heliports, longer taxiways of adequate strength to take modern transports, taxiways to speed ground movements, clear approaches to runways and larger ramp areas.

Terminal Trends

Most new airport terminal buildings were designed for smoother passenger traffic and more rapid flow of baggage to and from transports. They also were laid out for easy expansion to meet future needs.

The trend toward simple, direct circulation generally follows design criteria proposed by CAA in 1953.

► **Outstanding Projects**—Here are some of the outstanding terminals completed,

Airport Meetings

Two major meetings of airport operators and officials this month will set the pattern for meeting immediate airport needs and planning for future expansions. They are:

• American Association of Airport Executives' 1955 convention Apr. 16-20 at Tuscon, Ariz.

• Airport Operators Council's annual membership meeting Apr. 24-28 at Seattle.

Principal topic to be discussed by both groups is the Federal-Aid Airport Program. AAAE and AOC have joined with the National Association of State Aviation Officials in a survey of airport needs, which is to be reported on at the April meetings.

The private airport survey is intended to show: the amounts of local funds committed for airport construction and modernization and what will be needed in federal financial assistance.

continued, started or proposed during 1954 and early 1955:

• **New York's Idlewild International.** This \$60-million project is a new concept in permanent terminals, switching from the usual single structure to a 10-building layout.

The multi-unit design, to be constructed on a 655-acre oval, will be able to handle 140 aircraft at one time. A single building capable of accommodating this number of planes would stretch nearly two miles long and be virtually inoperable.

Main section of Idlewild's "Terminal City" will be a 2,200-ft-long International Arrival Building and two adjacent airline wings. Individual terminals will be housed in seven other buildings.

The largest air terminal proposed so far, this project is expected to handle more than 8.5 million plane passengers by 1965. The main section will be started this fall and is scheduled to be completed by early 1957.

• **San Francisco International.** Newest of America's air terminals, the \$14-million project is part of a \$50-million airport development program. It can accommodate 5 million passengers a year now and will be expanded to a 10-million annual capability by 1960. This is an outstanding example of design for easy growth.

The six-story main building uses a variation of the two-level system for vertical separation of passenger traffic. Arrivals are channeled through the



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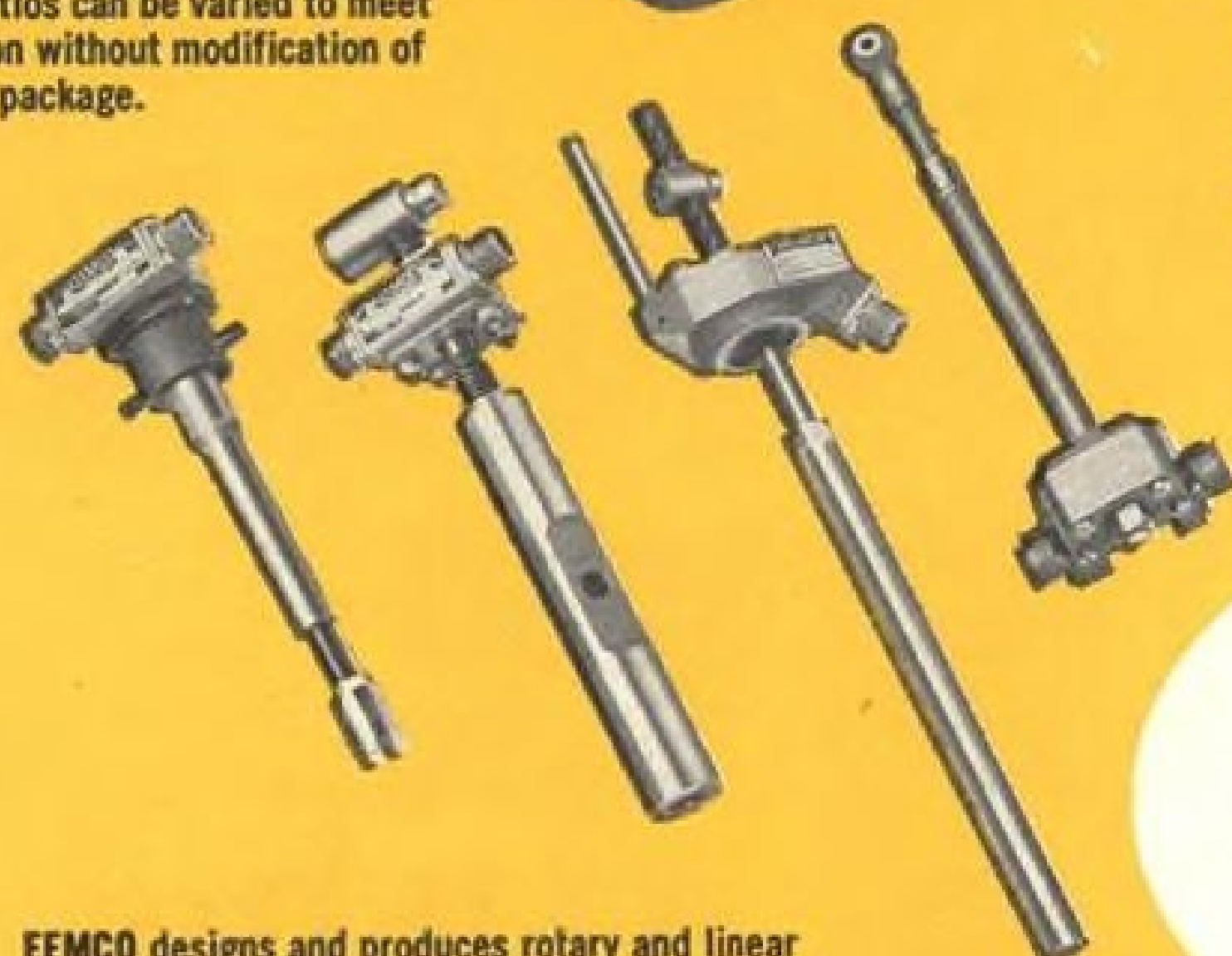


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SAN FRANCISCO INTERNATIONAL is typical of new design trend in airport terminals.

ground floor, and persons departing
from San Francisco are one level higher.

Two 420-ft.-long fingers, or con-
courses, project from the ends of the
terminal to serve transport loading po-
sitions. A 150-ft. finger may be
lengthened in the future. An two addi-
tional concourses will be added when
they are needed.

• **Chicago's O'Hare Field.** Now under
construction, O'Hare's new terminal
will consist of a curved two-level main
structure plus a 500-ft.-long, two-story
concourse. Two fingers will project out
from one corner. This first stage of a
master expansion plan will be able to
serve 3 million passengers a year and 16
transports at one time.

Cost of the initial construction:
\$1,880,000.

Size of the main element may be
doubled in the near future and a third
finger added. Ultimate expansion pro-
vides for a circular concourse with five
split-end fingers able to handle 90 air-
craft simultaneously.

• **Lambert-St. Louis Municipal.** This
new three-story terminal building, now
under construction, has a more radical
design than any other current project.

The \$4.5-million structure will have
a roof made up of three pairs of inter-
secting, thin-shell concrete cylinders.
Two-story fingers will project from the
midpoint and ends of the terminal to
plane loading positions.

For future expansion, three cylinders
may be added to the roof and the fingers
lengthened or more built.

• **Cleveland's Hopkins Municipal.**
Scheduled to be completed this year,
the new terminal is part of a 15-stage
construction program.

The \$6.5-million building consists
of a two-level main area with a ticket

and baggage wing and a seven-story con-
trol tower topped by a cab. It is ex-
pected to serve 1.8 million aircraft
passengers a year by 1960.

• **Wichita Municipal.** One of the na-
tion's newest complete airports,
Wichita's \$10-million field has a V-
shaped runway pattern with a \$2.1-
million terminal building set in the
apex of the taxiways.

Terminal area includes the main
structure, a seven-story control tower
and six-gate fingers for plane loading
that can be expanded in the future to
14 positions.

The new airport replaced Wichita's
former field, taken over by the Air
Force as a B-47 training base.

► **Lost Project**—One unusual and im-
portant project, Los Angeles Airport's
proposed new terminal building, was
lost when city voters refused to approve
a bond issue to cover the \$9-million
cost.

Plans called for a circular building
with six radial fingers projecting from
the main structure. Each finger would
have 10 loading positions for aircraft.
This layout was designed to minimize
walking distances for plane passengers.

The terminal building would have
had a domed roof, partly of glass.

Heliports and the Future

One of the key conditions to the
projected increase of yearly passenger
traffic is inauguration of scheduled heli-
copter service on shorthaul, inter-city
routes. Copter service also is needed
to shuttle airline passengers from the
centers of large cities to airports con-
structed away from heavily populated
areas.

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copter airlines must have heliports. But few rotary-wing air carriers have the resources to finance construction of terminals or to pay in full for the operation cost.

City governments and their agencies probably will be forced to construct these heliports and operate them at a loss for some years, as they did during early development of airports.

One of the first heliports in the United States will be built in midtown New York. Final plans are being delayed by indecision over whether to construct a small, interim facility or one able to handle expected traffic expansion of the next five to 10 years.

This heliport probably will be built and operated by the Port of New York Authority.

► **Size Limit**—One outstanding problem in planning terminals for rotary-wing aircraft is size. Most designs submitted so far would put the heliports on top of office buildings. Yet they must have landing and takeoff areas plus positions to park while loading or unloading passengers and cargo.

A possible answer to cutting down the needed area would be automatically folding rotor blades. But the complexity of rotor hubs and blades raises considerable doubt that this would be practical.

Taking this size factor into consideration, a study by the Port of New York Authority concluded that heliports should be 200 by 400 feet. Parking area would accommodate five parked helicopters, and the gate time would average 12 minutes.

Capacity of this heliport would be approximately 40 takeoffs or landings an hour.

► **Practical Approach**—Determination of a practical size and location for heliports will solve one of the largest barriers now blocking inauguration of helicopter service.

A working group of copter operators, brought together by the International Air Transport Assn. last November at Montreal, said any attempt to fix the characteristics of copter buses must be preceded by a realistic determination of the size and location of heliports.

"The helicopter must fit the landing area, rather than vice versa."

Senate Unit Aims for More Subcontracting

Senate Small Business Committee is going to consider three proposals to increase subcontracting by Defense Department prime contractors at hearings this session.

In its annual report, submitted by chairman John Sparkman, the committee listed them as:

- More mandatory language concerning subcontracting should be used in military contracts.
- Either Congress or Defense Department should stipulate an actual percentage of the total contract value which would be subcontracted.
- All government-owned equipment in prime contractors' plants which constitutes duplication of equipment in the subcontractors' plants should be withdrawn.

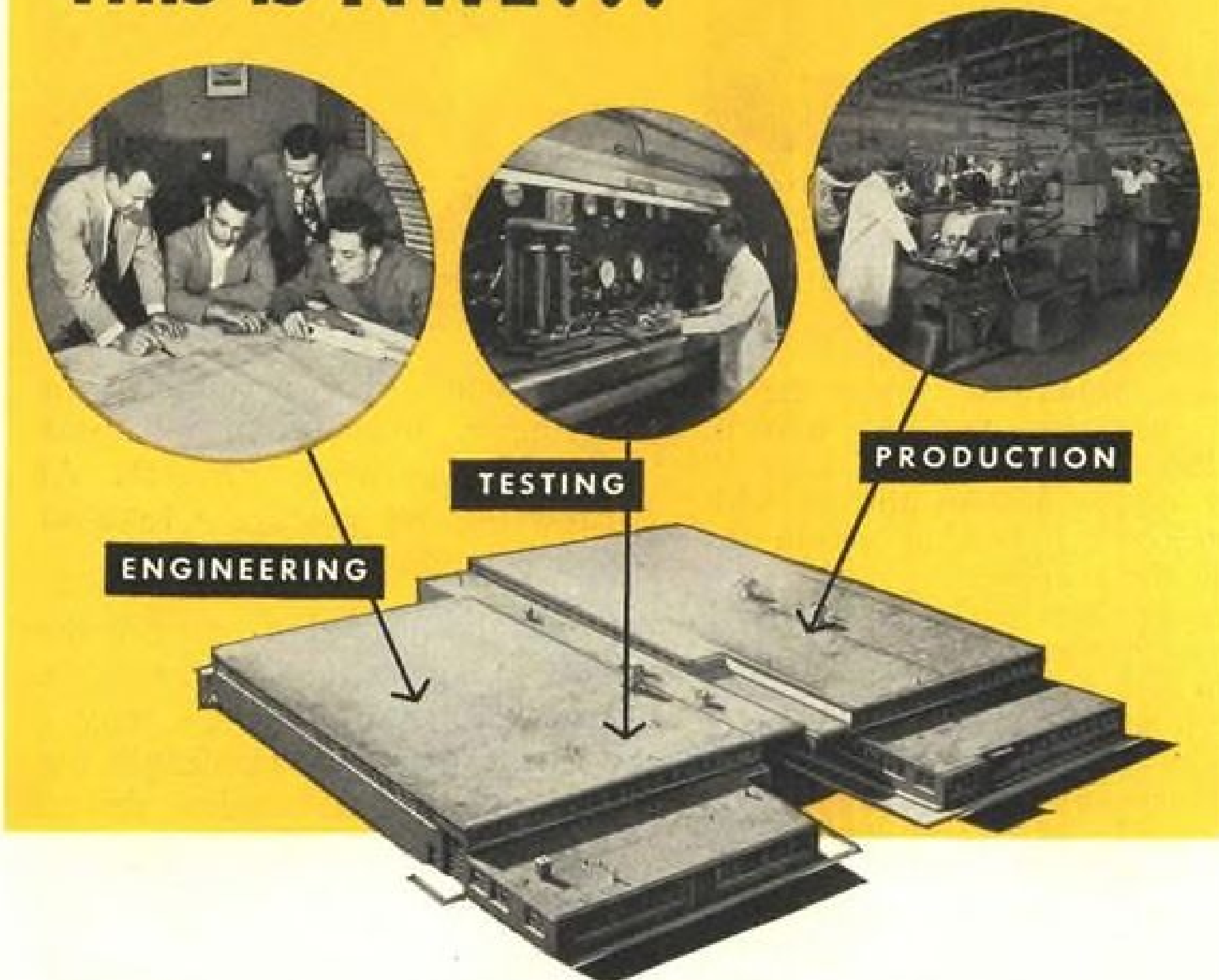
Other points made in the report were:

- Research and development is "a very real source of contracts for the small businessman . . . in many instances, it has been found that the small firm is more suited to research and development work than the large contractors."
- There is still a "large area of disagreement" concerning the procurement directive issued last December by Defense Secretary Charles E. Wilson, and top officials will be requested to testify on the reasons for issuing it.

Sen. Edward Thyne, ranking Republican on the small business group, has interpreted the procurement directive as setting up a list of preferred firms to receive the majority of defense contracts with no competition allowed from firms not on the selected list (AW Dec. 20, p. 12).

- Negotiation, which accounts for 90%

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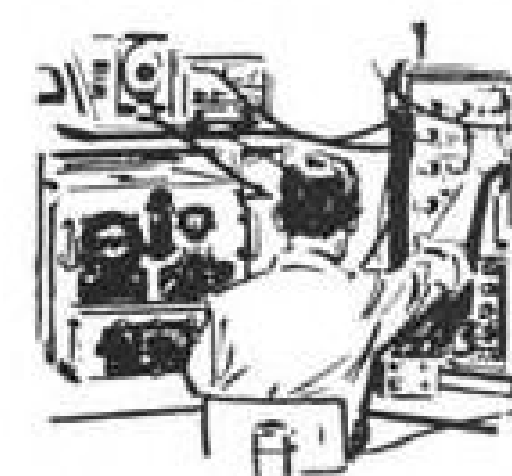
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of the dollar value of defense contracts since 1950, does not preclude competition. "But small businessmen cannot understand why the armed forces tend to flout the intent of Congress," the report added, "and they argue that they might have a chance to bid on contracts which are advertised, whereas when negotiation is used, they do not hear about the procurement and are thus precluded from submitting a bid or proposal."

Appropriations Group Cuts NACA Budget

House Appropriations Committee reduced National Advisory Committee for Aeronautics' budget request for Fiscal 1956 by \$8.8 million, despite warnings of inadequate aeronautical research effort by NACA members (AW Mar. 28, p. 18).

NACA asked for \$76.5 million. The committee allowed \$67.7 million, which is \$11.8 million more than NACA's Fiscal 1955 budget of \$55.9 million.

Major portion of the cut was \$7.5 million in the \$63.5 million requested for administrative and operational expenses.

NACA had planned an increase of 1,010 in its personnel next year to provide for the operation of three new windtunnels and increase the level of research effort. The \$56 million voted by the committee provides for an increase of only 210 to take care of the new facilities coming into operation.

NACA's \$13 million construction request for 13 new projects, including \$4.8 million for a nuclear reactor for testing of aircraft materials and components, was cut \$1.3 million. "If the NACA will place the projects open for competitive bids and watch construction costs carefully the entire program should be accomplished within the \$11.7 million provided," the committee claimed.

Construction projects in the NACA program include: Installation of an air removal system for the 16-ft. transonic tunnel at Langley Aeronautical Laboratory which will extend its speed range to include Mach 1.2, and provide for testing of large-scale models to determine characteristics of aircraft that become critical in the low supersonic range; a highspeed free-flight facility at Ames Aeronautical Laboratory which will provide for investigations into the tremendous heat generated by missile speeds from 7,000 to 14,000 mph.; a steel pipe firing test chamber and instrument room, also at Ames, that will permit investigation of airplane heating and stability at speeds from 2,000 to 6,000 mph.; conversion of the 8 x 6 ft. tunnel at Lewis Laboratory to permit transonic operation.

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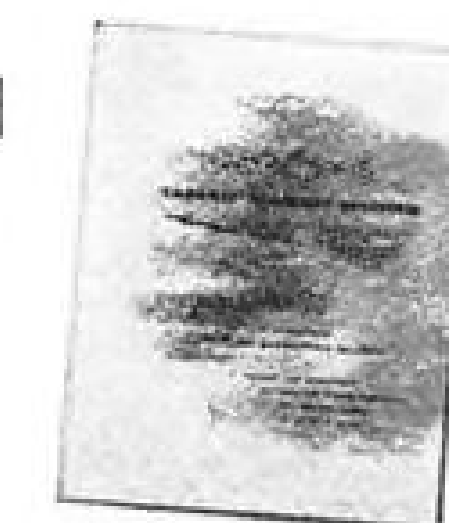
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AVIATION CALENDAR

- Apr. 14-15—American Ordnance Assn., symposium of Proving Ground Instrumentation Committee, Patrick AFB, Fla.
- Apr. 14-16—International Airline Navigators Council convention, San Francisco.
- Apr. 16-20—American Association of Airport Executives, 1955 annual convention and business meeting, El Conquistador Hotel, Tucson, Ariz.
- Apr. 18-21—Society of Automotive Engineers, Golden Anniversary Aeronautic Meeting, Aeronautic Production Forum and Aircraft Engineering Display, Hotel Statler and McAlpin Hotel, New York.
- Apr. 18-21—American Society of Mechanical Engineers, Diamond Jubilee spring meeting, including four aviation sessions, Lord Baltimore Hotel, Baltimore.
- Apr. 20-22—American Rocket Society, spring meeting, Baltimore.
- Apr. 24-28—Airport Operators Council, eighth annual meeting, Seattle.
- Apr. 27-29—Society for Experimental Stress Analysis, spring meeting, Hotel Statler, Los Angeles.
- Apr. 27-30—American Helicopter Society, 11th annual forum, Hotel Mayflower, Washington, D. C.
- Apr. 28-29—Michigan Aeronautical Conference, University of Michigan, Ann Arbor.
- Apr. 29—Institute of Navigation, eastern regional meeting, Friendship Airport, Baltimore.
- Apr. 29-30—New England radio-electronics meeting, sponsored by Boston and Connecticut Valley sections of IRE, Sheraton Plaza Hotel, Boston.
- Apr. 30—Air Force Assn., Illinois Wing's annual convention, Sheraton Hotel, Chicago.
- May 2-5—Society of Aeronautical Weight Engineers, national conference, Hilton Hotel, Ft. Worth.
- May 3-5—Instrument Society of America, first national Flight Test Instrumentation Symposium, Allis Hotel, Wichita.
- May 4-6—Fourth International Aviation Trade Show, 69th Regiment Armory, New York.
- May 5—First International Aircraft Mart Exposition, Will Rogers Memorial Coliseum, Ft. Worth.
- May 5-7—National Inter-Collegiate Flying Assn., annual convention and air meet, Meacham Field, Ft. Worth.
- May 7-8—Association of Northeastern College Flying Clubs, annual inter-collegiate air meet, Troy (N. Y.) Municipal Airport.
- May 9-11—National Conference on Aeronautical Electronics, Biltmore Hotel, Dayton.
- May 16—National Fire Protection Assn., annual aviation seminar, Netherland Plaza Hotel, Cincinnati.
- May 16-20—National Materials Handling Exposition, produced by Clapp & Poliak, International Amphitheatre, Chicago.
- May 18-20—National Telemetering Conference, Morrison Hotel, Chicago.
- May 23-24—American Society for Quality Control, ninth annual convention, Hotels Statler and New Yorker, New York.
- May 30—Federation Aeronautique Internationale and KNVvL Royal Netherlands Aeroclub, fifth International Air Display, Ypenburg Aerodrome, The Hague.



**when the
Tactical
Air Arm
pulls
the switch**

Today we're at peace... and the strong right arm of this man can help to keep us there.

He's 'Tac Air'! And in addition to his time-honored role of providing air superiority and air support for ground operations, this man now has new and greater responsibilities.

Increased mobility and today's lightweight thermonuclear weapons mean that the Tactical Air Arm can now carry a war to the enemy anywhere in the world — around the clock and in any weather.

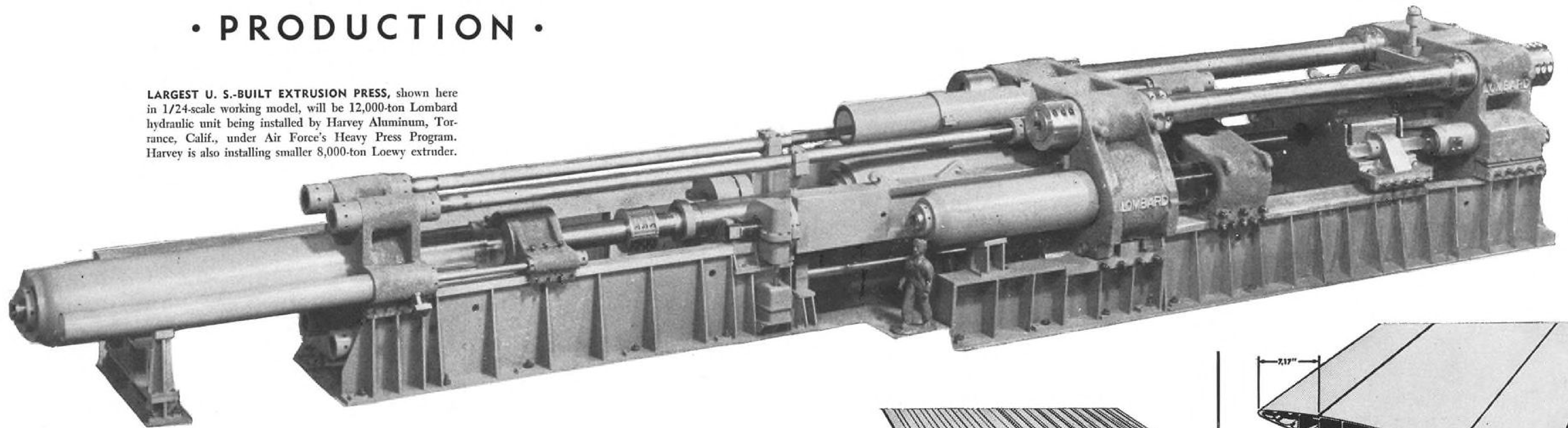
Today, a major part of Martin's development effort is geared to the top-level thinking on problems of the new Tactical Air Arm's arsenal.

MARTIN
BALTIMORE • MARYLAND



• PRODUCTION •

LARGEST U. S.-BUILT EXTRUSION PRESS, shown here in 1/24-scale working model, will be 12,000-ton Lombard hydraulic unit being installed by Harvey Aluminum, Torrance, Calif., under Air Force's Heavy Press Program. Harvey is also installing smaller 8,000-ton Loewy extruder.



Big West Coast Extruders Near Production Status

By Irving Stone

Torrance, Calif.—New potential for extruding aluminum alloy configurations for aircraft structures will soon be available in the West Coast area.

Harvey Aluminum expects to have in operation by fall of this year two new extrusion presses—an 8,000-ton Loewy and a 12,000-ton Lombard—under USAF Heavy Press Program.

Structures for housing the presses and their supplemental equipment, now

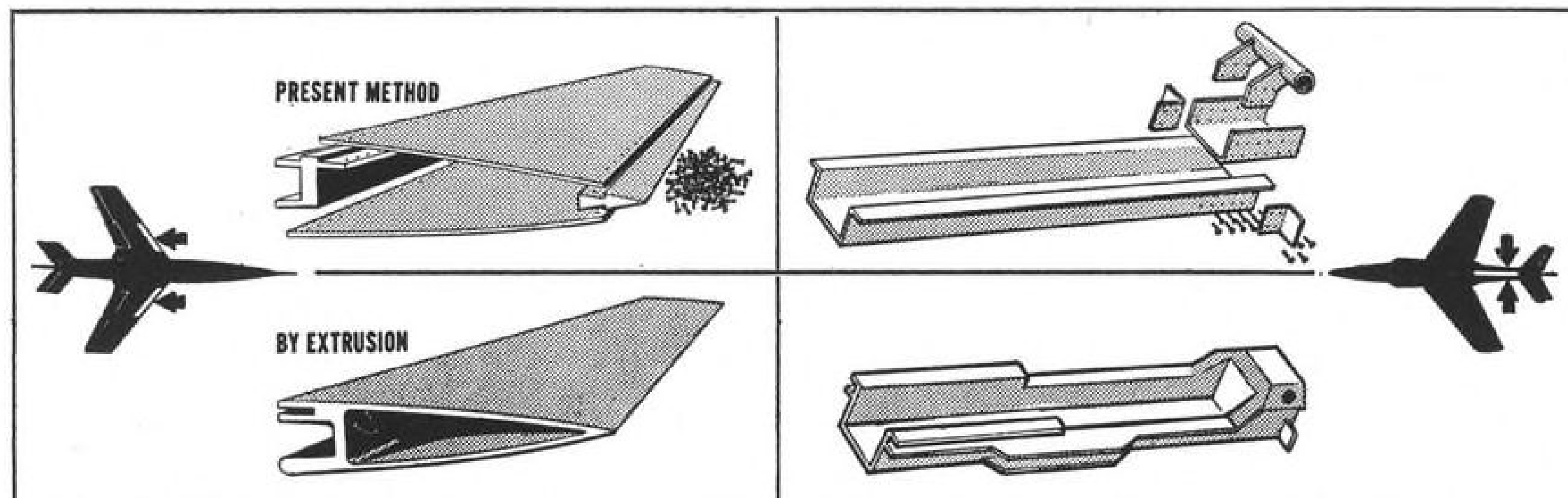
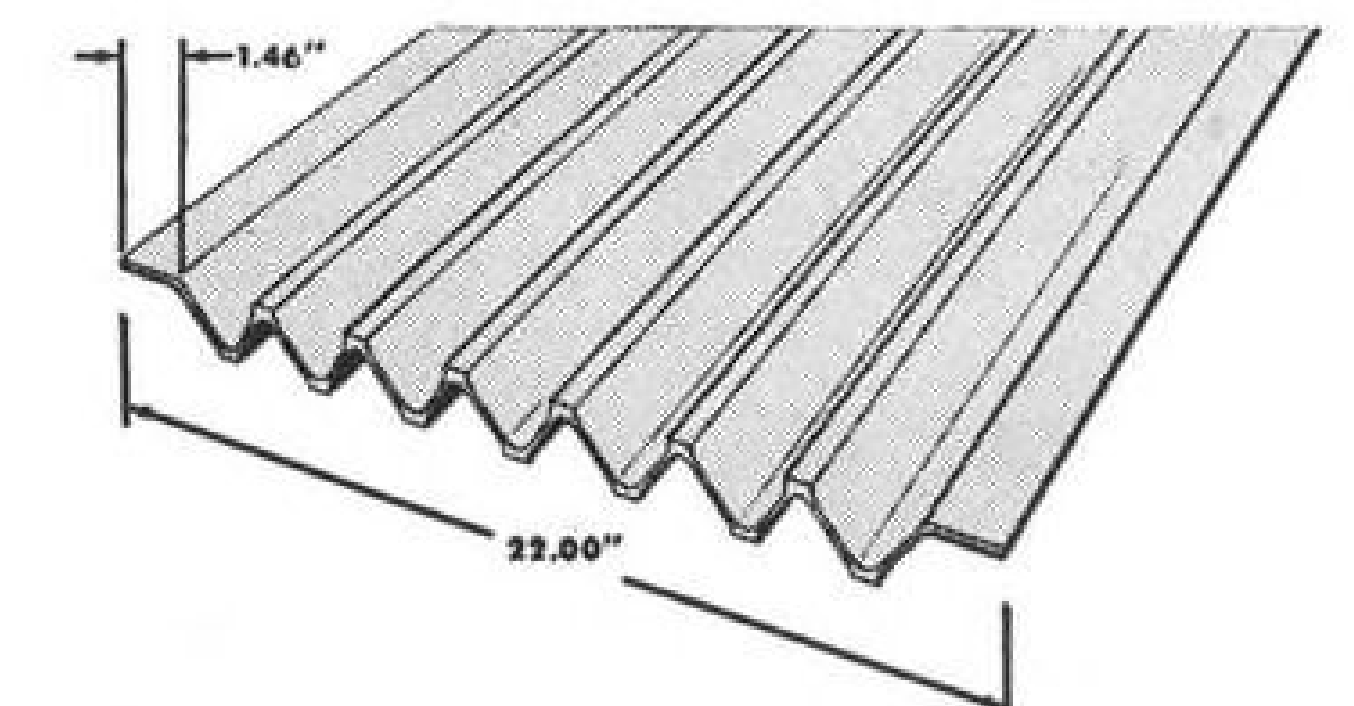
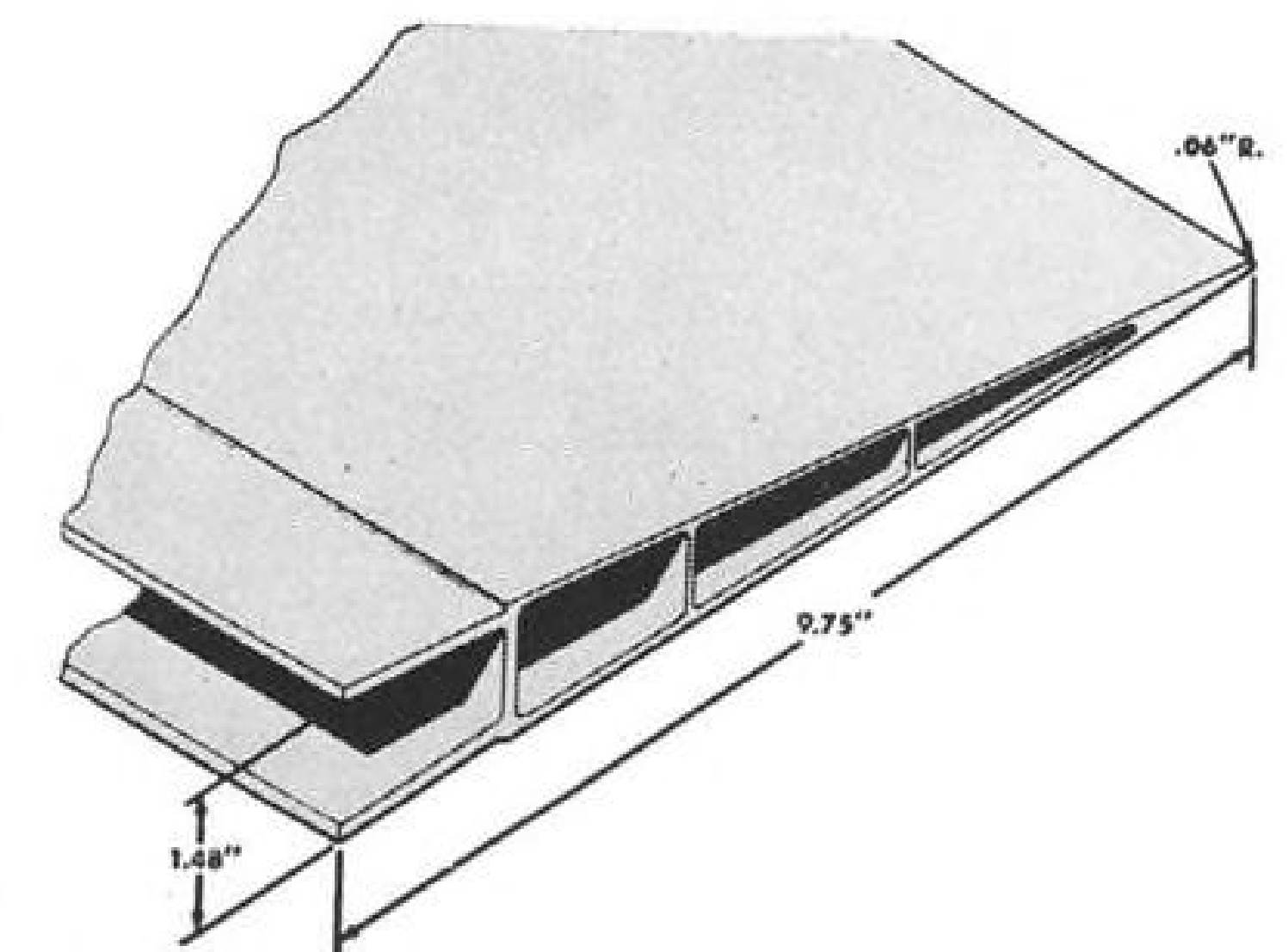
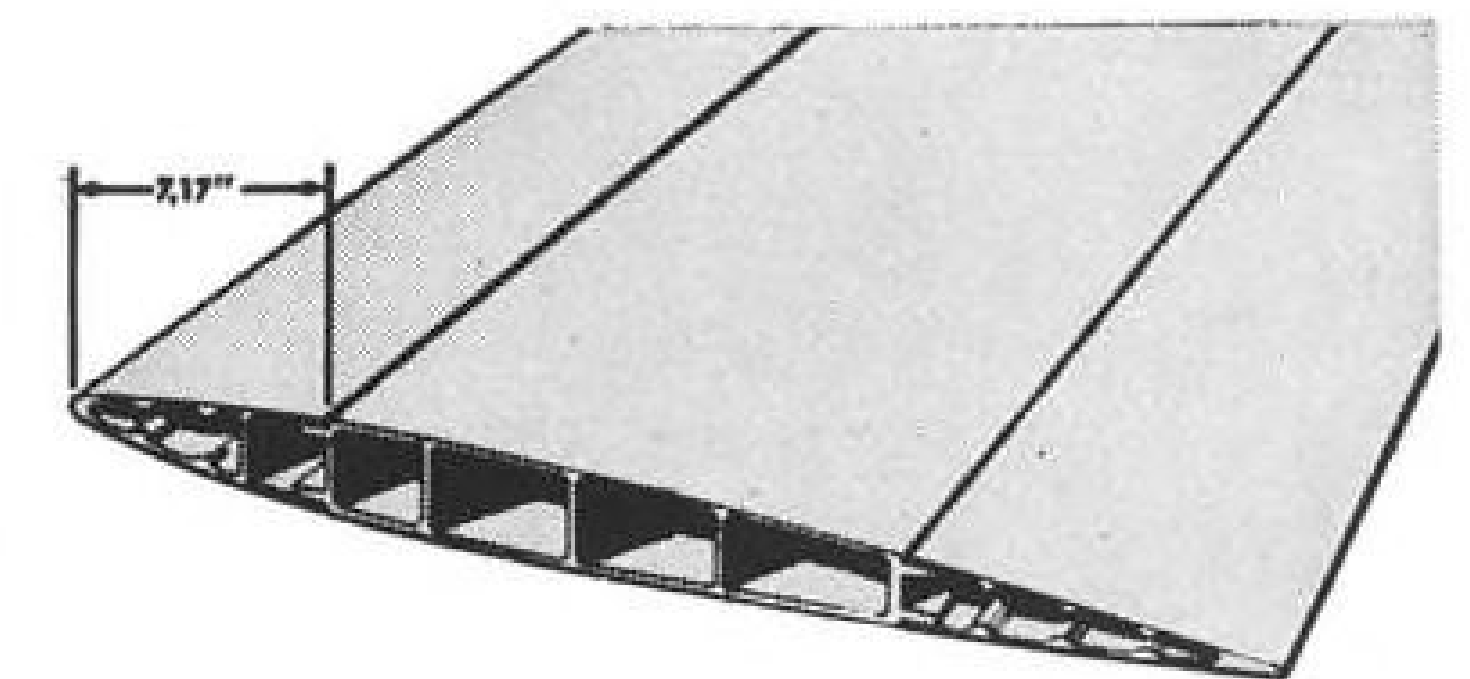
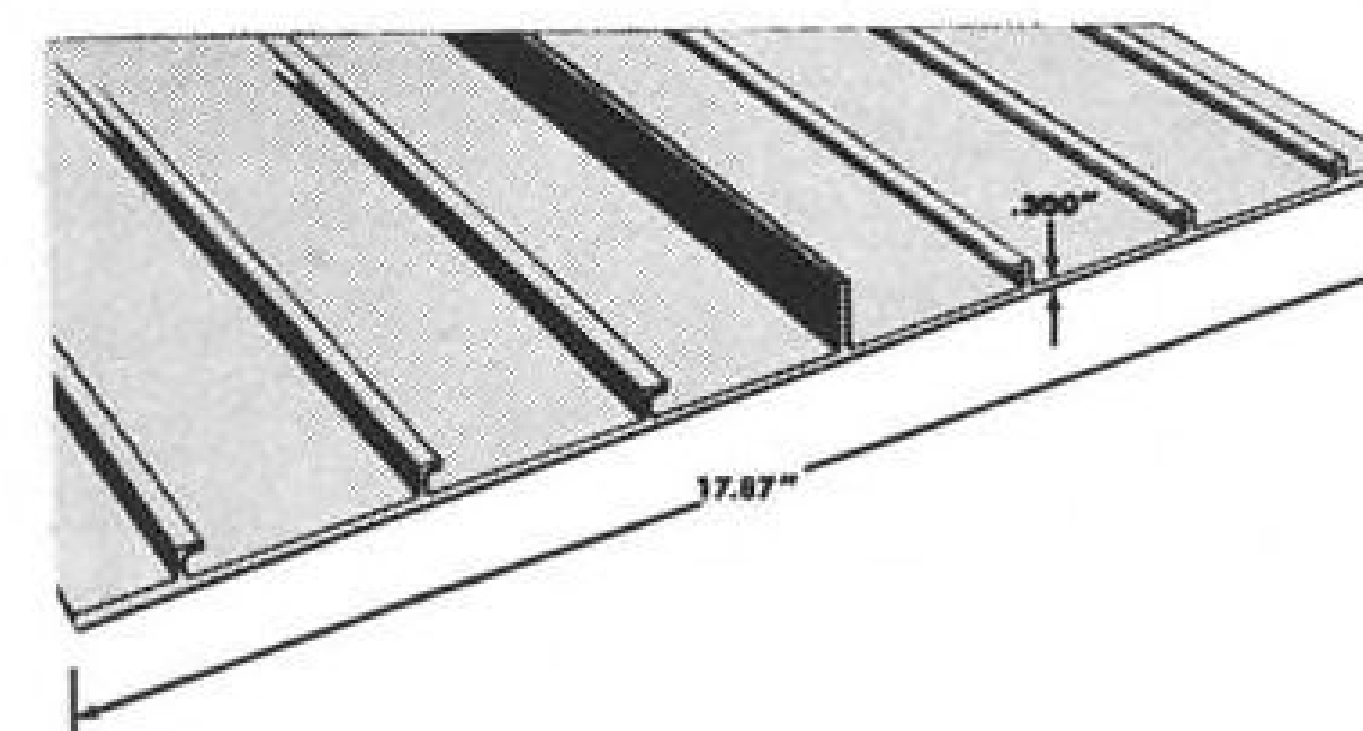
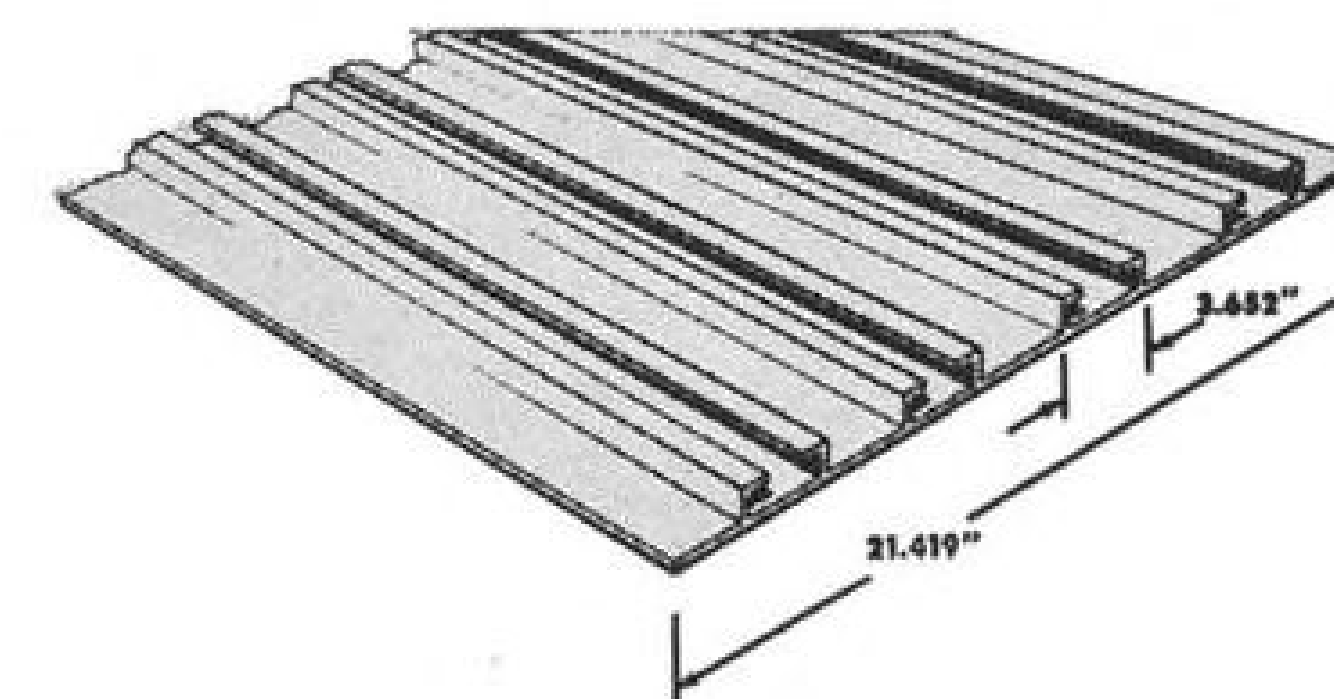
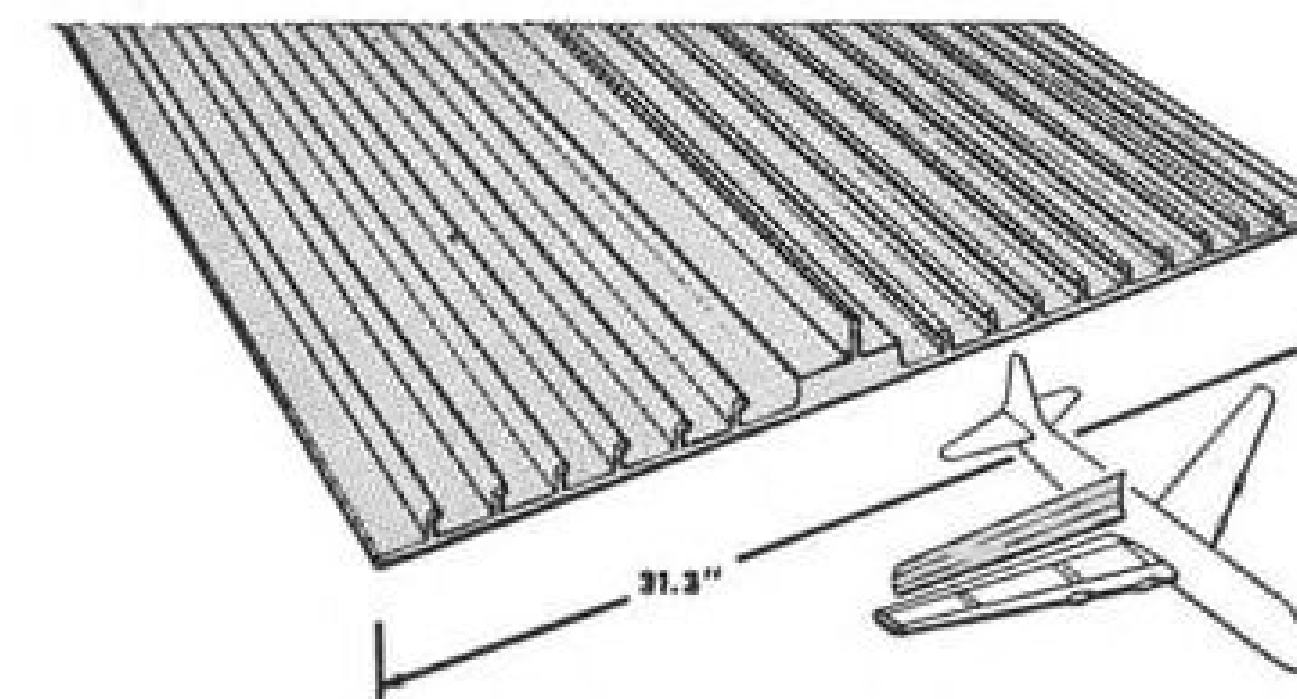
about 60% complete, have been erected with Harvey funds. Supporting equipment includes heat-treating, stretch-straightening, roll straightening units, as well as die-making facilities, an ingot plant, etc.

► **Press Array**—The 12,000-ton press will be in the largest-tonnage category of extrusion units to be built in this country.

Aluminum Co. of America (Lafayette, Ind.) is operating a 14,000-ton Schloemann extrusion press brought

from Germany; Curtiss-Wright Corp.'s Metals Processing Division, Buffalo, N. Y., also will operate a 12,000-ton (Loewy) extrusion press, but this will be basically for steel (see p. 36); and Kaiser Aluminum & Chemical Co. (Halthorpe, Md.) will operate two 8,000-ton extrusion presses for aluminum alloy.

► **Types in Picture**—Harvey is now geared to accept orders for airframe extrusions for both presses, is set up to proceed with required tooling. It is

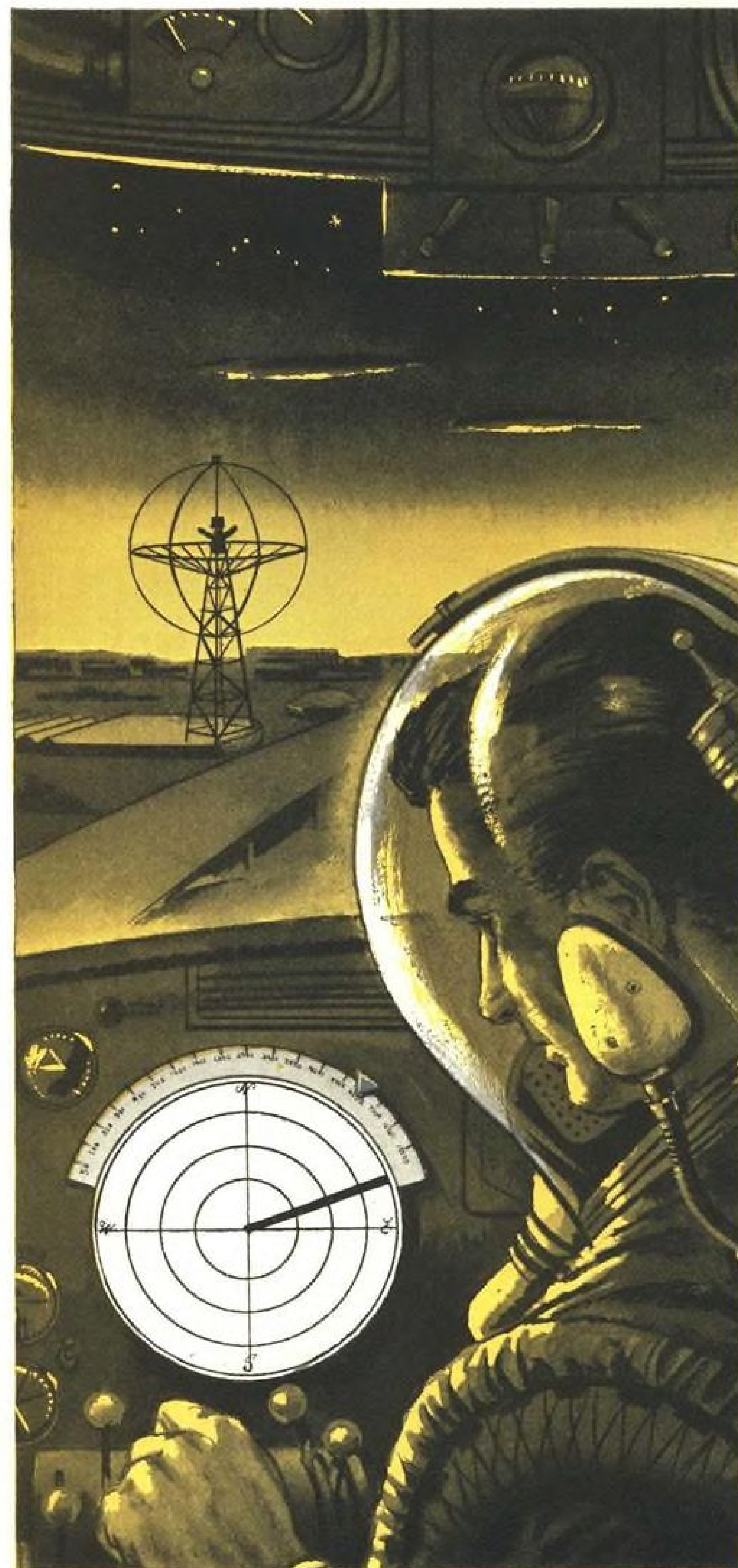


ONE-PIECE ALUMINUM ALLOY EXTRUSIONS produced on the big 12,000-ton press will replace units made by conventional 'bits-and-pieces' build-up. Left-hand drawing shows old and new wing leading edges; sketch at right compares old and new longerons.

PARTS PRODUCED ON BIG EXTRUDERS will offer lighter weight and greater strength. Typical applications: bulb-stiffened skin with integral spar at center (above, top); aft lower center wing skin blanket (middle); wing panel skin with integral stiffen-

ing and attachment members (left, lower); entire components for tail assemblies and small-craft main wings (above, top)—airfoil shown would be made of three separate parts; trailing edge elevon (above, middle); and Zee stiffener (above, lower).

"Bogey at 6,000 miles!"

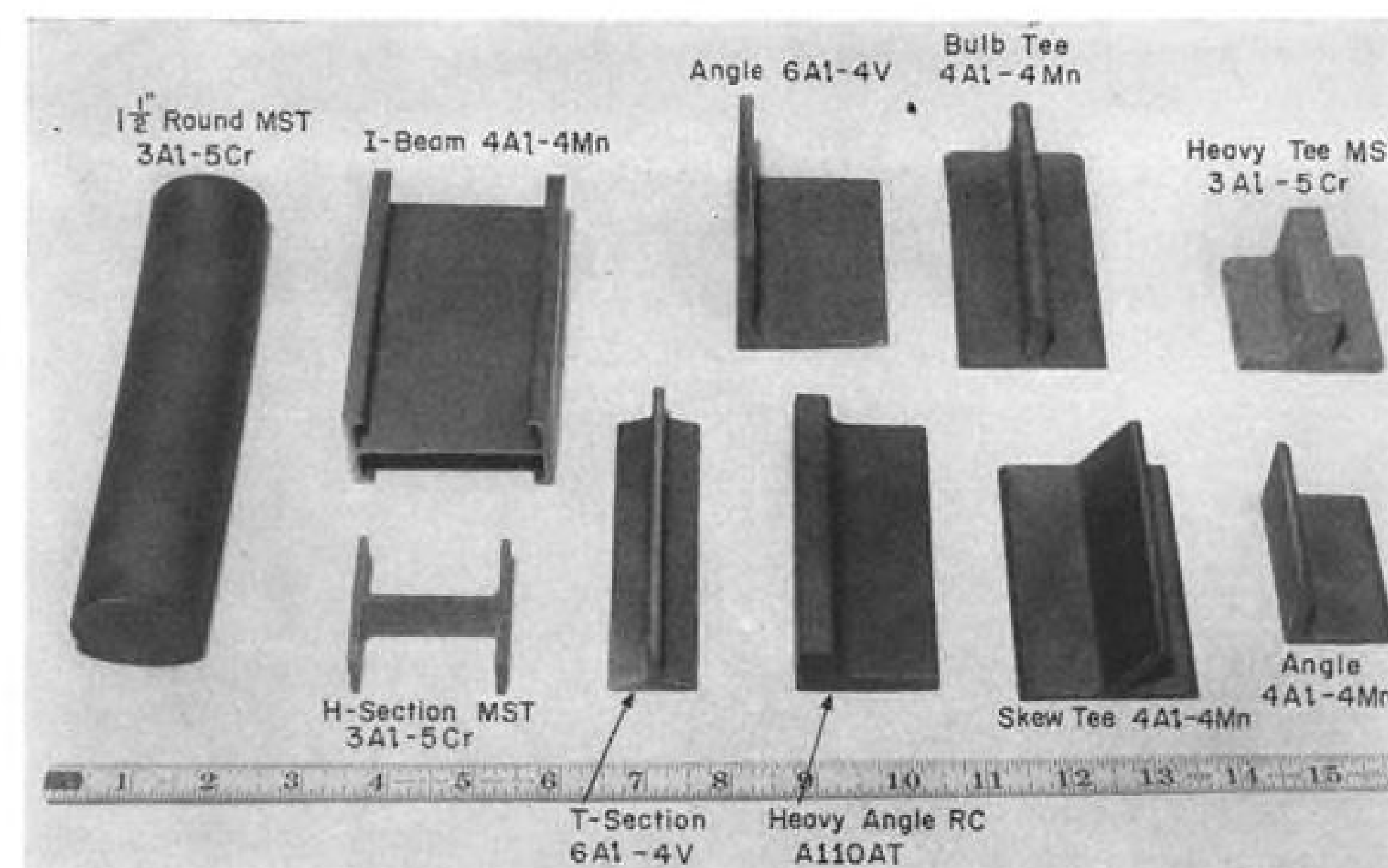


Sure, six thousand miles is beyond the range of today's radar equipment. But radar has been so highly developed since the end of World War II that who's to say how long it'll be until we're thinking in terms of thousands of miles . . . or more?

We're proud of the part we play in producing the world's most sensitive radar sets. Granted, it's a small part—*many* small parts—but our team of precision engineers, tool-makers and machinists makes certain that *If We Ship It . . . It's Right!* We work with practically every major builder of radar equipment—supplying the mounts on which the scanners turn, twist and probe. We're confident, too, that in the future, we'll continue to furnish component parts that will enable us to spot bogeys 'way out there—yes, even 6,000 miles away! For a book on our company—its facilities, its people and accomplishments—just write to: The Steel Products Engineering Company, Springfield, Ohio, and ask for our new Plant Brochure.



**THE STEEL PRODUCTS
ENGINEERING COMPANY**



TITANIUM ALLOY EXTRUSION SHAPES produced by Harvey in experimental USAF program. Delivery on a semi-production basis is expected by yearend.

now quoting on future-aircraft and missile component designs submitted by major airframe manufacturers and prime subcontractors. These components include a wide variety of:

- **Wide, integrally stiffened skin panels** for wings and fuselages.
- **Large, hollow extruded shapes**, such as leading edges, fuel tanks for missiles.
- **Stepped and tapered configurations**, such as wing spars.
- **Large one-piece parts**, such as complete spars (web plus caps), normally extruded in smaller units, then fastened for one overall piece.

► **Large Sizes**—Trend now indicates that the largest demand for any one type of section will be the integrally stiffened skin panel. The 12,000-ton press will supply flattened panels up to 60 in. wide

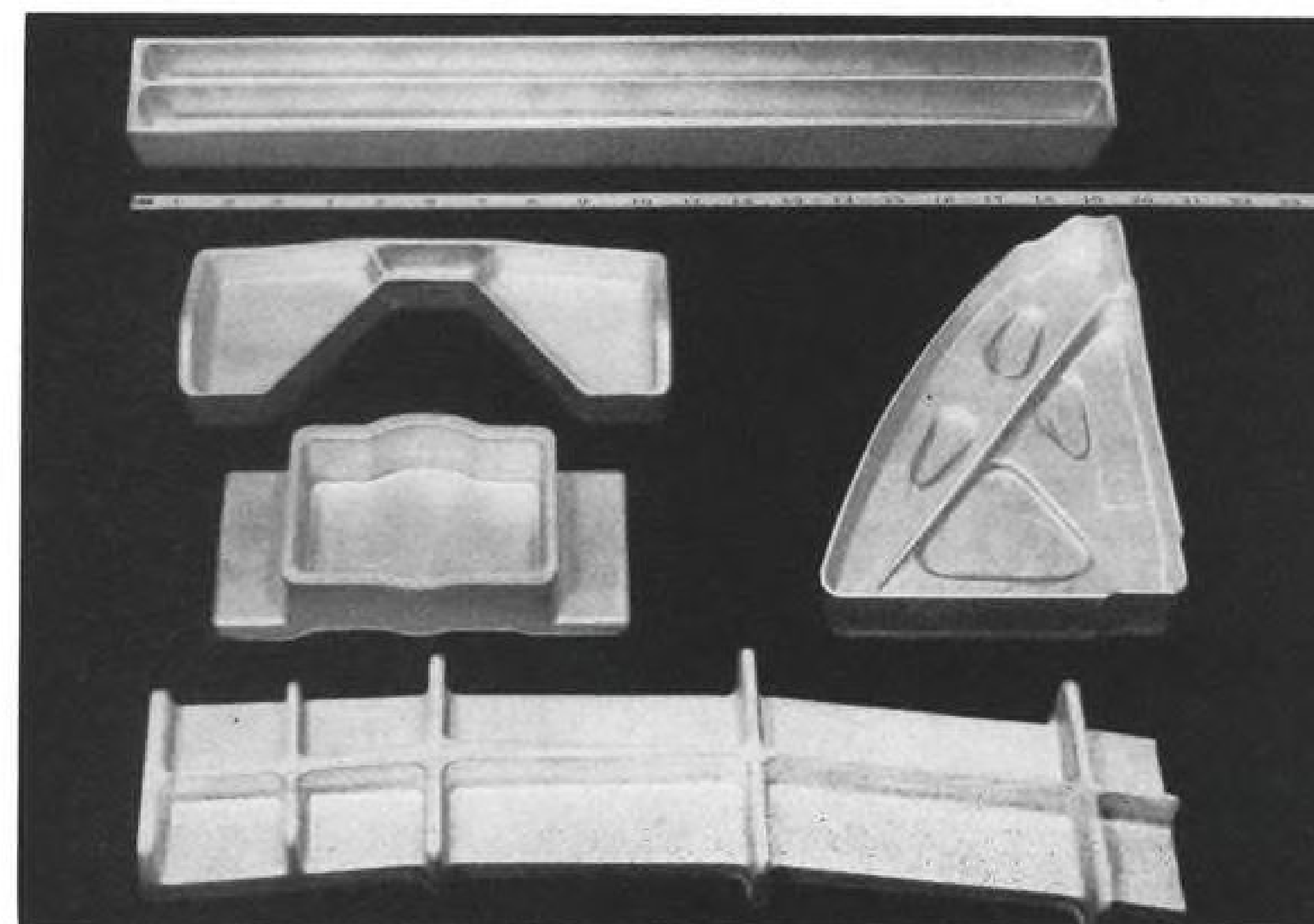
and as long as 80 ft. (limited by size of vertical heat-treat facility).

Minimum thickness generally expected at this time ranges between .100 and .120 in. with alloys such as 7075 (75S), 2014 (14S), 6066 (66S), and 7001 (HZM-100). Actual operating experience may vary these limits.

► **Steps & Tapers**—Stepped configurations, being produced at Harvey on 2,500- and 3,850-ton extrusion presses, will be available on the new presses with greater overall length and cross-sections and closer control of limits.

Tapered sections, generally considered to be in the development category today, should become more routine with the new presses, through refinements in alignment and mandrel control.

► **Equipment**—Supporting equipment is



CLOSE-TOLERANCE, NO-DRAFT PRESS FORGINGS include (on left, from top to bottom) stores ejector cap, ejection seat carriage rail, gun mount assembly bracket, engine air-duct vane support; (right center) airscoop frame forging.

A *New Approach* to PANEL LIGHTING



We are now manufacturing an absolutely shadowless edge-lighting fixture, used in edge-lighted panels, to illuminate the faces of back-mounted instruments. These fixtures conform to MS-25010 and MIL 7806. Part numbers 1900 with solder terminal and 1950 with screw terminal.

We Also Manufacture:

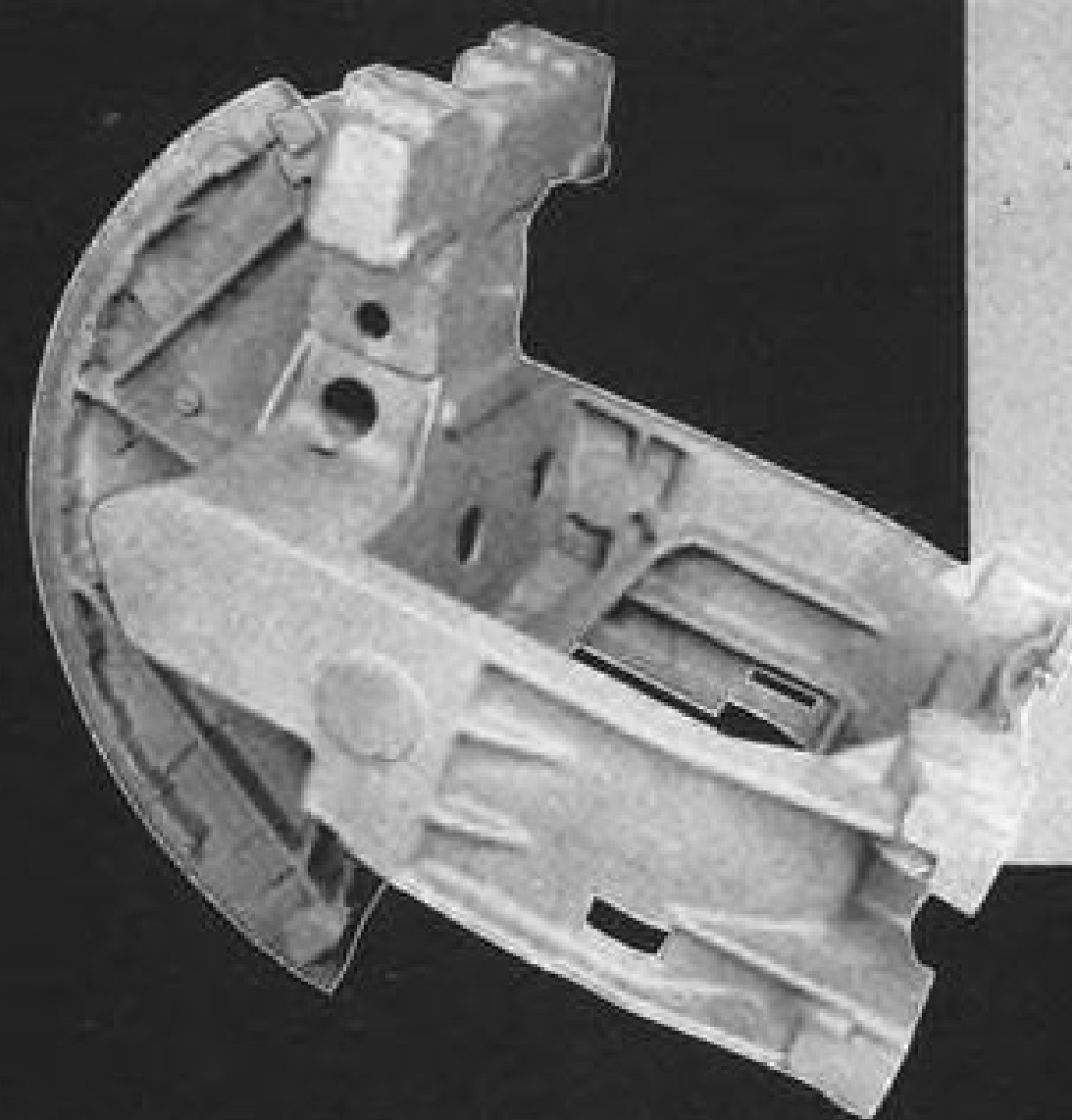
- CABIN LIGHTS - (Adjustable), READING AND COCKPIT FLOODLIGHTS.
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- ELECTRICALLY HEATED EQUIPMENT

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Rolle and Arma
solve another
casting problem...

COMPLEX STRESSED AREAS MADE THIS A CASTING NIGHTMARE

PROBLEM: Arma Division of American Bosch Arma Corp., Garden City, New York, knew the difficulties involved in casting the illustrated aircraft armament part before it left the drawing board. The part was characterized by complicated internal structure, with inequal wall sections, complex wall joinings, and intricate internal webbing. All of which made proper feeding and chilling of stressed areas extremely difficult. Yet, because of the tough service the casting would have to withstand, Arma required that the sand casting pass 100% x-ray examination to highest aircraft standards.

SOLUTION: Arma brought the drawings to Rolle, where experienced metallurgists and skilled foundry engineers attacked the problem from every conceivable angle. A unique core set-up was first devised to simplify feeding and chilling of important areas. Then a casting program was created, specifying every detail of every step in the casting process, from pouring temperature limits to heat treatment sequencing.

RESULTS: The complete story of this unusual part cannot yet be told, but sound castings are being produced at Rolle in production quantities, with each one meeting all of the rigid specifications.

YOUR CASTING PROBLEMS... whether they involve sand or permanent mold casting of aluminum or magnesium alloys... can always be solved quickly and economically if you bring them to Rolle. Write for free booklet on Rolle complete foundry service to Rolle Manufacturing Company, 309 Cannon Avenue, Lansdale, Pennsylvania.

PERTINENT DATA

Sand cast aircraft armament part.

Alloy Magnesium AZ91
Temper T-6
Size 36"x35"x23"
Weight 102 pounds

Fight weight with strength

with **ROLLE**
MANUFACTURING COMPANY

as much a part of the picture as the presses themselves. Thus, from a 42-ft. length limit for heat treat at Harvey today, the new facilities will almost double the length of part which can be handled.

Hydraulic stretch-straightener for the output of the new presses will exert pulls up to 1,500 tons to adequately handle the new, larger extrusions.

A complete ingot plant also is near completion, where aluminum will be alloyed and cast for the extrusion operation.

► **Titanium Work**—An active program with titanium alloys also is underway. Harvey now has a contract with the Air Force to investigate the extrusion of new titanium alloys (some of which are not yet commercially available) and the properties resulting from the extrusion process. Contract has been in effect about three months.

In addition to this, Harvey has been extruding titanium alloys on an experimental basis for the aircraft industry. These have included 4Mn-4Al, 3Al-5Cr, 3%Mn complex, 6Al-4V, RC-110AT and Ti-150A. Some of the shapes have been Ts and angles—basic configurations tailored to the customer's specs.

Extruding of titanium alloys has revealed a number of difficulties, as have other methods for processing these materials. Nevertheless, Harvey's development work has been very promising, it is reported. On basis of results it appears that the extrusion process will be one of the basic methods for producing structural shapes with the metal.

The company is expected to deliver titanium alloy extrusions on a semi-production basis before the end of the year. Full-scale capabilities may follow shortly thereafter.

► **No-Draft Forgings**—Another important phase of Harvey's work is the production of close-tolerance, no-draft forgings. Some of the no-draft units include items such as a stores ejector cap, engine air-duct vane supports, beam attach fittings and stiffener attach fittings.

In-process machining will be a big factor in conjunction with an 8,000-ton forge press also slated to go into operation in the fall of this year and procured under the AF heavy press program.

Aim of the in-process machining is to reduce forging tooling costs and produce parts competitive in size with those which ordinarily would have to be produced on a larger size press.

New Titanium Plant

Mallory-Sharon Titanium Corp. has completed a new melting plant at Niles, Ohio, which increases the firm's titanium capacity to 3 million lb. a year. The new plant uses four double-melting furnaces for melting titanium from sponge to ingot.



LOOK

at these facilities facts...



...and you'll
SEE WHY

FOOTE BROS. can serve you with the world's finest aircraft gears and power transmission units

There's a mighty good reason why many leading producers of aircraft engines and air frames see Foote Bros. *first* for precision gearing, power transmissions and mechanical actuators. It's because Foote Bros. offers a wealth of experience in design and production engineering and unmatched facilities for precision production. If you've never taken advantage of this unique combination, we would like to send you our newly-prepared booklet describing in detail the vast resources available and ready to serve your power transmission needs. Write for your **FREE** copy of the Foote Bros. facts on facilities today... it has important information you'll want to have on hand!

This trademark stands for the finest industrial gearing made!



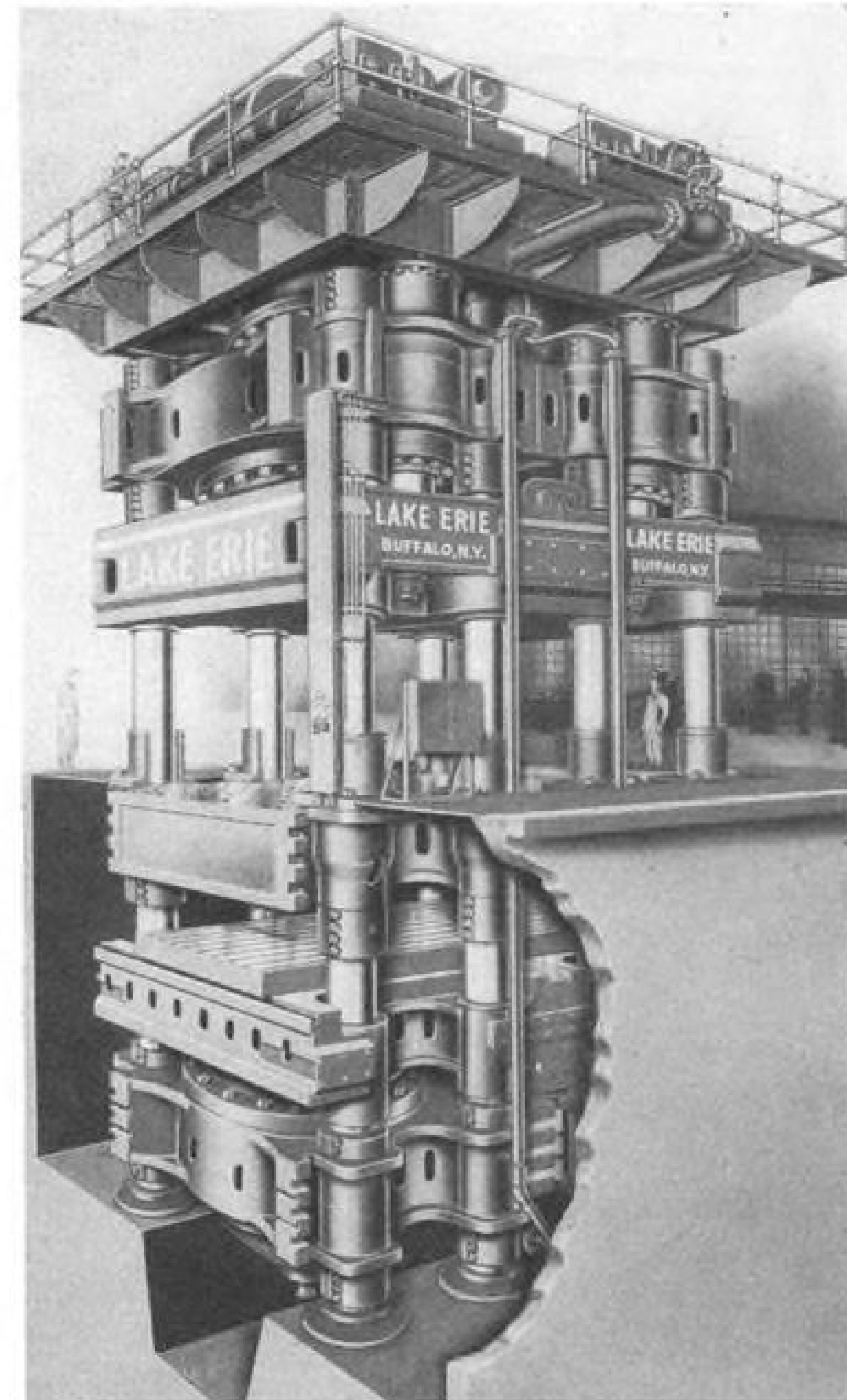
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1. AT WYMAN-GORDON . . .



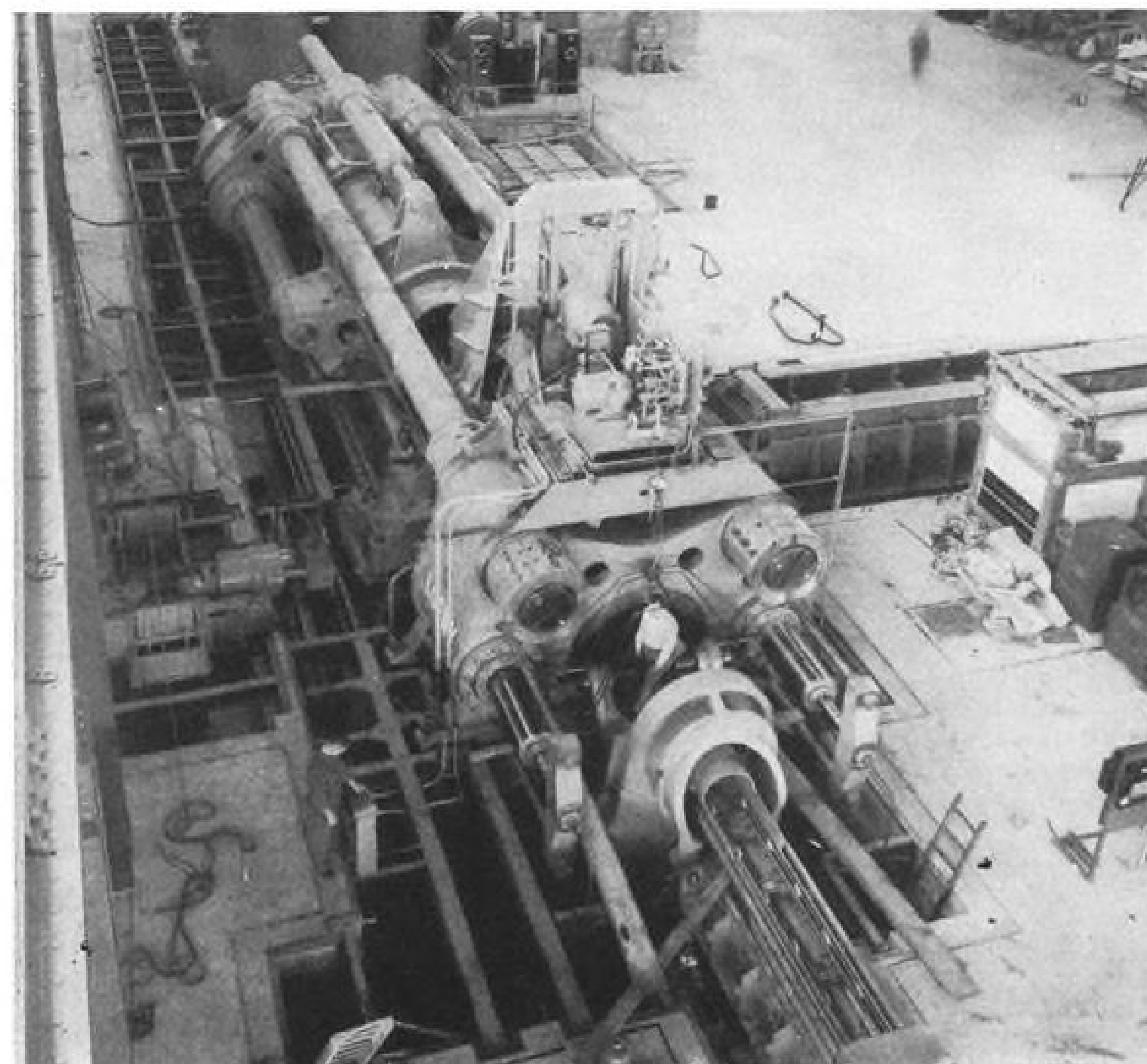
2. AT McDONNELL AIRCRAFT . . .

Industry Putting Giant Presses To Work

1. Convair F-102 aluminum wing spars were first production parts turned out by 35,000-ton closed die forging press. It is operated by Wyman-Gordon Co. at WG-USAF plant, North Grafton, Mass. Parts for Republic F-105, North American F-100, Boeing KC-135 jet tanker and other planes will follow.

2. Sheet metal forming will be job of 10,000-ton hydraulic press installed at McDonnell's St. Louis plant. Built by Lake Erie Engineering Corp., it comprises two 5,000-ton self-contained units. Additions can be made at either or both ends to give an aggregate press capacity of 20,000 tons.

3. Propeller blades, airframe parts will be among items turned out on this 12,000-ton steel extrusion press being readied for operation in June at C-W's Metals Processing Division, Buffalo, N. Y. Believed to be the largest of its kind in the world, press was built by Loewy Construction Co. It will also process titanium and non-ferrous alloys.



3. AT CURTISS-WRIGHT . . .

with the help of **EPON[®] RESIN...**

New paint prevents damage by hydraulic fluid, exhaust deposits, weathering on Douglas planes



Above right

Douglas DC-7, new record-breaking luxury airliner.

Applying Epon resin-based "Cat-A-Lac" to exterior wing section of a Douglas DC-7. Cat-A-Lac is manufactured by Finch Paint and Chemical Co., Torrance, California.



FIRE-RESISTANT hydraulic fluid, widely adopted by the airlines, attacks ordinary paint. Faced with this problem, materials experts of Douglas Aircraft Company began a search for a protective coating that would stand up to synthetic hydraulic fluid, as well as wind and rain, erosion at air speeds of 300-400 mph, and corrosive exhaust deposits.

In several years of investigation, more than 300 formulations were tested. But only "Cat-A-Lac" formulated from Epon resins, applied in exhaust path areas, was 100% intact after more than 1000 hours in actual airline service.

Because of the unusual durability

of Epon resin-based coatings, they have been adopted by Douglas and leading airline operators for plane areas exposed to hot exhaust gases, gasoline, hydraulic fluid and cleaning solvents.

If you want a paint that lasts longer, one that has excellent adhesion, resistance to abrasion and impact, ability to withstand extremes of heat, humidity and corrosive atmospheres . . . ask for Epon resin coatings. Call on our sales offices for names of suppliers. Write for the full Epon coatings story in the new brochure, "Planning to Paint a Pyramid?"

EPON resins are the epoxy polymers made exclusively by Shell Chemical Corporation.



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WHEREVER YOU FIND AIRPOWER, YOU'LL FIND LINK!



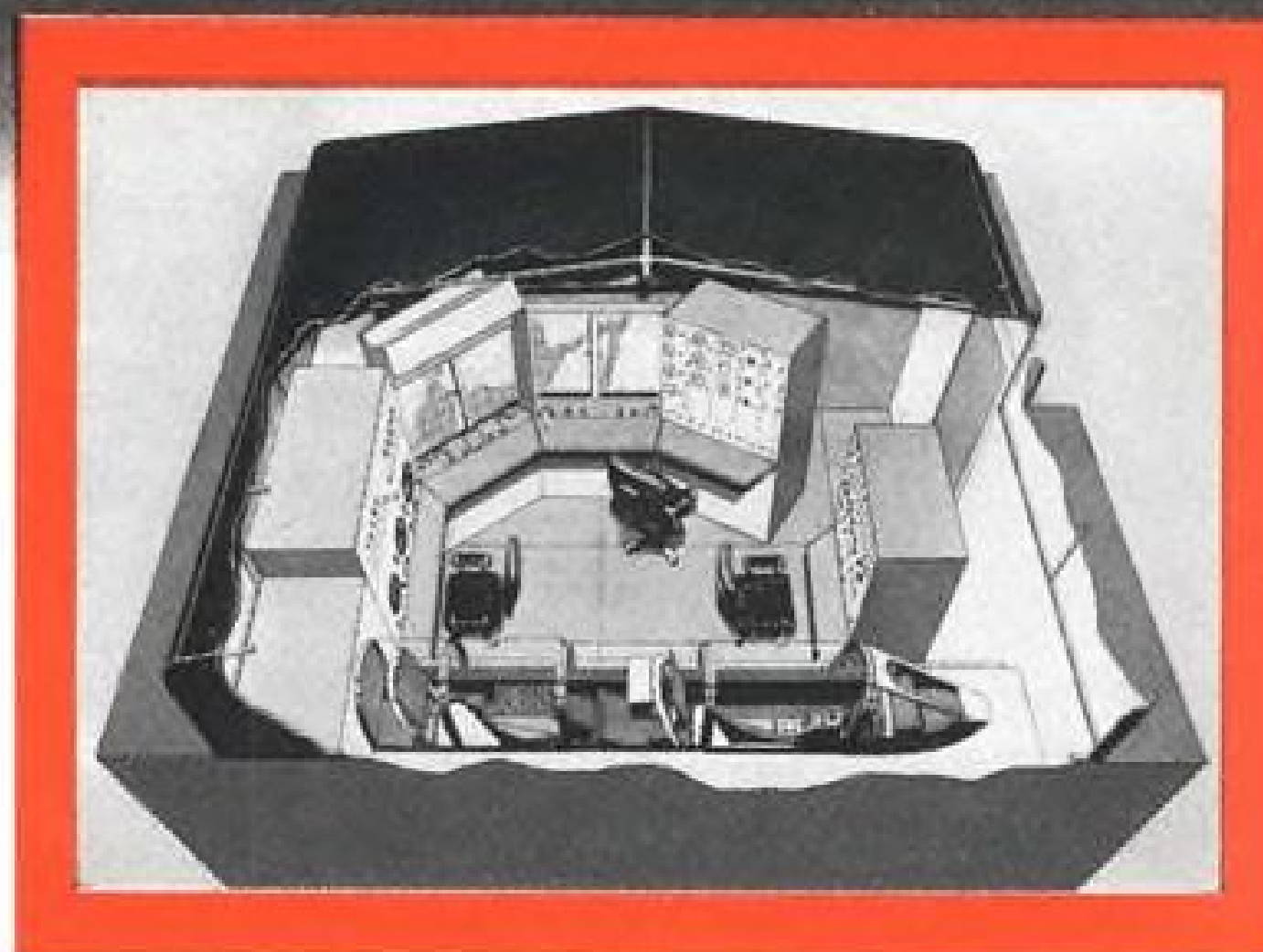
Meet one of the fightingest teams in our Air Defense Command!

Pilot and radarman of the Northrop F-89D Scorpion have difficult jobs to do, but they know their work well—long before they ever step inside their plane!

Rigorous training in Link's F-89D Jet Flight Simulator helps prepare both pilot and radarman simultaneously by duplicating on the ground the actual conditions they will meet when they fly their Scorpion.

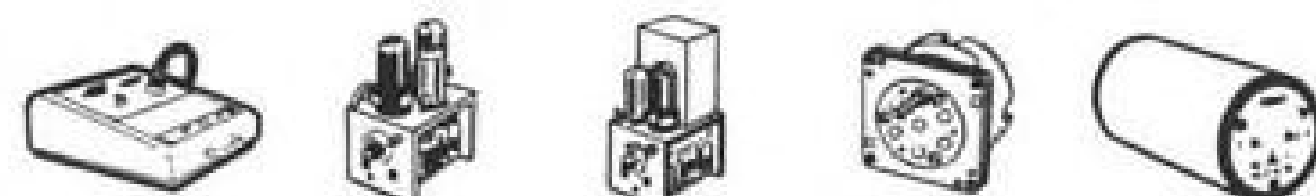
Link precision engineering re-creates exactly typical combat problems, cross-country flight, rough air, crash static and many other in-flight conditions. And, more important, the Link F-89D simulator reproduces precisely the Scorpion's "X-ray eyes"—the amazingly accurate radar system for fire control that makes this plane one of our deadliest air weapons. "Targets" are tracked and destroyed, "enemy planes" intercepted in astonishingly realistic missions, electronically duplicated on the ground.

In this way, Link helps the ADC pilot and radarman develop a working relationship with each other and with the mighty instrument of defense they will operate. Link helps them to work more efficiently, more effectively, in guarding America.



Fitting the sky between four walls, this Link F-89D Jet Flight Simulator, developed under Link basic patents, duplicates precisely the flight and radar characteristics of the Scorpion.

LINK INVITES APPLICATIONS FROM
QUALIFIED ENGINEERS AND DRAFTSMEN.



Manufacturers of world-famous Link trainers and simulators (such as F3D, B-47, F-89, F2H-2, F2H-3) • simulated aircraft instruments • specialized computers • servo mechanisms • computer components • gear boxes • friction over-drive clutches • precision potentiometers • ratio voltmeters • phase angle meters • and other electronic devices



Senator Seeks Titanium Data

Sen. James Murray, chairman of a Senate subcommittee on strategic metals, has requested comprehensive information on Air Force's utilization of titanium in aircraft and engines which will be used as a basis for future hearings.

Under the former chairmanship of Sen. George Malone, the subcommittee has continually prodded the Administration to increase titanium production in this country.

This is the data requested of Assistant Secretary of the Air Force Roger Lewis:

- A list of personnel handling titanium matters and their qualifications.
- The dollar appropriation for each year, starting with Fiscal 1952, for titanium research and development, applications engineering, product improvement, and fabrication, and an item-by-item justification.
- A list of titanium contracts let.
- The dollar value of all facilities furnished in support of aluminum, magnesium, steel, and titanium development, production, manufacturing, and fabrication under facility contract or lease agreement.
- The in-place weight of titanium and



Bandsaw Table Tilter

A telescoping leg fitted to a Do-All bandsaw table permits Temco Aircraft Corp. operators to change cutting angles precisely and quickly without need for assistance. Previously two assistants were needed for this operation: one to call out degree-of-tilt changes, another to support and move the table. The leg is a length of threaded rod fitting inside a 1 1/4-in. tube sleeve. An adjusting wheel meshes with the threaded drill rod. Table can be tilted to a maximum of 47 deg.

AVIATION WEEK, April 11, 1955

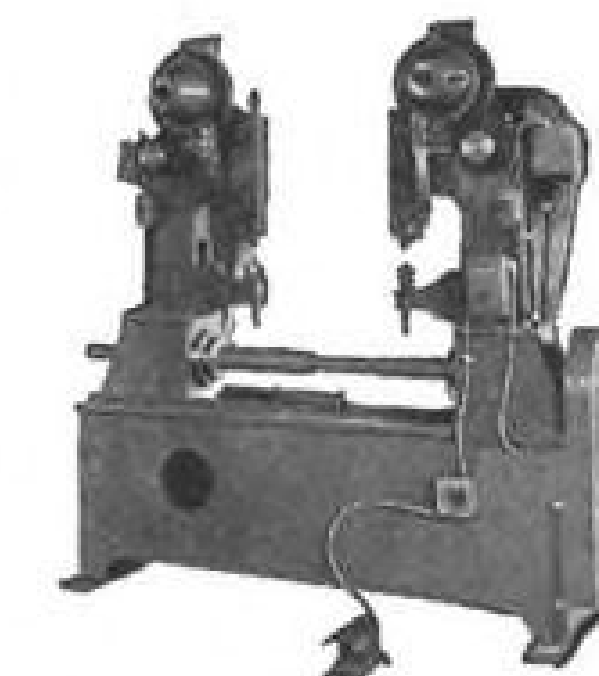
Save Labor...cut costs with

FASTER Riveting and Clinching!



RIVITORS

T-J RIVITOR used for automotive clutch plate assembly. Saves time and labor doing a four-fold job—assembly, setting, inspecting and ejecting.

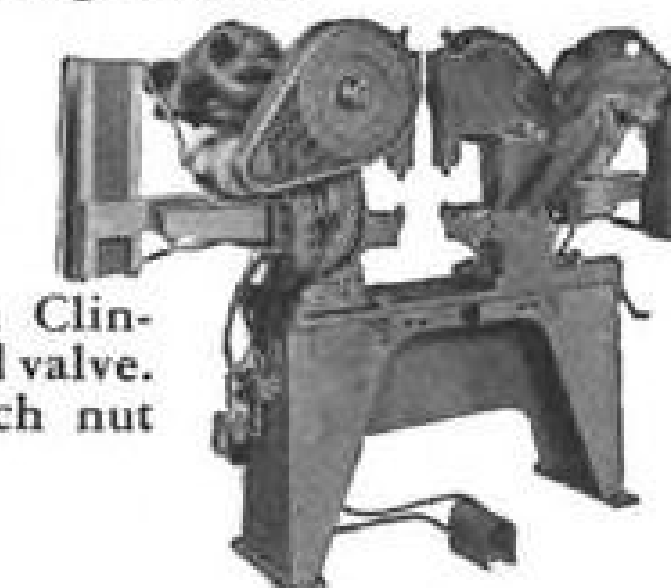


DOUBLE RIVITOR sets two rivets at a time! Equipped with 10" hoppers, and tooled to automatically feed and set two 1/4" dia. x 3/8" long wagon box head rivets at a time in elevator chain and raddle or elevator flight assemblies for farm implements. Controlled by one foot pedal.



CLINCHORS

T-J CLINCHOR... one of six special 8" throat Underfeed Clinchors used by a large automotive body manufacturer. Feeds and sets 11/16" square cased nuts in outside quarter panels, left and right hand.



DOUBLE CLINCHOR sets two nuts at once! Tooled to feed and set 3/8" x 1/2" x 1/16" thick Fabric-Steel nuts at each operation. Both Clinchors tripped by same foot-operated valve. Adaptable to wide range of clinch nut setting problems.

Automatic Feeding and Setting!

T-J meets your needs for labor saving SPEED in assembly... with performance-proved Rivitors and Clinchors for many jobs today... in aircraft, automotive, farm machinery, stampings of all kinds.

T-J CLINCHORS set clinch nuts 3 to 5 times faster! Fully automatic... controlled by a single foot pedal! Available in Underfeed and Gravity feed models, throat depths 8" to 36".

T-J RIVITORS automatically feed and set solid rivets... with high production! Electrically powered Rivitor sets 1/16" to 1/4" diam. solid steel rivets up to 3/8" long. Air-powered Rivitor sets aluminum alloy rivets up to 1/4" diam. or steel rivets up to 1/4" diam. and up to 3/4" long. Throat depths 8" to 36".

Write for Clinchor bulletin 847; Rivitor bulletins 646 and 847. The Tomkins-Johnson Co., Jackson, Mich.

37 YEARS EXPERIENCE



TOMKINS-JOHNSON

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

AIRBORNE

Where they're made. This is an aerial view of the main Aero Division plant in Minneapolis. Over 15,000 square feet of its 12 acres of modern plant are devoted to gyro assembly alone. Over 5,000 people work on aeronautical controls. Hundreds of these work exclusively on gyros, making Honeywell a leading specialist in the gyro business.

VERTICAL



Cageable Vertical Gyro, JG7044

Ideal as a vertical reference. For use in radar stabilization, fire control, bombing, navigation and flight control systems. Uncages in 3 seconds—cages in 10 seconds.



Vertical Gyro, JG7003

A proven vertical reference gyro with unusual reliability and sensitivity. Presently being used on autopilots, missiles and navigation systems.

No single gyro can meet all applications. One of these should match your needs.

GYROS

Why they're so dependable. Honeywell gyros are assembled in air conditioned, pressurized rooms guarded by a double air lock. To control lint and dust, workers are required to wear special caps and gowns. With test and production facilities unequalled in the business, Honeywell produces thousands of precision gyros a month.

FLOATED



HIG-4 Gyro, GG14

Lightweight, extremely accurate floated gyro being used on the latest fire control systems. Most accurate and sensitive of the miniature gyros.



HIG-5 Gyro, GG1

Most popular of the fully floated integrating gyros. There are over 15,000 of these versatile, precision gyros in use.



HIG-6 Gyro, GG12

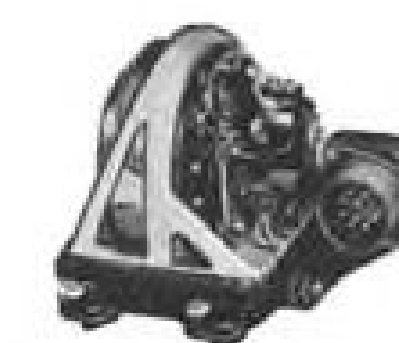
The world's most accurate production gyro. Yet a very small package that gives the extreme sensitivity and accuracy required for inertial stabilization.

RATE



Rate Gyro, JG7005

A general application rate gyro whose dependability and accuracy has been proven through many years of service in a multitude of different aircraft control systems.



Rate Gyro, GG13

Gives the ultimate in performance for a non-floated, damped Rate Gyro. Extremely rugged and light in weight.



Miniature Rate Gyro, GG16

A viscous damped, spring restrained rate gyro giving the qualities of high precision, small size and ruggedness needed for missile and flight control applications.

by **HONEYWELL**

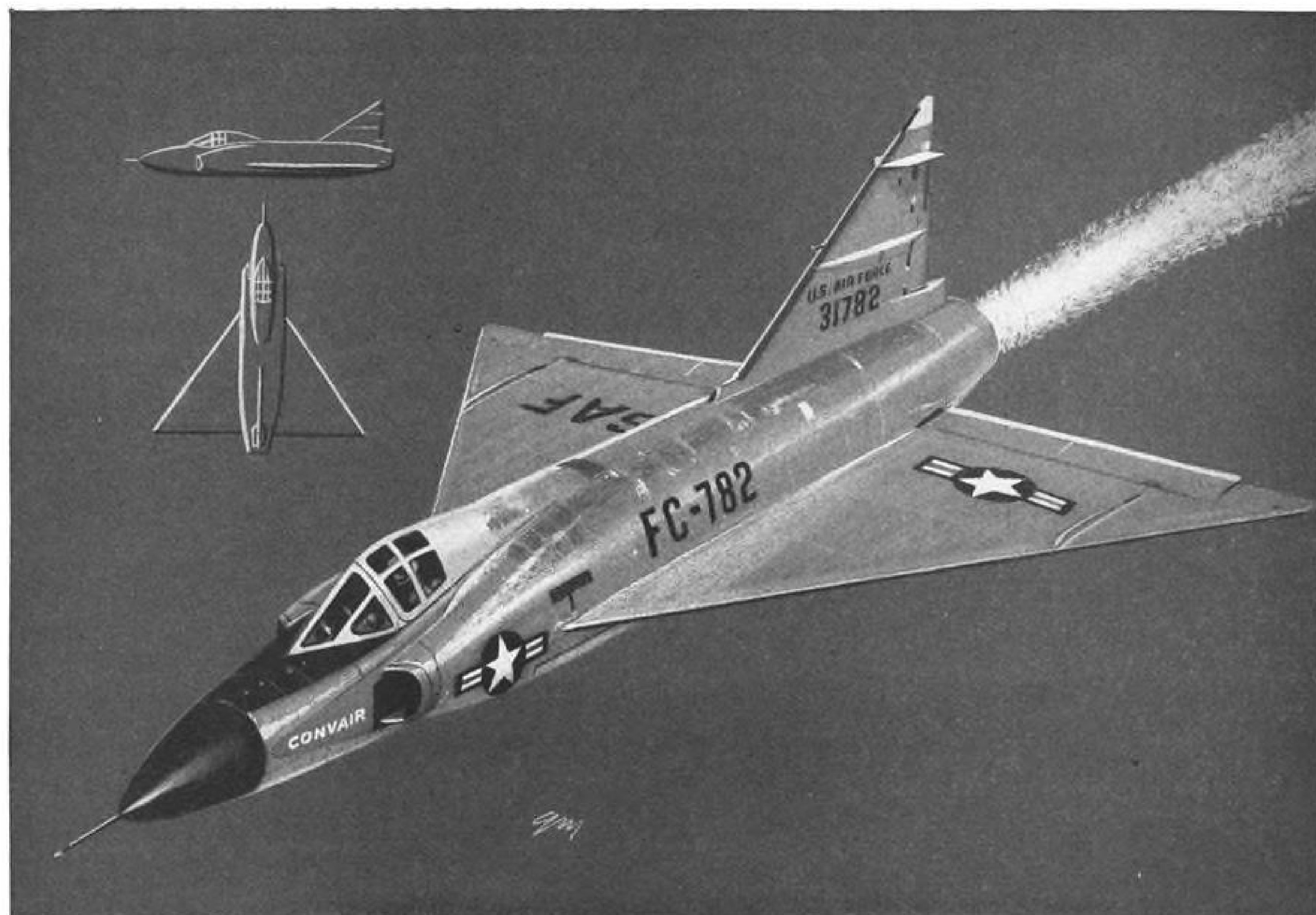
How to find out all about them. Honeywell gyros are available to manufacturers who require precision performance. For details write on your business letterhead to Dept. AW-4-53, at the address given below. Or, if you'd rather, pick up the telephone and call Sterling 1-8011 in Minneapolis.

2600 Ridgway Road, Minneapolis 13, Minnesota

MINNEAPOLIS
Honeywell

Aeronautical Division





CONVAIR F-102

Deadly New Delta-wing Interceptor

Powered by a Pratt & Whitney Aircraft J-57 turbojet engine with afterburner, the supersonic, delta-winged F-102 climbs like a rocket to altitudes reaching into the stratosphere. She is the latest 'round-the-clock interceptor, now in production at Convair Division of General Dynamics Corporation.

Like other jet aircraft, this new Convair interceptor has many parts made of Inco Nickel and Inco Nickel Alloys. That's because safe and satisfactory performance of supersonic aircraft demands that many parts have the unusual combinations of heat resistance, corrosion resistance, strength and ductility found in Inco Nickel and Inco Nickel Alloys.

At right you see where Inco Nickel Alloys supply outstanding properties for difficult service. Perhaps one of these alloys can solve your metal problem, too. Inco's Technical Service Section is ready to help you investigate. Why not outline your problem for their study.

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street, New York 5, N. Y.

WHERE INCO NICKEL ALLOYS ARE USED IN JET AIRCRAFT

Inconel Combustion liners Transition sections Insulating blankets Lock wire and rivets Fine fuel line tubing	Inconel "X" Turbine blades Rotor discs Afterburner bellows High temperature bolts
Inconel "W" Tail cones Afterburners	Nimonic Alloys Combustion liners Transition sections Vaporizer tubes Turbine blades Rotor discs
Incoloy "T" Transition sections Combustion liners	Nickel Electrical and electronic gear Alloying element in other materials
Monel Lock wire Fine fuel line tubing Rivets	



Nickel Alloys

MONEL® • "R"® MONEL • "K"® MONEL • "KR"® MONEL
"S"® MONEL • INCONEL® • INCONEL "X"®
INCONEL "W"® • INCOLOY® • NIMONIC® Alloys
NICKEL • LOW CARBON NICKEL • DURANICKEL®

of steel in each aircraft under contract.

- Assuming the substitution of titanium for steel in temperature zones of less than 900 deg. F., give the weight reduction for each turbojet engine under contract.

- Based on reduction in weight due to substitution of titanium for steel, estimate the improvement in performance of the aircraft under procurement in speed, range, rate of climb, length of takeoff strip, length of landing strip.

Portable Hoist for Turbojets, Missiles

A portable hoist, designed to handle jet engines, can be modified for loading and unloading missiles. It is air transportable, the manufacturer states, requiring only 25 min. for disassembly into five components with a net weight of 840 lb.

Designated Model H-1000, the new hoist is used by North American Aviation, Inc., Inglewood, Calif., for F-86 and F-100 turbojets. Operation takes two men.

The seamless tube frame, 14 ft., 4 in. high, 6 ft., 11 in. wide and 14 ft., 5 in. long with tow bar extended, supports a hand-operated Chisolm-Moore chain fall. Hoist is proof-loaded to tests of 11,000 lb.

Manufacturer is Regent Manufacturing Co., Downey, Calif.

USAF Contracts

Following is a list of recent USAF contracts announced by Air Materiel Command.

A.R.F. Products, Inc., 7627 Lake St., River Forest, Ill., dummy loads, 194 ea., \$27,180.

Acme Boat Co., Pearl St. at Big Four R.R., Miamisburg, Ohio, benches, work, wood, metal legs, 53 ea., \$25,716.

Aero Instrument Co., 11423 Vanowen St., N. Hollywood, switches, pressure, SPDT Aero model ASIA 1000-3, 600 ea., \$26,780.

Aerotec Corp., Comly Ave. & Pemberton Rd., Greenwich, Conn., switches, float, Aerotec, 106 ea., switches, pressure, Aerotec, 300 ea., \$29,162.

Bendix Radio Div., Bendix Aviation Corp., Towson 4, Md., transformer power filaments and plates, 1,000 ea., \$33,410.

Bomac Laboratories, Inc., Salem Rd., Beverly, Mass., tubes, electron, JAN type No. 4B31, 3,000 ea., tubes, electron, JAN type 1B58, 1,298 ea., \$171,920.

Cook Electric Co., 2700 N. Southport, Chicago 14, switches, pressure, 800 ea., \$25,806.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., switches, pressure, SPST, 397 ea., \$28,464.

Fisher Engineering, Inc., 2060 U.S. 24 E., P.O. Box 327, Huntington, Ind., transformers, 1,525 ea., \$35,227.

G. M. Giannini & Co., Inc., 580 Fifth Ave., New York 36, resistors, variable wound, 700 ea., \$35,147.

Polarad Electronics Corp., 100 Metropolitan Ave., Brooklyn 11, signal generators, 38 ea., signal generators, 47 ea., \$106,638.

Radio Corp. of America, RCA Victor Div., 19th and Federal Sts., Camden, N. J., power supplies, 149 ea., waveguide assemblies, 12 ea., yokes, deflection coil housing for tube

(Advertisement)

Valve Talk

for WM. R. WHITTAKER CO., Ltd.

by Marvin Miles,
Senior Member, Aviation Writers Assn.



How would you like to buy a \$3,000 precision-built aircraft valve for \$300? Or a \$1,500 valve for \$150?

In a sense that's the bargain you're getting when you buy Whittaker, for production of an average prototype costs the company from \$1,500 to \$3,000, although the initial valves sell for one-tenth the prototype price — and production units for about one-twentieth.

Why?

In the first place you must remember that valve production, like most other items in the supplier field, is a highly competitive business and not backed by development contracts such as are given airframe manufacturers for prototype aircraft or development programs.

Design and production of prototype valves is a speculative effort on a proprietary item. The company involved wins or loses according to its skill and business acumen, and if it over-reaches or under-reaches with any degree of consistency, it will fail.

Whittaker has expanded steadily because its planners know the business. They know what can and can't be done. They follow the trends and pinpoint upcoming demands—and they're ready for them when they appear.

And they back their decisions with Whittaker investment. Thus, if a company research project looks promising in view of all the criteria by which it is measured, or if the planners feel a good, efficient job can be done with a set of specs offered by a prime manufacturer, the green light flashes on.

Say a new airplane is taking shape. The builder needs four units of a special valve for a special function. Whittaker considers the requirements — wary of promises that can't be met — and bids on the job, figuring the initial investment will be, say, \$3,000, a gamble, if you like, with the backing of experience and capability. Say the bid wins.

Designers go to work and produce blueprints for the prototype shop, with its kitchen-clean maze of blue-and-grey milling machines, presses, grinders, lathes and measuring equipment.

But nothing is standard for a new valve, no fixtures, jigs, calibrating gear. The first units — plus an extra valve for the buyer and one for Whittaker test — must be virtually hand-carved from bar stock. The prototype crews must work with utmost care from point to point,

often taking hours for an operation that will eventually be accomplished in a few moments during production stage.

In a way it's exploration, tedious and oftentimes baffling, for a part requiring 30 operations may be ruined by the last operation. It may be held up for lack of special materials. It may jinx the sweating prototype men in one way and another for days before they conquer it. Then, when it goes to the test lab, they may find they haven't conquered it at all. From one (or many) false starts they must begin anew.

A change in military needs or prime manufacturer requirements may alter the project drastically at any time — even toss it out entirely under cancellation. Re-design may be necessary in increments of a millionth of an inch.

Still—starting from scratch and without special tooling — the shop turns out a new valve in an average two to three weeks, working perhaps a score of projects simultaneously, with another score on tap. Even so, you can readily see how the high production cost of prototypes mounts up in handwork and man-hours.

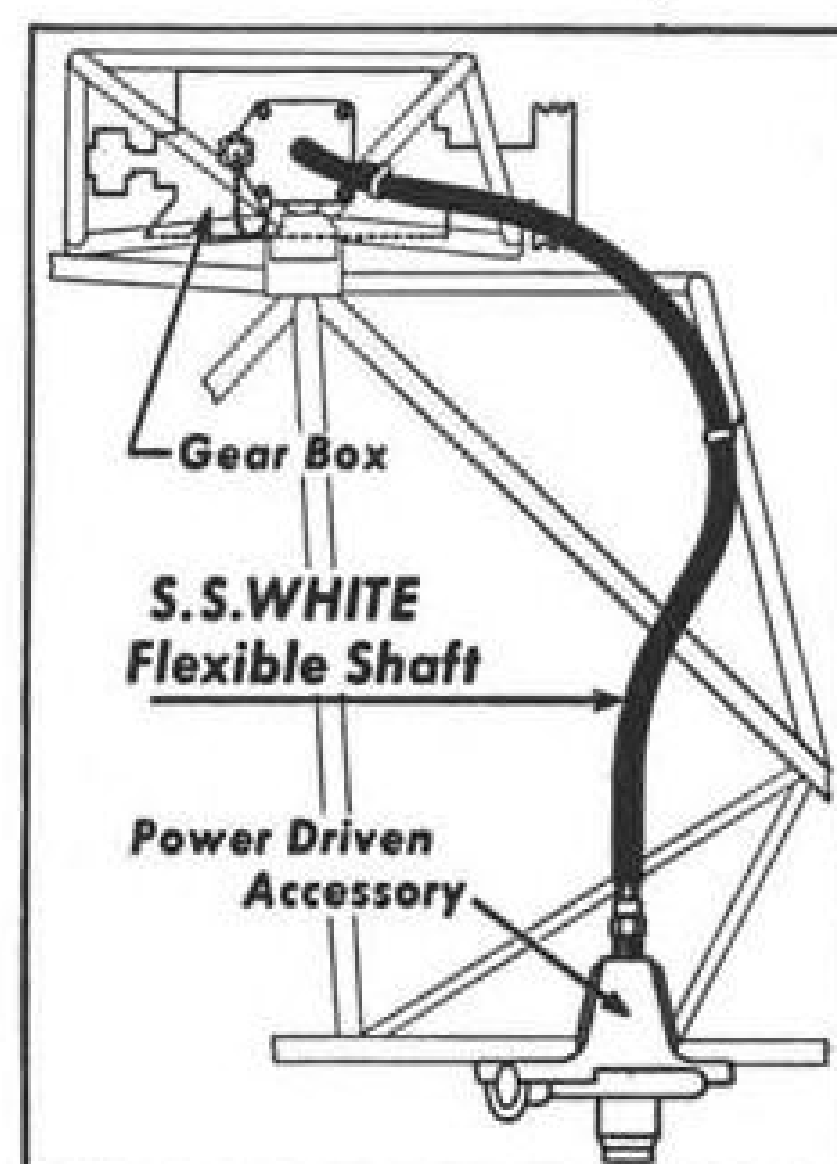
But because there are no contracts for design and prototype production, other than a specified per unit cost of the initial order, Whittaker takes up the expense, as do most other accessory manufacturers, and apportions it out over the entire field of its valve production to add but little to the price of each valve.

That's how you can buy a \$3,000 valve for \$300 — and for half that if you wait for regular production.

COST-SAVING IDEAS FOR DESIGN ENGINEERS

S.S.WHITE FLEXIBLE SHAFTS MAKE EFFECTIVE, LOW-COST DRIVES FOR PARTS AND INSTRUMENTS

The drawing illustrates the point. In this case, an auxiliary pump mounted on the bottom of a helicopter fuselage had to be driven from an accessory gear box. By using an S.S.White flexible shaft to transmit power between the two parts, the drive was accomplished with a minimum of parts and with big savings in installation and assembly time.



FLEXIBLE SHAFTS OFFER MANY ADVANTAGES

They are easy to install, they save parts, are completely dependable in operation, and often make possible simplifications in design which result in improved operation and lower manufacturing costs. It will pay you to investigate their advantages in your own products.

BULLETIN 5306 gives details on how to select and apply flexible shafts. Send for your copy. Address Dept. V.

THE S.S.White INDUSTRIAL DIVISION
DENTAL MFG. CO. 10 East 40th Street
NEW YORK 16, N. Y.

Western District Office • Times Building, Long Beach, California

deflection coil, 204 ea., supports, antenna, 128 ea., networks, pulse, 115 ea., \$60,605.

Radio Corp. of America, Tube Div., 415 S. 15th St., Harrison, N. J., tubes, electron transmitter, triode, general purpose, 62,000 ea., \$79,980.

Raytheon Mfg. Co., Receiving Tube Div., 55 Chapel St., Newton 58, Mass., tubes, electron, 7,100 ea., \$42,600; tubes, electron, transmitting, magnetron, 530 ea., \$46,375; tubes, electron, transmitting, rectifier, 2,450 ea., \$48,387.

Taylor Tubes, Inc., 2312 Wabansia Ave., Chicago 47, tubes, electron, transmitting, thyatron grid, 2,000 ea., \$39,900.

Triumph Mfg. Co., 1829 S. 55th Ave., Chicago 7, test sets, film magazine, 212 ea., \$98,452.

Western Electric Co., Inc., North Carolina Works, Winston-Salem, N. C., transformers, 280 ea., 100 ea., 20 ea., \$62,224.

Advertising Displays, Inc., Covington, Ky., photographic darkroom kits, 110 ea., 1 ea., \$90,597.

Airborne Accessories Corp., Hillside 5, N. J., assemblies, linear and data, 249 ea., \$57,751.

Beech Aircraft Corp., Wichita 1, propeller assys., 39 ea., \$54,748.

Bell & Howell Co., Chicago, spare parts, \$145,920; spare parts, \$78,031.

Bendix Aviation Corp., Bendix Products Div., South Bend, Ind., brake assys., 216 ea., 522 ea., 348 ea., \$656,066.

Bendix Aviation Corp., Eclipse-Pioneer Div., Teterboro, N. J., indicators, 1,401 ea., \$37,518; indicators, \$46,623; indicators, oil pressure, 1,210 ea., \$32,403; indicators, 650 ea., \$559,650.

Bendix Aviation Corp., Red Bank Div., Eatontown, N. J., voltage regulators, \$190,253.

Chicago Pneumatic Tool Co., Detroit, actuators, screwjacks and shaft assemblies, \$508,318.

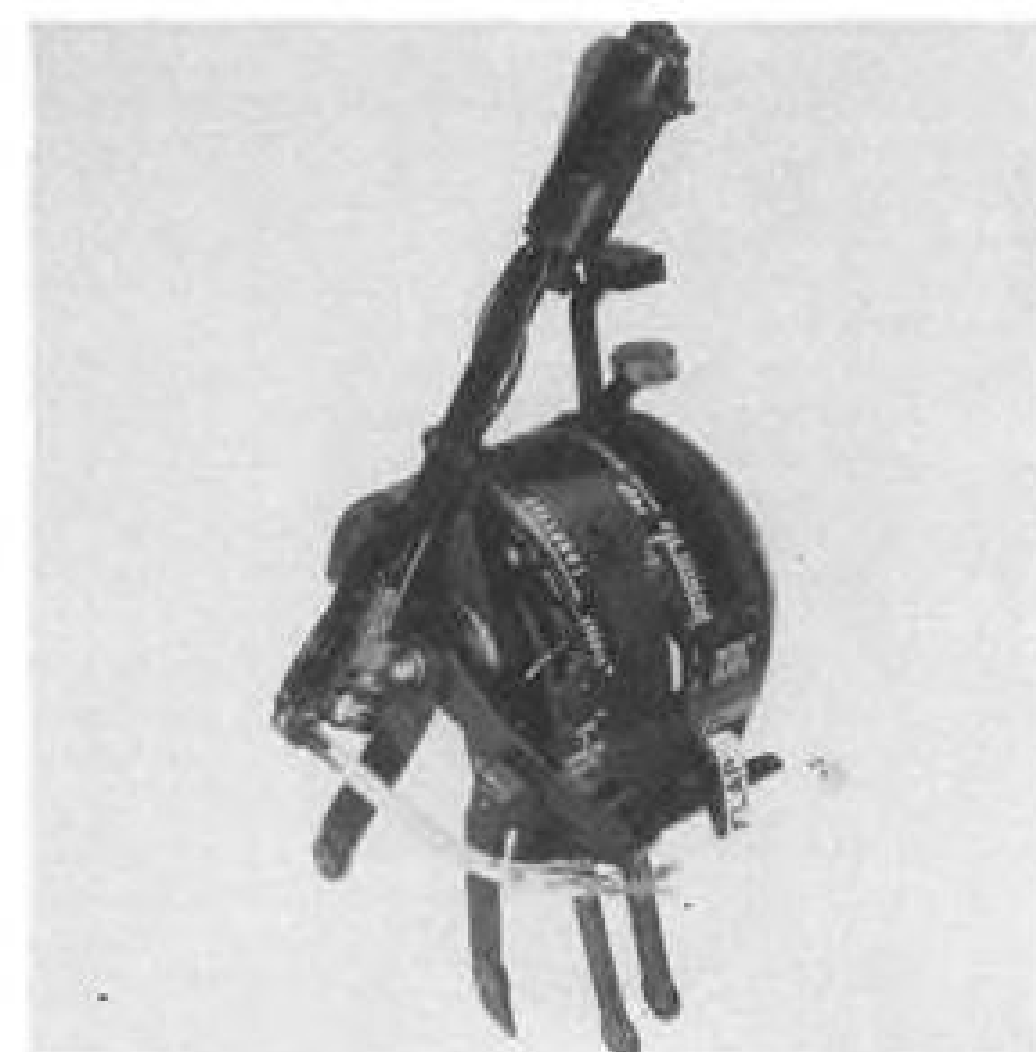
Continental Motors Corp., Muskegon, Mich., O-470-13B aircraft, engines, special tools & ground handling equip., 149 ea., \$476,140.

Curtiss-Wright Corp., Carlstadt, N. J., flight simulator trainers, spare parts, spec. tools and ground handling equipment, \$450,000.

Douglas Aircraft Co., Inc., Santa Monica, Calif., interior modification, \$130,000.

Farrand Optical Co., Inc., New York, Y-7 bombsights, 10 ea., \$428,621.

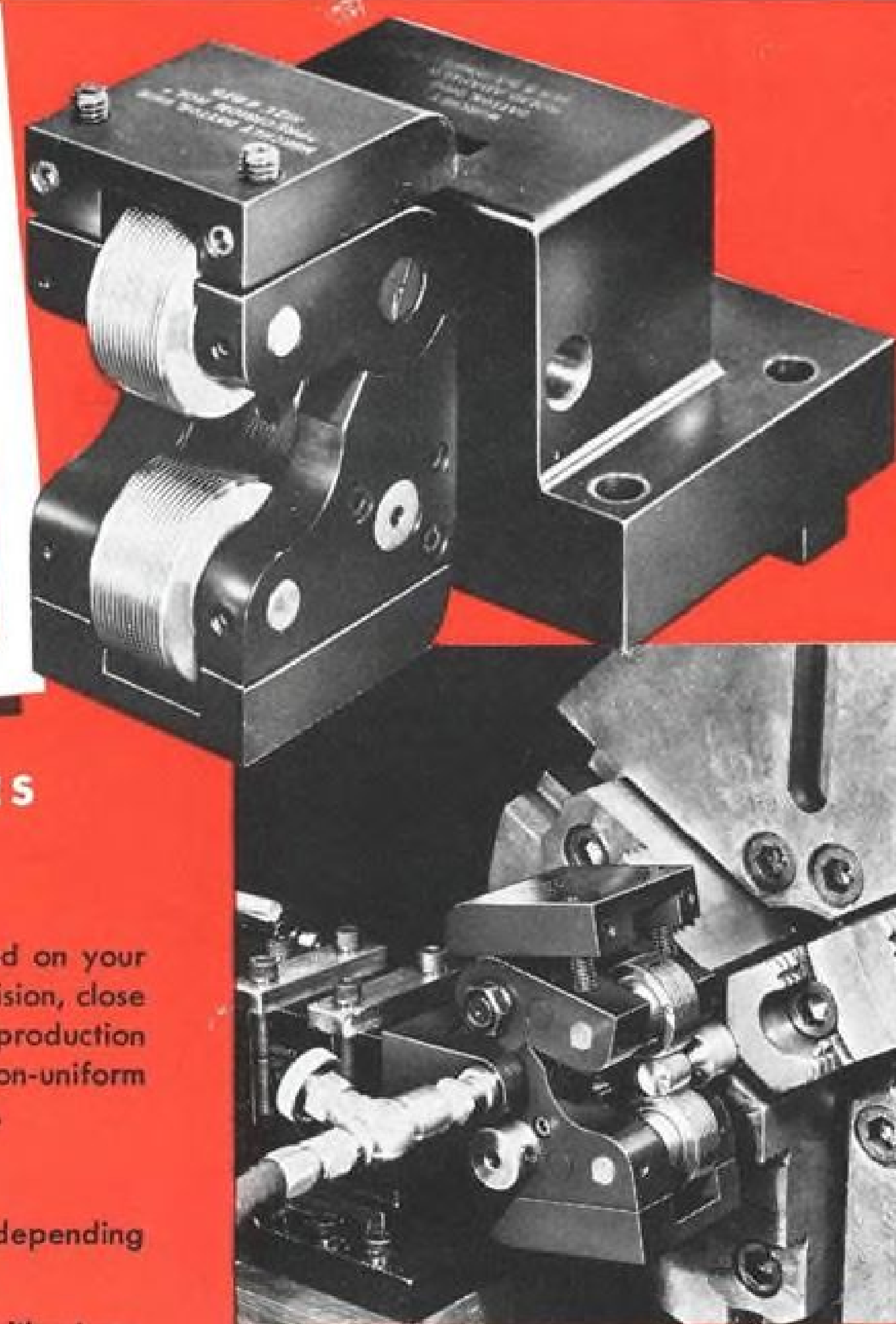
General Motors Corp., Allison Div., Indianapolis 6, turbojet engines, 69 ea., \$1,395,870; turboprop engines, \$120,900; turbojet engines, 107 ea., \$2,186,545.



T-28B Control Quadrant

Control quadrant of North American's T-28B advanced trainer is an all-in-one unit incorporating controls for throttle, propeller pitch, fuel mixture, supercharger, wing flaps, speed brake, mike switch, gyro caging, manual gun sight ranging system, and landing gear warning horn silencing switch. Quadrant is made by the Adams-Rite Mfg. Co., Glendale, Calif.

Roll THOSE THREADS for STRENGTH, ACCURACY and Overall ECONOMY on the Precision-Rol



EXCLUSIVE ADVANTAGES

- Just one adjustment for precision matching of rolls
- Just two adjustments to precisely set pitch diameter

The Sheffield-Murchey Precision-Rol attachment mounted on your automatic screw machine or turret lathe, rolls high precision, close tolerance uniform threads, right or left hand, at mass production rates. Annular or helical grooves, taper threads and non-uniform starts can be produced—also knurling and burnishing.

GEARING—All gearing TOTALLY ENCLOSED

ROLL LIFE—In excess of 100,000 work pieces, depending on material rolled—some jobs as high as 350,000

ROLL TIMING—Timing and adjustment of rolls without removal from the machine

Precision-Rol produces smooth finish threads with accurate lead. Write for Bulletin MU-PR454. Murchey Division, The Sheffield Corporation, Dayton 1, Ohio, U.S.A.

ACTUAL THREAD ROLLING CYCLES OBTAINED WITH PRECISION-ROL

PART	MATERIAL	THREAD	CYCLE TIME
TUBE FITTING	Aluminum	7/16-20 N.F.	3 Sec.
LOCK SCREW	4140 Steel	7/16-14 N.C.	5 Sec.
TUBE FITTING	Brass	7/16-20 N.F.	3 Sec.
STOP SCREW	4140 Steel	5/16-24 N.F.	5 Sec.
SPARK PLUG	Steel	3/4-20 N.F.	4 Sec.

See us at the
Machine Tool Show, Booth 1305



CAPACITIES OF STANDARD UNITS*

Attachment Number	Thread Diameter	Roll Face
437	0 to 3/4	3/4
875	1/4 to 3/4	3/4
1125	3/8 to 1 1/4	1 1/4
1500	3/4 to 1 1/2	1 1/2

*Special units can be furnished and installed.

aircraft
equipment
overweight?



NOT if it's LELAND

Whether your problem is weight, performance, or both, you can trust Leland to supply the answer, without sacrificing reliability.

Here, for example, is convincing evidence that Leland not only can, but has licked the problem of inverter weight, so vital in modern airborne equipment. And the same engineering skills, research facilities, and production experience are available to design your A.C. or D.C. power supply units.

Take a look at the chart at the right. Then bring your weight or performance problem to Leland. You'll be glad you did.

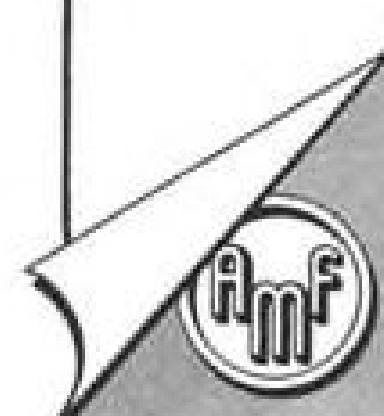
LELAND inverter weight averages 15.7% under specifications!

Description of Equipment	Max. Allow. Spec. Wt.	Leland Wt.	Weight Saved	Percent Under Weight Limit
E-5109 SE-16-2 250/250 VA	20.0 lbs.	13.0 lbs.	7.0 lbs.	35%
AN3532-1 SE-26-1 250 VA	18.25 lbs.	15.25 lbs.	3.0 lbs.	16.5%
*E-52804-2 SE-8-3 750/750 VA	30.0 lbs.	30.0 lbs.	—	—
AN3514-1 SE-6-2 750 VA	35.0 lbs.	30.5 lbs.	4.5 lbs.	13%
AN3534-1 SE-2-2 750 VA	35.0 lbs.	30.5 lbs.	4.5 lbs.	13%
AN3515-1 SD-135-4 1500 VA	43.0 lbs.	37.5 lbs.	5.5 lbs.	13%
E-1737 SE-5-2 1500/1250 VA	48.0 lbs.	39.0 lbs.	9.0 lbs.	19%
AF53C6767 SE-15-1 1500 VA hi alt.	45.0 lbs.	40.0 lbs.	5.0 lbs.	11%
E-54806-1 SE-20-2 1500 VA hi alt.	45.0 lbs.	41.0 lbs.	4.0 lbs.	9%
E-1725-1 SE-9-1 2500/2250	60.0 lbs.	41.0 lbs.	19.0 lbs.	32%
E-54807-1 SE-23-1 2500/2250 VA	62.0 lbs.	45.0 lbs.	17.0 lbs.	27%
*AF53C6016 SE-24-1 2250 VA	41.0 lbs.	41.0 lbs.	—	—

*Specification Weight established from Leland Unit.



Write
THE LELAND ELECTRIC COMPANY, Division of
American Machine & Foundry Company
Dayton 1, Ohio



Navy Contracts

Contracts recently announced by the Navy's Aviation Supply Office, 700 Robbins Ave., Philadelphia 11, are:

Aeroproducts Operations, Allison Div., General Motors Corp., Municipal Airport, Dayton 1, services and material, \$117,700.
Aerotec Corp., Comly Ave. & Pemberwick Rd., Greenwich, Conn., switches, \$33,997.

AiResearch Mfg. Co., 9851-9951 Sepulveda Blvd., Los Angeles 45, kits, 90 ea., \$48,249.
Atlas Paint & Varnish Co., 32-50 Buffington Ave., Irvington 11, N. J., paint & varnish, \$180,089.

Bendix Products Div., Bendix Aviation Corp., South Bend, Ind., maintenance parts for various aircraft, \$76,103.

Eclipse Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., transmitters, 162 ea., \$40,822.

Goodyear Tire & Rubber Co., Inc., 1144 E. Market St., Akron 16, wheel assys., 622 ea., \$122,198.

Kochler Aircraft Products Co., Inc., 814 Vermont Ave., Dayton 4, fuel valves, \$38,537.

Lewis Engineering Co., 339 Church St., Naugatuck, Conn., indicators, 306 ea., \$26,010.

Ludwig Honold Mfg. Co., Chester Pike & Folcroft Ave., Folcroft, Pa., metal containers for HRS blades, 100 ea., \$36,405.

Mario Papa & Sons, Inc., 121 S. Main St., Gloversville, N. Y., gloves, 13,536 pr., \$28,412.

Nash Engineering Co., South Norwalk, Conn., booster pumps, parts, 40 ea., \$47,125.

United States Gauge Div., American Machines & Metals Inc., Sellersville, Pa., fuel gages, \$40,219.

Weston Hydraulics Ltd., N. Hollywood, valve assys., 596 ea., \$29,800.

Atlas Paint & Varnish Co., 32-50 Buffington Ave., Irvington 11, N. J., enamel, \$97,144.

Barber-Colman Co., Rockford, Ill., actuators for use on AJ-2 & spare parts, \$25,484.

Bell Aircraft Corp., P.O. Box 482, Fort Worth, Texas, bubble assy.; parts, \$32,828.

Bruning Brothers, Inc., 4209 E. Chase St., Baltimore 5, Md., paint, oil, 12,000 gal., \$25,800.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., indicators, \$25,274.

Erlicott Johnson Corp., Endicott, N. Y., shoes, leather flight shoes, 10,575 pr., \$59,167.

Hub Paint & Varnish Co., Inc., 47-32 Fifth St., Long Island City 1, N. Y., paint, oil exterior, 24,000 gal., \$44,810; paint, 18,200 gal., \$35,406.

Aerial Machine & Tool Corp., 38-27 30th St., Long Island City 1, N. Y., safety belts, 10,000 sets, \$40,720.

Aeronautical Machinery Corp., Inc., c/o Nestor Johnson Mfg. Co., 1900 N. Springfield Ave., Chicago 47, jacks, 40 ea., \$30,491.

American Chain & Cable Co., Inc., 601 Stephenson Bldg., Detroit 2, tow target cables, 1,304 ea., \$473,469.

Aro Equip. Corp., Enterprise & Trevitt Sts., Bryan, Ohio, oxygen regulators and diaphragm assys., \$40,064.

Aviators Clothing Co., Inc., 143 Main St., Beacon, N. Y., kits, 2,280 ea., \$128,660; rafts, 1,485 ea., \$40,496.

Bendix Products Div., Bendix Aviation Corp., South Bend 20, Ind., maintenance parts to support control assys., fuel, \$35,884; carburetors, 51 ea., \$65,626; master controls, 212 ea., \$294,078.

Commercial Research Laboratories, Inc., 20 Bartlett Ave., Detroit 3, test stands, 2 ea., \$58,670.

Curtiss-Wright Corp., Wright Aeronautical Div., Wood-Ridge, N. J., kits, 550 ea., \$44,127.

Douglas Aircraft Co., Inc., 3000 Ocean Park Blvd., Santa Monica, Calif., services and repair parts, \$35,525.

Gill Electric Mfg. Corp., 624 W. Cirtus Ave., P.O. Box 431, Redlands, Calif., batteries, 3,000 ea., \$250,470.

Herman Nelson Div., 1824 Third Ave., Moline, Ill., spare parts for preheaters, \$49,180.

Western Gear Works, Box 192, Lynwood, Calif., gear boxes, 83 ea., \$56,007.

**"A COOL CAT" —
WHEN THE HEAT'S ON!**



Stainless Steel
Engine Shroud
48" dia. x 84"

Stainless Steel
Tail Pipe
26" dia. x 40"

ENGINE SHROUD AND TAIL PIPE assemblies by

Lavelle help keep these Grumman Cats cool, when "full power jet heat" is on.

Producing precision components to withstand tremendous stresses at high temperatures and jet speeds, demands the finest in fabrication. Experienced craftsmen, modern fabricating equipment and extensive welding facilities, enabled Lavelle to produce these stainless steel engine shroud and tail pipe assemblies to Grumman's exacting specifications in quantity . . . and deliver them on time!

This same capacity for efficient, quantity production of intricate parts and assemblies is ready to serve you . . . when you call on Lavelle for your fabricating needs.

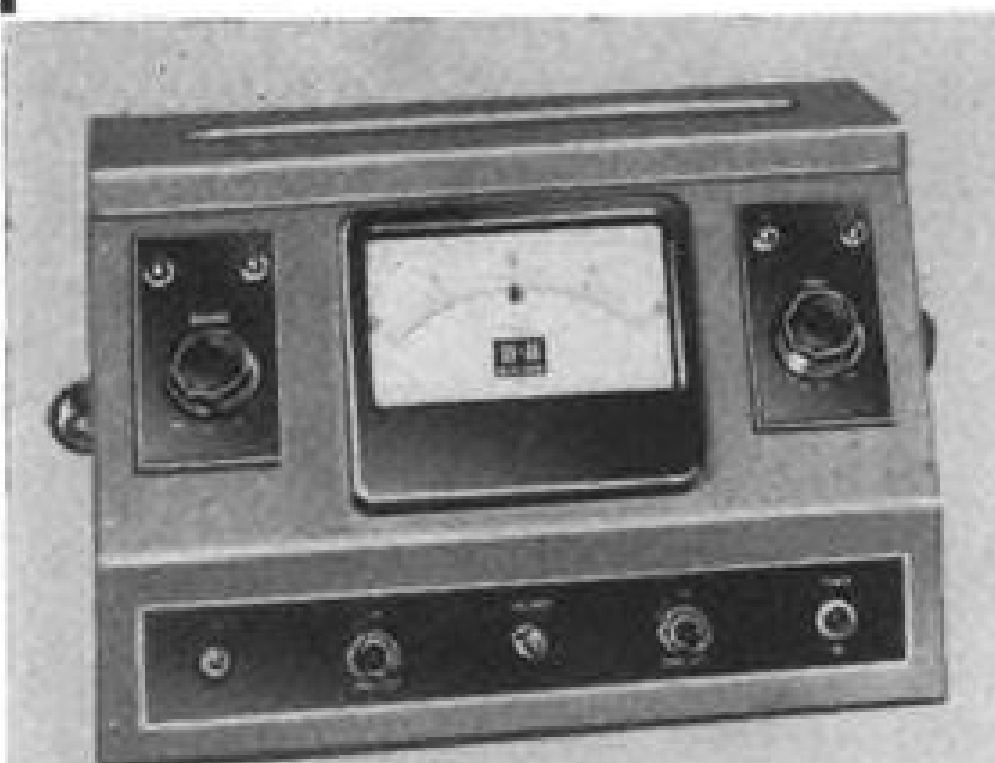
A new brochure describes Lavelle's specialized fabricating services. Write for a copy without obligation.

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D & B RESEARCH BALANCING MACHINE



MEANS:

- LESS BALANCING TIME
- ACCURATELY BALANCED PARTS
- GREATER SENSITIVITY
- LOW OPERATING COST



Kaman Aircraft Corp. Now Balances Their Helicopter Rotor Blades And Assemblies On a Dean And Benson Machine

Let Dean & Benson Staff Assist You On Your Balancing Problems—Inquiries Invited.

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PRODUCTION BRIEFING

► Brooks & Perkins, Inc., Detroit, is now rolling magnesium-thorium alloy HK31XA sheet and plate, for jet engine and missile applications.

► Barry Controls, Inc. is the new name for former Barry Corp., Watertown, Mass. Firm specializes in shock and vibration isolators.

► Precision Products, Inc., 1308 South 28th St., Phoenix, Ariz., is new firm specializing in manufacture of tools, dies and small components for the aircraft industry. President is Alexander Root, formerly with Boeing Airplane Co., Seattle.

► Product Packaging Engineering, Culver City, Calif., is new name for Fox Hills Tool & Die, maker of heat-sealing and packaging machinery, aircraft and industrial tools and dies.

► Measuring abrasion resistance of organic coatings on metals, regardless of gloss, color, thickness or surface area, can be done with new technique developed by National Bureau of Standards, Washington, D. C. Carbon dioxide gas under controlled pressure propels an abrasive powder from a vibrating storage chamber through a nozzle at high speed. Accurate measurement of the effects is possible.

► Deutsch Co., Los Angeles, is now manufacturing and distributing complete line of AN electrical connectors formerly made by Monowatt Division, General Electric Co., Providence, R. I. Deutsch also will make an improved quick disconnect, potted connectors and hermetically sealed connectors.

► Douglas Aircraft Co., Inc., El Segundo Division, Calif., plans to occupy a new \$426,300 structure for Controls Laboratory of Engineering and to display full-scale mockups. An electronic analog computer will be used for development and analysis of aircraft flight and fire control systems.

► Permacel Tape Corp., New Brunswick, N. J., has moved its Dallas, Tex., division warehouse and office to 9000 Denton Drive, Dallas 20.

► Robey Rotor, Inc., Culver City, Calif., has expanded its facilities. Firm makes sub-miniature and miniature rate and directional gyros, vertical gyros, synchronous a.c. motors and miniature d.c. motors. Aerosmith Instrument Co., Hawthorne, Calif., former exclusive sales agent for Robey, has become a part owner of the firm.

WE'RE LOOKING FOR ENGINEERS WITH ABILITY

Stratos—now developing new air-conditioning systems, air-turbine drives, controls and other pneumatic accessories for aircraft and industry — is interviewing well-qualified men as

RESEARCH ENGINEERS

For investigations and studies in pneumatic refrigeration and very high speed power turbines.

PROJECT ENGINEERS

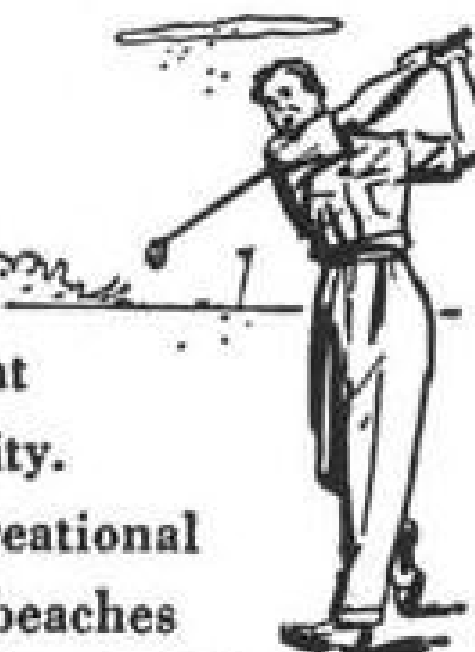
Several — Intermediate and Junior.

DESIGN ENGINEERS

Seniors and Juniors.

Write to R. T. Bartlett, outlining your qualifications for these interesting and challenging positions. Your correspondence will be kept in complete confidence, of course.

Excellent housing available in area. Convenient to New York City. Wonderful recreational facilities. Fine beaches — Fishing, Boating, Golfing.



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Manufacturers of air-conditioning equipment and pneumatic accessories for high speed aircraft.

LORD FACTS ON VIBRATION

ANYONE CAN MAKE VIBRATION CONTROLS

Practically every mechanism is subjected to either destructive wear or impaired performance because of vibration or shock . . . and practically anyone could make a unit to "solve" these problems to some degree. It is important, however, that the vibration control units contribute to improved operation and efficiency of the mechanism—and at reasonable cost.

The use of makeshift or incorrectly applied units usually makes the condition worse instead of better.

LORD has devoted over 30 years to the successful solution of thousands of vibration and shock problems. LORD research, engineering, and production facilities have produced over 27,000 types of highly effective control units for all kinds of applications.

Exceptional engineering and manufacturing skills plus the use of only the best materials provide users of LORD products with several outstanding advantages:

EFFECTIVE VIBRATION ISOLATION—LORD units reduce operating vibration, shock, and noise to the lowest practical level—over a long, service-free operating life.

LOWER MAINTENANCE COSTS—Effective isolation provided by LORD systems reduces destructive vibration—lowering maintenance adjustment and parts replacement costs.

FLEXIBILITY IN USE—LORD extensive design and production facilities have developed a group of standard mountings of several types. These are adaptable to many standard vibration control applications and provide effective and economical solutions to a wide range of problems.

The extensive facilities at LORD are available on request for solution of your problems, whether they are simple or complex. Simply call or write the Home Office, Erie, Pa. or the LORD Field Engineer nearest you.

LORD MANUFACTURING COMPANY • ERIE, PENNSYLVANIA

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NEW YORK, N. Y. Circle 7-3326	PHILADELPHIA, PENNA. LOcust 4-0147
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PLATE FORM MOUNTINGS



BINAURAL MOUNTINGS



TUBE FORM MOUNTINGS



CHAN-L-MOUNTS



TENPROOF MOUNTINGS



FLEXIBLE COUPLINGS



DESIGNERS AND PRODUCERS OF BONDED RUBBER PRODUCTS

SINCE 1924

WHAT'S NEW

Telling the Market

Data on vibration, and products to alleviate the phenomenon, are included in Bulletin 616 offered by MB Manufacturing Co., Inc., New Haven, Conn. . . . **Alloys Steels Pay Off** is title of 200-page handbook aimed at engineering, purchasing and management personnel. More than 60 case histories of use of this material in modern equipment are given. Write on letterhead to Climax Molybdenum Co., 500 Fifth Ave., New York 36.

Rack and panel ribbon-type contact electrical connectors, available in pin polarization and new barrier polarization, are described in Catalog R1, available from American Phenolic Corp., Chicago 50. . . . Uses of pressure-sensitive tapes for numerous metalworking operations are given in 56-page manual being distributed by Minnesota Mining & Manufacturing Co., Dept. P-537, St. Paul, Minn.

Two grade of RC 55 and RC 70 titanium tube and pipe with advantages and applications, physical properties and handling characteristics, are described in bulletin being distributed by

Alloy Steel Tube Division of Carpenter Steel Co., Union, N. J. . . . **Universal joints** are comprehensively described and applications given in 12-page catalog available from Joint Division of Gear Grinding Machine Co., 3901 Christopher, Detroit 11.

Colonial "4" convertible broaching machine, capable of horizontal pull broaching and vertical push and pull-down broaching and press work, is covered in Bulletin FW-55. Write Colonial Broach Co., Box 37, Harper Station, Detroit 13. . . . **Full-view Rotameters** for measurement and control of flow are detailed in Bulletin 115 being distributed by Brooks Rotameter Co., Lansdale, Pa.

Type 21-103C mass spectrometer, capable of determining composition of mixtures with as many as 30 or more components varying in weight and complexity, is described in Bulletin 1800C available from Consolidated Engineering Corp., 300 N. Sierra Madre Villa, Pasadena 15, Calif. . . . **New high-pressure molding techniques** for economical production of glass-reinforced plastics in complicated shapes with metal inserts, if required, are covered in Bulletin GRP-1 by American Hard Rubber Co., 93 Worth St., New York 13.

Recommendations for minimizing porosity in aluminum castings are given in Producing Leakproof Aluminum Castings. Write George Sall Metals Co., 2300 E. Butler St., Philadelphia 37, Pa. . . . **Subcontracting activities** of Mack Equipment & Machine Co. are provided in brochure; 327 N. Indiana Ave., Atlantic City, N. J.

Selection tables, instructions and installation data on new screw-lock insert is given in Bulletin 715-B available from Heli-Coil Corp., Danbury, Conn. . . . Details on small 28-v. dc. continuous-duty motor for applications requiring high torque and good speed regulation are given in Form PM4-954. Write Dalmotor Co., 1315 Clay St., Santa Clara, Calif.

Technical data on 17-7 PH (precipitation-hardening) wire providing corrosion resistance and elastic qualities similar to high-quality spring steels and music wire are given in bulletin available from National Standard Co., Niles, Mich. . . . **Numerous types of materials handling and storage equipment**, including stackbins, stackracks, pallets, trucks and tool storage items are covered in booklet being distributed by Stackbin Corp., 1311 Main St., Pawtucket, R. I. . . . Complete standard line of Type FSR RF interference suppression filters is provided in catalog by Filtron Co., Inc., Flushing, N. Y.

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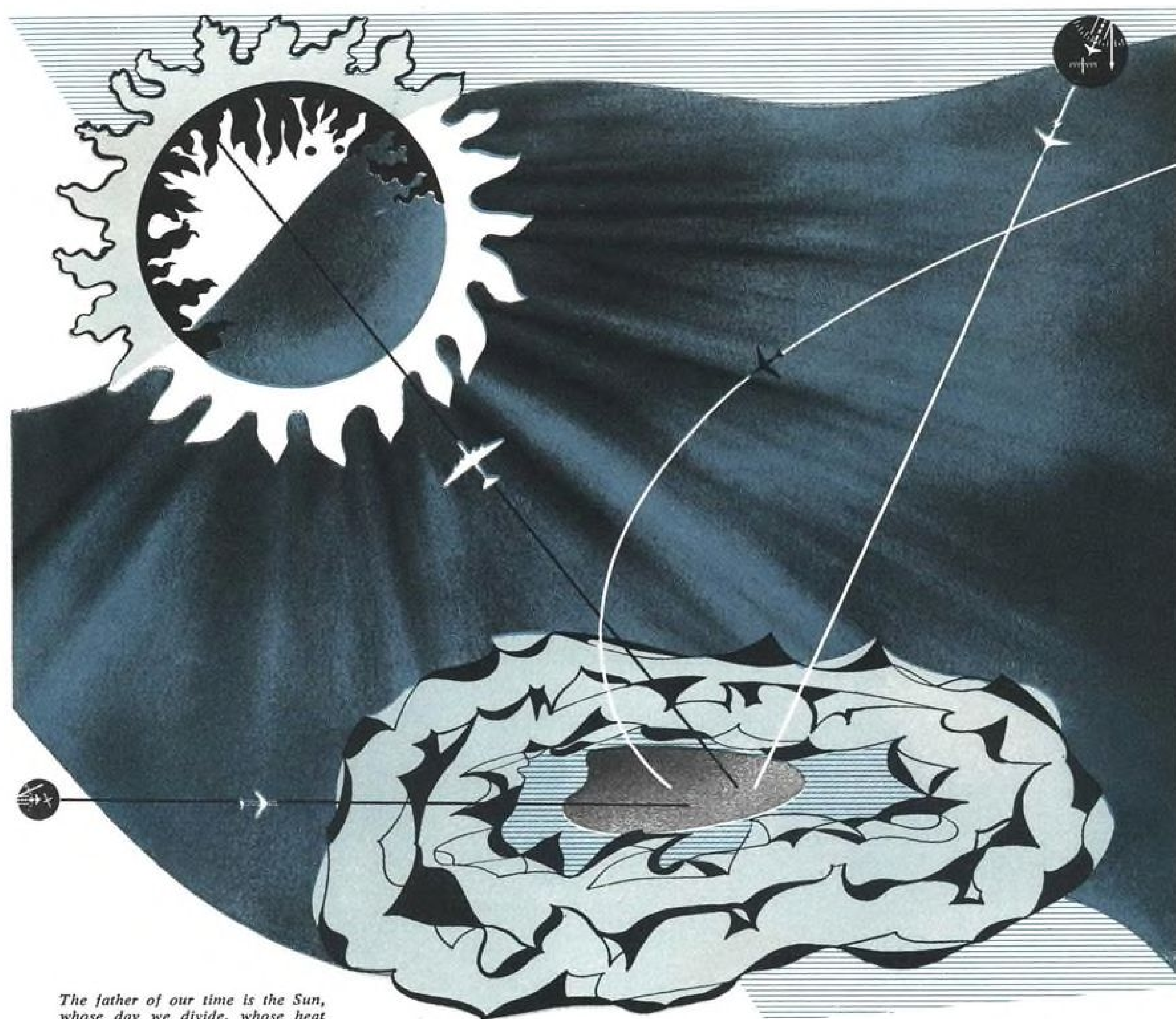


DISPLACEMENT 36 cu. in.
WEIGHT 1.4 lbs.



U-516880-1 FUEL TO OIL HEAT EXCHANGER	
Inlet Temperature, °F—Oil	400
Fuel	160
Flow, lb/min—Oil	30
Fuel	16.7
Pressure Drop, psi (isothermal)—	
Oil, 30 lb/min at 100°F	8.6
Fuel, 167 lb/min at 80°F	22.5
Static Proof Pressure, psi—Oil	250
Fuel	1000

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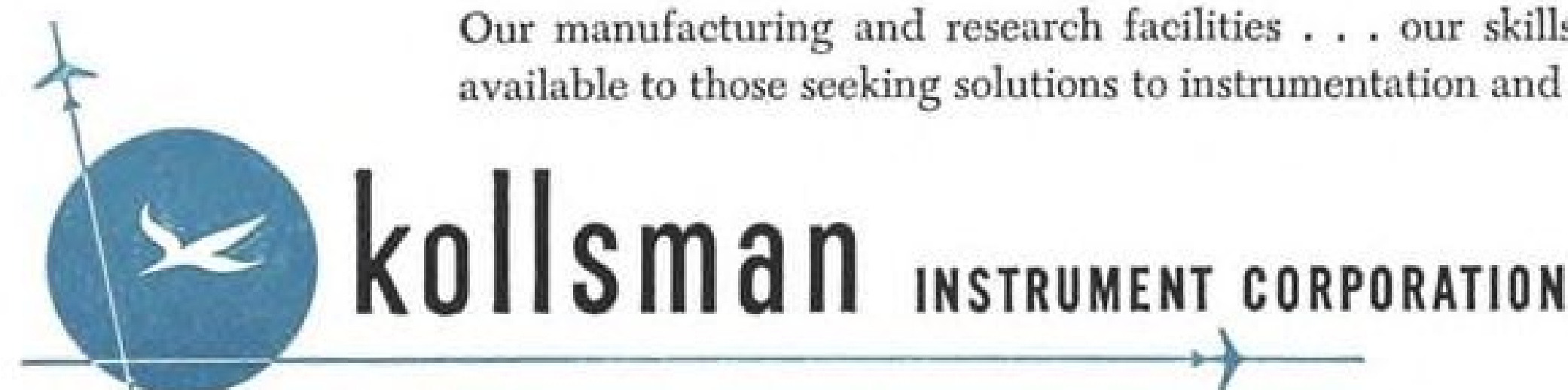
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V-2 VEHICLES are portion of the mobile fleet required to transport, erect, service and launch this early ballistic missile.



NIKE NEEDS are served by acquisition and guidance radars, vans for control and command centers and mobile launchers.

Support Units Are Key Part Of Aerial Weapon System

By David A. Anderton

Sixty-three items of support equipment go into squadron service with one of today's typical missile systems.

They range from simple handling and transport fixtures to synthetic trainers as complex as the missile itself. More than 30 of these pieces of equipment are as big, physically, as the missile.

Design, development and production responsibility for all these "extra" items falls on the shoulders of the prime systems contractor.

► **Building on Wheels**—"We started to build missiles, and wound up in the trailer business," said one executive recently.

He was looking out over an assembly floor on which two parallel lines led toward the factory doors. Down one line stood missiles, brightly painted, in various stages of completion. Down the other was an enormous assortment of wheeled vehicles: small trailers, large trailers, transport fixtures, wheeled dollies, hooded wagons. Each of these items had a specific place in the missile system; each was a vital link in the final operation against an enemy.

To this contractor, the missile system was a complete reversal of the conventional aircraft business, where the airframe was the biggest end product. Here was a business where the airframe was almost subordinate to the rest of the

contract, where wagons and trailers and trainers cost more dollars than expendable missiles.

This helps explain why an aircraft company is no longer essential to the development of an air weapon, and how a company can fall into the role of a sub contractor to an electronics firm, a university or an automobile manufacturer.

Ancillaries

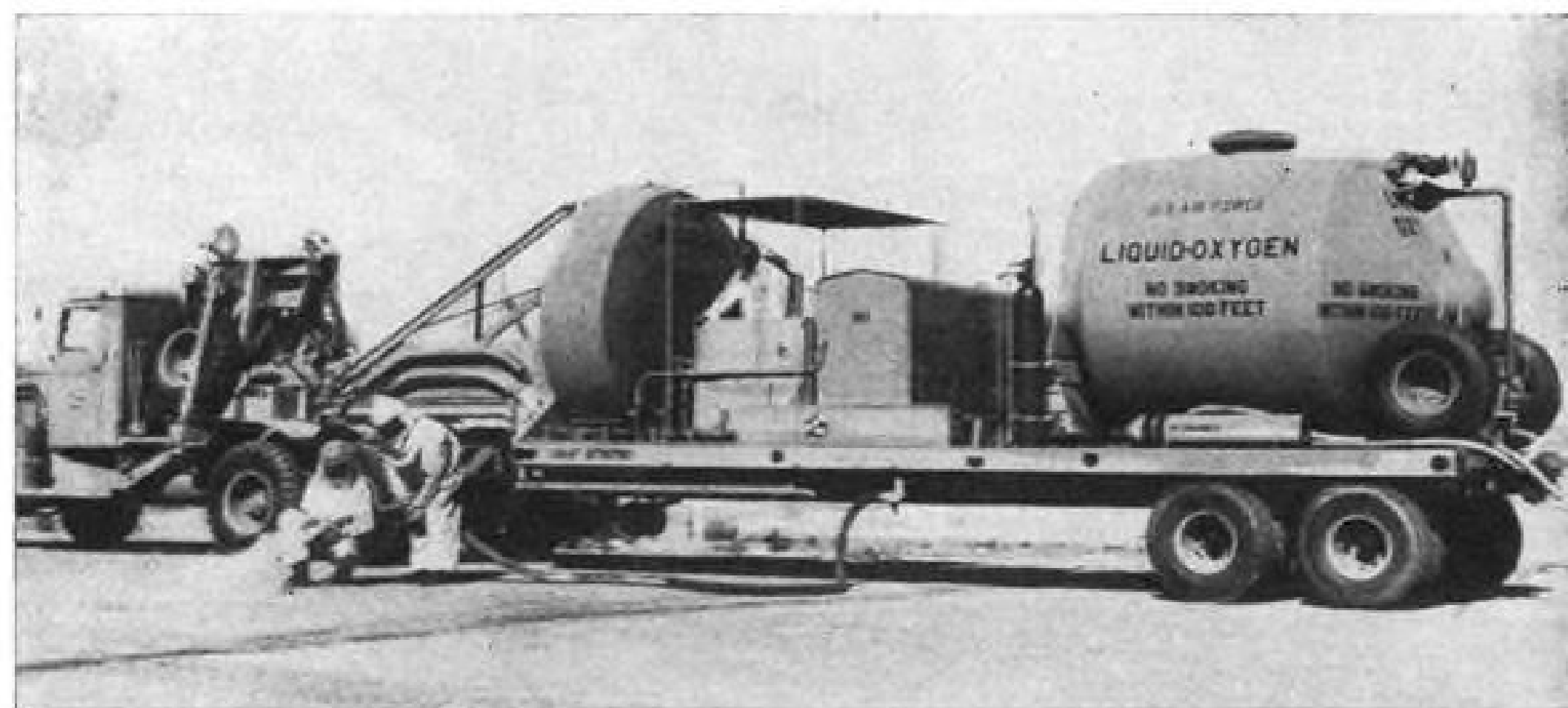
There are a half-dozen types of equipment that support a missile operation in the field: servicing, handling, loading, checkout and test, launching and training.

► **Factory to Field**—Trace a typical rocket-powered missile from the time it is shipped from the factory until it goes on its final mission.

It is off-loaded from the train, plane or boat that brings it near the operational area, and transported to an assembly and inspection area. After assembly, it is checked out; its avionic gear and powerplant may be tested



MATADOR uses zero-length launcher mounted on trailer for mobility, needs three other vehicles for firing-site support.



REPUBLIC mobile servicing unit for liquid oxygen, alcohol and pressurizing gas.



HONEST JOHN transporter-launcher.

separately, or as part of a complete missile check with a static firing.

Next stop is the storage area, where the missile is kept on a ready alert basis. When the mission is ordered, the missile may require specific adjustments for the job. Its final fueling and warhead installation are done in separate areas. There is a final checkout, and the missile is transported to the launcher and fired.

This multi-step operation has required about 50 mobile pieces of equipment.

► **The Breakdown**—Handling equipment is probably the least sophisticated of the lot, and is largely composed of casted fixtures with one or more support points for the missile components. There might be one such wheeled fixture for each major component—warhead, guidance compartment, fuselage

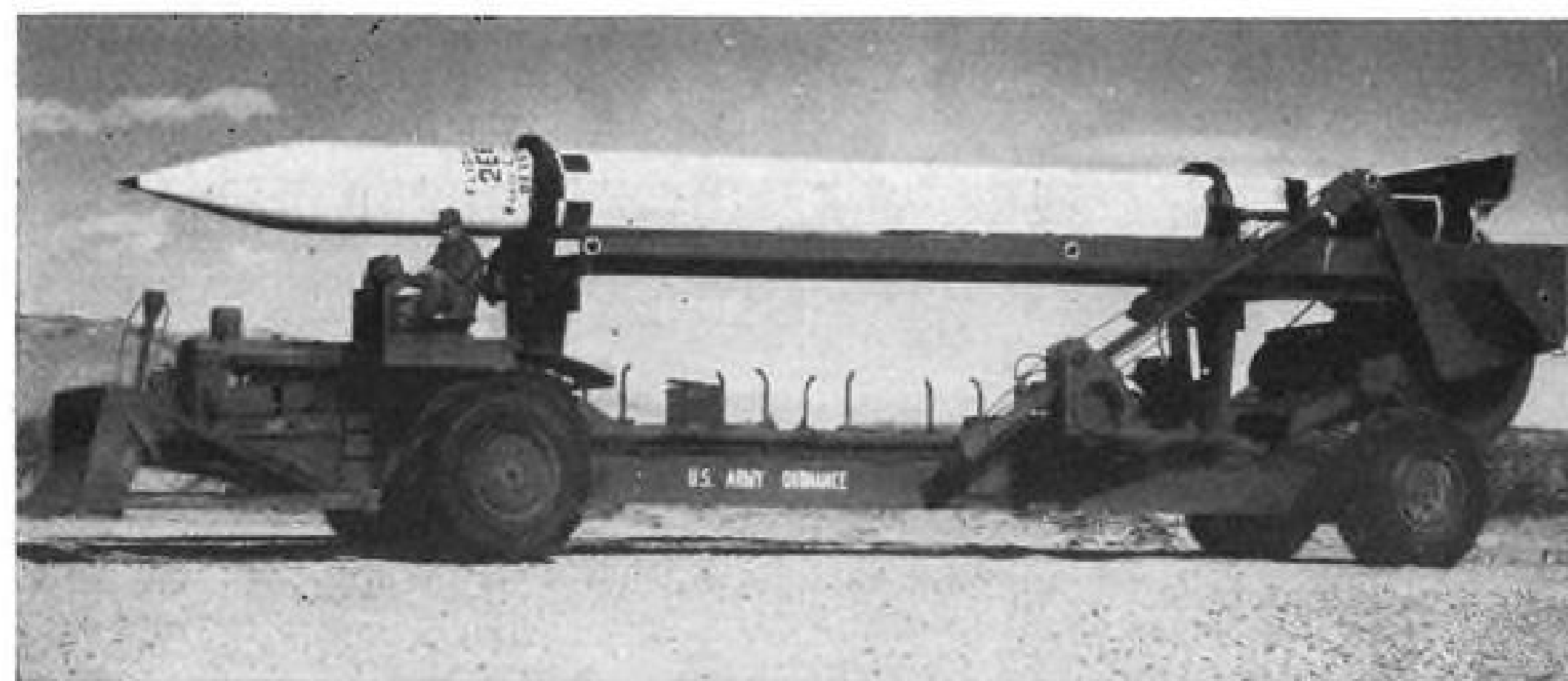
shell, wings or tail, powerplant—plus one for the entire missile, for a possible total of six separate pieces. One contemporary missile uses 12 of these.

These might or might not also double for transport vehicles in the battery area.

Servicing equipment is not an unfamiliar problem to the airframe manufacturer. These items include portable power supplies with compressed air, hydraulic fluid, oxygen, electrical power in various voltages and similar items. Missiles may require these supplies at higher delivery pressures or under different circumstances than an airplane, but the basic problems are well-known.

► **Danger Areas**—Loading of propellants into a rocket-propelled missile is greatly different from wheeling a tank truck under the wing of an airplane. Separate trailers for each propellant component are used, perhaps plus another for loading fuel for the turbine pump drives. Men working the fuel transfer must have protective clothing, a portable field shower and first-aid equipment.

Here the aircraft company has to de-



CORPORAL vehicle: transport, launcher, servicer and bulldozer on one set of wheels.

FLY WEATHER-WISE

[These weather items prepared in consultation with the United States Weather Bureau]



It pays to keep a reserve supply of fuel in your tanks.

For instance: You lose more time flying from A to B against a headwind than you regain in the same wind returning from B to A. This is because the headwind acts on you longer than the tailwind does.

The example at right illustrates how you may lose 1hr-6m flying from Albany to Buffalo, but only pick up 27 minutes returning from Buffalo to Albany with the same wind.

BUFFALO		ALBANY	
TAS = 120	Wind 30	TAS = 120	
GS ₁ = 160		GS ₂ = 75	
Flying Time ALB-BUF with wind as above = Dist. = 220 = 2.93 hrs = 2hr 56m		GS ₂ = 75	
Flying Time BUF-ALB with wind as above = Dist. = 220 = 1.38 hrs = 1hr 23m		GS ₁ = 160	
Still Air Time = Dist. = 220 = 1.83 hrs = 1hr 50m		TAS = 120	
TAS = True Air Speed		GS = Ground Speed	



Flying across country on a clear, still night, the initial formation of *ground fog* may often be detected by the fuzzy, blurred appearance of lights in low spots where the air is nearing saturation. This may be followed shortly by dense ground fog lasting until after sunup in the morning. Don't get caught too far from an airport when you see these signs of fog.

Warning: Lights on *high* ground may not appear blurred, even though ground fog is forming at lower, damper spots and will soon spread to these higher elevations.

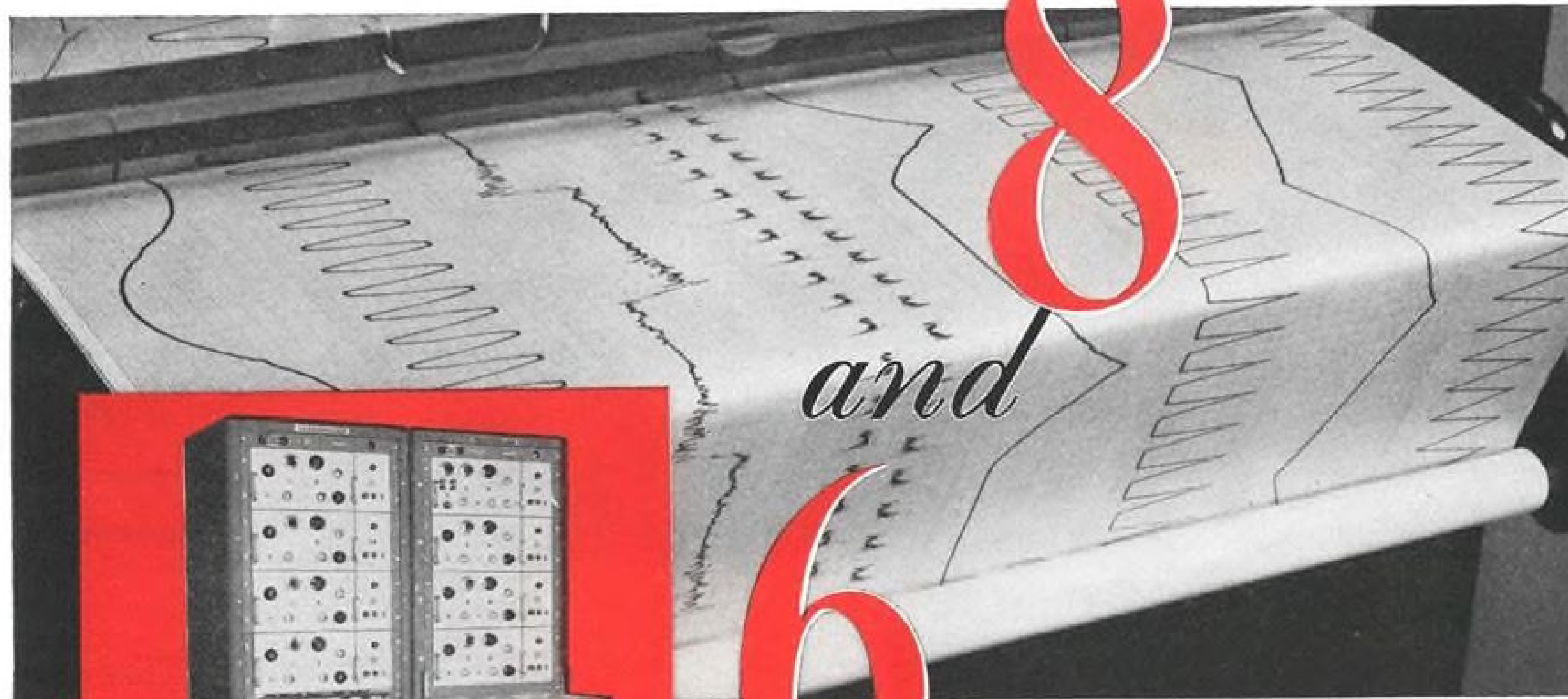
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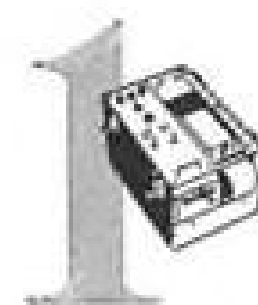
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Channel
Models

These new additions to the "150 family" follow the original "150" design concept which permits rapid change-over from one set of recording requirements to another by means of interchangeable, plug-in type preamplifiers.

The Model 158-5460 eight-channel system (upper left photo) consists of an eight channel recorder assembly and eight Driver Amplifier-Power Supply units. To this basic assembly the user adds any combination of Sanborn "150" plug-in preamplifiers to meet his requirements. Each channel provides a 4 cm deflection.

The six-channel system (156-5460) has the same basic assembly, except for two less galvanometers and one less Driver Amplifier-Power Supply unit in each cabinet. Each channel provides a 5 cm deflection.

Both systems offer: nine chart speeds (0.25 to 100 mm/sec.); extended frequency response; improved regulated power supplies; individual stylus temperature control for each channel; improved control of input signals by 1, 2, 5, 10, 20, etc. attenuator ratios; controls for timing, manual and remote coding.

SANBORN COMPANY
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Also 8 and 6 Channel Systems for recording analog computer outputs,

or other applications where 1 volt/cm sensitivity is usable. complete eight-channel system shown comprises four Model 150-2000 Dual Channel DC Amplifiers and an eight-channel Recorder Assembly. Each Dual-Channel Amplifier is complete with common power supply. (The six-channel version is identical, except for two less galvanometers and one less Dual-Channel Amplifier.) Also four channel models.

Write for catalog material on any
Sanborn "150" Recording System

sign three tank trucks and an emergency vehicle. In one case, an aircraft company designed a single-unit servicing vehicle to handle propellant loadings for an airplane powered by an auxiliary rocket unit. The truck was about as big as a commercial fire engine. This is some indication of the size and complexity of the problem a designer must tackle.

Rocket powerplants have a unique problem in the case of an aborted mission that never gets off the ground: The fuels must be off-loaded. This requires special equipment for emptying fuel tanks and purging them, and either dumping or transferring the off-loaded fuel to another vehicle. This operation requires the same safety equipment as fueling would.

► **Pre-Flight Proof**—Design and number of checkout and test vehicles depends on the system, according to one contractor. For his missile, there is only one checkout vehicle, with an assortment of go-no-go techniques that quickly determine whether or not the missile is ready to go.

The same missile requires three special test pieces of test equipment for the powerplant and seven for the rest of the weapon.

These items contain all the necessary check and test functions to prove the readiness of a missile. They furnish a way of checking the complete operational cycle of the missile on simulated runs from a ready status up to the launch.

In several of the contemporary missiles, a completely new philosophy of testing had to be developed, with the consideration that the system was to be operated in the field by men without specialist ratings.

Thus every checkout operation had to be built around an automatic or foolproof sequence. This was done with interlocking sequence switches which cut the item under test into a circuit with a simple "good" or "bad" indication. If the answer came up "good" the switch could be advanced to the next position. If "bad" then the switch could not be advanced until the faulty item was replaced with a complete new component.

In the design of the missile system, the components were developed as plug-in units. In the event of a malfunction, there is no need to trace circuits at the field level. Instead, the faulty unit is hauled out and a new one plugged in with a minimum of delay. This means one more piece of mobile equipment: a stockroom of duplicate components.

In addition to test equipment that goes into the field with the missile battery or squadron, there has to be a complete set of test gear developed to fit other unique requirements of the fac-

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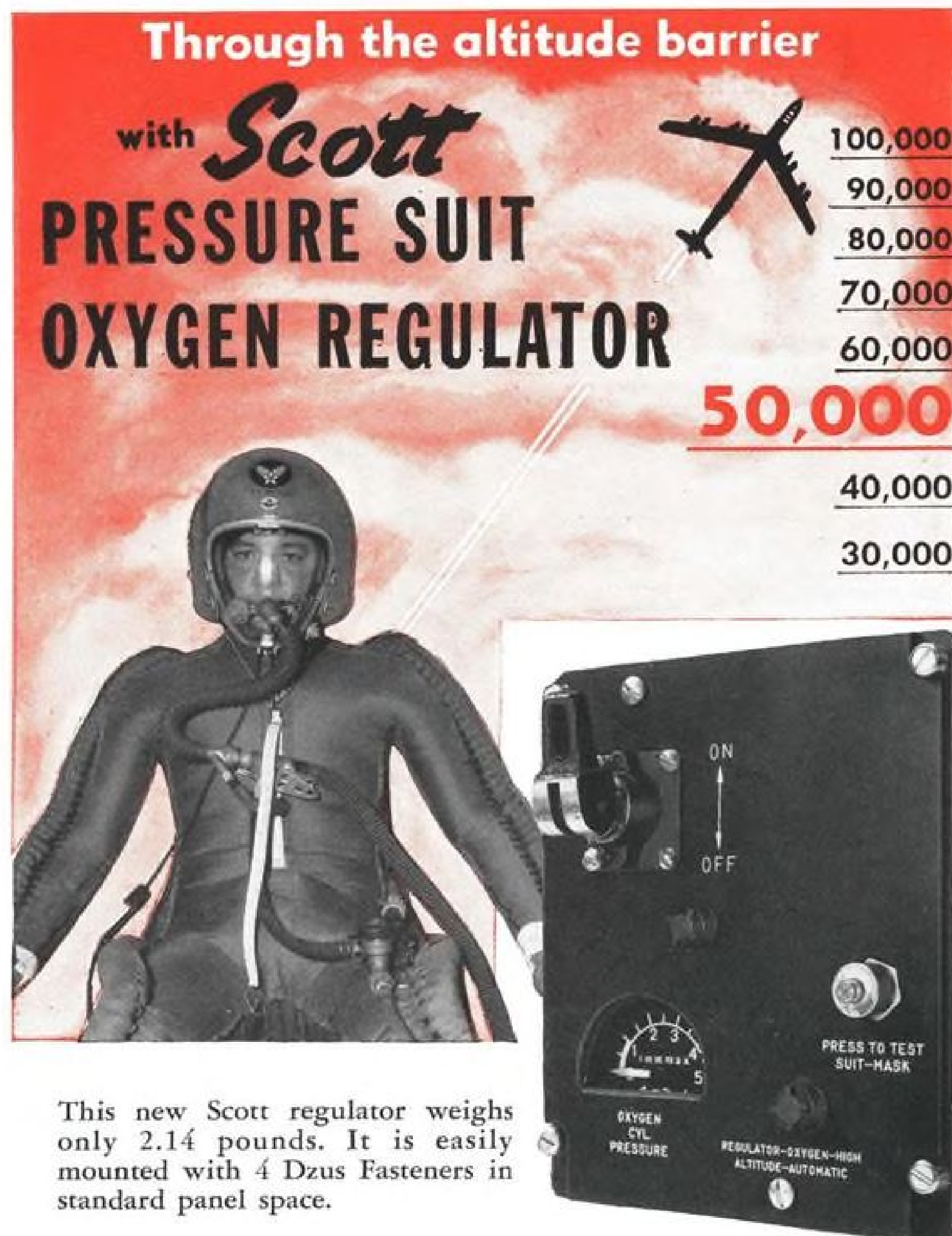


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tory assembly area and the test firing site.

General practice with rocket powerplants is to put them through a proof run at the factory under static and environmental test. When the field units get missiles, they check only the powerplant functions without an actual firing.

The first rocket firing after leaving the factory is the real one, for the mission. This procedure is possible only where reliability is excellent; this is the case for current rocket motors.

► **Launching**—Missile launchers come in a wide variety of complexity, from the fixed underwing racks of some air-to-air missiles through the multi-missile storage magazine and racks for the Nike system.

In some cases, the missile support during transport and handling becomes an integral part of the launcher (as in Nike). In others, the launcher is a completely separate item.

Ground-to-ground missiles require a simple stand that can be leveled (Corporal) or mobile self-propelled unit adjustable in elevation angle and capable of traveling over the rugged terrain of the battleground (Matador, Honest John).

Training Aids

Training techniques and equipment are a major project in the systems contract.

One air-to-surface missile nearing field use is accompanied by 11 mobile trainers, including special flight simulators for the pilots in the director aircraft, a missile simulator, synthetic operations trainer and several pieces of maintenance training aids.

► **Simulated Missions**—This same project used, during its development phases, some modified jet aircraft flying simulated missions with the guidance equipment mounted in the nose of the plane. These were checkout tests; even these had trainers for pilot familiarization before first flights.

The importance of training aids for maintenance personnel has long been known in the services and industry. The increased complexity of missile systems has made imperative an expansion of training aids to include actual components that can be fed simulated faults, much as unusual situations are fed into flight simulators for pilot training.

► **Buildings, Too**—This list of mobile equipment has not included the amazing number of buildings or shelters that have to be provided for operations in the test area and later in the field.

Command centers for field operations are usually in a trailer containing the launching control panels, presentations of tracking and guidance systems for the entire battery, countermeasures

for improved readability, specify the new

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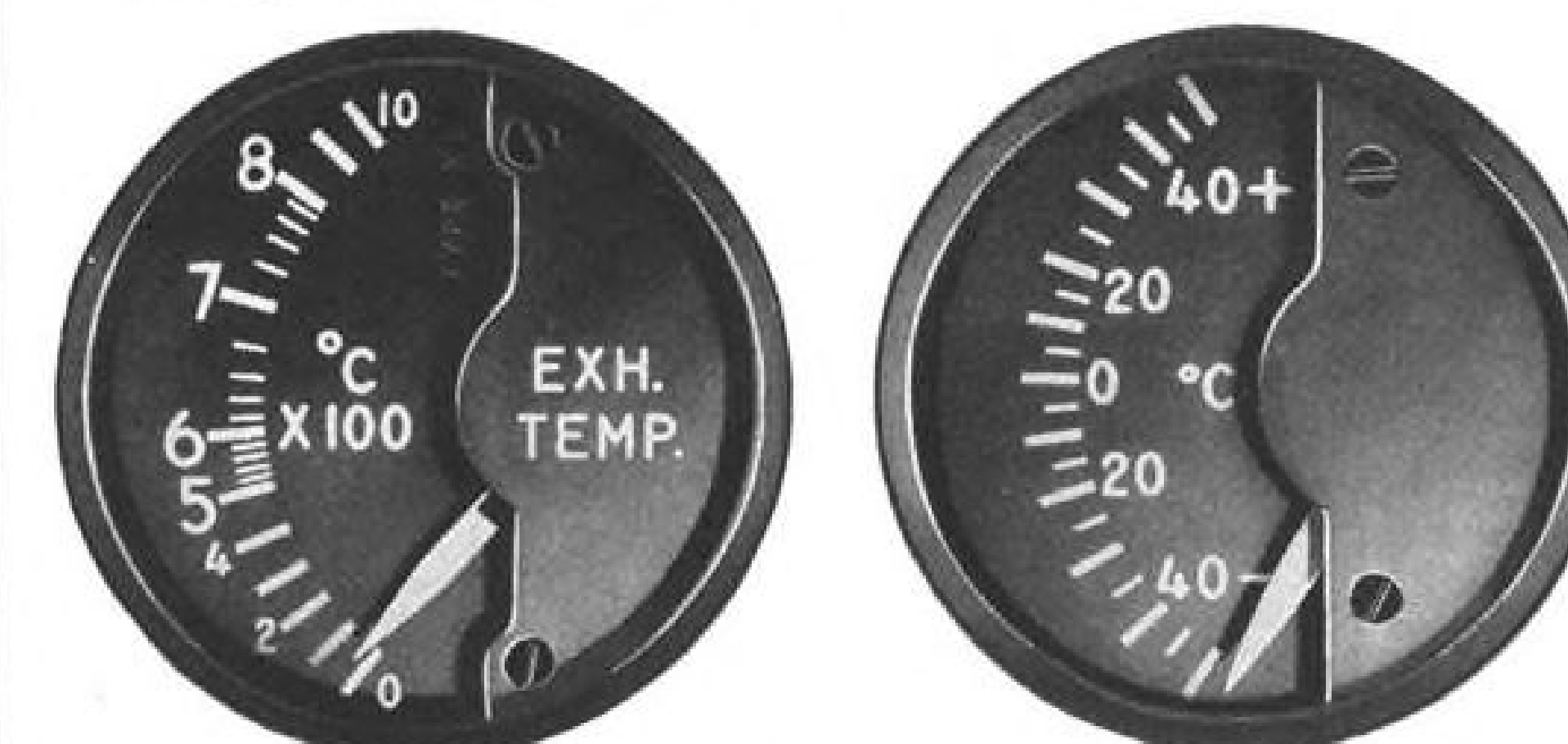
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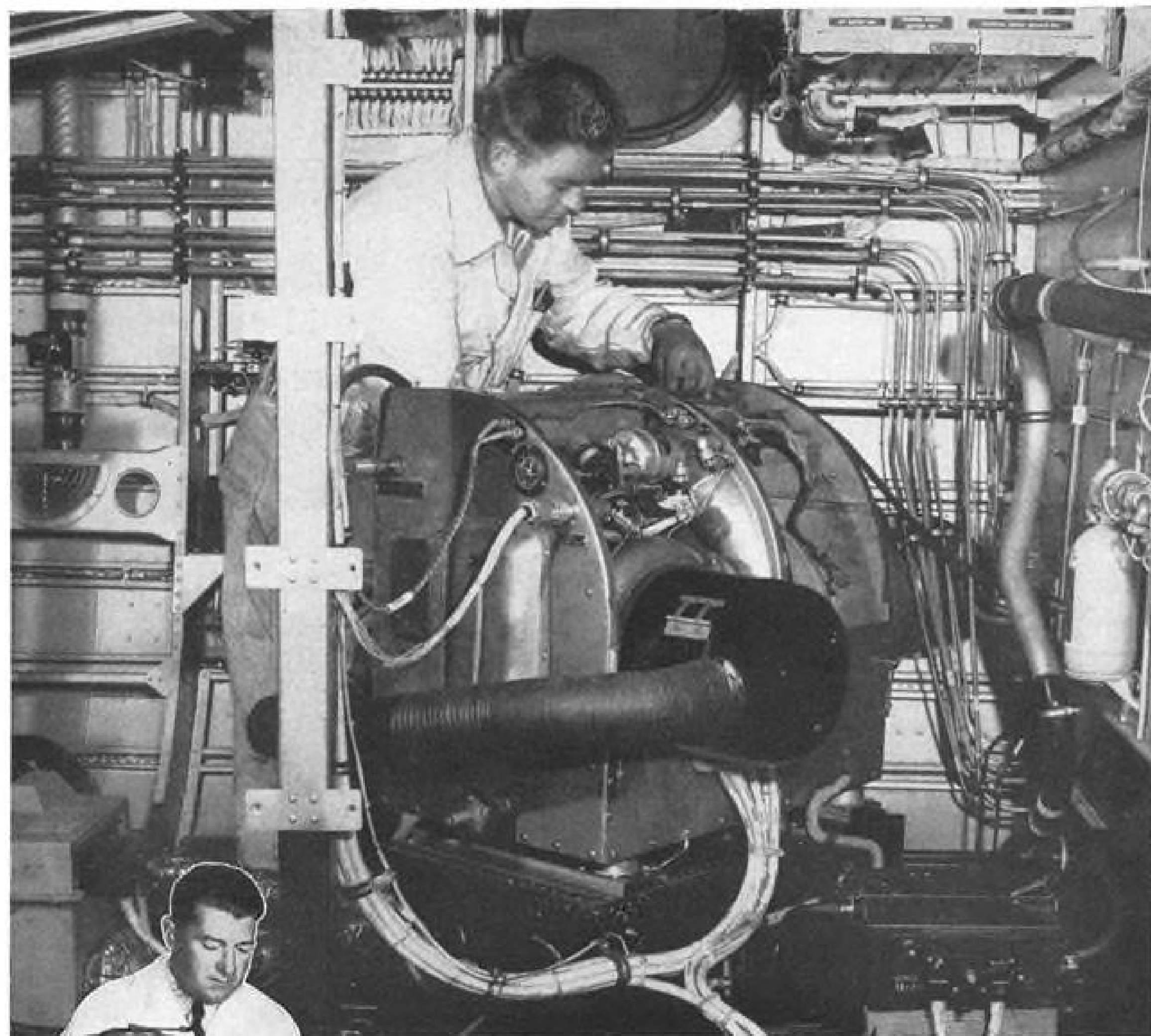
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On C-124C Globemaster, the Mars APU supplies power on the ground for cargo loading, engine starting, etc., as well as providing airborne auxiliary and emergency power



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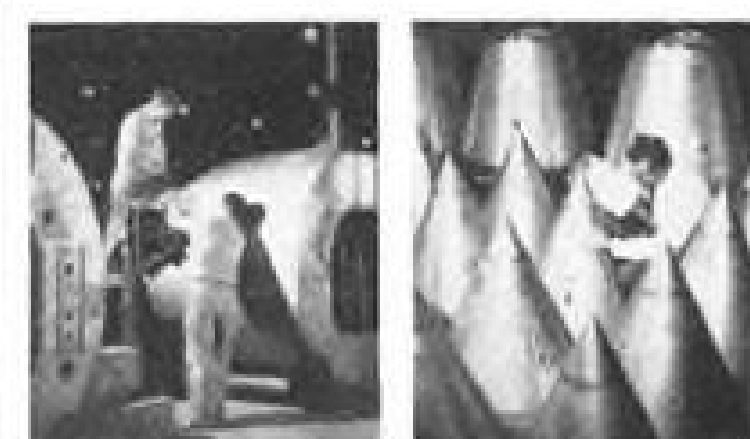


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INFORMATION

For more information regarding Solar Gas Turbines or any Solar product or service listed above, write Solar Aircraft Company, Department A-91, San Diego 12, California

controls and similar equipment.

Each of these many ancillary units is considered a non-expendable item, so that eventually, the aircraft systems contractor will probably make more missiles in quantity than trailers.

This introduces another complicating factor, which is that the auxiliary vehicles are never built in quantity enough to justify mass production techniques. So the contractor is faced with a tough decision: Should he produce a few items uneconomically, but under direct control, or should he subcontract the vehicles and lose some measure of design and production control?

Logistics

Under the broadest interpretation of the weapons system concept, the contractor is allowed to change accepted practice within the military service itself. He can recommend changes in squadron or battery organization, alter the numbers of specialist ratings required, suggest curricula for studies.

► **Higher Echelons**—One of the first problems still under consideration is what to do about maintenance beyond the field level—at the USAF depot level, for example. Under the current Air Materiel Command system, prime depots have been designated as maintenance centers for specific tasks—jet engine overhaul, avionics overhaul, airframe modification.

Under a weapons system concept, this kind of maintenance and overhaul is not acceptable. It should all be done under one roof.

At least one systems contractor now is studying the operation of a missile depot for USAF as one solution.

There is criticism by contractors that service supply channels are not equipped to handle missile systems. Studies of logistic support fall within the systems contract, and active measures are being taken by a couple of the contractors.

► **More Than Meets the Eye**—The contractor who said that he started building missiles and wound up in the trailer business was understating his case.

He could also wind up operating a supply and maintenance system, running a graduate school in propulsion and electronics, a technical school in maintenance of complex assemblies, an airlift of test personnel, a publishing house for technical manuals and engineering changes and a complete test range.

The missile he develops and produces, and the half-hundred specialized items of mobile equipment that go along to battle with the missile, are the new look in aircraft production.

(This is the second of three articles on weapons systems. The first, "How an Air Weapons System is Evolved,"

appeared Apr. 4, p. 32. The third will cover the weapons system from the time of its acceptance by the military to field operations).

Human Engineering Course Opens in June

An advanced course in human engineering will be conducted by Dunlap and Associates, Inc., at their Human Engineering Institute, during the week of June 6-10.

The annual session will feature the design of equipment, products and workplaces, with special emphasis on systems requirements. Advisors will be assigned to each enrollee for individual guidance during the course, the new feature in this year's study.

Registration fee of \$290 includes texts and handbooks, technical materials and two evening activities. Deadline is May 6. Enrollees for the course are invited to bring material illustrating a specific design problem of interest to them; private conferences will be scheduled to talk over these individual problems.

Further information is available from Dr. Martin A. Tolcott, Director, Human Engineering Institute, Dunlap and Associates, Inc., 429 Atlantic St., Stamford, Conn.

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Sanders Beats Out Top Avionics Firms

By Philip Klass

Nashua, N. H.—Three things mark Sanders Associates, Inc., as a fast-rising avionics newcomer that bears close watching:

- **Fast growth**—fast even for an industry where rapid expansion of new companies is almost commonplace.

- **Numerous significant new developments** in a variety of fields that would do credit to a firm several times its size.

- **Long-range development program** for a highly classified equipment which, if it "hits," could prove as big as the interceptor fire control program which launched Hughes Aircraft on its meteoric rise. The company scored over two major avionics firms (Westinghouse and Bell Telephone Labs), which also had Phase I study contracts, to get the Phase II hardware contract.

► **Fast Rise**—It was less than four years ago that a hopeful group of 11 young engineers, with \$75,000 capital raised by mortgaging homes and life insurance, set up shop here in the top floors of a mill (and community) that had been abandoned by a textile firm.

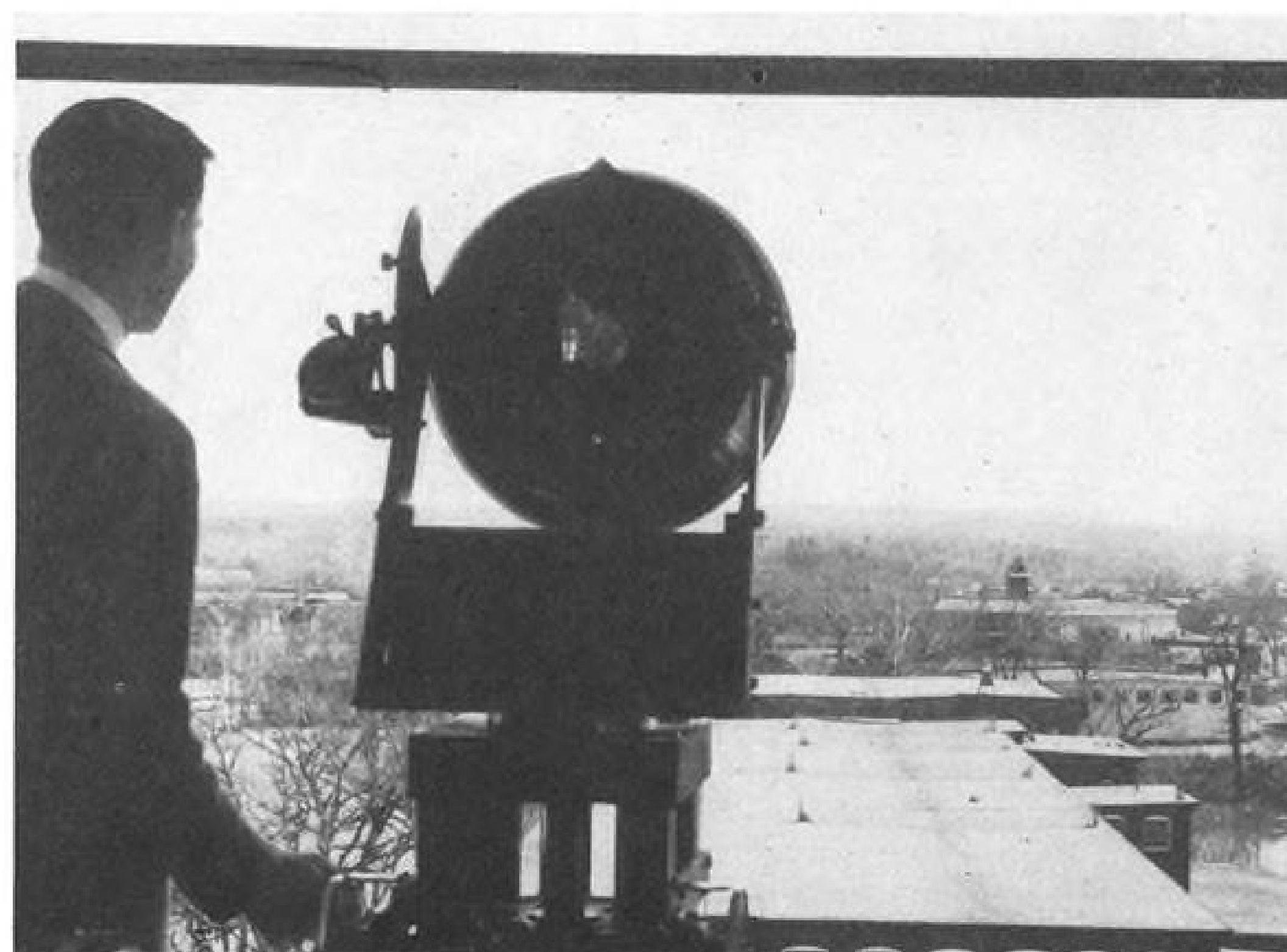
Today the company employs 350, a figure expected to rise to 500 by July. Its current year's gross sales will run nearly \$5 million, and by 1958 should go "well over \$12 million," with employment topping 1,000, a company official says.

The firm's president, Royden C. Sanders, Jr., a prolific inventor with 33 patents, is credited with the development of FM/CW radar in America.

► **Notable Achievements**—At the moment Sanders probably is best known for its tiny floated rate gyro, measuring 1 in. in diameter and 2 in. long, and weighing only 3 oz. When first announced nearly three years ago, it was by far the world's smallest rate gyro, a distinction it may still hold, although with more competition. Sanders also made news as a participant in the Navy's Project Tinkertoy automatic factory program. Its contribution was the adaption of several existing avionic equipments to Tinkertoy construction for comparative evaluation of the new technique. This type of activity is continuing, and the firm recently received an order for "Tinkertoy-ized" sonobuoys.

New Developments

However, these appear destined to be overshadowed by developments spawned during the past several years



NEW RADAR UNDERGOING TEST atop abandoned textile mill looks out on Nashua, once famous for textile industry, but now home for Sanders, fast-rising avionics firm.

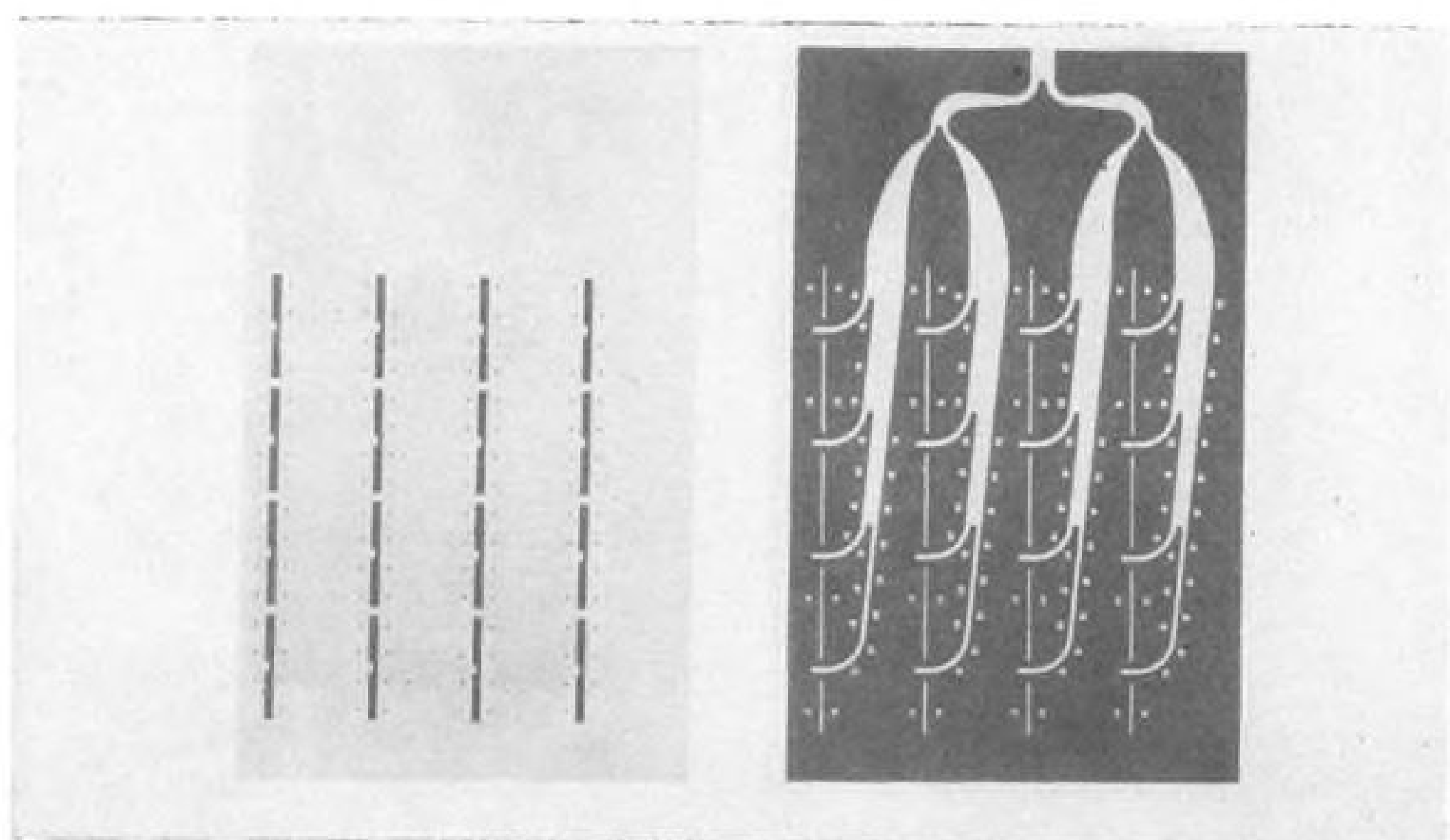
and now ready for disclosure, or those still in process. Some of these, which hold considerable promise of making Sanders Associates a well-known name in the avionics fields, include:

- **Transistorized low-high altitude radar altimeter**, which reportedly will give the high accuracy of an FM altimeter at low altitudes and the accuracy of a pulse-type radar altimeter at high altitudes, yet will weigh only half as much as the best FM or pulse-type altimeter now available. The new APN-93, a USAF-

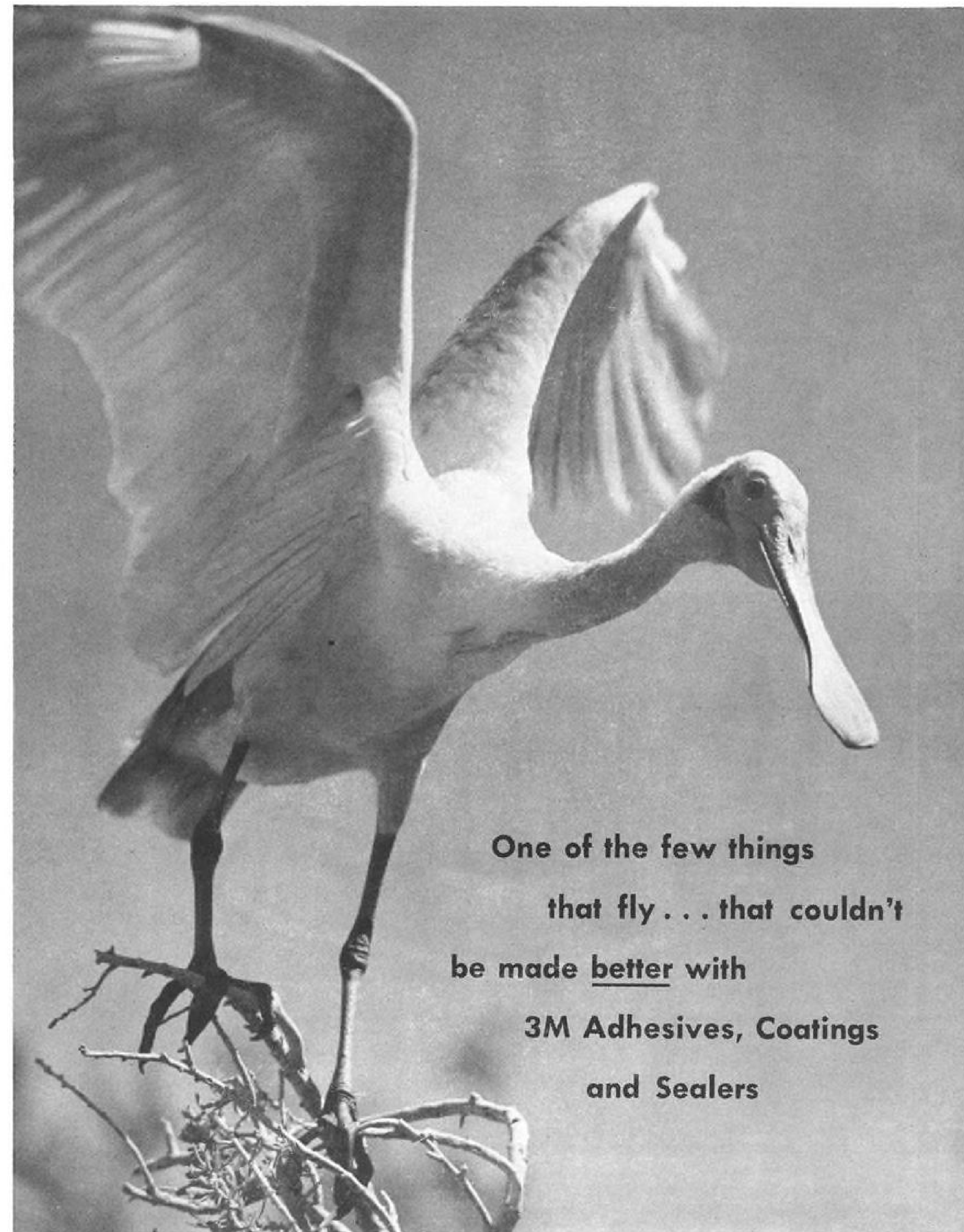
sponsored development, is expected to weigh only 25 lb., operate up to 80,000 ft. altitude. Sanders beat out 17 other firms to get the contract.

- **Novel airborne radar antenna feed**, which permits the radar to get three times as many "looks" at the target (300/second) as conventional feeds. The feed mechanism requires no rotating joints and is statically and dynamically balanced, eliminating usual vibration problems.

- **Plastic radar antenna dish** which



FLUSH-MOUNTED radar antenna, under 1/4 in. thick, for highspeed aircraft, employs 4x4 slotted array. Power divider (r.) uses new photo-etch technique.



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ADHESIVES AND COATINGS DIVISION MINNESOTA MINING AND MANUFACTURING COMPANY



Vital link between thought and action paces all military and industrial activity

RADIO COMMUNICATION, oldest of the electronic sciences, has long played an important role in the thought-action process; yet today it is being called upon for capabilities and performance characteristics far beyond those afforded by the present state of the art.

Such demands stem from the basic importance of advanced communication systems in maintaining American military superiority.

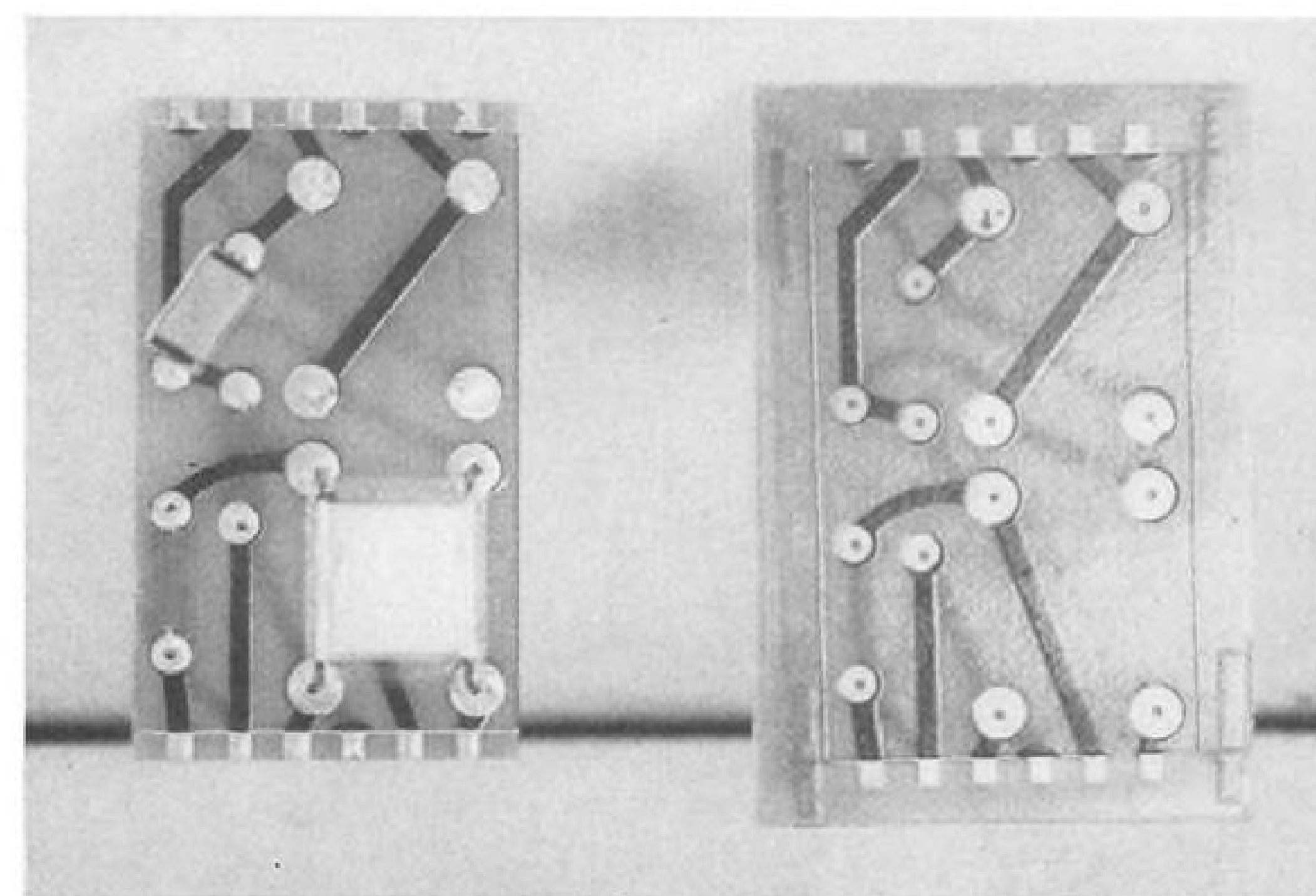
Recognizing this, The Ramo-Wooldridge Corporation is today engaged in research and development activities leading to the production of radio communications systems capable of providing the *information capacity, versatility, range, and reliability* necessary to insure maximum performance of our weapons systems.

And yet the challenge is not all military. It is inevitable that the application at Ramo-Wooldridge of these advanced modern theories and new techniques will lead to significant accomplishments in the field of commercial communications as well.

The Ramo-Wooldridge Corporation

DEPT. AW, 8820 BELLANCA AVENUE; LOS ANGELES 45, CALIFORNIA

Engineers and physicists qualified to undertake advanced work in systems analysis and engineering, circuit development, transmitter and receiver engineering, modulator development, and propagation studies are invited to investigate the opportunities existing in HF and microwave communications, data transmission, facsimile, and allied fields, awaiting them at Ramo-Wooldridge.



HERMETICALLY SEALED printed circuit boards and flush-mounted high-temperature resistor and capacitor (mounted at left) are new Sanders developments.

Sanders says can be molded more accurately than conventional spun aluminum or magnesium dishes, giving a boresight error of $\frac{1}{2}$ angular mil or less. The plastic dish is stronger, weighs only half as much as aluminum and has approximately $\frac{1}{6}$ the moment of inertia. This reduces drive-motor power requirements.

- **Midget two-stage solenoid valve**, measuring only $1 \times 1 \times 3\frac{1}{2}$ in. and weighing only 0.7 lb., yet capable of controlling 5 hp. of hydraulic flow from an electrical input of only 40 ma. (see photo, p. 66). Frequency response reportedly is flat to within 3 db. at frequencies out to 100 cps., and the unit has built-in chip-clearing protection to prevent jamming.

The new "bootstrap valve," as it is called, is approximately $\frac{1}{5}$ the weight and size of comparable units, and will sell for 25-50% less, Sanders says.

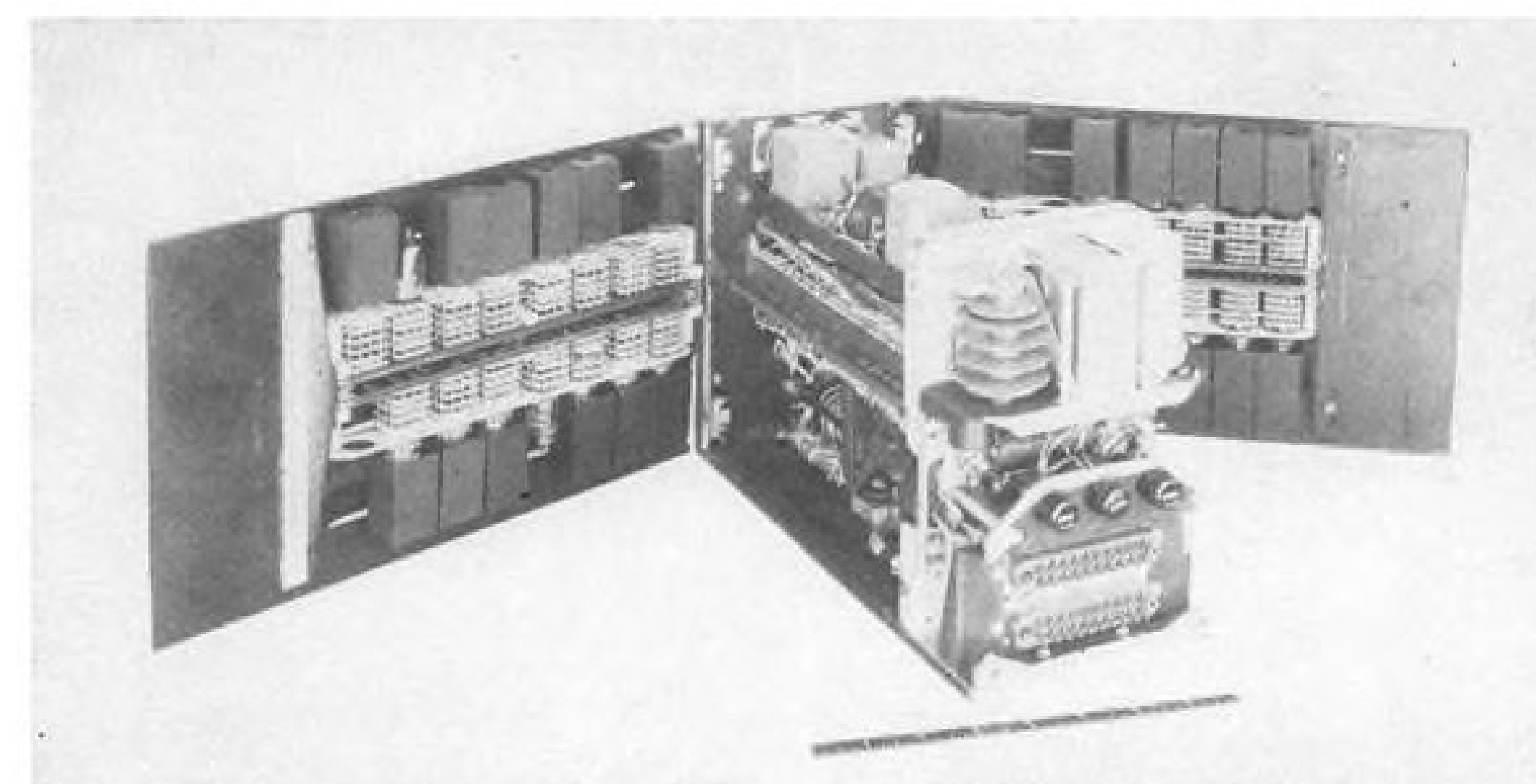
- **Photo-etched microwave components**, including waveguides, attenuators, hy-

brid junctions and flush antenna feed arrays. These new "Tri-Plate" microwave components are considerably smaller, lighter, and cheaper than conventional components, and offer certain advantages over competitive photo-etched microwave components, according to Sanders. These include lower radiation leakage, lower cost, less microphonics from shock and vibration.

- **New magnetron**, capable of producing coherent pulses with an excitation power equal to only 1% of the tube's output, approximately $\frac{1}{10}$ the excitation previously required for cohering maggies, a Saunders official says.

To date this has been achieved only with experimental low-power units. However, Sanders expects the same can be applied to very-high-power tubes. This might enable magnetrons to recapture some of the ground lost to high-power klystron tubes in recent years.

- **Helicopter hovering device** (operating



TINKERTOY VERSION OF AN/APN-22 radar altimeter is one of several equipments which Sanders has redesigned to use modular-type construction.

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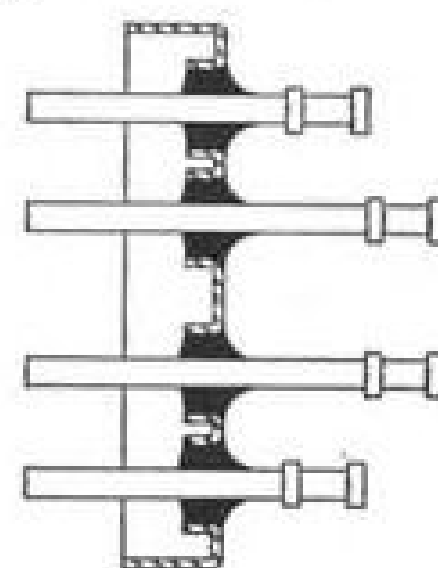
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We suggest that any hermetically sealed electrical component that may be called upon to fly should have rugged light weight Fusite Terminals.

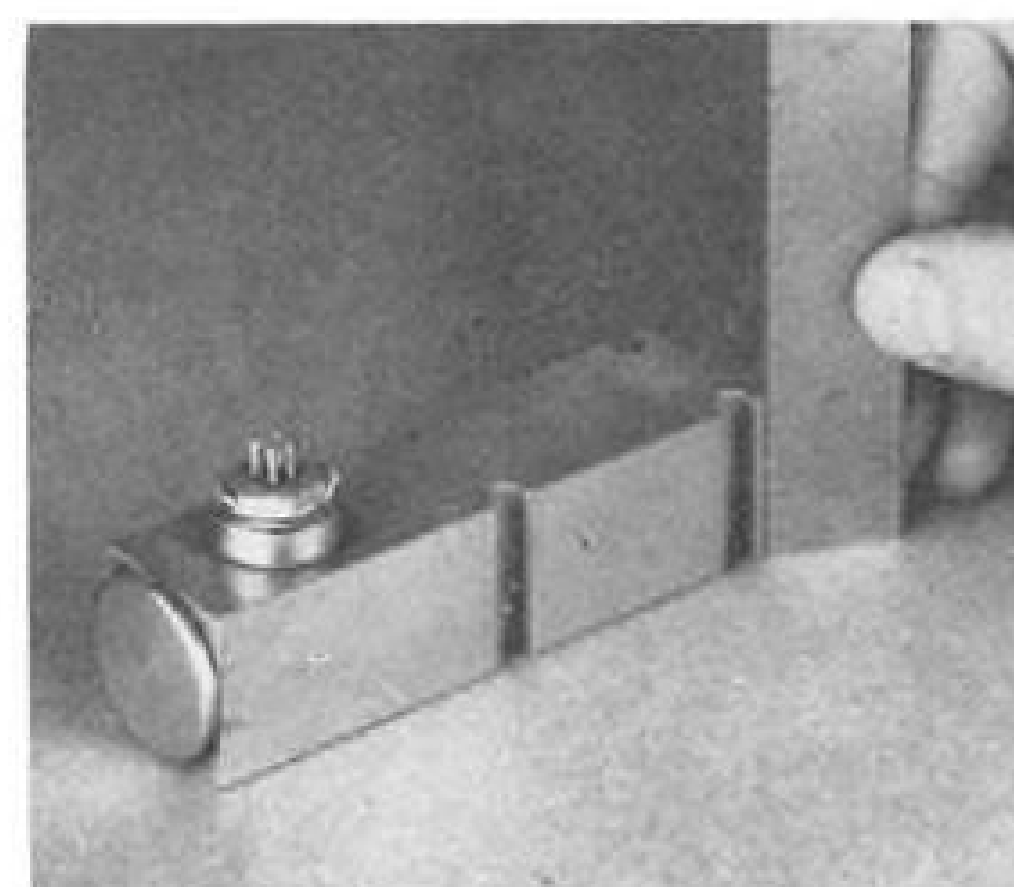


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BOOTSTRAP solenoid valve for missile use can handle 5 hp., has frequency response of 100 cps., weighs only .7 lb.

on the Doppler radar principle) which weighs less than 25 lb. Sanders delivered the research model less than four months after receipt of the Navy contract. Weight of the production prototype, now under construction, will be only one-third the contract spec figure. This is partly due to the use of Tri-Plate plumbing.

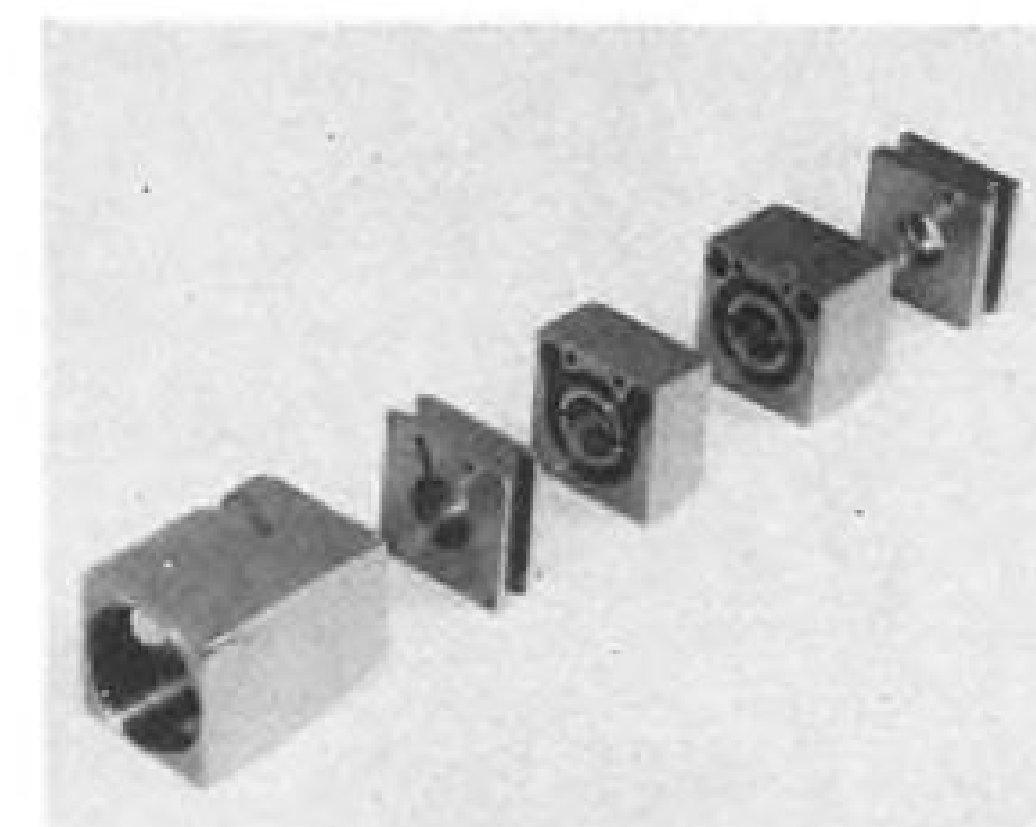
- Flat capacitors and resistors, especially designed for flush mounting on printed circuit boards or Project Tinkertoy module wafers (see photo, p. 65).

Both types of components will be designed for 150C operation. At present, Sanders is making the components by hand, but plans to tool up for production during the coming year.

- Hermetically sheathed printed circuit boards which keep out moisture from the enclosed printed circuitry and make it possible to dip-solder both sides without solder sticking to unwanted portions of the circuitry.

The Sanders-developed process consists of bonding thin transparent sheets of Kel-F to both sides of an epoxy resin base board upon which circuits have been etched. At those points where solder is desired, it is only necessary to grind away the thin layer of Kel-F (see photo, p. 65).

Although developed originally for its own needs, Sanders plans to produce the hermetically sealed units for other



BUILDING BLOCK construction simplifies machining of internal ports and orifices, makes more compact unit.



It takes a lot of spadework

On any new design, it takes a lot of spadework...a lot of sweating...before plans mature.

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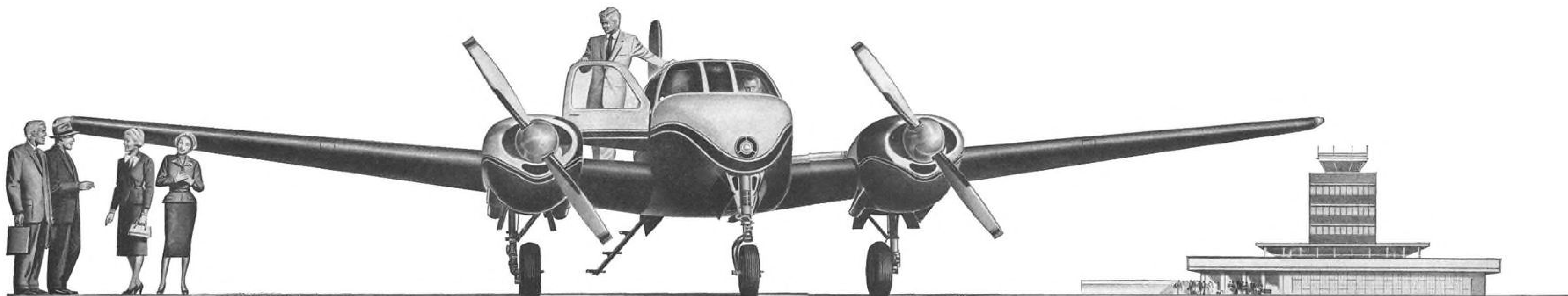
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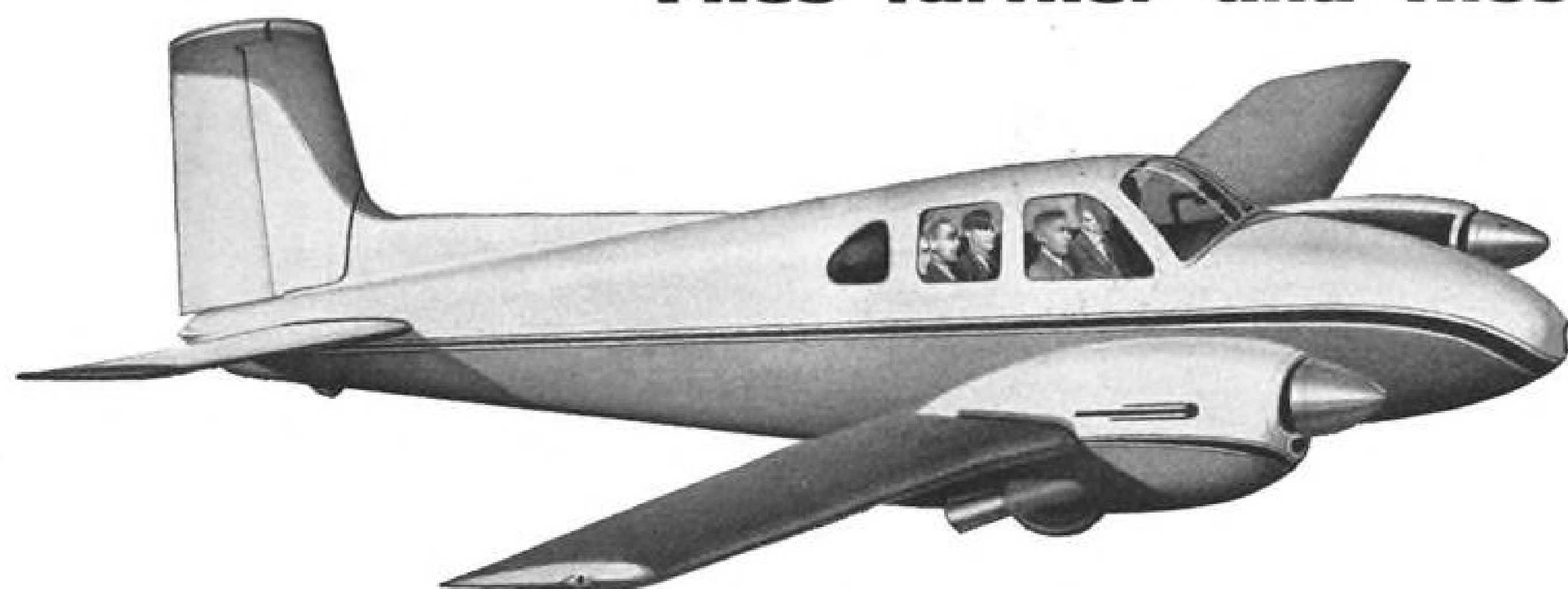
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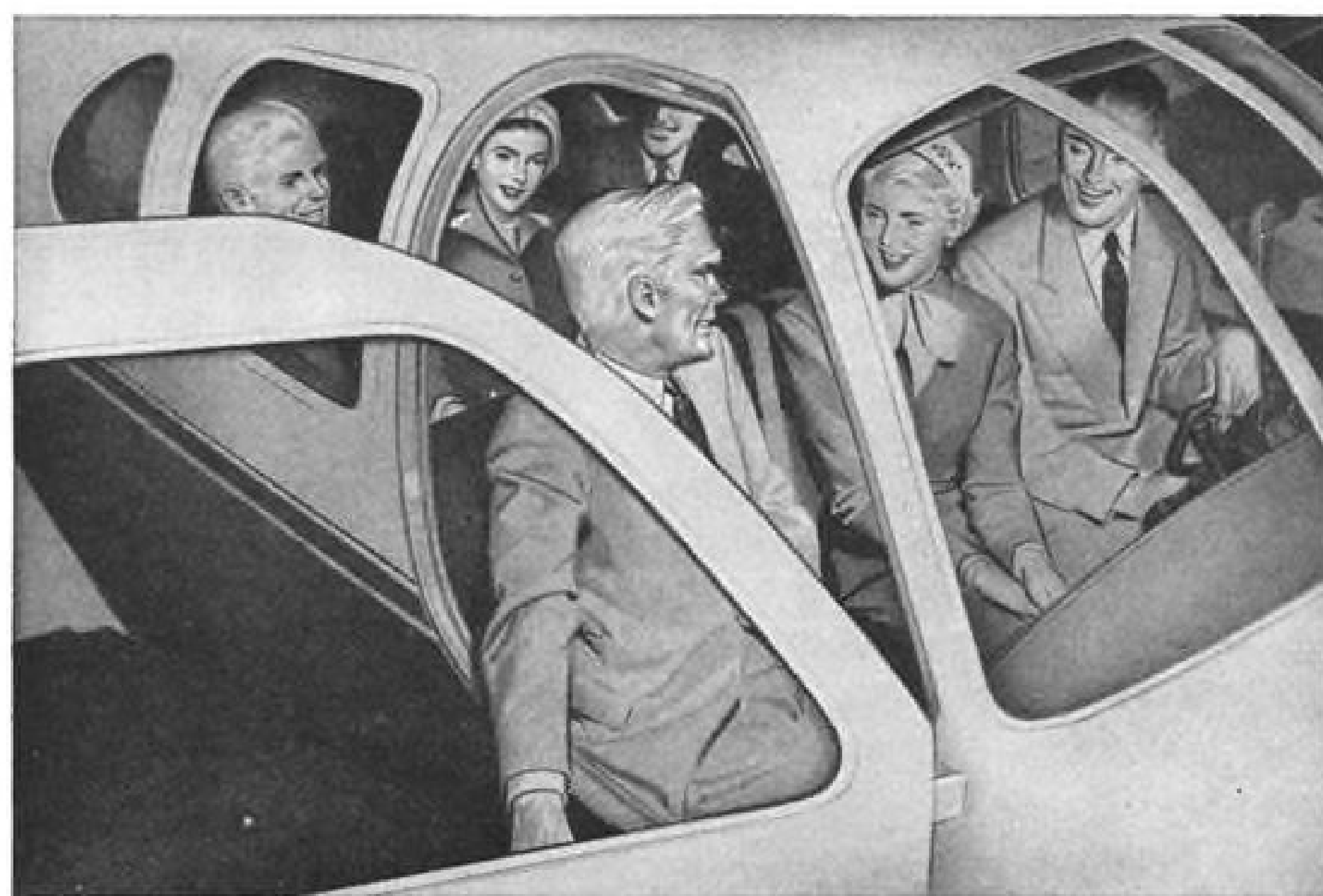
Flies farther and flies faster than any other plane in the six-place field!



Appearance, performance, comfort, and safety merit pride of ownership in the Twin-Bonanza, but careful comparison reveals many more *plus factors* that add up to the 'best buy' in its field — and millions of in-flight miles have proved its rugged dependability. At full gross weight, and at only 66.6 per cent power, this new BEECHCRAFT cruises at 200 miles per hour. It has a top speed of 210 miles per hour.

There's a real travel-thrill in store for you during your first ride in this new Twin-Bonanza. Here is real airline performance with the ultimate of private air transportation comfort. Once you see and fly this BIG six-place Twin-Bonanza you'll agree that *this is flying — 1955 style!* With a range up to 1,100 miles, Chicago to Houston, San Francisco to Denver, or Detroit to New Orleans can be nonstop trips.

Luxurious sound-insulated and air-conditioned comfort with greater visibility can be yours in the Twin-Bonanza. This big quiet cabin permits more freedom and greater vision than any other plane in its class. Once you see it you'll agree that here is a most compelling invitation to relax and enjoy flying at its 1955 best.



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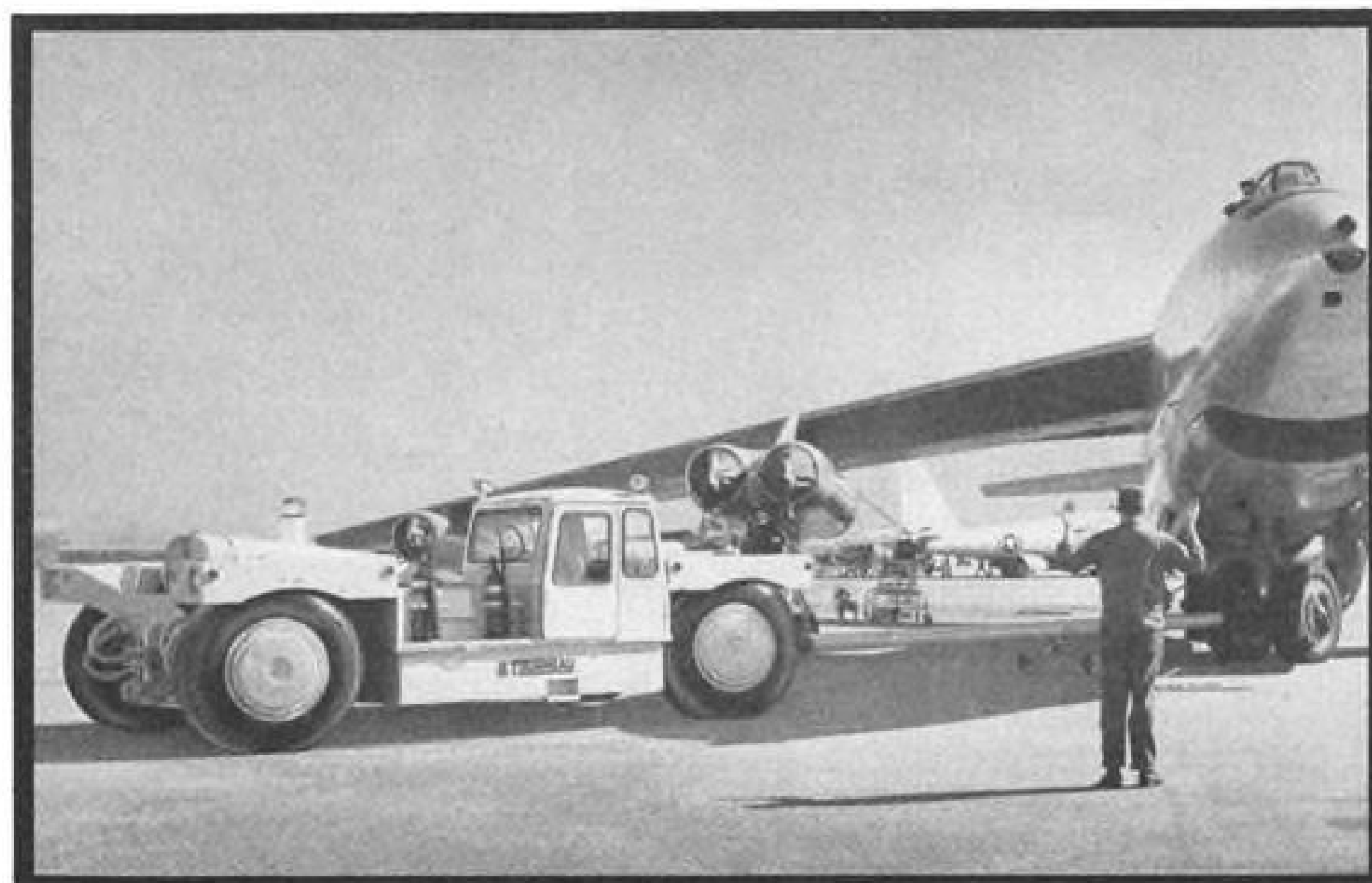


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Smooth electric power — easily controlled — makes the LeTourneau Air Tow highly effective for towing the biggest bombers into position. "Easy-does-it" starts protect air frames, equipment, and delicate instruments.

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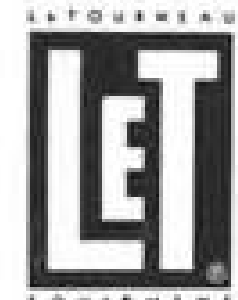
Works On or Off the Apron. Oscillating axle keeps all wheels on the ground; big tires provide flotation and

traction on smooth concrete, through mud, or over frozen surfaces.

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MOLDED PLASTIC radar dish reportedly is stronger, lighter, more accurate than conventional spun aluminum dish.

avionics firms to their individual circuit requirements.

Engineer Ownership

Sanders Associates is an engineer-owned and operated business. All the voting stock is held by management, consisting of 14 associates, including Roy Sanders. All but one of the 14, the assistant treasurer and controller, is an engineer. Average age of Sanders' management is about 36.

Ninety percent of the non-voting stock (which pays the same dividends as the voting variety) is held by company employees, according to E. C. Best, assistant to the president. (Best, a former Marine colonel, headed BuAer's electronics division prior to joining Sanders.)

Balance of the non-voting stock is held largely by local Nashua people. Contrary to early reports, Sanders has no large corporate backer.

►Early Start—Sanders himself has an interesting background. While a junior engineering student at Rensselaer Polytech in 1938, he conceived the first radio (FM) altimeter. Sanders took the idea to what is now the Wright Air Development Center. The Air Force liked the idea, but was reluctant to give then-precious development funds to a young engineering student, no matter how ingenious. So the Air Force contracted with Bell Labs for the development.

Sanders interested Radio Corp. of America in the idea, quit school, and joined them. With Navy backing, Sanders and RCA developed the APN-1 radio altimeter, which saw wide use during the war.

►Nucleus Starts to Form—Three of the men who worked with Sanders in the APN-1 development were Martin Richmond, William Mercer, and Daniel Blitz, all now associates in the present company. Richmond is executive vice president and head of systems development. Mercer is director of research,



SCRAMBLE!... When time is scarce and speed vital . . . G-E motor-driven power units provide Air Force alert hangars with fast, reliable starting power. Shown is an F-86D Sabre, equipped with G-E J-47 jet engine.

HAMILTON AFB REPORTS

G-E Ground Power Units operate 2 years with "No electrical repairs required"

G-E motor-driven units provide reliable ground power in 325th Fighter Squadron alert hangars

During a scramble, speed depends on flawless performance by men and machines. For fast, reliable aircraft starts *absolutely essential* in an F-86D Sabre jet scramble, the 325th Fighter Squadron at Hamilton AFB, California, uses G-E Motor-driven ground power units. For over two years, they've used four G-E units for starting duty in their alert hangars, and in that time, "No electrical repairs have been required."

This is just one example of reliable performance G-E Ground Power Equipment is providing many Air Force

alert hangars throughout the United States for both jet and reciprocating engines.

Power for instrument and device checking is also available with G-E 400-cycle Frequency Changer Packages. Motor-driven units in 265-, 500- and 1000-amp ratings, plus a-c and d-c generators for engine-driven or vehicle power units, fill out General Electric's complete line.

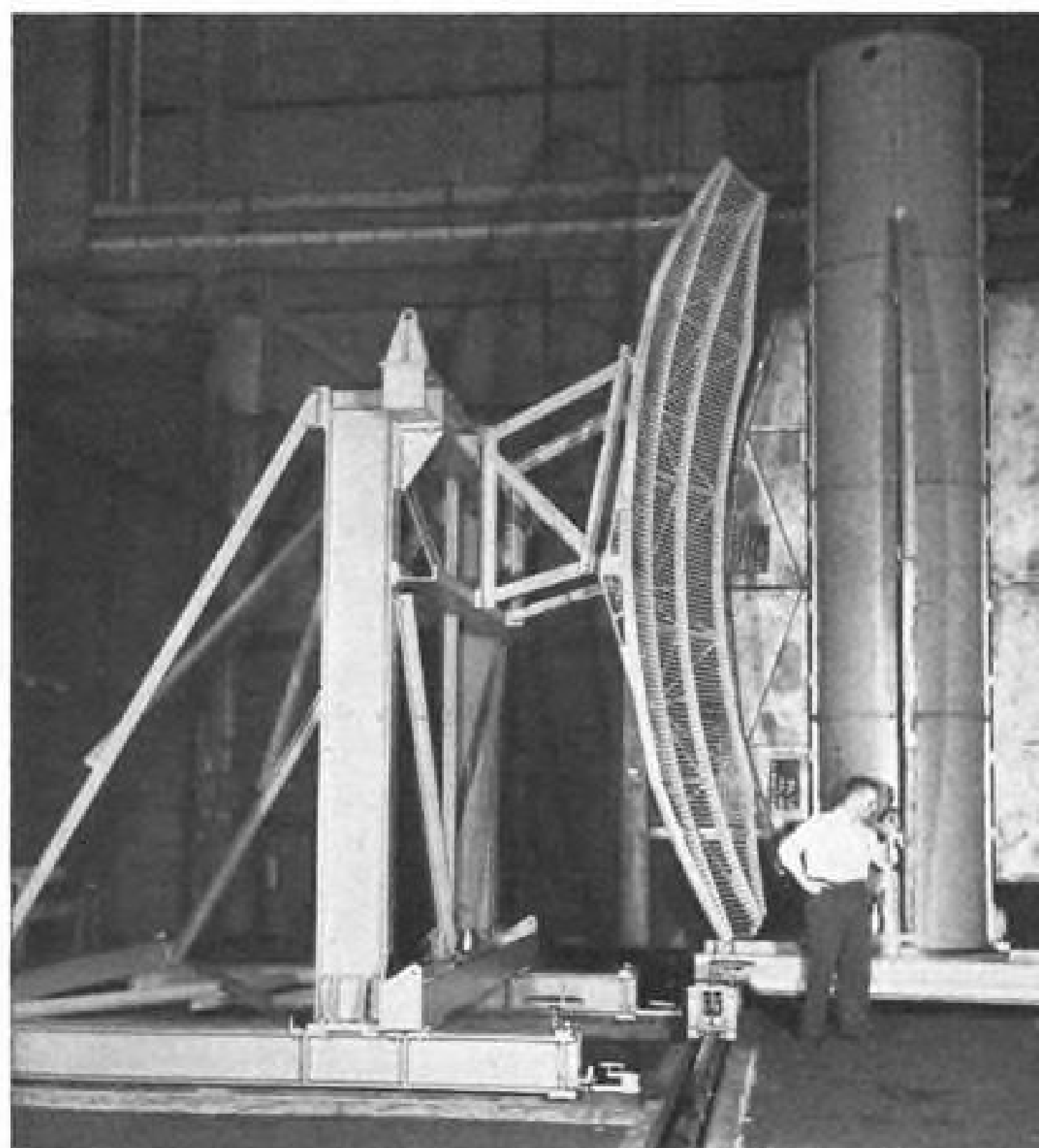
For further information, contact your nearest G-E Apparatus Sales Office, or write Section 814-1, DC Motor and Generator Dept., General Electric Co., Erie, Pa.

GENERAL  ELECTRIC



COMPLETE ELECTRICAL TESTING of giant FPS-7 radar search antenna being made on G.E.'s modern pattern test range. This range can test radiation patterns of all sizes in all standard radar frequencies and is the final step in making sure all radar antennas meet operational performance requirements.

PRECISION MECHANICAL INSPECTION to assure the meeting of exacting contour design requirements is being made here with the aid of G.E.'s Contour-Checking Tower. Antenna contours up to thirty feet by forty feet can be checked to within one hundredth of an inch through the use of this unique facility.



Why G-E precision antennas can make your radar systems more effective

Advanced quality control and testing techniques enable General Electric to give you highly reliable precision antenna equipment that will help your radar system give maximum potential range and accurate return-signal interpretation.

For example, the meeting of precise mechanical design requirements of radar reflectors is checked to within one hundredth of an inch by G.E.'s Contour-Checking Tower. Electrical performance is completely tested on a modern pattern testing range.

For information on how G.E. can help you with radar antenna research, development, design, manufacturing, and field servicing, contact your nearest G-E Apparatus Sales Office or write for bulletin GEA-6279, Section 223-1, General Electric Company, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL  ELECTRIC

G-E SPS-8, one of the first shipboard height-finding and search radar antennas, had astigmatic parabolic reflector which presented difficult quality control problems. High accuracy of construction was maintained through the precision inspection afforded by General Electric's Contour-Checking Tower.



CHIEF PROJECT ENGINEER Harvey J. Brown (seated), Ryan Industries, Inc., Detroit, discusses new G-E motor for Ryan Industries' intervalometer-directed disseminator with G-E Sales Engineer Hugh Folsom.

G.E. develops a versatile new aircraft motor to meet rigid specs of Ryan Industries, Inc.

"Recently we required an aircraft motor of extreme versatility to meet radio-interference, explosion-proof, and other military specifications on an intervalometer-directed disseminator we are developing," says Chief Project Engineer Harvey J. Brown of Ryan Industries, Inc. "We took our problem to General Electric because of their proved ability to produce prototype and production models to meet our tight schedules."

"General Electric engineers developed a new motor which fully met our needs. And the close teamwork between our G-E sales engineer and his factory specialists

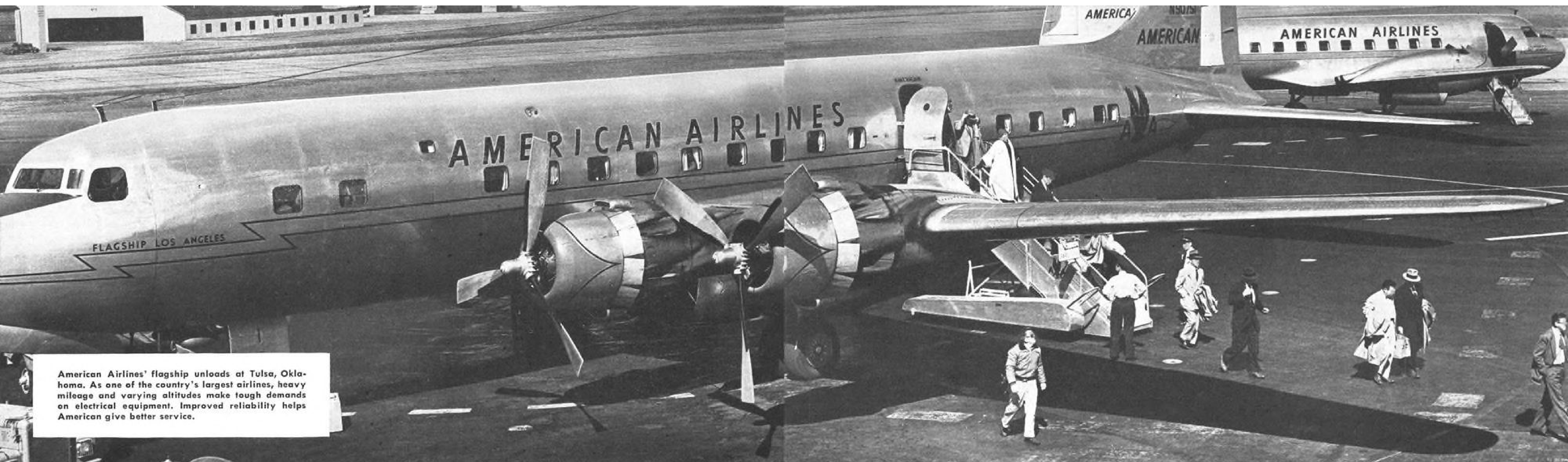
enabled us to complete our development on time."

IN SERVING YOU, G-E engineers can draw on unmatched experience gained in solving this and hundreds of similar aircraft-motor problems. And they have at their disposal G.E.'s extensive aircraft-motor development and testing facilities.

To take full advantage of this extensive engineering service, contact your local G-E Apparatus Sales Office *early in your planning*. And for more information, write today to Section 704-31, General Electric Company, Schenectady 5, New York.

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American Airlines' flagship unloads at Tulsa, Oklahoma. As one of the country's largest airlines, heavy mileage and varying altitudes make tough demands on electrical equipment. Improved reliability helps American give better service.

G.E. HELPS AMERICAN BOOST AIRCRAFT



Part of American Airlines' overhaul base at Tulsa, Oklahoma, shows DC-6 hangar. G.E. works here with airline's engineers to improve service life of equipment.

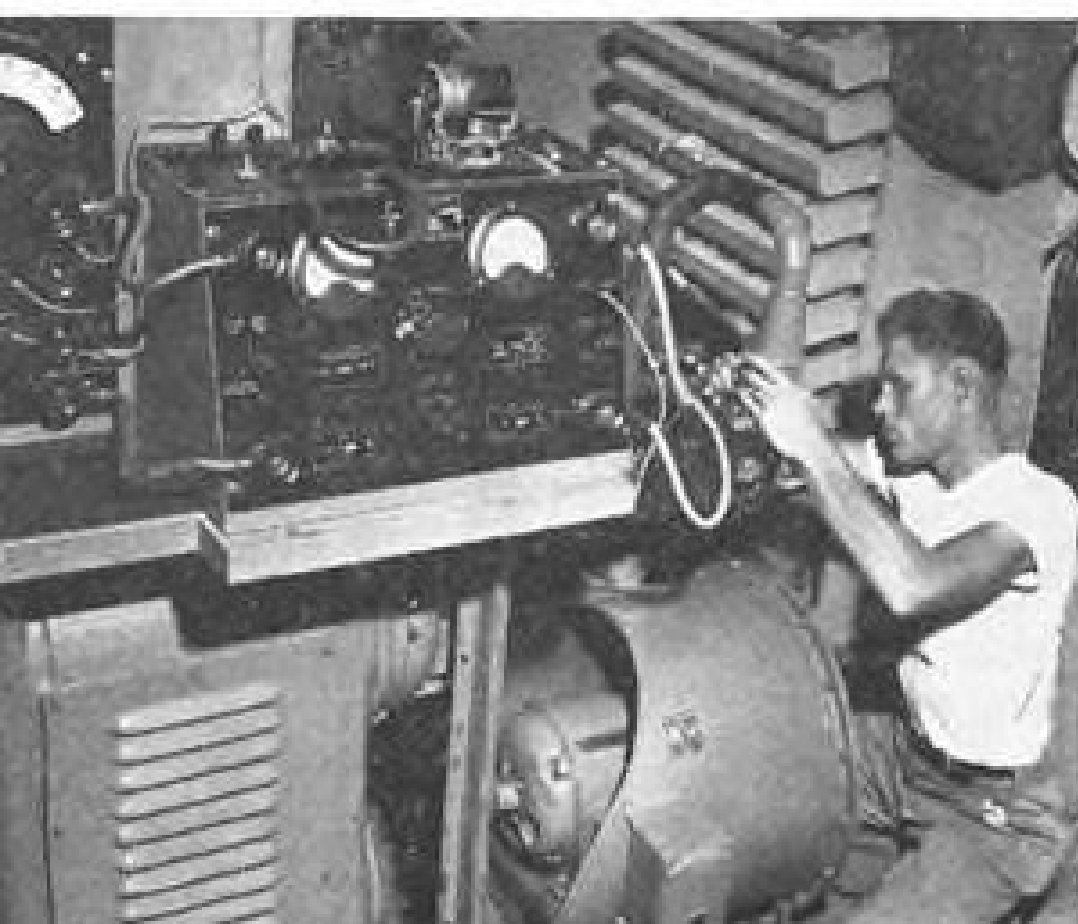


Sitting in co-pilot's seat, American project engineer removes generator control panel in Convair. Maintenance is facilitated by easy removal of generator protective devices which are grouped in G-E load-center units.

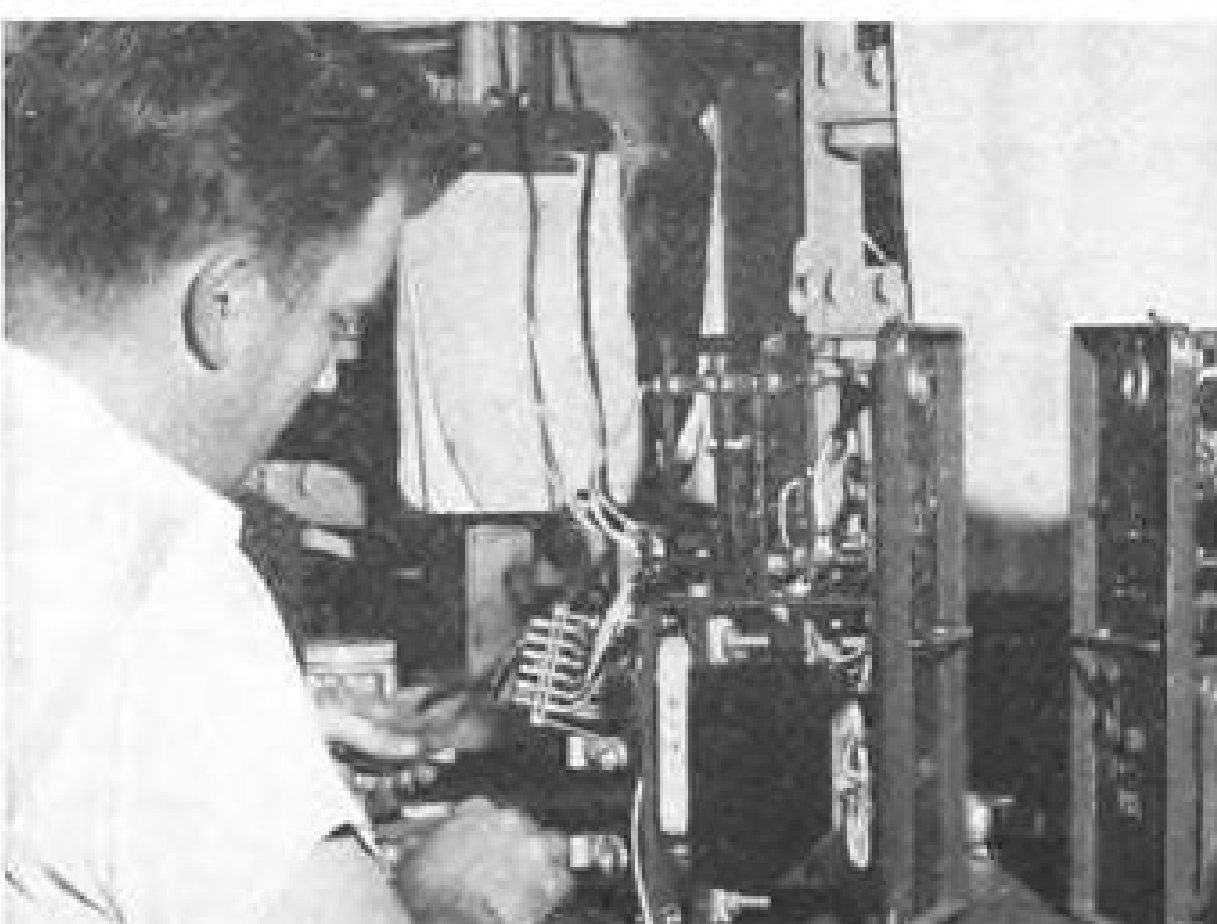


G-E representative discusses generator installation with American project engineer. Average total generator life is about 12,000 hours. Some last 18,000 hours.

G-E 300-amp generator is prepared for operational check before installation on aircraft. New brush design can withstand effects of sea level and high altitude.



Convair generator control panel undergoes overhaul in American's accessory shop. To further increase electrical system's reliability, all of American's Convairs are equipped with a G-E generator protective system.



G-E aircraft representative C. M. Gordon discusses success of electrical improvement program with E. H. Raiguel, Director of Aircraft Engineering, American Airlines.



GENERATOR SYSTEM LIFE 100%

Power systems on Douglas DC-6's and Convair 240's give increased life between overhauls—maintenance time on other G-E components reduced

American Airline engineers, with the help of General Electric, have increased aircraft generating system life on their Douglas DC-6's and Convair 240's 100%. The systems were installed in 1946. For example, the expected generator life between overhauls of 700 hours on the DC-6's has been boosted to 1800 hours. This increase is the result of American's effort to extend its aircraft electrical component life between overhauls to keep pace with its engine overhaul schedule.

How equipment life, performance were improved

Longer generator life has been brought about three ways:

- (1) Spline wear has been reduced while keeping adequate damping of torsional vibrations.
- (2) Bearing failures have been diminished by supplying a special shielded type that will not rotate in its housing.
- (3) An entirely new type brush has been developed that will perform equally well at both high and low altitudes.

The original components such as the reverse current relays and reverse current breakers have given American long hours of low-maintenance service. In addition, co-operative efforts between G.E. and American have resulted in over-all system improvements such as over-voltage protection at minimum cost.

How American Saves Dollars

E.H. Raiguel, A.A.'s Dir. of Aircraft Engineering states, "Reliability and low maintenance cost of G-E aircraft electrical equipment mean dollars to American Airlines." This reliability and low maintenance is a result of careful systems engineering and sound equipment design which have

been brought about by a continuous co-operative effort among American, G.E., and the airframe manufacturers.

How G.E. Helps American

Early in 1947, American inaugurated service with Douglas DC-6's, and later, with Convair 240's. Naturally, they placed high value on the reliability of their electrical equipment. G.E. co-operated closely with them and the airframe builders in working out the details of the system.

This co-operation did not end with the delivery of the equipment. Since that time, General Electric has been working continually with American's engineering staff at Tulsa, Oklahoma, to improve the equipment's ability to withstand tougher environmental conditions and varying operational demands. The success of this program was a main reason for American specifying G-E equipment on a new order of DC-6B's and again last year when they ordered DC-7's.

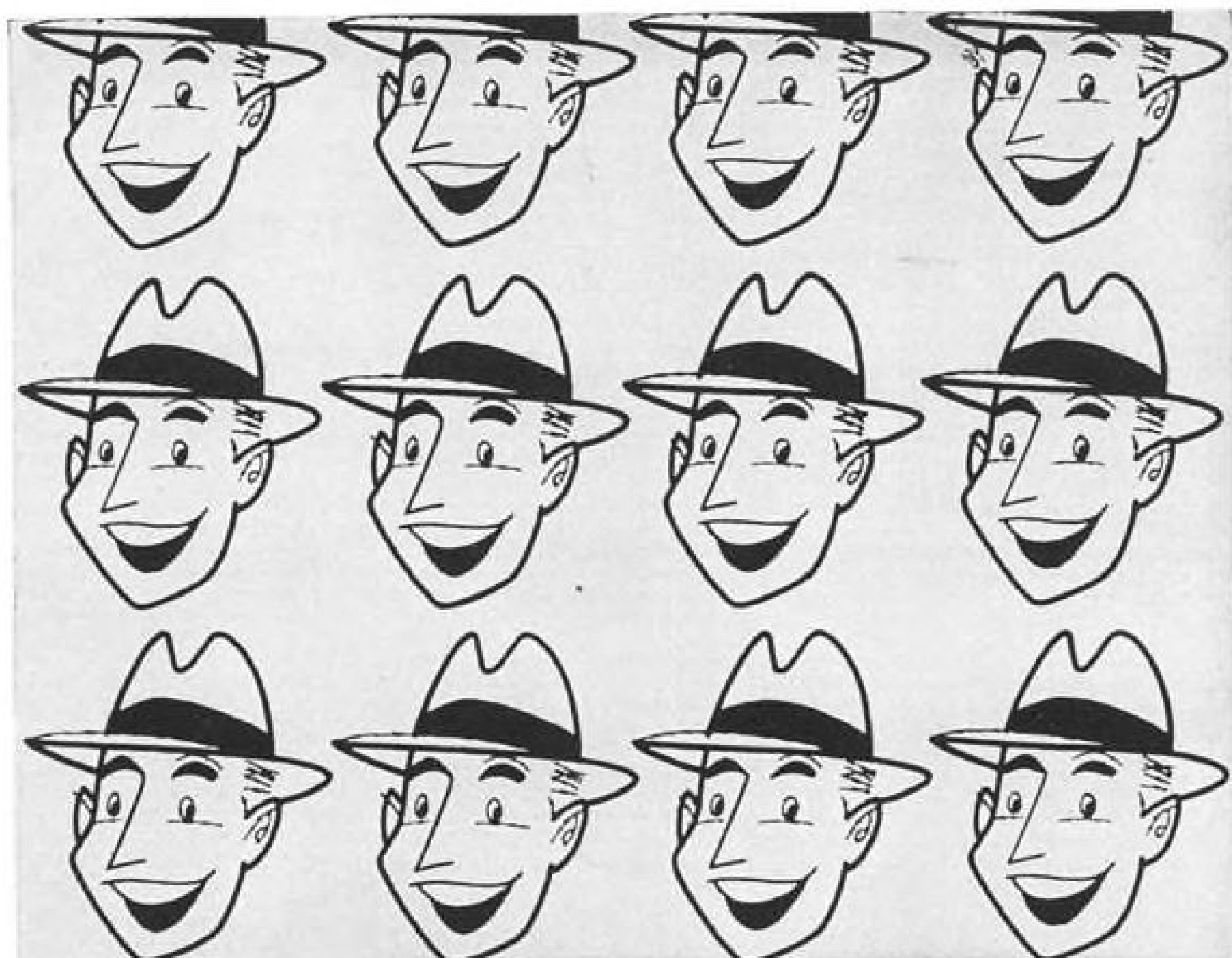
Service Available to You

The story of General Electric's co-operative improvement program with American is being repeated with many of today's major U.S. airlines. G-E application and service engineers are ready to work with you in both design and development of your aircraft equipment needs. For further information, see your nearest G-E Apparatus Sales representative. General Electric Co., Schenectady 5, New York.

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Users of E-P Precision Synchros enjoy the happy combination of extreme dependability, high accuracy and low cost. All result from our more than twenty years' experience in this specialized field.

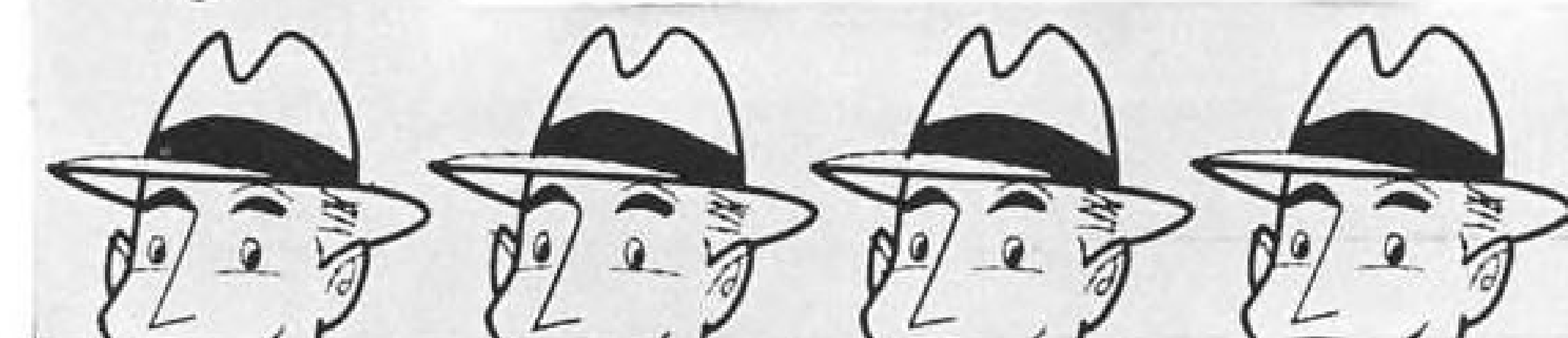
As the number one manufacturer of precision synchros, we suggest . . . with (we hope) pardonable pride . . . that we can supply the most efficient answer to your synchro requirements, too.

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and Blitz is head of commercial development.

Following the APN-1, the group developed the APN-42 radar altimeter, the APG-6 night fighter radar, and the APG-17 low-altitude bombing radar.

In 1945, this group of four moved to Raytheon to work on the Lark missile. Sanders was manager of Raytheon's guided missile and radar division and the others held top posts in the division. At Raytheon, the foursome was joined by others, including Norman Wild (present head of Sanders microwave department) and Morton Goulder (head of special products department).

By 1951, the group had decided to attempt what many engineers dream about—a company of their own. Scraping together \$75,000, Sanders Associates was formed and moved into the two top floors of the abandoned mill in Nashua. The city, hard hit by the loss of its long-established textile industry, welcomed the new firm.

It is doubtful if even the most optimistic Nashuans could foresee that within four years, the tiny new enterprise would have expanded so that its payroll exceeds that of the departed textile firm.

► **Rapid Growth**—Within nine months, the company had developed its miniature rate gyro, a tiny blower for cooling avionic equipment and a miniature solenoid valve, forerunner of the present bootstrap model. First year's sales were \$500,000, jumping to \$1.5 million the second year and nearly \$3 million in the third.

On the strength of present and anticipated future needs, Sanders recently purchased the six-story building in which it had been a tenant, giving it a total of 450,000 sq. ft., roughly six times what it previously occupied. Old textile machines stored in the lower floors are now being cleared out preparatory to remodeling for Sanders' needs.

► **Move to Systems Work**—From its initial start in the components field, Sanders recently has moved into the systems and sub-systems business in a big way.

A year ago, the company had no prime systems contracts on its books. Today, approximately 70% of its current billing is for prime systems contracts, according to Best. At present, most of this is development or prototype work.

The only "large-scale" production at present is on miniature rate gyros (85 per month) and Tinkertoy modules. Within a couple of years, however, Best expects that several current developments will be well along in production.

Approximately 45% of Sanders' prime systems contracts are with BuAer, 35% with the Air Force, and the



Silicone News

FOR DESIGN ENGINEERS

Silicone Paint on Space Heaters Gives Durable, High Style Finish

The trend to light, natural finish furniture has created a demand for home heaters that complement such furniture. To meet the demand, Duo-Therm of Lansing, Michigan, a leading manufacturer of space heaters, offers a "platinum" finish achieved by applying an off-white veiling over a buff colored, modified silicone coating.



Formulated by Glidden Company, the platinum finish is more durable than any organic finish. It easily passes Duo-Therm's life test of 500 consecutive hours at a surface temperature of at least 450 F. Under the same test conditions, light colored high temperature coatings based on organic resins discolor, crack and flake. The modified silicone coating shows no deterioration.

To increase customer satisfaction, Duo-Therm also applies a modified silicone-aluminum coating to the heat chambers of most of their heaters. Able to withstand temperatures in the range of 600 to 900 F, this silicone finish eliminates the smoking of organic coated heat chambers when they are first fired in the user's home.

Because it does not crack or peel in service, this modified silicone-aluminum coating is also applied to the stove body, flue and stack shield of the new Duo-Therm incinerator. The incinerator cover is coated with a straight silicone-based finish that withstands temperatures up to 1000 F with no discoloration or visible deterioration.

Duo-Therm sprays and cures silicone based coatings with the same equipment they use to apply organic based paints. Oven times and temperatures are also the same, ranging from 6 to 12 minutes at maximum temperatures of 450 F.

No. 34

Silicones Reduce Maintenance; Aid Designers of New Machines

In building a machine to meet high speed production requirements, the National Drying Machinery Co. of Philadelphia makes good use of three Dow Corning silicone products. Designed to be the fastest and most efficient festoon-type textile dryer and curing oven ever developed, the fully automatic "Model G" has an evaporative capacity of 16,000 pounds of water per hour. Speeds range up to 160 yards per minute per strand.

Much of the increased capacity of this new dryer is due to operation at temperatures up to 450 F. But in developing the unit, National designers found that such high operating temperatures presented problems not previously encountered. The wooden festoon-supporting poles or rollers used in ovens of this type, splintered and charred after a few weeks' service. Similarly, at 450 F, organic greases have very limited life and the prospect of frequent bearing failures in an otherwise expertly designed machine could not be tolerated.

National solved the roller problem by installing heat resistant, lightweight poles molded of a silicone resin-mineral composition. To prevent any possible moisture absorption and to provide a better gripping surface, the poles are coated with Silastic, the Dow Corning silicone rubber.

The rollers last indefinitely, but the gripping surface should be renewed after 6 to 12 months' service. National furnishes their customers with a Silastic compound that is easily applied and cured without removing the poles from the dryer.

The lubrication problem was easily solved with Dow Corning 41 Grease. Packed into the eight flange-type ball bearings in the conveyor system, this heat-stable silicone lubricant keeps bearings rolling at maximum operating temperatures for years without relubrication.

The selection of Dow Corning 41 was based on previous experience with this silicone grease in the bearings of National's HR-4 roll dryer. Bearings lubricated with organic greases and exposed to 450 F in the HR-4 failed in less than 6 months; 41 Grease has yet to cause a failure.

No. 35



Silastic Insulates Inductor Coil in High Temperature Electronic Unit

Washers fabricated from Silastic*, the Dow Corning silicone rubber, are major components in the new high-Q toroidal inductor developed by Vector Manufacturing Co. of Houston. Used to insulate the unit's doughnut coil from the case, Silastic also provides a heat-stable resilient cushion against physical shock. Tests indicate the Silastic washers retain their original excellent dielectric and physical properties after prolonged exposure to operating temperatures of 400 F.

Vector also makes use of the scrap Silastic left after the washers are stamped from sheet stock. They use the ground-up scrap to fill voids within the inductor case. Firmly packed, the macerated Silastic further cushions the coil; holds it securely in position; eliminates the need for supporting frames or braces. Because Silastic has a high order of thermal conductivity, the washers and packing also help to dissipate heat generated in the coil.

No. 36

*T. M. REG. U. S. PAT. OFF.

Revised listing of Silastic Fabricators names more than 80 rubber companies ready to make Silastic parts to your specification.

No. 37

Design Edition 8

DOW CORNING CORPORATION - Dept. 0904
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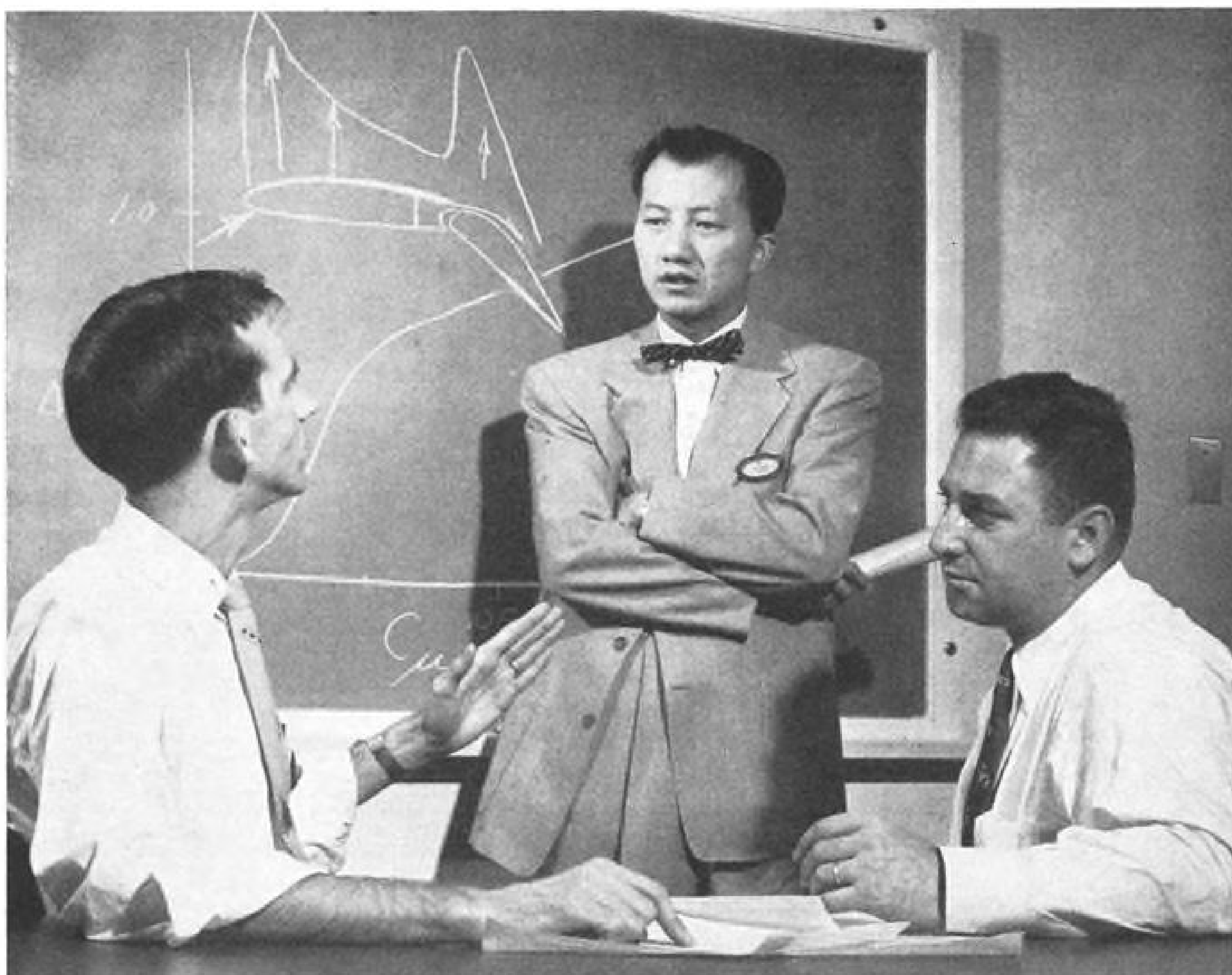
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Richard Cantrell, aerodynamicist (left), Jim Hong, Aerodynamics Division head (center) and Irving Litrownik, aerodynamics engineer and boundary layer control specialist, discuss effects of blowing boundary layer control on lift increments and pressure distribution.

Now in a stage of major expansion, the Aerodynamics Division is one of the fastest-growing organizations at Lockheed, with unusual opportunities for achievement and promotion. Assignments cover virtually the entire spectrum of aerodynamics endeavor.

The expansion program includes such projects as nuclear applications to aircraft, extraordinarily high-speed fighters, new concepts in vertical rising aircraft, advanced versions of trainers and bombers, turbo-prop and jet transports, and a number of significant activities. Typical aerodynamics problems are:

1. Estimate improvements in maximum lift of sweptback wings with Boundary Layer Control for use in future commercial transports.
2. Estimate maximum speed and altitude capabilities of advanced supersonic military designs.
3. Determine ability of vertical rising aircraft to make transition from horizontal to vertical flight.
4. Estimate direct operating costs of new turbo-prop commercial transport under wide range of operating conditions.
5. Determine design tail loads on turbo-prop cargo airplane for all types of engine failure.
6. Determine ability of new trainer to make carrier landings and catapult take-off.
7. Establish design criteria for auxiliary damping servomechanisms on future fighters.
8. Optimize approach and landing technique for use on rough, short fields by rescue aircraft.

Career-minded Aerodynamics Engineers and Aerodynamicists are invited to participate in this expansion program. Address inquiries to E. W. Des Lauriers, Dept. A-3-4.

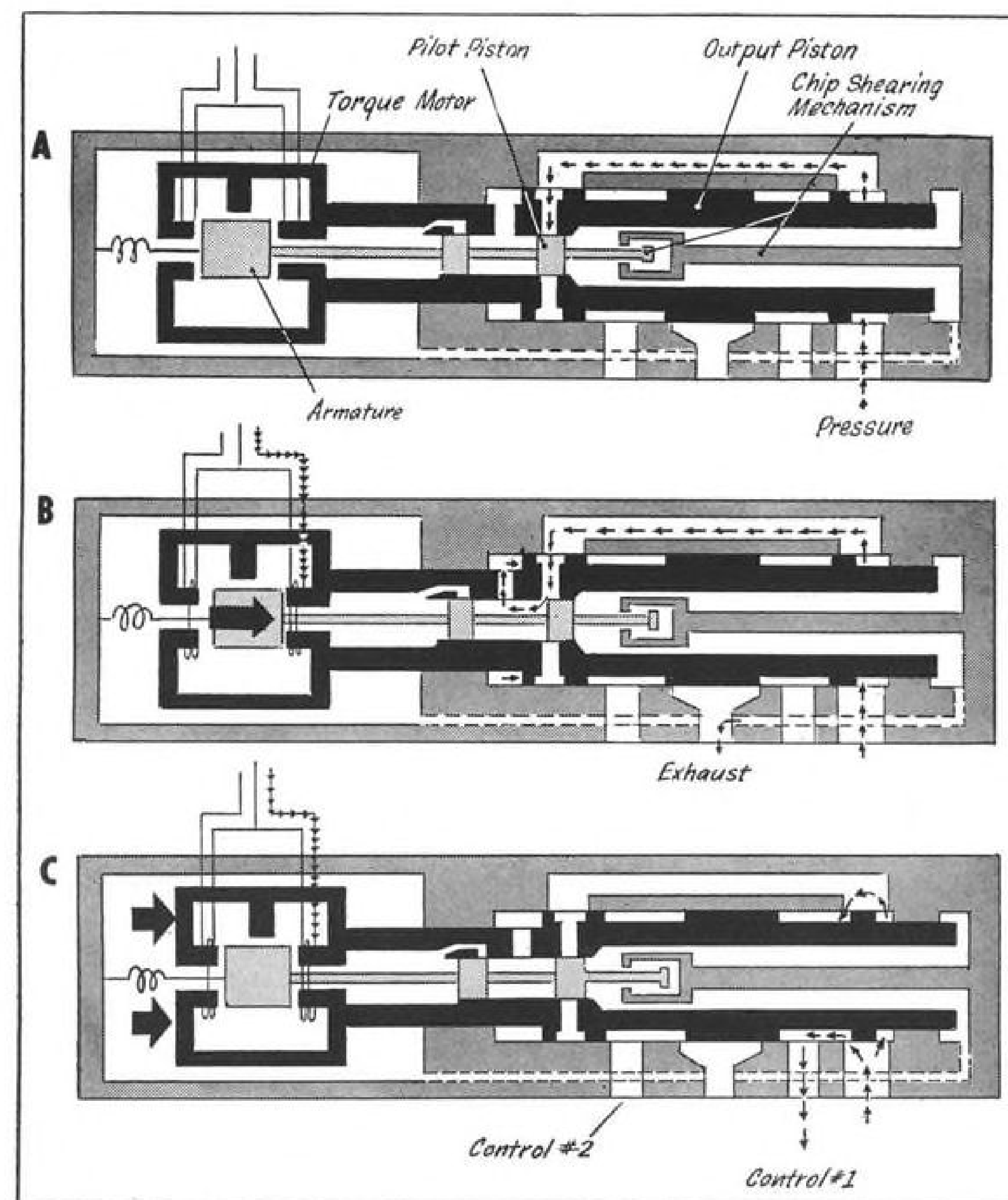
LOCKHEED

AIRCRAFT CORPORATION

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Hovering to high-speed flight:

Lockheed expansion program offers wide range of aerodynamics assignments



NOVEL BOOTSTRAP VALVE is centered, with no output from either control port, when balanced signals exist in torque motor (A). When signal predominates in right side of motor (B), armature moves right, opening center port which vents line pressure to second stage output piston. This moves piston to the right (C) until armature recenters and center port is closed, simultaneously venting line pressure to control port No. 1. When signal is applied to left side of torque motor, line pressure is vented to control No. 2.

balance with Army Ordnance.

► **Inventive Management**—Considering Sanders' relatively small engineering staff, numbering around 80, the firm has undertaken an ambitious number of projects. One partial explanation for its ability to handle so many: Sanders management takes an active part in technical operations. The 14 associates collectively hold nearly 450 patents.

In these days of high engineering turnover, Sanders has lost only two engineers during the past year, according to Best.

Bootstrap Valve

By means of an ingenious internal self-nulling (bootstrap) principle, Sanders has been able to extend the frequency response of high-power two-stage hydraulic valves out to 100 cps., simultaneously cutting size, weight and cost.

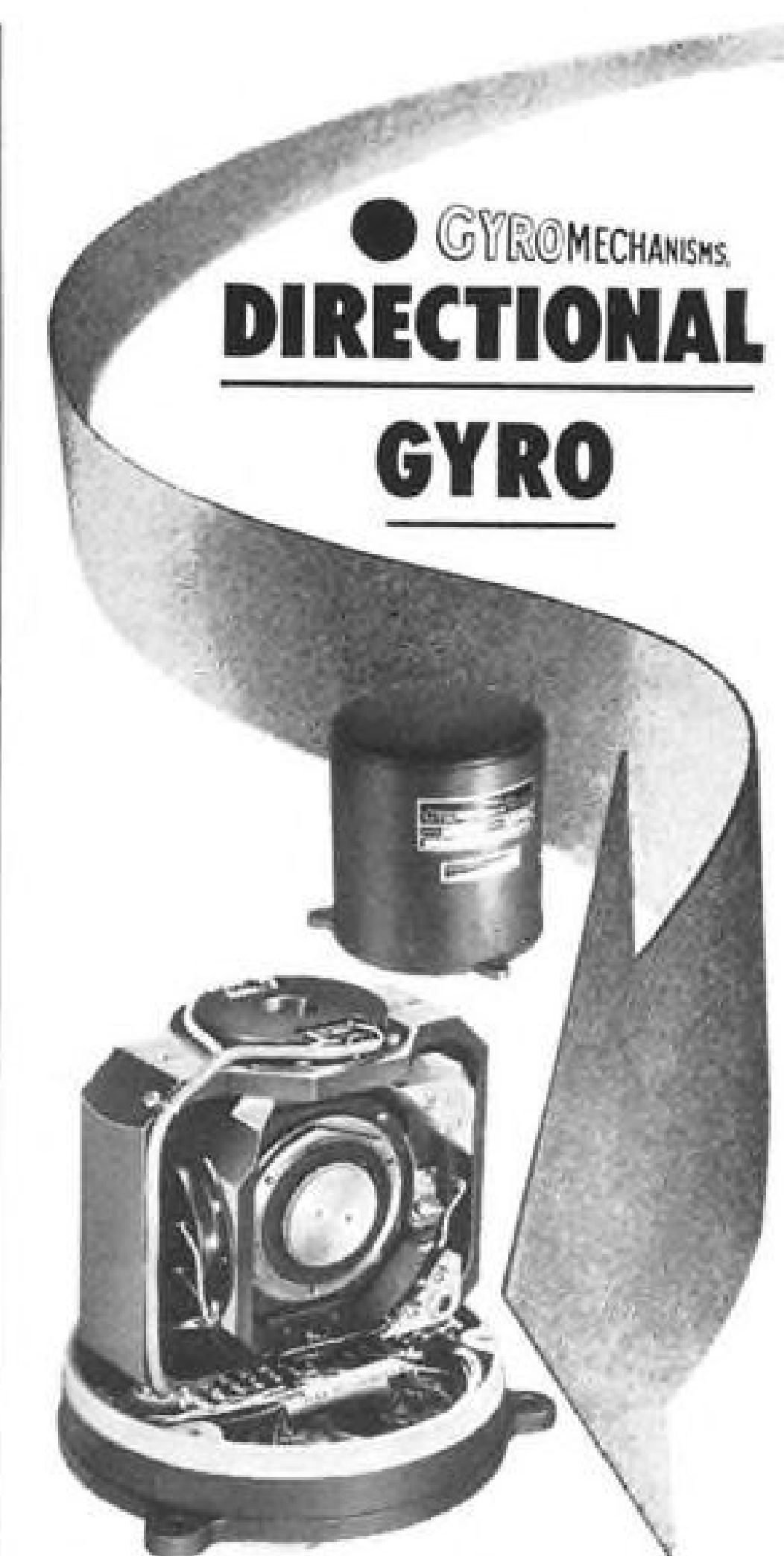
The new valve, particularly suited

to the control of highspeed aircraft and missiles, is a Sanders-financed development.

Early solenoid valves, developed during World War II, were single-stage devices in which electrical signals were applied to a solenoid whose armature moved the valve stem, producing a hydraulic flow proportional to the input signal. Because hydraulic flow forces reacted against the solenoid armature, the postwar need for higher hydraulic power required the use of larger torque motors with increased armature travel. This in turn reduced the valve's frequency response.

To get around this limitation, industry designers came up with a two-stage valve in which the torque motor armature was required only to actuate a small pilot piston, which ported hydraulic pressure to actuate a second-stage piston. This controlled the output to the hydraulic actuator.

As a result, it was possible to build



This Directional Gyro incorporates advances in the art of gyroscopics which achieve an unusual degree of accuracy, and at the same time extreme ruggedness, making it ideal for aeroplane and missile applications where low drift is required; even under maximum vibration conditions.

SPECIFICATIONS:

Size: Diameter 5 inches
Length 5 1/2 inches
Weight: 5.5 lbs.
Drift rate on Scorsby
(excluding earth's rate)
± 6°/hour maximum
Life: 1000 hours minimum
Potentiometer Pickoff—
resolution 0.18°
linearity 0.1%
Induction Motor—400 cps, 115 volts.
Vibration: Mil E 5272 A Procedure I
extended to 2,000 cps.
Temperature Range: —54°C to +71°C
Gyromechanisms' engineering specialists are available for consultation on possible applications, without obligation.

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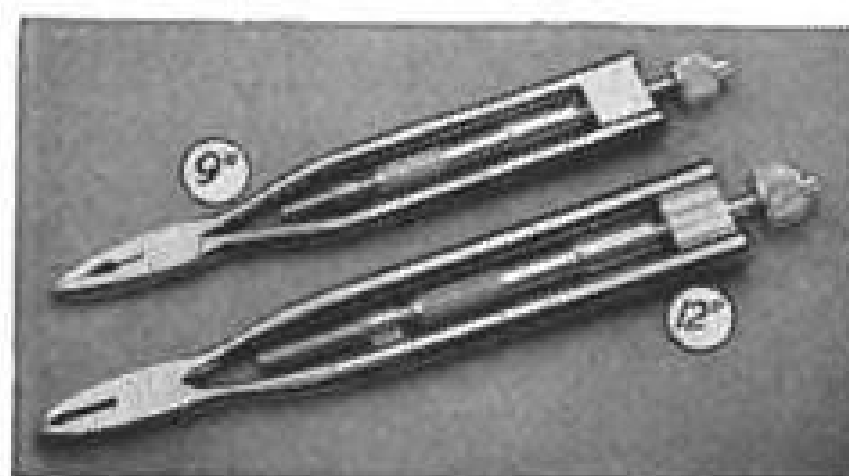
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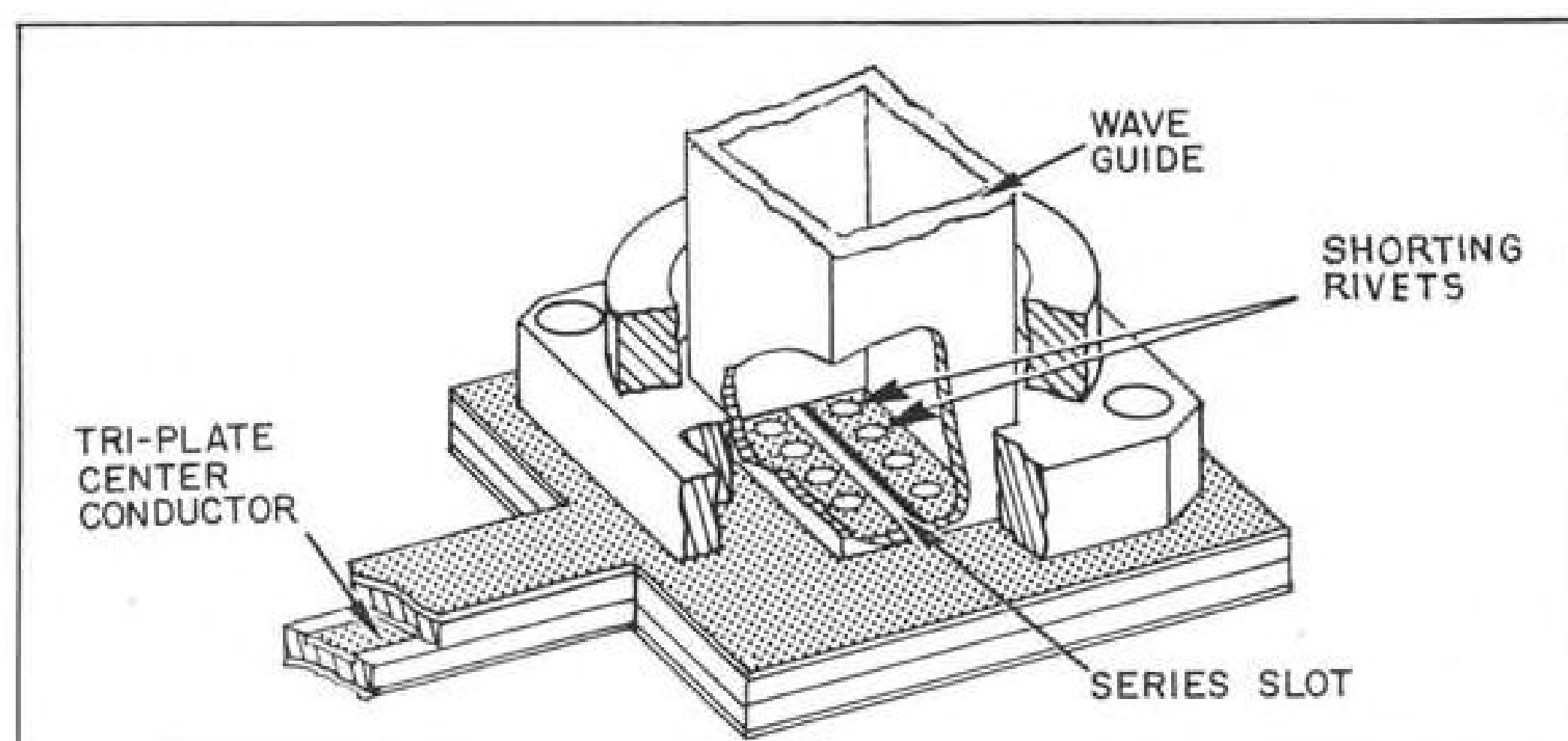
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TRI-PLATE makeup is shown in cutaway of connection to conventional waveguide.

valves capable of delivering several horsepower, using smaller torque motors with reduced armature travel (approximately ± 0.01 in. versus ± 0.05 in.), and hence to obtain improved frequency response.

► **Built-In Feedback**—Recognizing that even higher frequency response could be achieved and smaller torque motors used if armature travel could be further reduced, Sanders engineers sought a way to make the solenoid motor essentially a pure "force" device instead of a "force and motion" actuator. This they have now achieved by attaching the solenoid motor to the second-stage valve, instead of anchoring it to the valve housing as in the past (see sketch, p. 79).

The result is that motion of the armature relative to its solenoid is slashed to approximately ± 0.002 in., only $\frac{1}{3}$ that previously required. Even this tiny displacement exists only momentarily, until the second-stage valve responds, re-centering the torque motors and its armature. The advantages of this "bootstrap" design include:

- **Higher frequency response**, which Sanders expects ultimately may reach 125 cps. in production models.
- **Extreme linearity** between input signal and output flow. Maximum deviation is 14% of full stroke in prototype models tested, a figure which Sanders hopes to cut to 5% in production.

► **Mechanical Features**—In addition to the "bootstrap" principle, the new Sanders valve boasts several other interesting features. These include:

- **Anti-friction pilot valve** which rides on ball bearings to eliminate sliding friction between the pilot piston and second-stage valve sleeve normally caused by side loading on the piston. This eliminates need for "dither" (high-frequency electrically excited vibration), except where extreme positioning accuracy is required, Sanders says.

- **Chip clearing mechanism**, provided by small ram attached to the pilot piston (see sketch, p. 79).

If metal chips should get past hy-

draulic system filters, momentarily causing the pilot piston to bind in a displaced position, the full hydraulic pressure acts against the second-stage valve piston and the ram with a force of 110 lb., shearing off the chips and freeing the pilot piston, Sanders says.

- **Building block design**, in which valve body is built up from a series of stainless steel blocks which are then brazed together with full surface brazing of the body (see photo, p. 66).

This construction makes it possible to machine internal orifices and ports, instead of employing external drilling and plugging of passages required in conventional one-piece body construction. It also makes it possible to provide rectangular orifices and ports, for better linearity. (The torque motor is completely enclosed in the valve body, assuring no external leakage.)

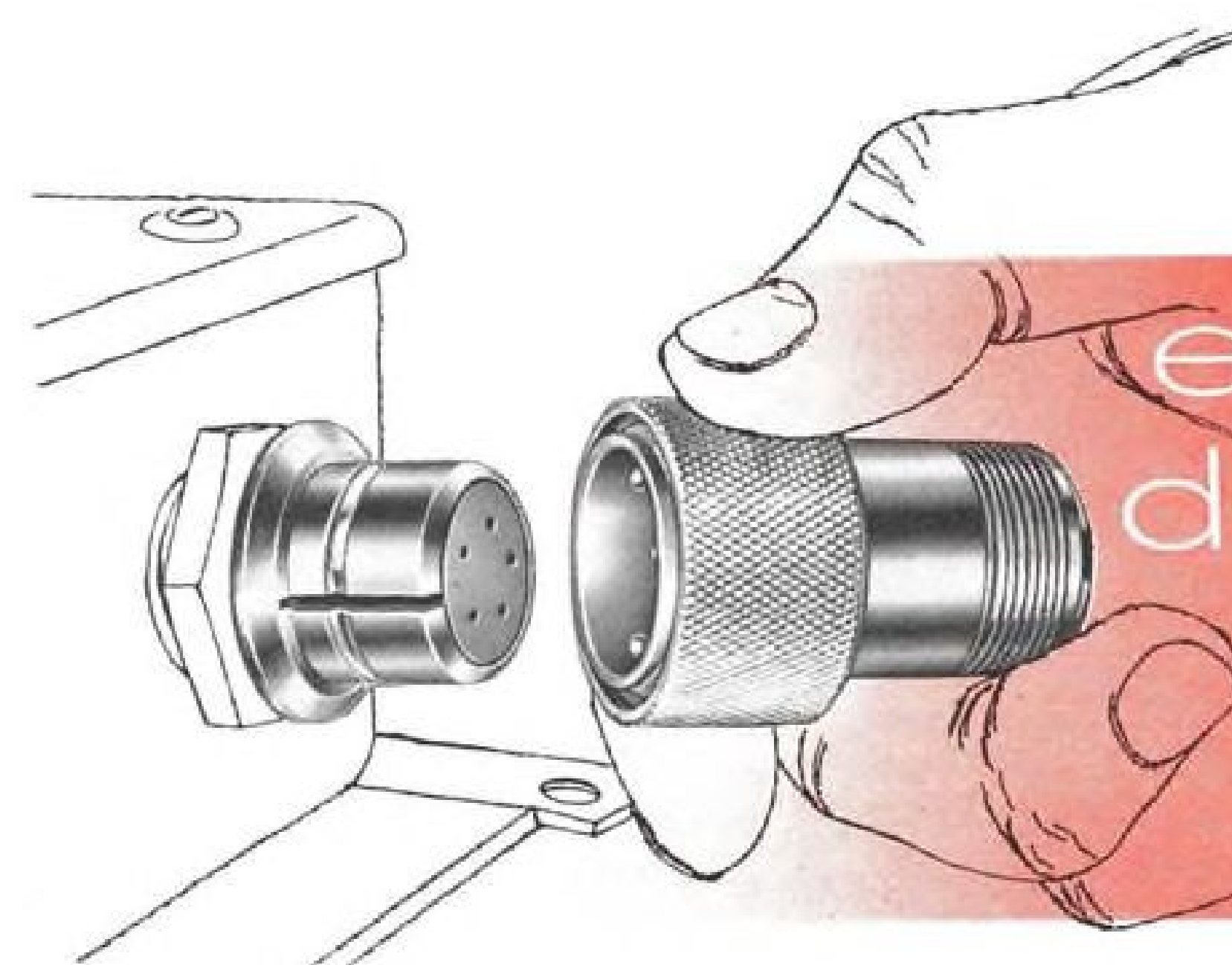
Prototype models of the Sanders SA-14 bootstrap valve will handle a 3 gpm. at 3,000-psi. system pressure (with 1,000-psi. drop across the valve), or roughly 5 hp., in an envelope measuring $1\frac{1}{2} \times 1\frac{1}{2} \times 5\frac{1}{2}$ in. In production models of the same dimensions, Sanders hopes to up this capacity to 4 gpm. The firm also expects that the basic design can be scaled up to provide a 25-gpm. valve in a $1\frac{1}{2} \times 1\frac{1}{2} \times 5\frac{1}{2}$ in. package, and a 200-gpm. unit in a $2\frac{1}{2} \times 2\frac{1}{2} \times 9$ in. package.

Sperry Gyro and several other firms already have purchased the new SA-14 for evaluation. In sample quantities, it sells for \$800, but a price of \$225 is being quoted in quantities of 1,000 units or more.

Tri-Plate Line

Recently an aircraft manufacturer faced a tough problem: How to fit the 5-in.-deep RF head of a radar altimeter into the very thin wing of a new fighter.

Sanders came up with the solution by redesigning, to substitute its new Tri-Plate for conventional microwave plumbing. This cut RF head depth from 5 to 3 in., enabling it to fit into



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Just pull... no twisting or turning

To connect, you pull the coupling ring back... engage the plug with the receptacle... release. The coupling ring springs forward to lock the connection... no safety wiring needed. To disconnect, simply pull on the knurled coupling.

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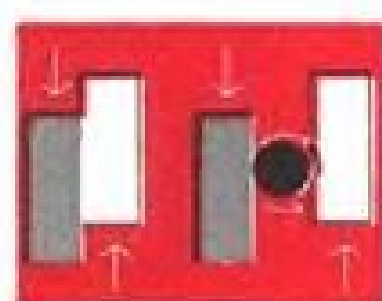
New Saginaw b/b Spline makes all ordinary splines obsolete!

By applying the flight-proved principle of the recirculating rolling ball (already made famous by the *Safety b/b Screw*), Saginaw has revolutionized spline design! The new *Safety b/b Spline* is so far superior to any spline ever before built that aircraft engineers are adopting it with open arms—particularly for landing gear applications, where it's a "natural".

In any application where column length must change under torque load, the *Safety b/b Spline* offers unprecedented freedom from spline restrictions.

AVAILABLE IN ALMOST ANY SIZE
Every *Safety b/b Spline* is individually engineered for its particular application, with the wealth of know-how that only Saginaw, the pioneer, can offer. Our engineers are ready and eager to help you.

WHAT IT IS AND HOW IT WORKS:



Let's start with the familiar principle that there's far less friction in rolling than in sliding. The average coefficient of friction of the sliding spline is .2—while that of the ball-bearing spline is only .005.

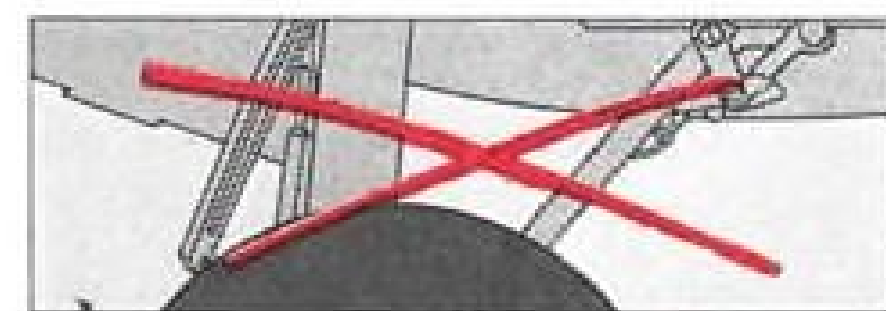


By applying this principle, the *Safety b/b Spline* radically increases the efficiency of transmitting or restraining high torque loads. Instead of sliding against each other, the mating surfaces glide on rolling balls.



The steel balls recirculate in closed circuits formed by mating longitudinal raceways spaced around the circumference of both the inner and outer splines. Ball guides return the balls to their starting point.

HOW THE *Safety b/b Spline* CAN HELP SOLVE YOUR AIR- CRAFT ACTUATION PROBLEMS



The *Safety b/b Spline* offers great advantages over the conventional "scissors" unit in landing gears.

The coefficient of friction of the *Safety b/b Spline* is approximately 40 times better than that of the conventional spline. It can be fitted with integral gears, clutch dogs, bearing and sprocket seats or other attachments for use with electrical, hydraulic or pneumatic units—forming a unit with tremendous advantages for the aircraft engineer. It can enable you to:

ACHIEVE THE "IMPOSSIBLE"—By reducing weight and space requirements, the *Safety b/b Spline* permits engineering designs hitherto impractical.
INCREASE DEPENDABILITY—Greatly decreased friction means less wear—longer life—safer, more dependable operation is assured.

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Making Tri-Plate

To form Tri-Plate, Sanders photo-etches away portions from one side of a copper-clad Teflon-glass laminate, leaving a copper strip conductor on one side, the complete copper plate (ground plane) on the other. At this interim stage, it resembles FTL's Microstrip in appearance.

The next step is to place two identical (mirror image) pieces together so that the two copper strip conductors effectively become a single conductor sandwiched between the dielectric and two outside copper ground planes.

The two pieces are fastened together with rivets, which also function as shorting pins to maintain the two outer surfaces at the same potential.

the wing. Even greater size reduction would have been possible except for limits imposed by the magnetron and associated components, according to Norman Wild, head of Sanders' microwave group.

Like previously announced photo-etched microwave plumbing and components made by Federal Telecommunications Lab (Microstrip) and Airborne Instruments Lab (Stripline), Sanders Tri-Plate offers considerable saving in size, weight and cost over conventional microwave plumbing in many applications.

However, Sanders naturally believes that its Tri-Plate offers certain advantages over the FTL and AIL designs.

► **Variety of Components**—The Tri-Plate fabrication techniques can be applied to a variety of microwave components, including waveguide, hybrid junctions and directional couplers, variable and fixed attenuators, single and double stub tuners, and even to the new ferrite gyrators and resonators (see photos, pp. 83, 84).

One of the most significant applications for Tri-Plate is in the construction of compact antennas for flush mounting on highspeed aircraft. Sanders has constructed one X-band Tri-Plate 4x4 slot array antenna which measures only 1/4-in. thick (photo, p. 62).

Using photo-etch techniques, it is relatively easy and inexpensive to fabricate a slot array with dividers which provide equal in-phase power to all slots.

► **Tri-Plate Advantages**—Although Tri-Plate costs slightly more to fabricate than FTL's Microstrip, Sanders claims advantages which it believes more than outweigh this factor:

• **No radiation leakage.** The enclosed nature of Tri-Plate eliminates the problem of radiation leakage encountered

with FTL's Microstrip, Wild says. (FTL says it can provide a shield for its Microstrip which restricts radiation.) This makes it possible to run several Tri-Plate lines close to one another, permitting more compact equipment design. Sanders tests at 4,200 mc. show that cross coupling between two parallel strips of Tri-Plate is down 15 db. when the two are separated by 1/8 in., 70 db. when the separation is 1/4 in.

• **Conventional measurement techniques.** Unlike Microstrip, where special techniques are usually employed to make VSWR and phase measurements because of stray radiation leakage, Tri-Plate characteristics can be obtained using conventional slotted line techniques, Wild says.

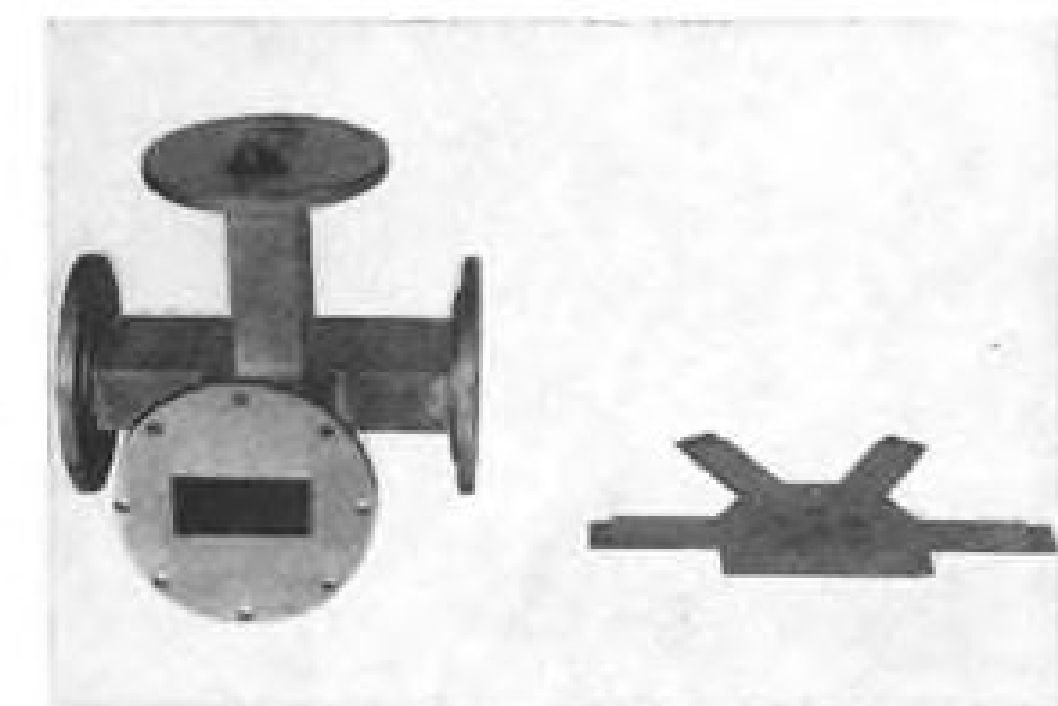
► **Slightly Higher Losses**—Using a Teflon-glass laminate, Tri-Plate losses will run about twice those of Microstrip, according to figures provided by the two companies.

At 5,000 mc. Microstrip attenuation is 0.33 db./ft., compared to 0.8 db./ft. for Tri-Plate. At 9,000 mc., the figures are 0.60 vs. 1.35 db./ft. However, because of the extremely compact construction made possible by photo-etched plumbing, total system losses are relatively low for both types in many applications.

AIL's Stripline, consisting of a supported conductor operating in air between two metal ground planes, has lower losses than either Microstrip or Tri-Plate. However, it is more costly to fabricate. Added disadvantage, according to Wild, is that AIL's line is less rigid than Tri-Plate, hence more subject to vibration-caused microphonism in both aircraft and in missile applications.

Wild points out that etching the center conductor on both dielectric plates in the Tri-Plate line (instead of on only one), makes it relatively insensitive to clamping pressure of the securing rivets. A separation of as much as 1/8 in. is possible without any observable change in VSWR and with less than 15 degrees phase shift, Wild reports.

Like Microstrip, Tri-Plate has comparatively broad band characteristics. For example, a new variable attenu-



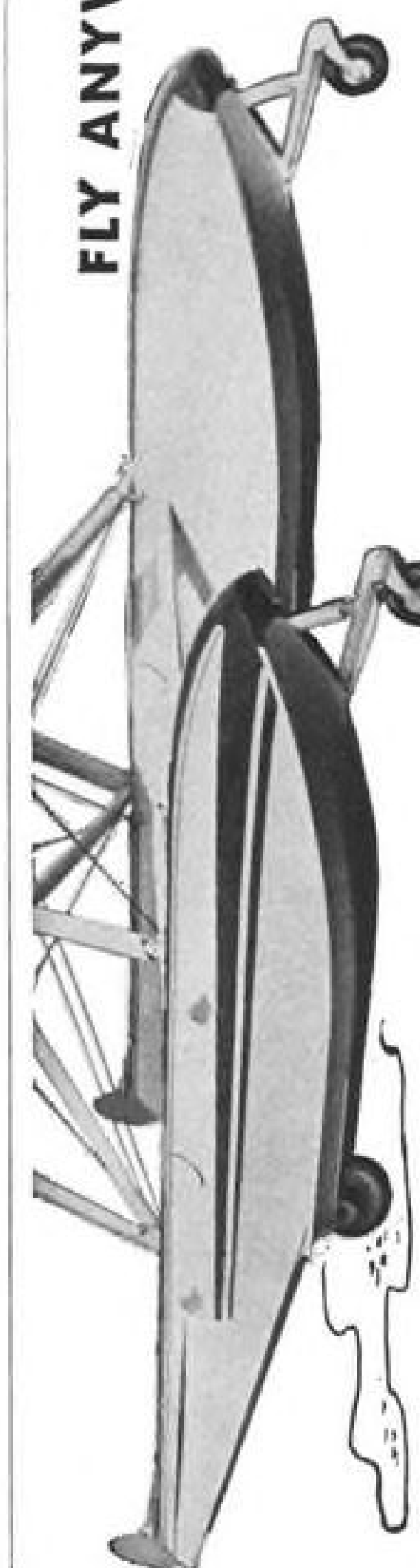
TRI-PLATE hybrid ring (r.) is much smaller than conventional component.



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Model S-570A
Trailer Type

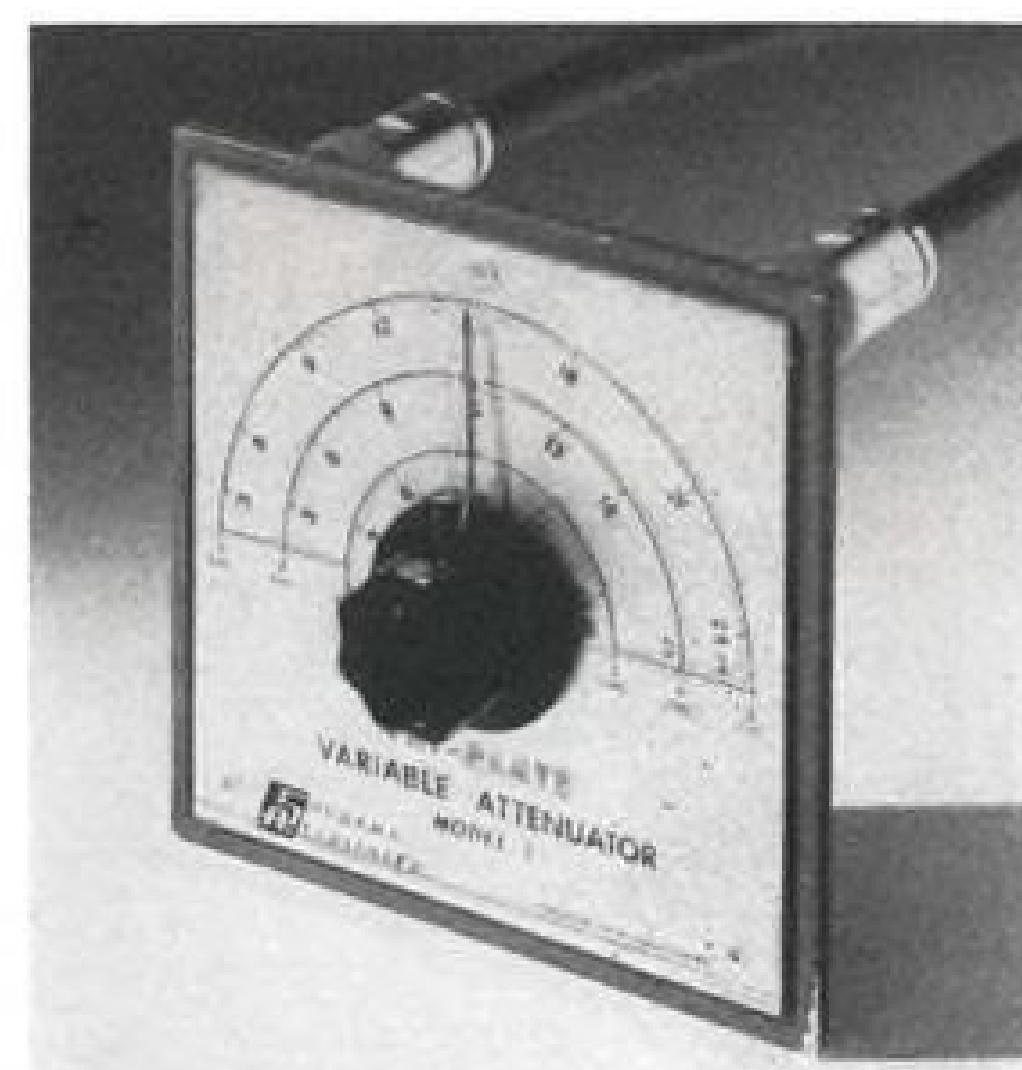
Sprague S-570 Series units are equipped with internal combustion engines and two-stage rotary compressors. Now furnishing quick, quiet starts for J-57, J-71, T-34 and T-56.

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Model S-570



TRI-PLATE variable attenuator is broad-band, lightweight, low-cost pad.

ator employing Tri-Plate construction, which Sanders recently put on the market, can be operated as a calibrated pad at 3, 4, and 5 kmc. With an error of no more than 2 db. (photo above).

It can be operated as an uncalibrated pad over the frequency range of 1 to 6 kmc. The unit is extremely light, compact, and low priced.

Wild reports that Sanders has completely explored Tri-Plate techniques at frequencies up to 6 kmc., and current work at X-band should extend this range. In addition to applying Tri-Plate to its own microwave equipment developments, Sanders is anxious to take on outside work in this field.

Sanders' Tri-Plate development program, originally sponsored by Navy Bureau of Aeronautics (Industrial Planning Division) and National Bureau of Standards, is being sponsored by USAF's Cambridge Research Center.

New Silicon Diode Operates Up to 150C

Several new high-temperature silicon and germanium diodes and power rectifiers have been announced recently by two manufacturers. The new semiconductor include:

- **Silicon junction diodes**, suitable for operation up to 150C, with extremely high forward conductance and inverse resistance, are available in several types. One, the 1N138B, is rated 40 ma. at +1 volt. Others, with inverse ratings up to 300v are available also from Transitron Electronic Corp. Company also is producing a line of silicon power rectifiers capable of delivering rated power at 125C. Company's address is Melrose 76, Mass.

- **Germanium diodes** in three new types, 1N265, 1N266 and 1N267, can be operated at temperatures ranging from -60C to 100C, according to manufacturer. The 1N267 is rated at



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He's been taught by experts. Taught to live by strict Navy rules of safety and common sense. He's learned to bear responsibility and authority. He's proved his executive potential by earning his envied wings of Navy gold.

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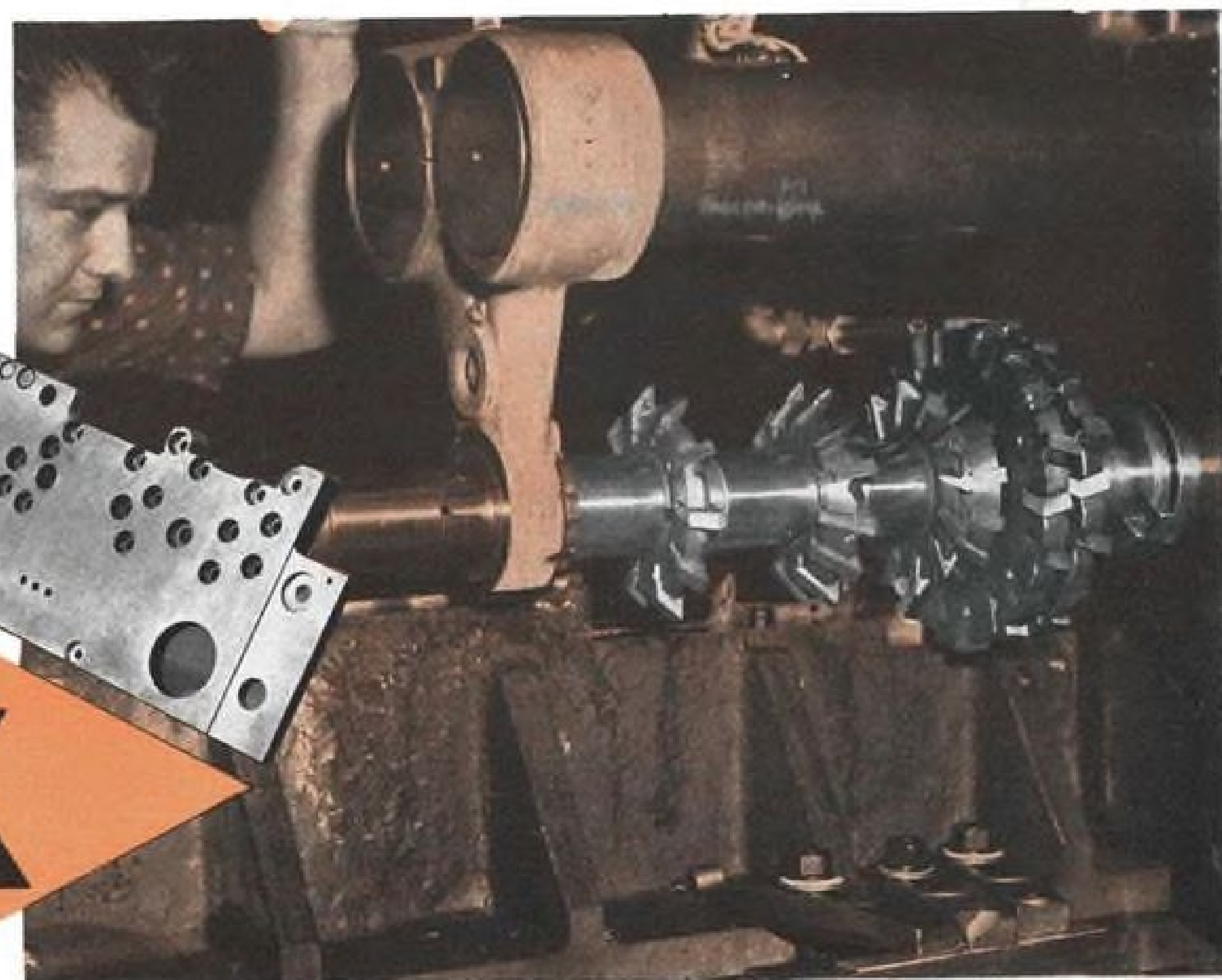
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CV-6

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At FARMINGDALE, LONG ISLAND, *Liberty Products Corporation*, achieve outstanding results on a complicated profile milling job using OK Tool high speed steel inserted blade milling cutters. A gang set-up of standard interlocking alternate angle, half-side and special chamfer mills take out 44 cubic inches of metal in the fast time — for finish milling — of better than one cubic inch per minute.

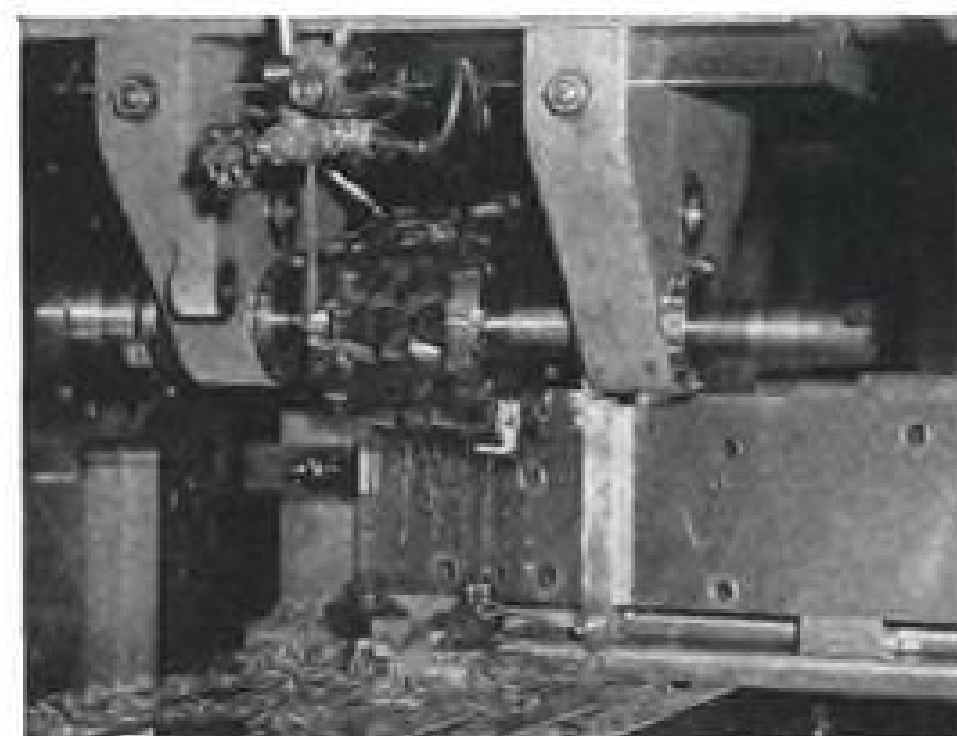
¶ Three plates, 33 x 8 x 1 3/8, chrome-molybdenum steel, are solidly bolted together using pilot pins to

spot locations. The job is completed in four operations as shown in the photographs. Number three Kearney & Trecker milling machines are used and the *total time for all operations* is 120 minutes, an average of 40 minutes per plate. Tolerances are held to plus or minus .005 inches.

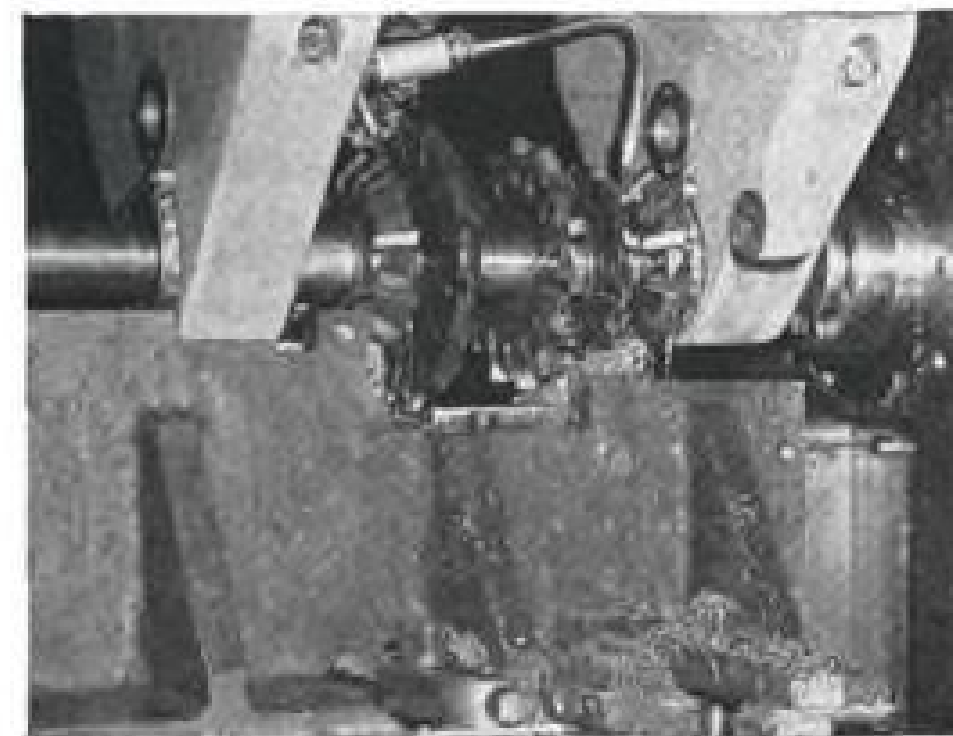
¶ This is another instance where high efficiency and economy are gained by correct job analysis and good judgment in the use of *modern milling cutters on modern milling machines*.



FIRST OPERATION — Seven alternate angle cutters (four 8s and three 7s) make a two-step cut through three chrome-moly plates bolted together.



SECOND OPERATION — Six alternate angle cutters (one 10, three 8s and two 6s) are gang mounted to make this three-step cut.



THIRD OPERATION — Five chamfer milling cutters (three 7s and two 10s) miter more slots made on previous operations.

Write for OK Tool Catalogs



OK

modern milling cutters
for modern milling machines

"MODERN MILLING CUTTERS FOR MODERN MILLING MACHINES"
"AMERICA'S FIRST SYSTEM OF SINGLE POINT TOOLS"

THE OK TOOL COMPANY, INC., Milford, New Hampshire

4 ma. (min.) at +1 volt, 0.04 ma. at -10v, with 20v d.c. maximum inverse voltage, at 85C. Units measure 0.23 in. in diameter x 0.47 in. long. Bulletin ER-191A gives application data. International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif.

Traveling-Wave Tube Tips Scales at 4 lb.

A new small lightweight S-band traveling-wave tube, which weighs only four pounds including solenoid, is one of several recently announced microwave devices.

The new TW tube, Model SL24-10M, reportedly has a 35 db. gain, 10 mw. output over the 2-4 kmc. band. Both dispersive and non-dispersive tubes are available in packages measuring 1 1/2 in. dia. x 13 in. long, including solenoid. Manufacturer is Stanford Laboratories Co., 1610 Broadway, Redwood City, Calif.

Other new microwave components:

- **Miniature IF radar amplifiers**, incorporating low-noise front ends, measure only 8 1/2 in. x 3 in. x 1/2 in. and weigh 1 lb. Specification for typical IF amplifier is: 20 to 100 mc. center frequency, 2 to 12 mc. bandwidth, up to 120 db. gain, 100 db. or greater automatic and/or manual gain control, better than 2 db. noise figure. Amplifiers reportedly will operate between -65C and 100C, and under 30G shock and 10G vibration.

Manufacturer: RS Electronics Corp., 435 Portage Ave., Palo Alto, Calif.

- **Miniature broadband co-axial switch**, permits switching of four circuits by remote control. New SP4T units are available in models for frequencies up through X-band, have 10 millisecond actuating time, weigh 12 oz., measure

3 x 3 1/2 x 2 1/2 in. Ambient operating range is -65F to 225F. Actuator power rating is 18 to 30 v.d.c.

Manufacturer: Transco Products, Inc., 12210 Nebraska Ave., Los Angeles 25, Calif.

- **Low attenuation delay line**, Model DL 0600-03/120 has a d.c. attenuation of 0.4 db. for a 36 microsecond delay and a 0.36 μs rise time. Unit is a 120 section lumped constant delay line which can be supplied with taps every 0.3 μs. Delay tolerance reportedly is 3%, characteristic impedance is 600 oms, tap capacity is 400 mmfd., and spurious reflection less than 3%. Size is 13 1/4 x 3 x 1 1/2 in. Unit is designed for

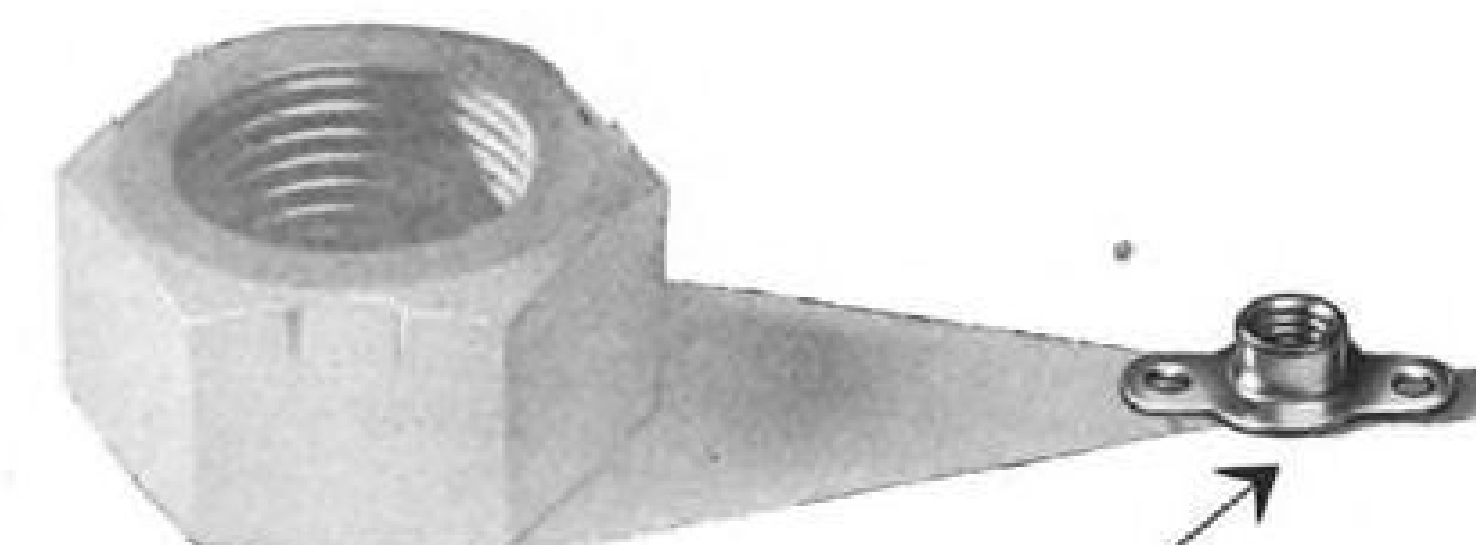
operation at temperatures of -55C and 125C, but special units with drift of less than 20 ppm./deg. C can be supplied for operation between -65C and 150C.

Manufacturer: Epsco Inc., 588 Commonwealth Ave., Boston 15, Mass.

Radio Station Signal Gives Position Fix

A new radio intersection has been established near Rhinelander, Wis. by North Central Airlines to facilitate straight-in approaches to the town's airport during instrument weather.


The radio fix, called Shalbreck Inter-



BOOTS NEWEST PLATE-LOK*

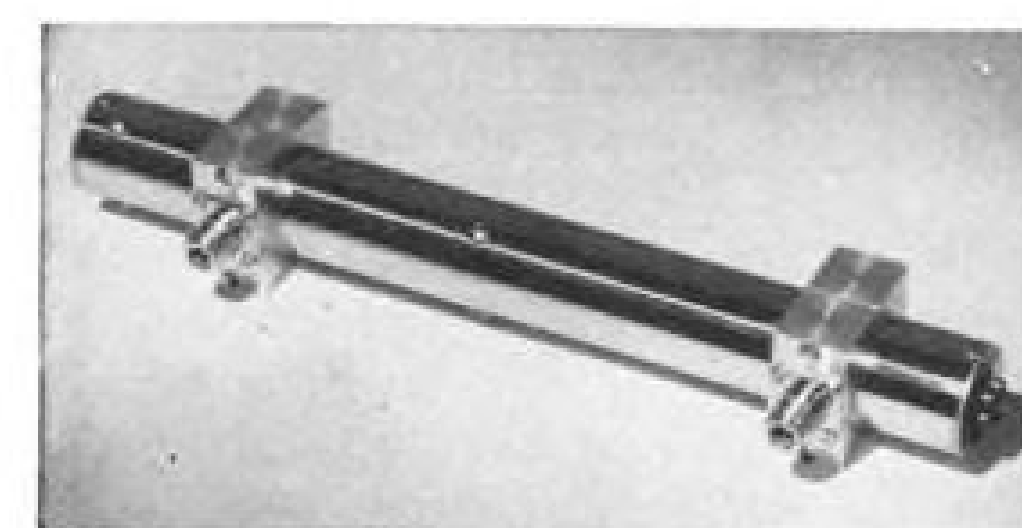
STRONGEST . . . LIGHTEST

▶ A new, light weight series of Boots **PLATE-LOK** . . . miniature, self-locking anchor nuts (fixed or floating) designed to meet MIL-N-25027 specifications. **PLATE-LOK** fasteners are a proven development by Boots, pioneers in miniature plate nuts since 1942.

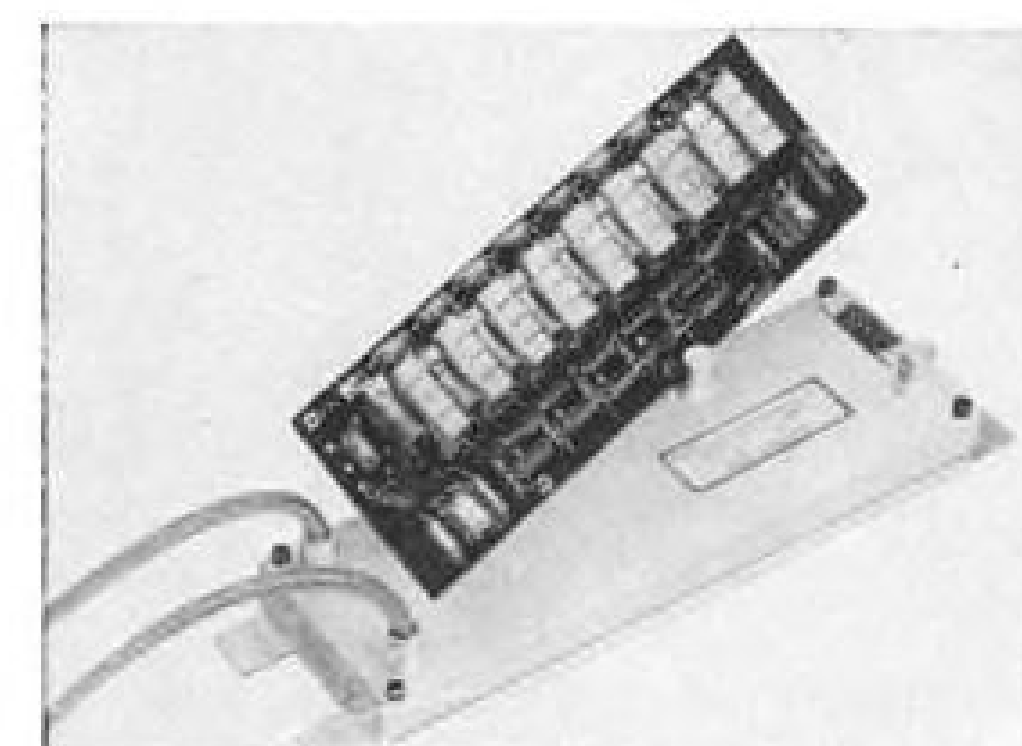
▶ **PLATE-LOK'S**  triangular locking design provides consistent centering of screw or bolt, its spring steel construction assures highest tensile strength and lightest weight plus infinite reuseability.

▶ The new **PLATE-LOK** is *another first* by Boots. Its development traces back to Boots **TRI-LOK** hexagon nuts, known for unfailing service since 1945. Consult Boots on all self-locking nut requirements.

*Patented. Patents pending.



STANFORD LABS' traveling-wave tube.



RS ELECTRONICS' tiny IF amplifier.

BOOTS

AIRCRAFT NUT CORPORATION



529 NEWTOWN TURNPIKE • NORWALK, CONNECTICUT

MORE **ACTION** IN SMALLER **SNAP-ACTION** SWITCHES

To Hetherington engineers, snap-action in a switch means a whole lot more than a little detent action accompanied by a loud "click". Thus, in every Hetherington snap-action switch, whether for push button, toggle, or rotary operation, the patented beryllium mechanism shown here provides four definite advantages:

... an exceptionally positive snap-action that makes it impossible to "tease" the switch ON or OFF contact.

... lightning-fast contact make or break for reduced arcing. (Hetherington switches are smaller, carry higher ratings because of this unusually fast action.)

... the "snap" and the contact make or break are simultaneous. (Deceptive "clicks" or "snaps" just can't occur with the Hetherington snap-action mechanism.)

... highest quality construction—polished taper, beryllium copper springs, contacts and terminals of copper with heavy silver overlay—all designed for a minimum life of 50,000 cycles under rated load.

Today more and more appliance and equipment manufacturers recognize that using dependable, space-saving Hetherington switches is really far-sighted economy. Send details of your application for a prompt recommendation by Hetherington switch specialists.

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indicator light combinations •
Relays • Aircraft and
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West Coast Division: 8568 W. WASHINGTON BLVD.
CULVER CITY, CALIF.

section, will be the nation's first airline navigation fix using the signal of a standard radio broadcast station, says North Central. The airline is awaiting Civil Aeronautics Administration approval.

The intersection, 4.2 miles southeast of the town's airfield, is made by the airport's homing beam and signals from Rhinelander's radio station, WOBT, which intersect at an angle of 50 deg. A pilot, homing in on the beam (330-deg. heading), can tell that he is 4.2 miles from the field when his radio compass, tuned to WOBT, shows a 50 deg. separation. He then initiates his let-down from the 1,200-ft. altitude at which he was flying.

North Central hopes that with establishment of the Shalbreck intersection, CAA will lower limits at Rhinelander Airport from its present 700-ft. minimum to a 400-ft. minimum and allow straight-in approaches instead of the currently executed lengthy procedure turns during IFR landings.

FILTER CENTER

► Britain Adopts ARC-52—Navy's new UHF transceiver, the AN/ARC-52 developed by Collins Radio Co., has been adopted for use in all future British military aircraft, according to reliable reports. Equipment will be made in Britain by Plessey International, Ltd. Italy presently is undecided whether to adopt the ARC-52 or USAF's ARC-34, developed by RCA (AW July 26, 1954, p. 44).

► Transponder Beacon Symposium — Air Navigation Development Board is sponsoring a symposium on the new civil radar transponder beacons May 18-19 in Washington to acquaint interested avionics manufacturers with technical problems involved in the design of suitable equipment.

► USAF Seeks Transformer Automation —Air Force is awaiting industry bids for the construction of a small automatic factory facility for manufacturing transformers, presumably using the slice-coil technique developed by Sylvania Electric (AW June 14, 1954, p. 68).

► Wescon Seeks Authors—The Western Electronics Convention, slated for Aug. 24-26 at San Francisco, is seeking authors to give technical papers. Interested persons should submit a 200-word abstract together with either a 2,000-word summary or the complete text to Dr. Wm. A. Edson, Chairman of the Technical Program Committee, c/o General Electric Microwave Lab, Palo Alto, Calif. Closing date, May 1. —PK

ACCO
products

NEW "NO-MAG"

NON-MAGNETIC AIRCRAFT CABLES

- GOOD THERMAL CHARACTERISTICS
- CORROSION RESISTANT
- HIGH FATIGUE RESISTANCE
- HIGH ABRASION RESISTANCE
- PREFORMED CONSTRUCTION

TRU-LOC
SWAGED FITTINGS

Eliminates Instrument Interference!

ACCO, originators of Preformed cable and strand, swaged terminals for aircraft cable use and many other important firsts in the aircraft cable industry, announces the development of a new non-magnetic aircraft cable to eliminate another of the problems that have plagued aircraft designers for years. The new cable, named "NO-MAG," has these characteristics:

Non-Magnetic Properties... "NO-MAG" cable is made from type 305 stainless steel. This steel remains non-magnetic after severe cold working—in contrast to standard stainless steel aircraft cable which shows a pronounced increase in magnetism after swaging, wire drawing or other cold working operations.

This non-magnetic property of new "NO-MAG" cable eliminates the possibility of instrument interference caused by cable magnetism.

Corrosion Resistance... New "NO-MAG" cables have corrosion resistant qualities similar to, but

slightly better than, cables made of standard stainless steel.

Good Thermal Characteristics... The thermal expansion characteristics of new "NO-MAG" cable are much closer than those of standard stainless steel or carbon steel cables to the characteristics of aluminum alloys used in making aircraft. This greatly simplifies maintaining cable tension under various changes in temperature.

High Fatigue Resistance. Preformed construction and careful processing give new "NO-MAG" cable high fatigue resistance, as established in extensive testing procedures.

High Abrasion Resistance... New

"NO-MAG" cable shows greater abrasion resistance than standard stainless steel aircraft cables.

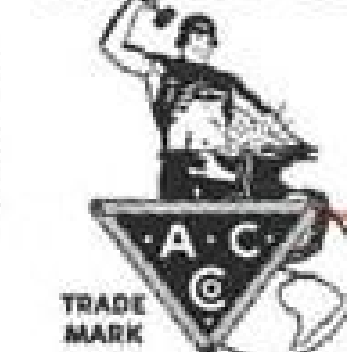
Tensile Strength, while lower than that of stainless and carbon steel, is sufficient to enable replacing these, size for size, with "NO-MAG" on many applications where the characteristics of "NO-MAG" are required.

Use with Swaged Terminals... Swaged terminals can be applied to standard AN dimensions.

Complete Range of Sizes, Constructions. New "NO-MAG" cable is furnished in sizes from 1/16" to 1" in all of the constructions found most desirable for aircraft use.

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NEW AVIATION PRODUCTS



One Man Works Airline Stair

Flightstair, Jr., is a one-man-operated, 1,500-lb. airline passenger boarding stair with an 8-in. adjustable platform range.

Steps, step stringer and platform are an integral, formed and welded steel plate unit. Design is said to conform to recommendations of the National Safety Council pertaining to stairways.

Hand pump actuates two cylinders to raise the platform. Stair and platform rotate slightly about pivot pins just above the bottom step. Maximum deflection from horizontal is 1½ deg.

Phelps Manufacturing Co., Van Nuys, Calif.



Magnetic Tester Is Portable

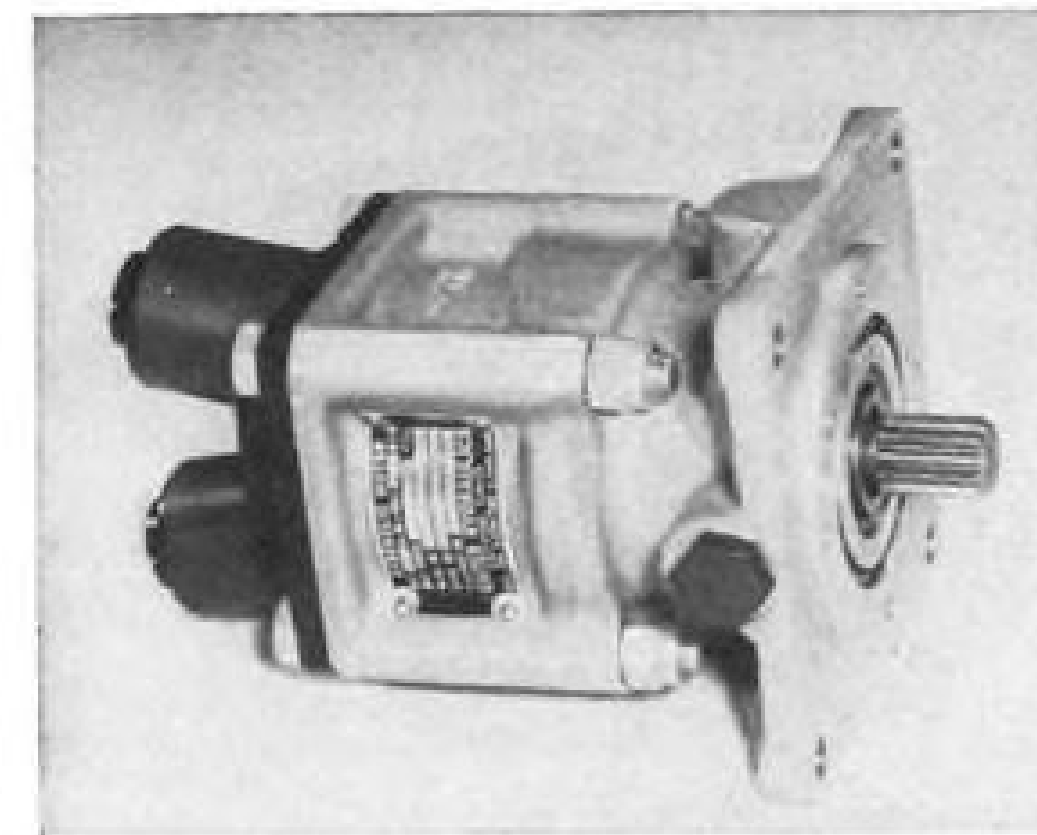
A new portable magnetic particle inspection kit that weighs only 11 lb. and requires no current, makes it possible to investigate part failure in service or inspect parts during manufacture.

Purchasers of the device include Hiller Helicopters, Inc., Palo Alto, Calif. and Spartan Aircraft Co., Tulsa, Okla.

The SempuN detector is a permanent magnet with ball pivots and a number of self-adjusting magnetic pins to give good contact on the part being checked. The device is placed in contact with the component being inspected and the part is sprayed with iron-oxide solution or magnetic powder, which comes with the kit. Where the particles gather on the surface, flaws are indicated.

The kit includes a check piece with known surface and subsurface flaws of various depths to determine whether the unit needs remagnetization. The set comes in an 8½x5x6-in. carrying case.

Rice-Peterson Sales, Inc., P.O. Box 1114, Palo Alto, Calif.



Hydraulic Motors Weigh 6-7 Lb.

Lightweight hydraulic motors, developing 9.7 hp. and 14.6 hp. and shaft speeds to 4,000 rpm. and pressures of 3,000 psi., have particular application to aircraft and missiles, the manufacturer reports. The models are designed to MIL-M-7997, and weigh from 6 to 7 lb.

Nine axial pistons operate against an inclined hydraulically balanced thrust plate. Shaft is supported by anti-friction bearings to provide a dynamically stiff drive to a rotating barrel containing the pistons. Low moment of inertia permits fast reversing.

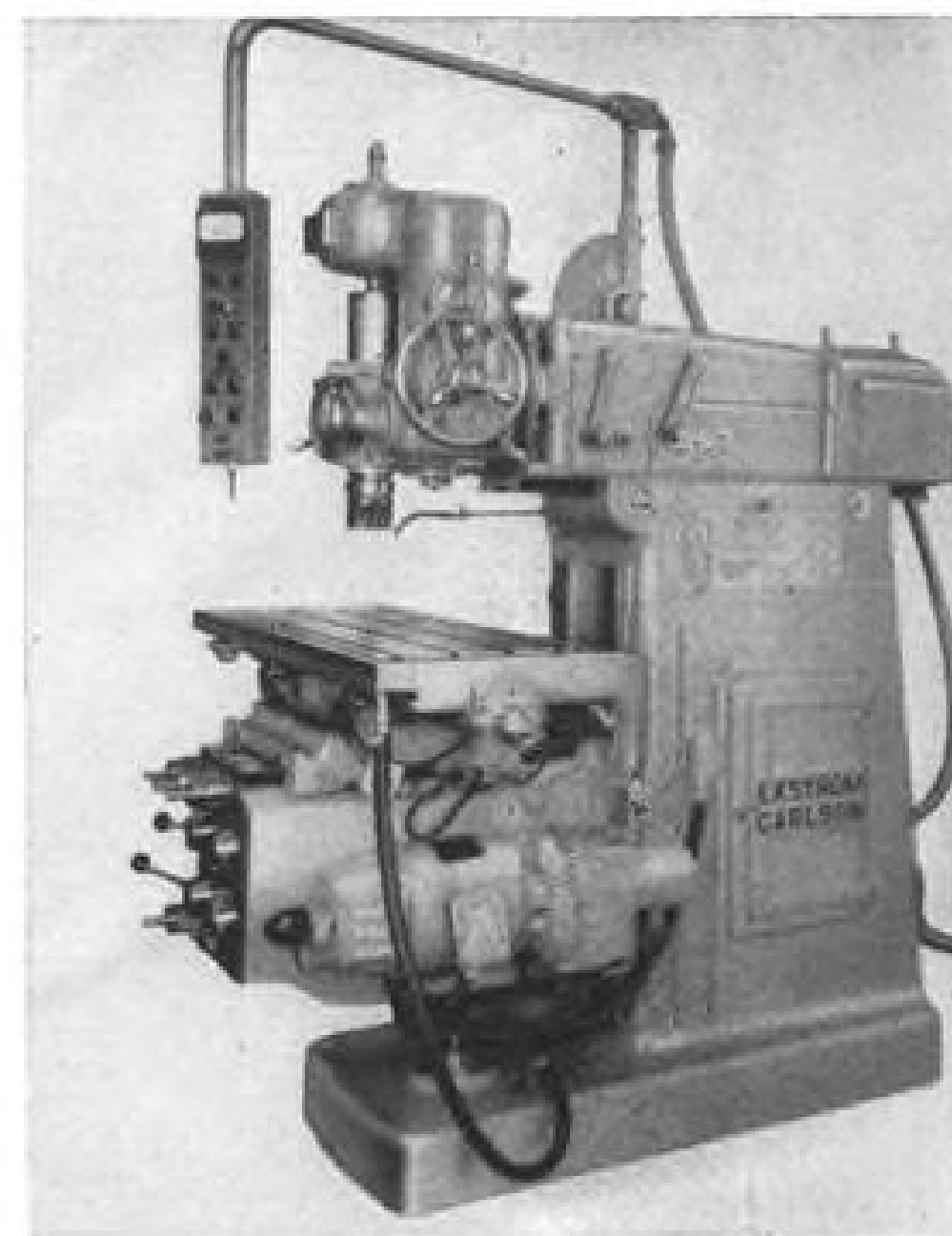
United Hydraulics, Inc., 110 Terrell Court, Dayton 7, Ohio.

Tiny Hardware for Electronics

Miniature precision hardware specially designed for electronic, printed circuit and instrument applications includes gold-plated eyelets and rivets to eliminate the problem of metal splatter when these parts are set, the maker states.

Items also include instrument screws and instrument split lock washers. Screws are cadmium-plated to military specs.

Circon Component Co., 17544 Raymer St., Northridge, Calif.



Miller Has High Feed Rate

High rates of work table feed and wide range of spindle speeds make new Ekstrom, Carlson No. 5VA Vertimil particularly adaptable for milling of aircraft aluminum alloy parts, the manufacturer states.

Cross and longitudinal table feed ranges are from 0.250 to 100 in./min. in two stages, continuously variable in each stage; vertical table speed range is from 0.70 to 38.3/min. Spindle speed range is from 72 to 2,480 rpm. using the 25-hp. spindle drive motor.

Maximum vertical throat clearance is 19.5 in. and minimum and maximum distances from spindle to base column are 8 and 30 in. respectively. Work table is 29 in. long and has a 13-in. cross-feed. Table will tilt 30 deg. toward or away from the operation.

Ekstrom, Carlson & Co., Rockford, Ill.

Rivet Cooler Holds 50 Cans

New 5-cu. ft. rivet cooler for aircraft use has room for 90 fastener cannisters. The cooler operates efficiently at a temperature of minus 30F, the manufacturer reports.

Model RSZ503 has lifetime-oiled ¼-hp. hermetic compressor with fan-cooled condenser and operates on 110-120-v. a.c., 60-cycle, single-phase current.

Other models: SZH153, is a 1.5-cu. ft.-capacity cooler that can operate as low as -90F; down to -95F when run continuously in normal room temperature; model SZH653, a 6.5-cu. ft. unit, can operate to -80F. These two models are equipped with an auxiliary lid that minimizes heat losses while the main lid is open.

Revco, Inc., Deerfield, Mich.

AEROJET-GENERAL NEEDS:
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ELECTRONIC ENGINEERS, MECHANICAL ENGINEERS, PHYSICISTS, AERONAUTICAL ENGINEERS.



HIGHER PAYLOADS and HIGHER PERFORMANCE

This compact, light-weight rocket powerplant, designated by the U.S. Air Force as the LR63-AJ-1 liquid-propellant rocket, has been successfully flight-tested on the Republic F-84F airplane. Used for assisted-takeoff, this powerplant and its big brother, the YLR45-AJ-1, which was extensively flight-tested on Boeing's B-47B Stratojet during 1954, have proved the practical application of rocket power to piloted aircraft.

SOLID- AND LIQUID-PROPELLANT ROCKET POWERPLANTS FOR MISSILE AND AIRCRAFT APPLICATION • AeroBRAKE THRUST REVERSERS (SNECMA) • AUXILIARY POWER UNITS AND GAS GENERATORS • ELECTRONICS AND GUIDANCE • ORDNANCE ROCKETS • EXPLOSIVE ORDNANCE AND WARHEADS • UNDERWATER PROPULSION DEVICES • ARCHITECT-ENGINEER SERVICES FOR TEST FACILITIES

Aerojet-General CORPORATION

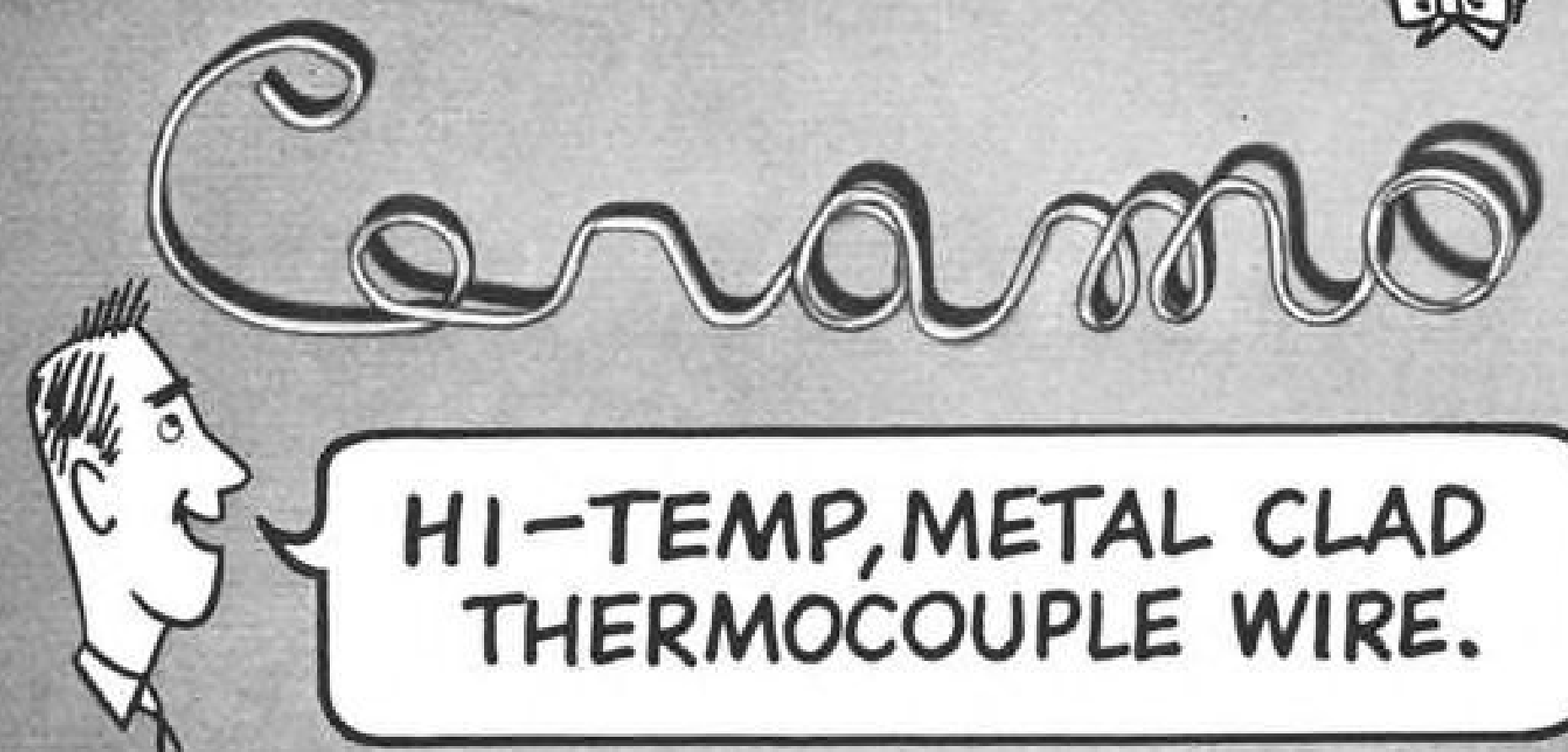
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SACRAMENTO, CALIFORNIA

MORE POWER FOR AIR POWER

WHAT IS "CERAMO"?

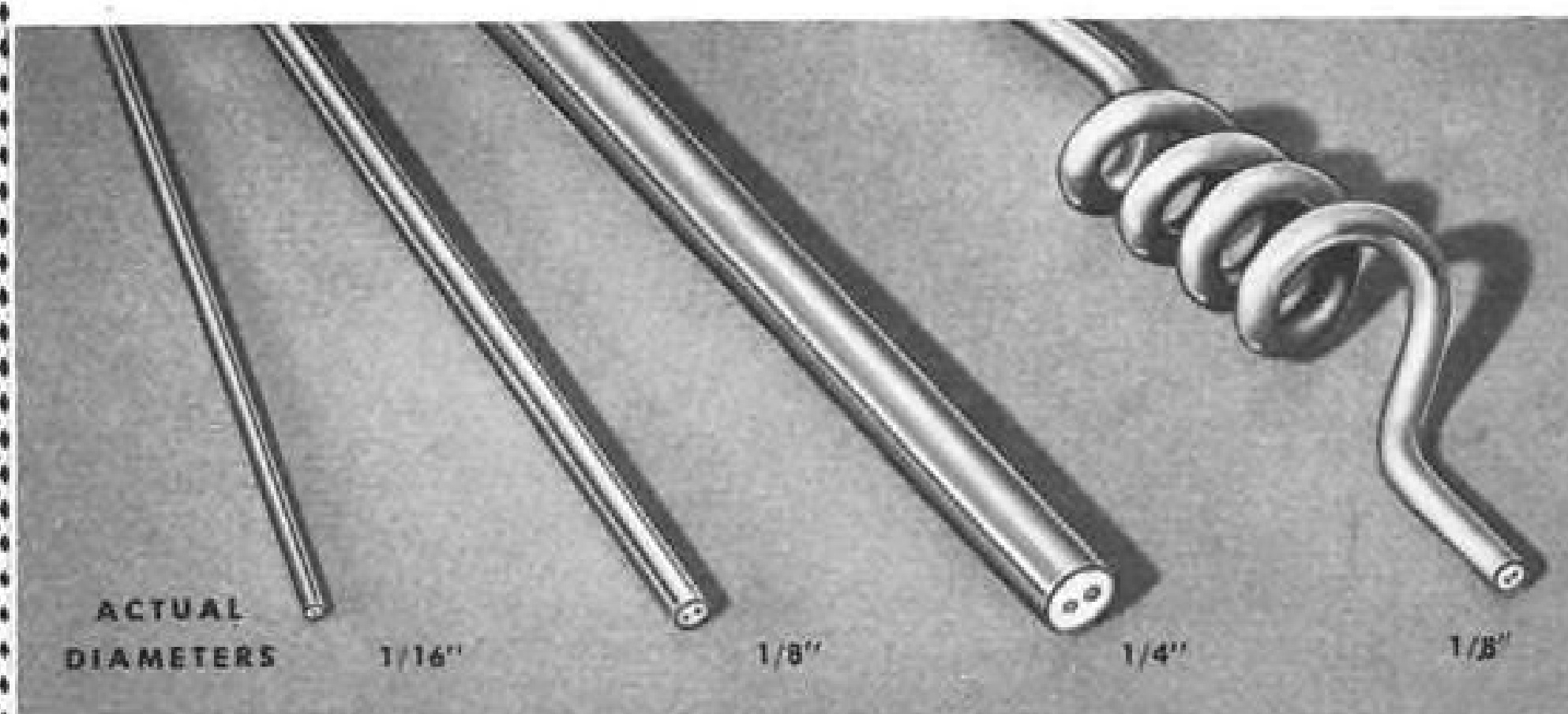


**HI-TEMP, METAL CLAD
THERMOCOUPLE WIRE.**

T-E's "Ceramo" wire consists of thermocouple material conductors, surrounded by magnesium-oxide insulation, with seamless metal tubing overall.

Thermocouples or extensions made of "Ceramo" wires will fit into openings that are too small for most ordinary thermocouples or extensions. Furthermore, they can be formed easily to any configuration without short-circuiting—in fact, "Ceramo" can be bent on a radius as small as its own diameter. The durability of the outer metal tube makes conduits unnecessary. Not even a hammer blow will injure it; in fact, it will withstand pressures up to 40,000 psi. These metallic clad wires have excellent resistance to high temperature, moisture, chemicals, petroleum products, atomic radiation or abrasion.

"Ceramo" thermocouple wires are made in Iron-Constantan, Chromel-Alumel, Copper-Constantan, Chromel-Constantan, and Platinum-Rhodium Platinum. Wires are sheathed with seamless tubing of stainless steels, Inconel, aluminum, or copper. Made with 30, 22 and 16 gage conductor material; overall diameters of 1/16", 1/8", and 1/4" respectively; lengths up to 30 ft.



"Ceramo" thermocouple extension wires are made in Iron-Constantan, Chromel-Alumel, or Copper-Constantan with copper-nickel alloy, plain or galvanized cold drawn steel sheath overall. Made with 20 and 16 gage conductor material; overall diameters of 1/8" and 1/4" respectively; lengths up to 2000 ft., depending on the type of metal tubing and outside diameter. "Ceramo" is made also in single conductors or multi-conductor cables.

Interested? Write for bulletin 31-300-C

Pyrometers • Temperature Monitoring Systems • Thermocouples • Protection Tubes
Quick-Coupling Connectors and Panels • Thermocouple and Extension Wires

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SADDLE RIVER TOWNSHIP, ROCHELLE PARK POST OFFICE, NEW JERSEY
IN CANADA—THERMO ELECTRIC (Canada) Ltd., BRAMPTON, ONTARIO

ALSO ON THE MARKET

Low-hydrogen electrode for alloy and mill steels. Strikeeasy LH-1, has powdered metal added to coating. Deposition rate is 61% faster than conventional electrodes, the maker claims.—General Electric Co., Schenectady 5, N. Y.

Hydraulic hose designed to operate at 3,000 psi. and temperatures over 400F, and to carry all known synthetic or petroleum-based fluids, Fluoroflex-T YR700 now is available for field testing in 3/8-in. and 1/2-in. sizes; 1/4-in., 5/8-in. and 3/4-in. hose will be available soon.—Resistoflex Corp., Belleville, N. J.

Electrodynamic shaker system for vibration testing develops 100-lb. peak force output over 40-3,000-cps. frequency range and displacement amplitudes exceeding 0.4-in. peak-to-peak in the 5-40-cps. range. Designation is "68" system.—Calidyne Co., 120 Cross St., Winchester, Mass.

Mark-N-Count numbers or initials at the same time as it counts production items. Price with one standard stamp, \$49.50 net, f.o.b.—May Engineering Co., 6055 Lankershim Blvd., North Hollywood, Calif.

Hydraulic test stands for aircraft engines and government applications are combined with temperature test cabinets as package installation to provide compact facility.—American Research Corp., 11 Brook St., Bristol, Conn.

Toolsite hole punches for titanium are claimed to have life 100 times greater than ordinary tool-steel devices.—Toolset, Division of General Riveters, Inc., Buffalo, N. Y.

Clean-Tread is tacky mat for safeguarding critical work areas from dust and dirt tracked in on shoes.—Merit Paper & Chemical Corp., Cambridge 40, Mass.

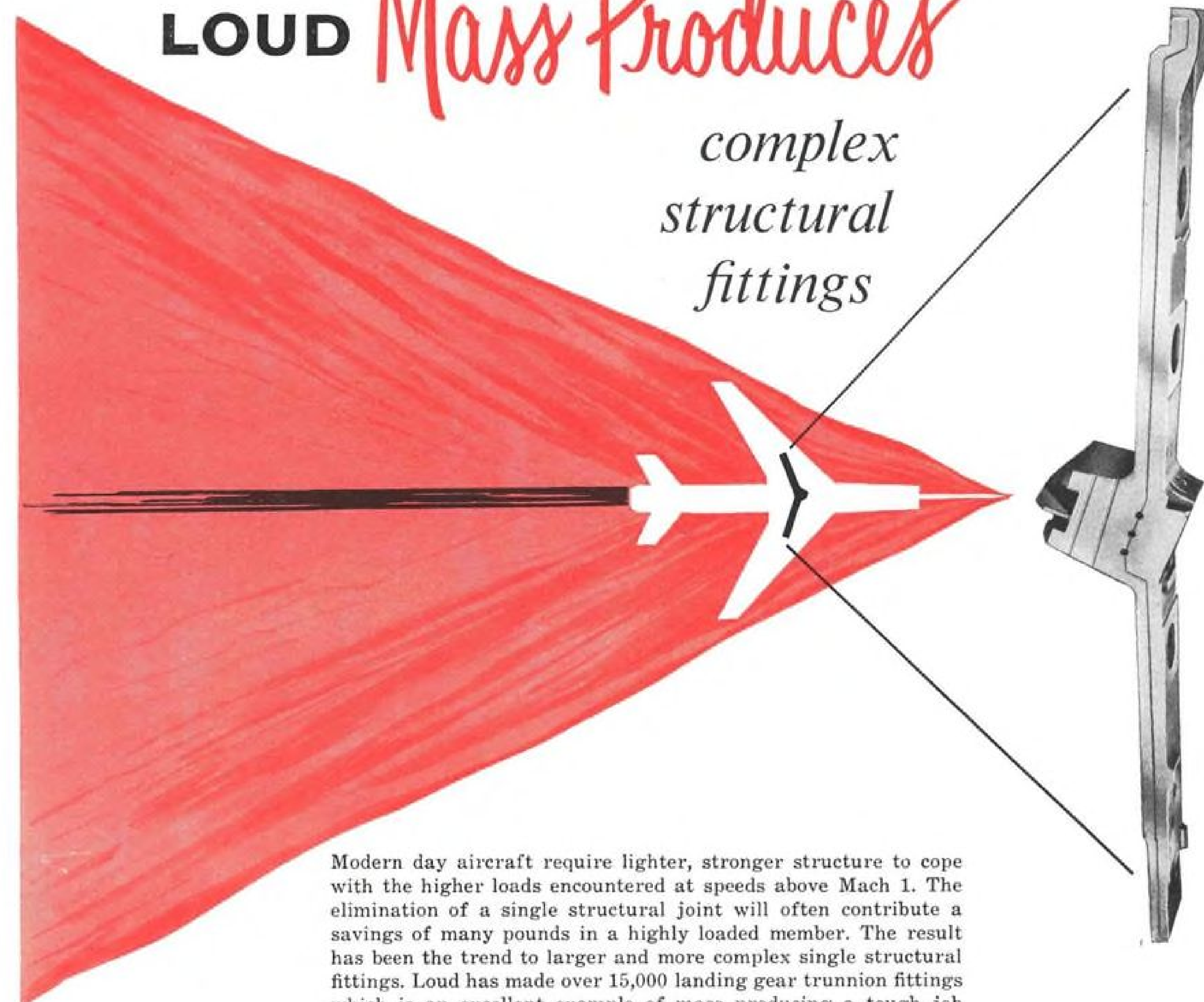
Sound barrier curtain, a specially treated flame-resistant burlap, is designed to reduce high noise level. Transwall curtain is chain spaced and supported by steel top plates operating on nylon wheels in an enclosed track. Available in several colors.—Bemis Bro. Bag Co., Physical Research Dept., 325 27th Ave., N. E., Minneapolis, Minn.

Nylon cord airplane tire has flat profile, wide ribs and new tread compounds giving up to 20% longer life, manufacturer claims. Tradename: Sky Champion Gear Grip.—Firestone Tire & Rubber Co., Akron, Ohio.

LOUD

Mass Produces

*complex
structural
fittings*



Modern day aircraft require lighter, stronger structure to cope with the higher loads encountered at speeds above Mach 1. The elimination of a single structural joint will often contribute a savings of many pounds in a highly loaded member. The result has been the trend to larger and more complex single structural fittings. Loud has made over 15,000 landing gear trunnion fittings which is an excellent example of mass producing a tough job while maintaining a high degree of quality.

CASE HISTORIES

Today's airplane is being built out of large forgings rather than fabricated sections. The spar fitting which combines landing gear trunnion support and wing spar into one single forged and machined fitting is representative of planes of tomorrow. Although this fitting is over 8 feet long it is machined on Loud's 120 inch Cincinnati hydrotels. Advance in designs create more complicated machined operations.

The maximum utilization of facilities is illustrated in the flash welding of a stabilizer beam. The change from the previous bolted joint design saved over 16 pounds per airplane in addition to saving considerable cost and providing a stronger fitting.

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First choice for light plane ignition

Over the years, Bendix ignition has been the choice of leading engine manufacturers and plane builders in the light plane field.

For example, Bendix magnetos are widely used by such outstanding engine builders as Continental, Aircooled and Lycoming, and are found on such popular types of planes as Beech Bonanza and Twin-Bonanza, Cessna 170, 180, and 310, Aero-Commander, Grumman Widgeon, Piper 135 Pacer, Tri-Pacer, and Apache, Riley Twin-Navion, and Ryan Super-Navion.

There is good reason for this widespread acceptance in the light plane field. Long experience in all phases of aviation has enabled Bendix to design magnetos incorporating every desirable feature of performance at prices compatible with light plane manufacturing requirements.

Again the ingenuity and facilities of the Scintilla Division demonstrate just why Bendix is The Most Trusted Name in Ignition.

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S-50 SERIES



S-20 SERIES

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LETTERS

More on Approaches

[The writer of this letter is the inventor of the British Calvert approach lighting system.—Ed.]

As one who has criticized the slope-line system, and has been associated to some extent with the group of pilots who, according to Mr. Pearson, has scurrilously abused and misrepresented this system, I would like to reply to his letter in your issue of Feb. 21 ("Slope-line Lights," p. 53).

In the first place, the slope-line system has been rejected by pilots all over the world, and not by a "small and unrepresentative group," and this after nearly 10 years of argument and counter-argument and numerous flight trials, some of which were on an international basis.

A good system of visual aids is a matter of life and death to pilots, and a matter of financial importance to operators, and it is, on the face of it, unreasonable to imply that they are all so stupid as to have been misled by a small malicious group. It is, of course, conceivable that everyone is out of step except Mr. Pearson, but even if he were technically in the right, he should realize that those who differ from him are sincere.

What possible motive could any pilots have for misrepresentation when the lives, and perhaps to some extent the livelihoods, of both themselves and their colleagues depend on their picking the best system?

►How the Pilots Feel—A more plausible explanation for the rejection of the slope-line system, is that there are flaws in Mr. Pearson's theories, flaws which are hidden from him, but are known to airline pilots from personal experience, although they may not be able to give clear technical reasons why they feel as they do. That, however, is the job of the visual psychologist, not of the pilot.

After all, the object of any system of visual aids is to supply guidance to the ordinary operational pilot, and if the majority of these agree that they do not in fact get the right kind of guidance, then who is at fault, the chairborne engineer who thought up the system, or the airborne user?

When Mr. Pearson claims that the slope-line system is the "only one yet tried" which gives the pilot the guidance he needs, he is making a sweeping claim in the field of visual psychology, a field which is as yet largely unexplored, and in which few illumination engineers have special qualifications.

►Fundamental Flaw—I suggest that the fundamental flaw in the theory of the slope-line system is the assumption, which is largely unconscious, that an aircraft, or indeed any vehicle, can be accurately steered on displacement information alone. (The engineer who designed the ILS cross-pointer meter made the same mistake, although he had the advantage of being able to show the displacements in the vertical and horizontal planes, instead of in planes at 45 degrees.)

When the pilot applies bank, the effect is to produce a rate of change of heading, i.e. he causes the tangent to his track to swing to a new direction. He thereby establishes

in Omni equipment also...

IT'S EASIER WITH TWO!

A helper on any job brings results with half the effort... and in flight navigation a dual ARC Omni installation can double the pilot's efficiency, ease and confidence. He can make a fix faster with dual omni 15D equipment... fly any omni track while also cross-checking for position. And it's easier to make transition from omni to runway localizers. Where there are two pilots,

the work load can be shared by using both omni instruments simultaneously for different jobs.

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AIRCRAFT TUBING

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- A.I.S.I. 1025..... AN-WW-T-846

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\$50,000 NOW... \$50,000 IN 1985

It's easy! It's fun! It's actually two contests in one. You can enter one or both parts . . . win both first prizes for a grand total of \$80,000. And you can start right away because the entry blank to Part 1 is on the opposite page!

There's never been such a contest before! Just think what you could do with one of the big cash awards! Why you could pay off the mortgage, send the children to college, and still have plenty of money left over for travel to all those enchanting lands you've always dreamed of seeing some day. What's more, you may even win the big \$50,000 cash prize in 1985 by entering Part 2 of TWA's Cosmic Contest!

So get busy this minute. Think of all the wonderful things you like about traveling by airplane, and why TWA is the way to fly. Read the tips on how to win both parts of this exciting contest printed on this page. Then fill in the official entry blank for Part 1 in this advertisement and mail it promptly. In a few days, you'll receive your official entry blank for Part 2, and another chance to win even more money!

30 CHANCES TO WIN RIGHT NOW!

1st PRIZE	\$30,000
2nd PRIZE	5,000
3rd & 4th PRIZES	2,000
5th through 10th PRIZES	1,000
11th through 30th PRIZES	250
	\$50,000

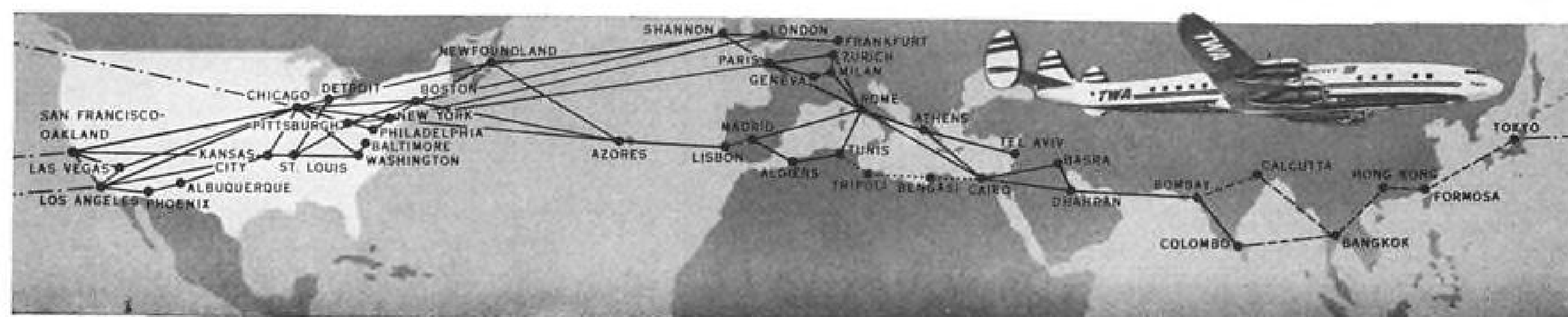
Here's all you do. Just complete the following statement in 30 additional words or less: "Flying is the way to travel, and TWA is the way to fly because . . ."

Winners will be announced on or before September 30, 1955!

\$50,000 IN CASH!

To be awarded 30 years from now in 1985!

Here's how to enter Part 2 of TWA's Cosmic Contest. When you send us your entry for Part 1, we will send you a special entry for Part 2. On this form write in 200 words or less what you think commercial air travel will be like thirty years from now! Your entry will be micro-filmed and sealed in a special vault at TWA's new maintenance base in Kansas City, Mo. Then, in 1985, a selected board of judges will examine the entries and pick the winner.



TIPS ON HOW TO WIN PART 1

Simply think of all the many reasons why you'd like to travel by world-proved TWA. You'll find it easy to list advantages, such as speed, comfort, dependability, convenience, ideal schedules, world-wide routes. And to help you, here are just a few things you might say about TWA's many contributions to air travel:

TWA has put a two-week vacation in Europe within reach of millions more Americans by pioneering low-cost Sky Tourist service and developing a simple "Time Payment Plan" for travel anywhere.

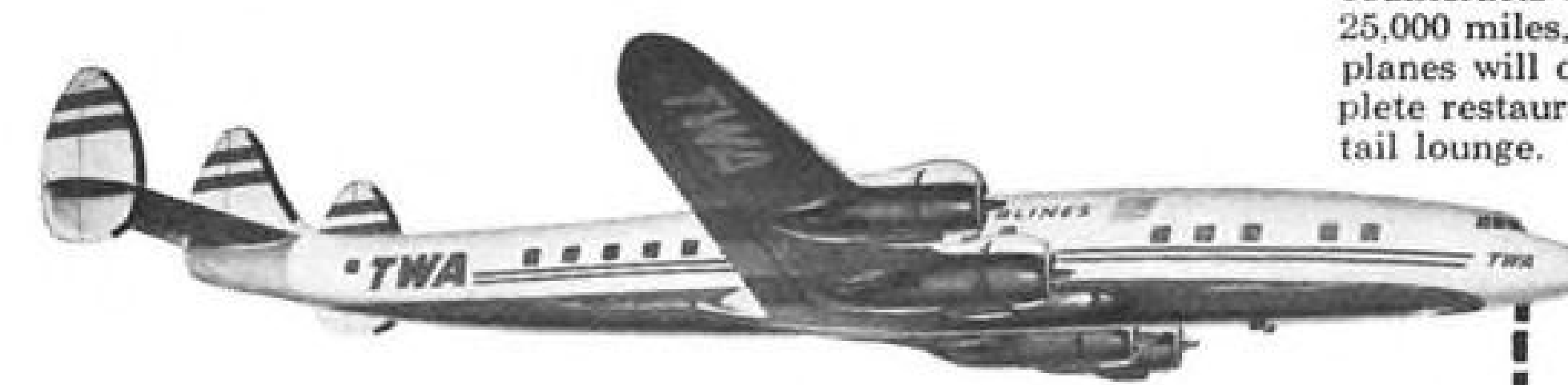
Through its active support of the American creed of free enterprise and competition, more people than ever are now able to enjoy all the advantages of air travel.

TWA's voluntary assistance to countries of the free world in helping to organize their own efficient airlines has helped promote friendship between the U. S. and other nations.

TWA's swift, dependable service between 80 key cities on 4 continents has stimulated world trade and friendship.

TWA's leadership in efficient, economical operation has shown the way toward elimination of costly government subsidies with great savings to taxpayers.

TWA's leadership in mechanical and technical advances, its great fleet of Constellation aircraft and its skilled, courteous personnel have set new standards of speed, comfort and dependability in air travel.



OFFICIAL RULES FOR TWA's COSMIC CONTEST

1. TWA's Cosmic Contest consists of two parts. You may enter either one or both parts. Entries for both parts of the contest must be postmarked on or before July 31, 1955, and received not later than August 31, 1955. To enter Part 1, simply complete this statement in 30 additional words or less, "Flying is the way to travel, and TWA is the way to fly because . . .". To enter Part 2, state in 200 words or less what you think commercial air travel will be like thirty years from now (1985). A sketch of the type of aircraft used then may also be submitted, but the complete entry must be held to space provided in the official entry blank.

2. You may submit as many entries as you wish, but in each case an official entry blank must be used. An official entry blank for Part 1 is printed in this advertisement. Entry blanks for Part 2 will be mailed to you when your entry to Part 1 is received. Additional entry blanks for both Part 1 and Part 2 may be obtained at TWA ticket offices, on board TWA planes and in most authorized travel agencies; or by writing to TWA, P. O. Box 85, N. Y. 46, N. Y.

3. Contest is open to everyone except employees of Advertising Distributors of America, Inc., TWA or its advertising agencies and members of their immediate households and families.

4. Prizes listed on entry blank and in this advertisement will be awarded on the basis of sincerity, aptness and originality. Literary skill is of secondary importance. Neatness will count. Entries to Part 1 will be judged by Advertising Distributors of America, Inc. Winners will be announced on or before September 30, 1955, and names of winners may be obtained by written request to the address above, enclosing a stamped, self-addressed envelope. Entries to Part 2 will be microfilmed and stored in a vault in Kansas City, Mo. The chief executive officer of TWA will name the independent judges of Part 2 on or before January 1, 1985, and the winner will be announced before July 1, 1985. In the event the contestant submitting the winning entry to Part 2 is not living on the date the winning entry is announced, the prize money to Part 2 will be paid to the person authorized by the last will and testament of that contestant or otherwise authorized in law to receive such payment, or to the legal representative of the estate of that contestant. Judges' decisions are final; duplicate prizes in case of ties.

5. Entries must be the original work of contestants and submitted in their own names. All members of a family may enter, but only one prize for Part 1 will be awarded to a family. Contest is subject to all governmental regulations and causes and conditions beyond TWA's control. All entries become the property of TWA, and submission of entries to one or both parts of the contest gives TWA full rights to reproduce, publish and use such entries as TWA sees fit at any time.



Fly the finest . . . **FLY TWA**
TRANS WORLD AIRLINES
U.S.A. · EUROPE · AFRICA · ASIA

TIPS ON HOW TO WIN PART 2

Here's what some people think air travel will be like in 1985! It's so much fun to imagine what flying will be like in 1985. Just read these answers. See how easy it is to predict things to come. Then write your own predictions on the official entry blank TWA will send you when your entry to Part 1 is received.

For example, a housewife may write: "In 1985, I think aviation will be like this: It will be possible to fly all the way from Los Angeles to London without stopping. It will take just 6 hours, and you'll fly in an airplane that looks like a flying saucer, with no wings or tail and a huge cabin that is divided into many private staterooms. There will be no runways at airports because these planes will take off straight up and land like helicopters. The average speed of these planes will be about 1000 miles an hour. They'll fly about 30 miles up in the stratosphere. These planes will use atomic power that will last indefinitely, and their engines will be made of materials that last for years and years without attention."

A businessman might say: "In 1985, I think commercial aviation will be like this: Planes will be powered by rockets using a new type of fuel. They will fly at altitudes of 50 to 100 miles above the earth at a speed of 2000 miles per hour. Because of this speed, special watches will be designed so passengers can keep up with the rapid change in time zones. These space planes will take off straight up in the air. They will land the same way, using a special device that counteracts the gravity pull of the earth. They will have a range of 25,000 miles, so they can fly non-stop anywhere in the world. These planes will carry as many as 500 passengers and will feature complete restaurant service, a movie theatre, soda fountain and a cocktail lounge."

OFFICIAL ENTRY BLANK PART 1 TWA's COSMIC CONTEST \$50,000 IN CASH AWARDS NOW!

TWA's Cosmic Contest
P. O. Box 85
New York 46, N. Y., U. S. A.

Dear Sirs: Here is my completed entry blank for Part 1 of TWA's Cosmic Contest. I understand you will send me an official entry blank for Part 2 when you receive this entry.

**Flying is the way to travel, and
TWA is the way to fly because:**

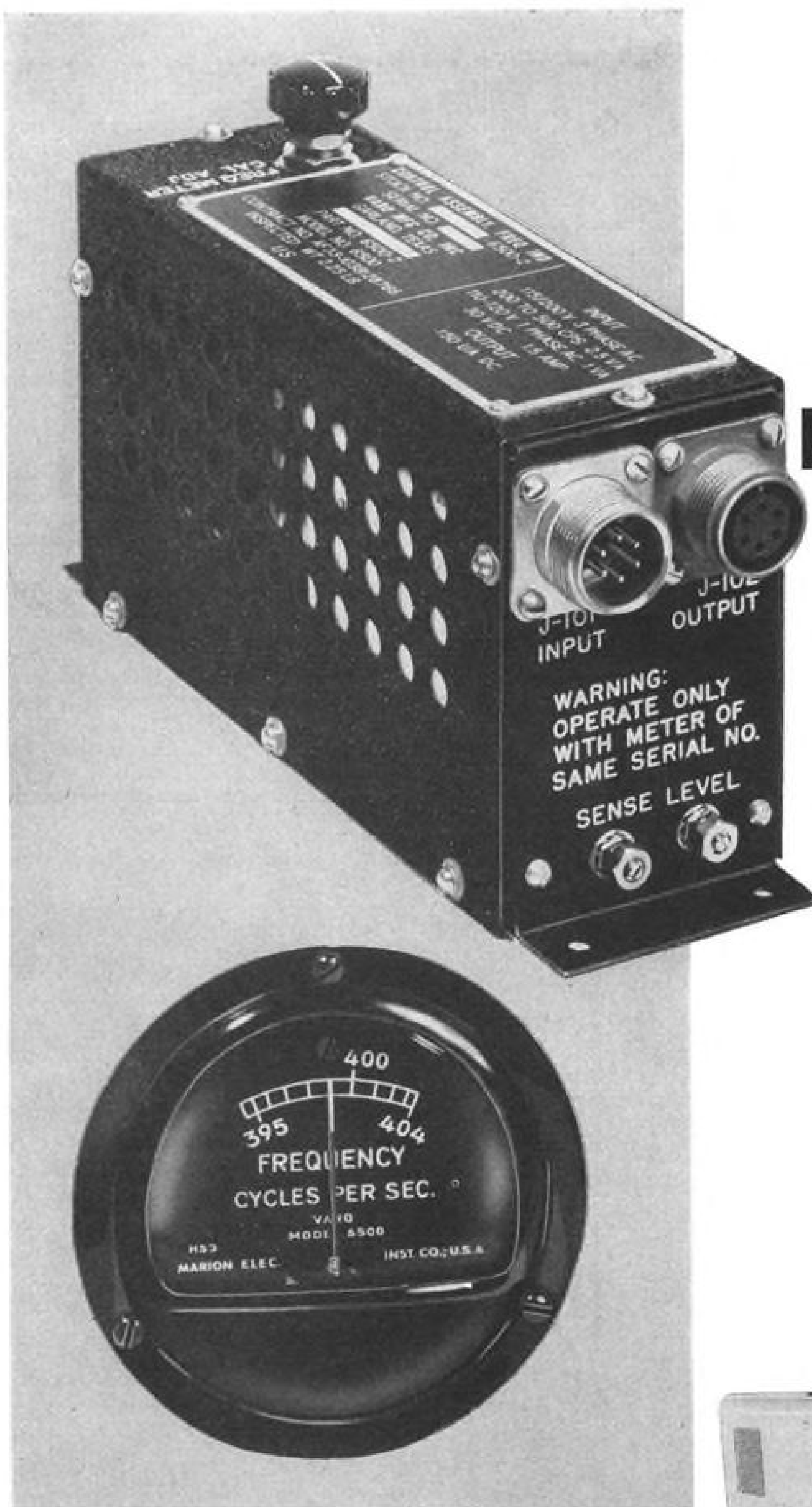
(Complete in 30 additional words or less)

Name _____

Address _____

City _____ State _____

Country _____



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DIRECT READING FREQUENCY METER

FOR AIRBORNE AND GROUND POWER EQUIPMENT

When an electrical system requires a reliable Direct Reading Frequency Meter — check VARO. This ruggedly built Frequency Dial Meter and Control Box is accurate to $\pm 0.2\%$.

It meets all military environmental specifications and no temperature correction is required. A precision tuning fork is used as the reference standard and the signal to the indicator can be used simultaneously for chart recordings where permanent record is desired. The 400 cycle calibration on the meter face is offset from null position to cause actual indicator movement for more positive calibration.

Compact and light in weight, the VARO Frequency Meter is ideally suited for either airborne or ground power equipment.

Other VARO Products made for Military Aircraft Fire Control and Navigational Systems.

Frequency Standards	Electronic Inverters
Frequency Changers	Regulated Supplies
Voltage Regulators	Speed Controls
Voltage and Frequency Sensitive Relays	



The MD-3 Ground Power Equipment designed and manufactured by Beech Aircraft Corp. is used by the Air Force to check out aircraft in pre-flight test. The VARO Frequency Meter is utilized as part of the system to provide accurate and reliable measurement of 400 cycle electrical systems.

VARO

For further information please write:
MANUFACTURING CO., INC.
2201 WALNUT STREET, GARLAND, TEXAS

SPECIFICATIONS

INPUT: 110 to 120 Volts AC
350 to 450 cycles (Meter not damaged at 200 cps.)
28 Volts DC at 1 ampere

OUTPUT: Meter scale calibrated at 1 cps. intervals between 395 and 405. Pointer indicates high or low over the range of 350 to 450.

PHYSICAL DESCRIPTION

CONTROL SECTION	INDICATOR SECTION
Height: 4 inches	Standard meter case per MIL-M-10304 for sealed ruggedized instrument.
Width: 2 1/2 inches	Body dimensions 2.800" max. diameter and 1.405" depth. Weight: 14 oz.
Depth: 7 inches	
Weight: 2 lbs., 14 oz.	

Representatives: Box 553, Far Hills Branch, Dayton, Ohio; Pacific Scientific Co., 1430 Grande Vista Ave., Los Angeles 23, California

LETTERS . . .

a new track, and continually watches the ground pattern to see how this new track affects his displacement from whatever line he wishes to follow. In mathematical language, he manipulates a rate-rate, establishes a new rate, and at the right moment, i.e. when the displacement is zero, makes the rate and the rate-rate zero. In other words, to close and hold a desired path, he must zero three things simultaneously, displacement, rate and rate-rate, and if he cannot do so, his attitude will be unstable and he will weave from side to side.

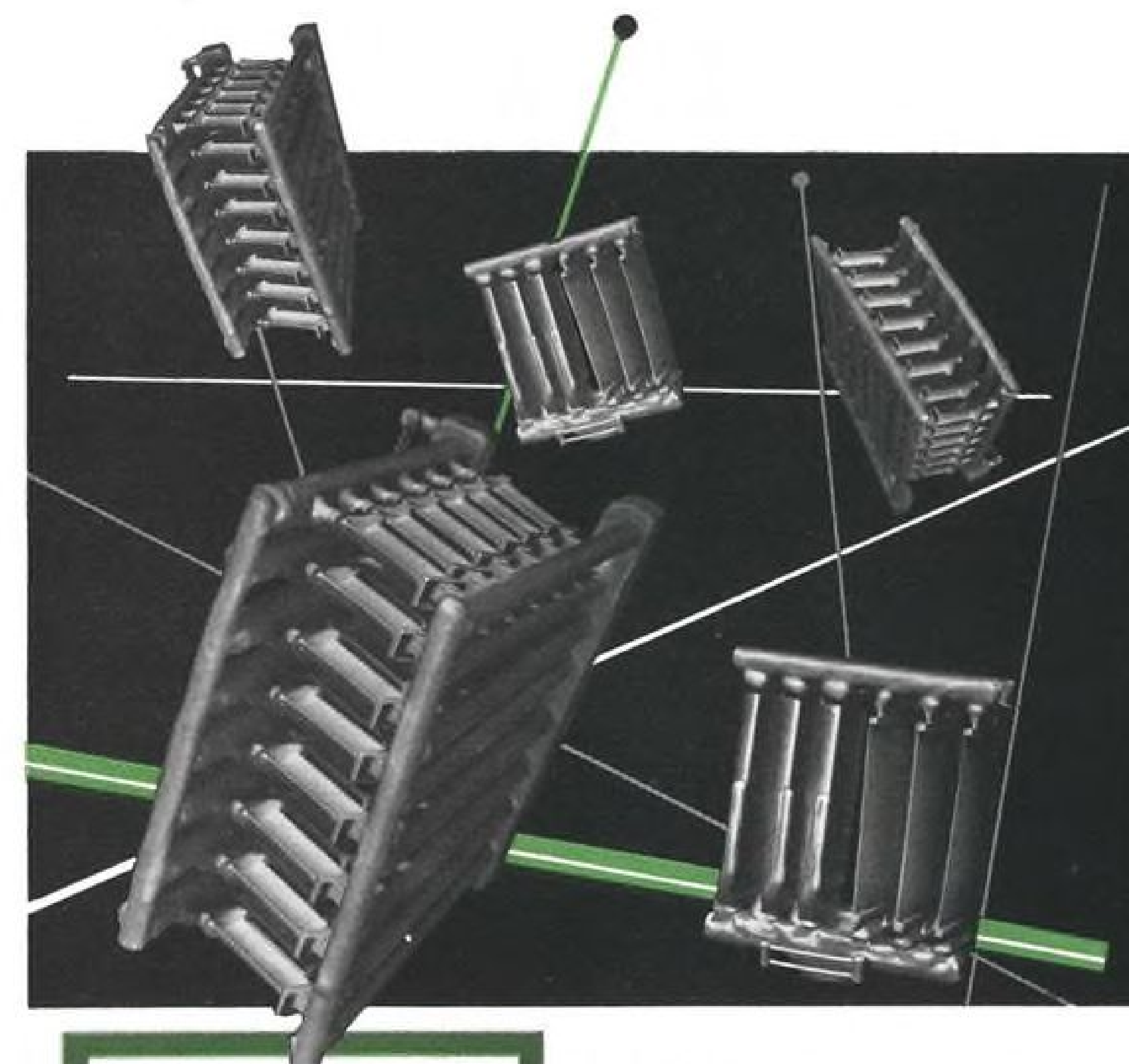
The slopline system failed because it puts the emphasis on displacement information instead of on rate information, and to make matters worse, presents this displacement information in an unnatural manner.

It may or may not be relevant to the Idlewild accident to point out that if the pilot, when on the glide slope, unconsciously treats the lines of sloplights as parallel, (it is difficult for him without special training to avoid doing so because parallel lines are so common in ordinary life) then he will steepen his angle of descent to 5 deg. in order to make the perspective angle open out at the rate it would do if the lines of lights were parallel. It is true that after a second or two the echelon effect should theoretically show him that he is low, but due to the difficulties of interpretation, and the sluggishness of the aircraft, the realization of what is wrong may come too late.

► **Visual Ambiguities**—The process by which the pilot extracts rate information from the pattern is the root of the matter, but Mr. Pearson's last sentence does not give me the impression that he fully realizes its over-riding importance. Another fact pointing to the same conclusion is that he failed to include positive attitude, i.e. rate-rate indications, in the slopline system until we in Great Britain pointed out the ambiguities between bank and lateral error which could be caused by this omission. He also ignores the "downhill illusion" or "valley effect" caused by using converging lines in the approach in combination with parallel lines on the runway.

These are not imaginary bugbears "hatched up by a minute group of critics," but are the simple facts of perspective geometry and visual psychology. Pilots who make hundreds of landings per year on a particular system in bad visibility, as did the test pilots at Arcata on the slopline system, can learn to cope with the dangers inherent in defective or unnatural indications. The ordinary airline pilot who makes on the average only one or two marginal landings per year, has not got this experience, and to him any system which does not give the indications in a form he can easily assimilate can be a deathtrap, if, as occasionally happens, a number of unfortunate circumstances combine, as for instance, fatigue with bad visibility and turbulence and perhaps some low cloud between him and his aiming point.

► **Centerline System**—A centerline approach lighting system without crossbars is another defective pattern, and there have certainly been accidents with this, but, so far as I know, there has as yet been no serious accident when approaching on the full centerline and crossbar pattern, although this pattern has been fully operational at London since November 1948, and in one or other



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give you the Finest Investment Castings

These are the three fundamentals of Austenal production. Only all three brought together can guarantee the finest investment-cast parts for American defense and industry.

By means of Austenal's Microcast process such exact parts as jet turbine buckets and vanes are being cast, eliminating costly machining and holding finishing to a minimum. Thus, these vital jet components are available for national defense in greater numbers and more economically than ever before.

These three factors of sound production can work effectively for industry. Austenal has solved many industrial problems where fine, accurate and dependable cast parts were required for efficiency as well as economy.

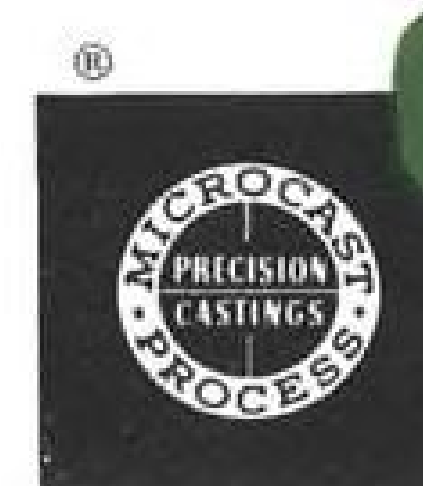
Depend upon Austenal's greater skill, versatility and experience when you need investment castings. These are your assurance of the finest precision cast parts.



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● LETTERS . . .

of its forms, is widely used throughout the world.

Mr. Pearson bases his claims on the tests at Arcata, but these tests have to be interpreted with a certain amount of insight.

I myself took part in the tests at Arcata during three winters, and on quite a few occasions stood behind the pilots and watched them land in visibilities of the order of $\frac{1}{8}$ th mile. It is common knowledge that landing success in these visibilities is determined mainly by skill in instrument flying, and the Arcata pilots were certainly very skillful.

I am quite certain that none of the approach lighting systems installed there (and in the last season these included the center-line and crossbar system) provided more than monitoring information, and even that only for a few seconds. The reason for the lack of guidance even when the lights are in view is that rate indications disappear from any system of visual aids before the displacement indications. In other words, the pilot may be able to see where he is, without being able to see where he is going.

The poorness of the rate indications becomes very marked when the visual range falls below 500 yards, and since good rate indications are necessary for a safe flare-out, it is not operationally possible to land in lower visibilities (on visual aids) without lowering the safety factor far below what can be accepted in airline operations.

► **Proof of the Pudding**—Much work has been done on approach success by the Sperry Gyroscope Co. in the U. S., and by the Blind Landing Experimental Unit in the U.K. (see paper by J. F. Mercer, "A Quantitative Study of Instrument Approach," J. R. Aero. Soc., 58, 83). Further information on the rate theory of visual guidance can also be found in my own paper entitled "Visual Judgments in Motion," (Journal of Institute of Navigation, July 1954). These two papers give figures for the approach success actually achieved in the field with various combinations of electronic and visual aids, and Mr. Pearson would do well to ponder on them, for they provide the final and incontrovertible proof that he is mistaken.

Theories are useful as stimulants to thought, but in operational matters the final proof of the pudding is the eating.

E. S. CALVERT
Bears House
Upper Park Road
Camberly, England

Scientist Shortage

AVIATION WEEK should be commended for its thorough exposition on "Scientist Shortage Threatens Defense" (Mar. 21, p. 31).

I feel that the most successful way to interest youth is to present aeronautical engineering to them in the form of a challenge. My principal reason for studying aeronautical engineering was because I felt it was a great challenge. I imagine that others entered the aeronautical engineering field for the same reason.

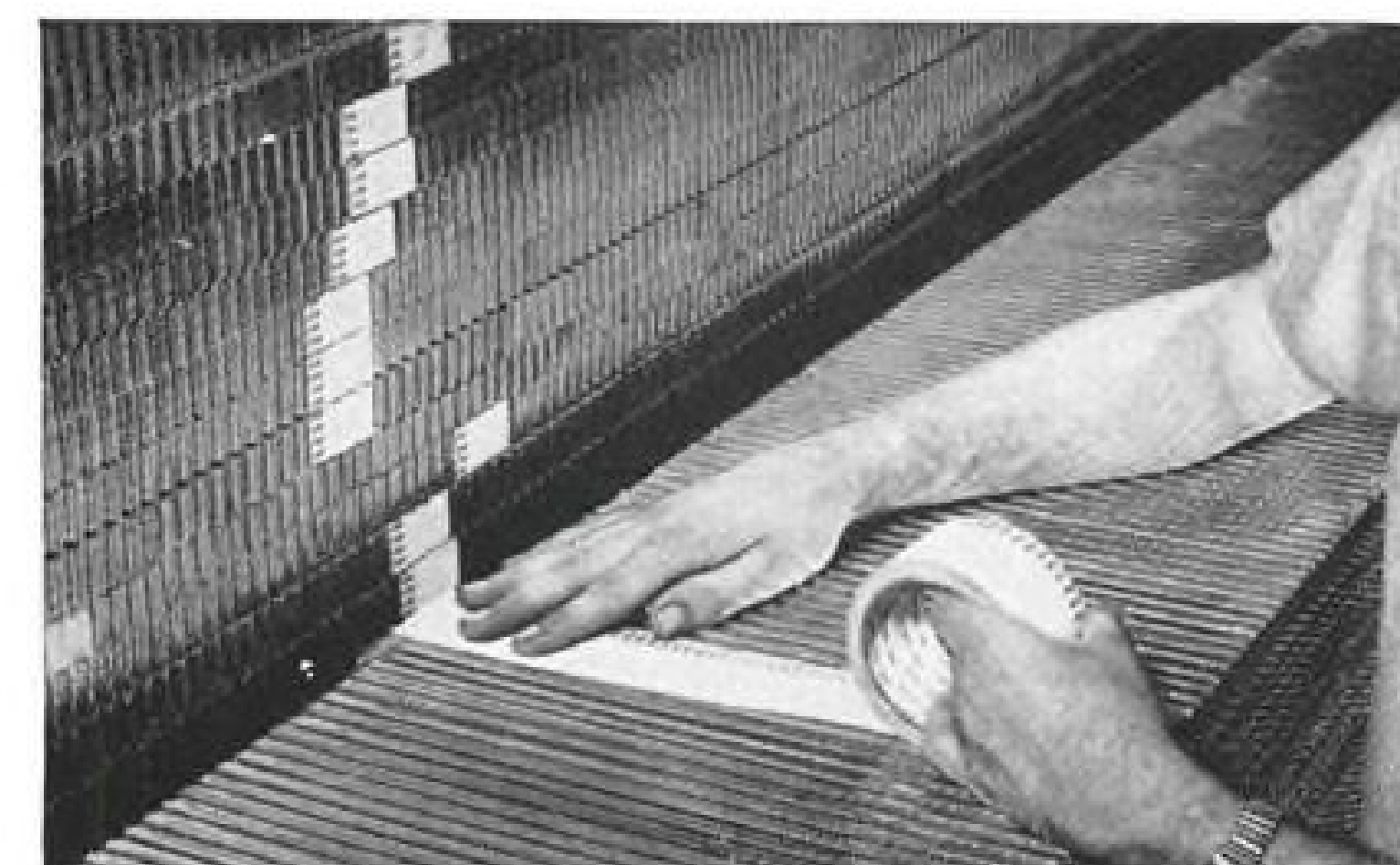
JEROME LEDERER
Flight Safety Foundation, Inc.
471 Park Ave.
New York 22, N. Y.

AVIATION WEEK, April 11, 1955

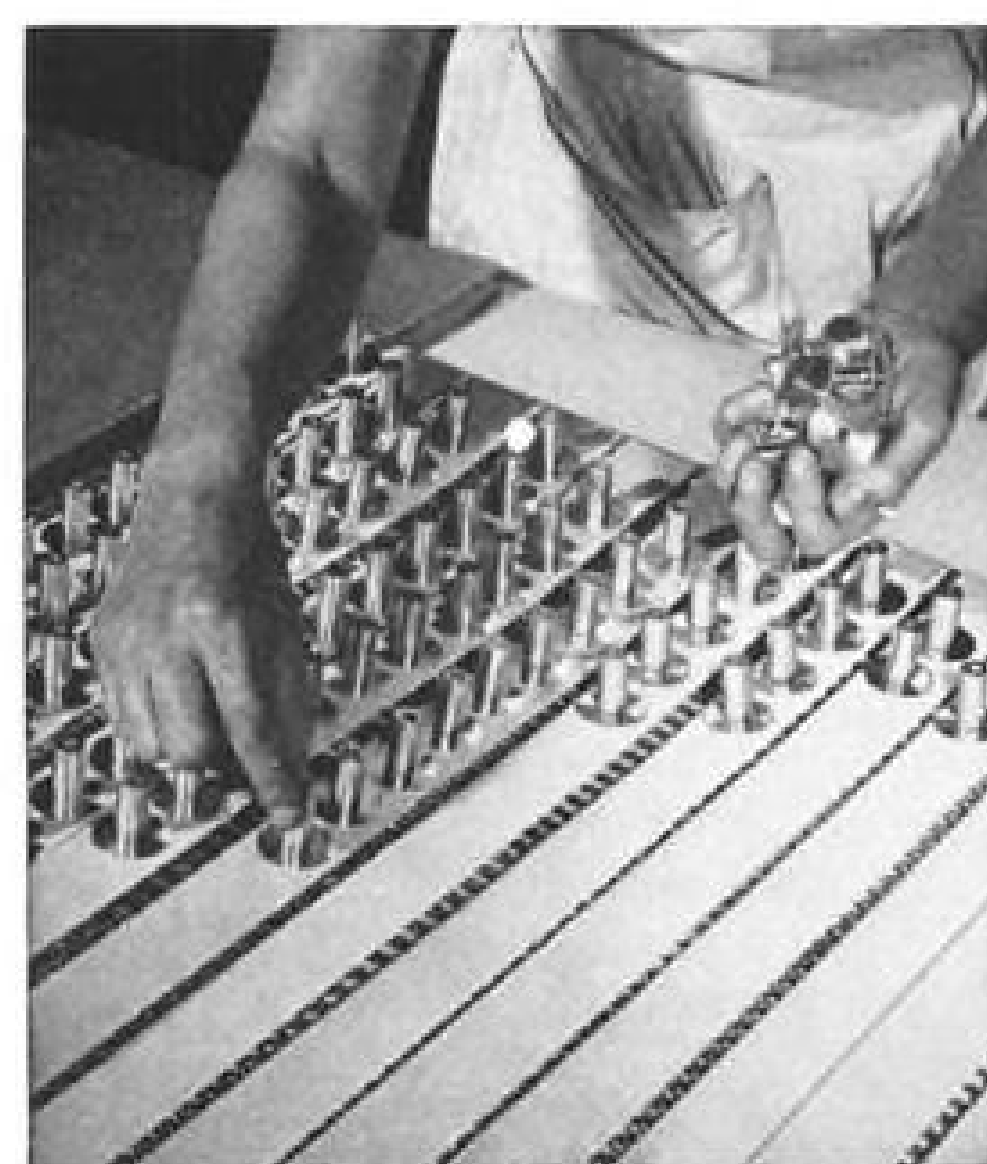
Whatever the job . . .
PERMACEL TAPE



ECONOMY IN PRODUCTION of the Martin Matador, new pilotless bomber, is the result of new techniques in which Permacel Tapes are used for a wide variety of cost and time saving applications.



HONEYCOMB "LUMBER" of aluminum, used in new adhesive bonding technique, is marked by Permacel 725 Printed Tape with part No. identification prior to being sawed into various size panels.



PERMACEL 77 Crepe Paper Masking Tape, adhesive side up, holds light-weight aluminum thimbles for adhesive spraying.



ELECTRICAL TERMINALS insulated with Permacel 30 Heavy Duty Plastic Tape for exceptionally high dielectric strength.



"FLYING COLORS" for all aircraft quickly, easily—by masking paint jobs with Permacel 71 Stain-Resistant Masking Tape.

SELF-STICKING
PERMACEL TAPES

Many jobs can be done faster, better, easier, with self-sticking tape . . . write Permacel Tape Corporation, New Brunswick, N. J.

EQUIPMENT

Direct Injection Cuts Fuel Consumption

By George L. Christian

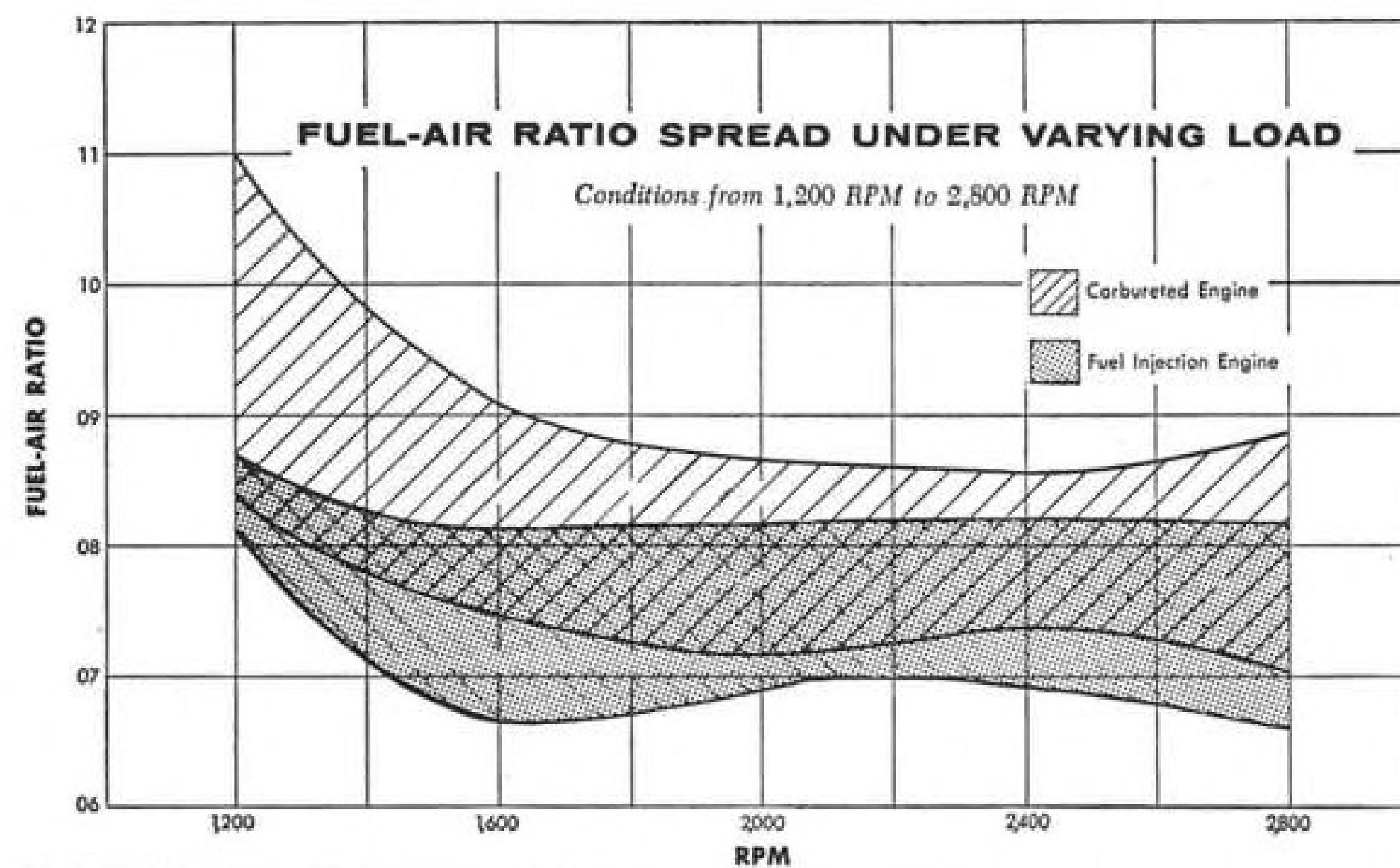
Vergennes, Vt.—Direct fuel injection on aircraft engines in the low to medium horsepower bracket is made possible by a new fuel pump now going into production at Simmonds Aero-cessories manufacturing facilities here.

Designed for use on aircraft and helicopter engines in the 200-800 hp. range, the pump has been released for production on three Continental Motors powerplants—AVSI-1790-6, AVI-1790-8 and AOSI-895-3, and is being prototyped for nine other fixed- and rotary-wing aircraft engines, among them the Jacobs R755 and Pratt & Whitney Aircraft's R985 and R1340.

► **From Tanks to Planes**—The pump, which is the heart of the Simmonds S. U. Fuel Injection System, has been in production at Simmonds for four years as a tank and ordnance vehicle engine fuel injection pump.

Design of the aircraft unit is essentially the same as the ordnance vehicle pump, installed on over 1,000 engines, according to company engineers.

Simmonds manufactures the pump under license agreements with the S. U.



GRAPH SHOWS ECONOMY of direct injection compared to carburetion in ordnance tank engine operations. Same applies to 200-800 hp. aircraft piston engines.

Carburetor Co., Ltd., Birmingham, England.

► **Economy and No Icing**—Two of the more attractive features of the Simmonds S. U. system are: 5-10% fuel economy throughout the engine's rpm. range, and the fact that the system's

air intake duct cannot ice up, except possibly at the inlet.

Injection systems are inherently more economical than carburetion systems, according to Simmonds spokesmen, the pump allows the engine to deliver up to 5-10% more power for the same displacement.

Icing danger—a very real hazard on single-engine aircraft especially—is eliminated by eliminating the carburetor, whose venturi is the critical icing point. The injection pump requires only a butterfly valve-type throttle in the air duct just ahead of the intake manifold.

Carburetor elimination also ends need for carburetor pre-heat controls, saving space and weight, and ends engine power losses due to carburetor heating.

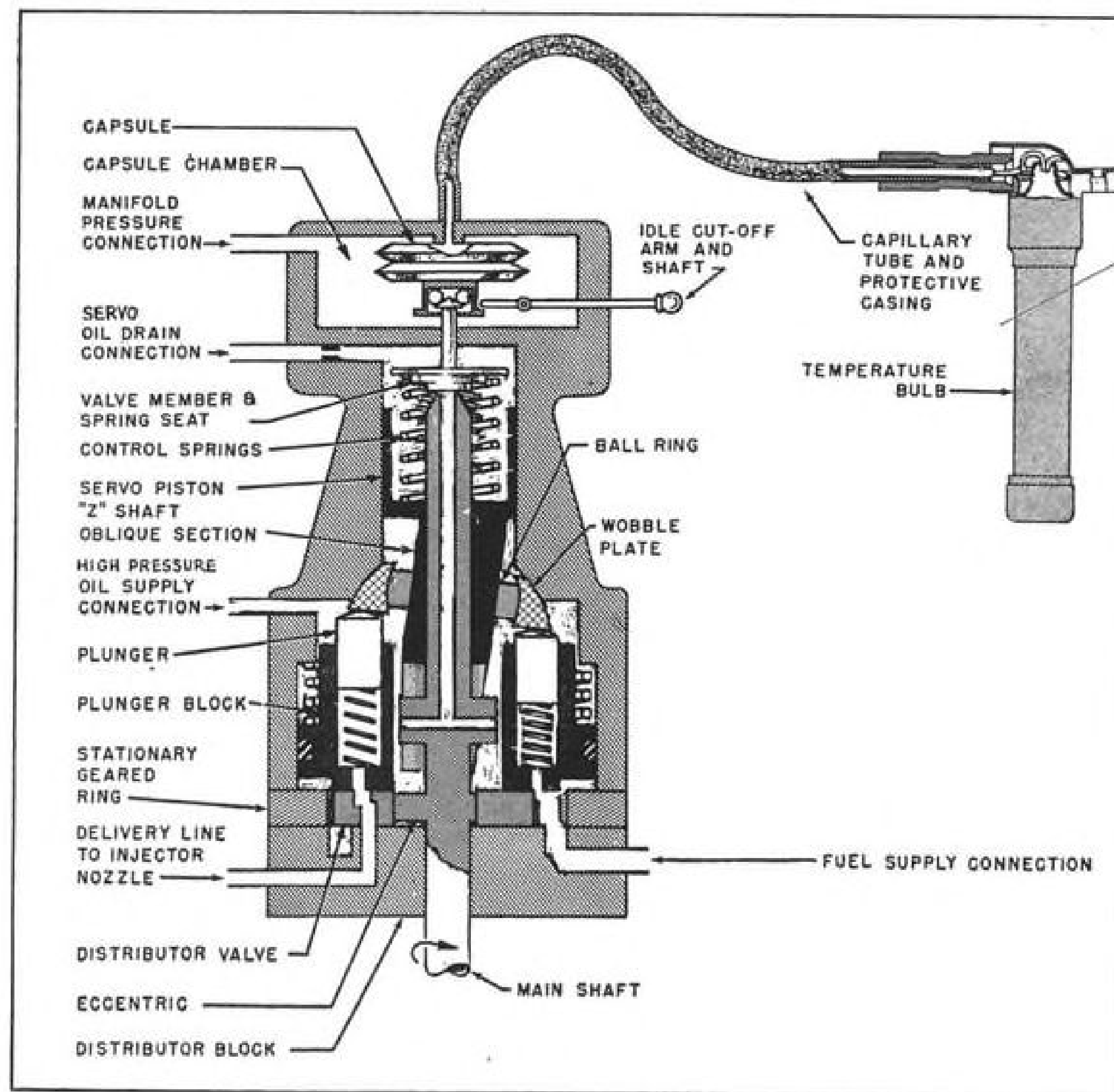
► **Good for Helicopters**—Simmonds engineers say that the S. U. injection systems are particularly good for use with helicopter powerplants. The fuel with its anti-fouling additives is injected directly into the cylinder just ahead of the intake valve.

With standard, carburetor- and manifold-type fuel induction systems, additives tend to deposit themselves along the manifold's walls or to be centrifuged out by the blower if the engine is supercharged.

Another advantage of the injection systems: Fuel distribution to all cylinders is uniform and manifold design is simplified.

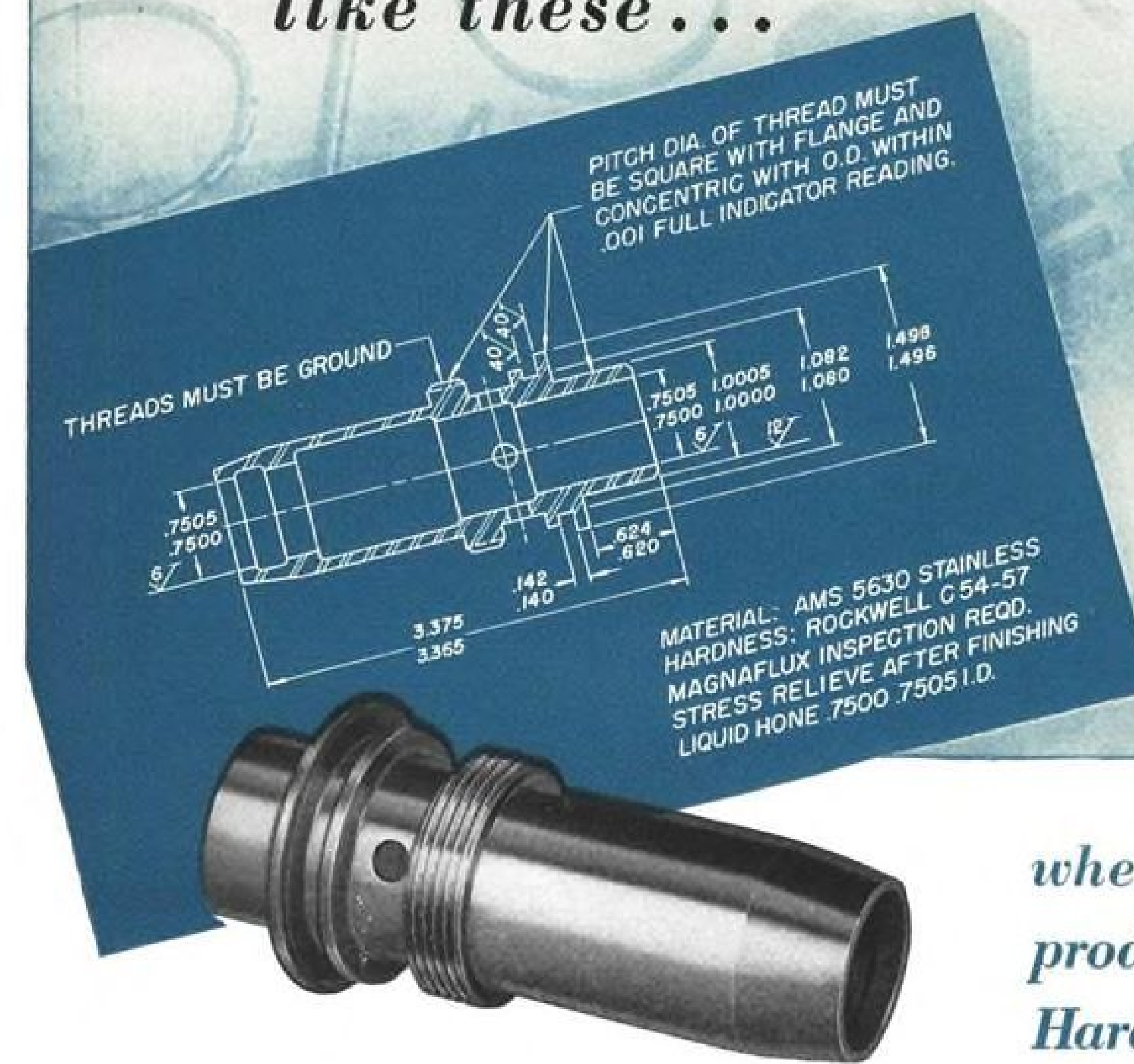
► **Special Features**—The S. U. injection system incorporates several features not found in other aircraft engine injection systems:

The injection nozzles are located in the intake manifold directly ahead of



S. U. PUMP cutaway shows major components, temperature bulb, fuel connections.

You Can Specify and Get
TOLERANCES and FINISHES
like these...



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ALLITE (ZINC ALLOY) AND
PLASTIC • R-B INTER-
CHANGEABLE PUNCHES
AND DIES



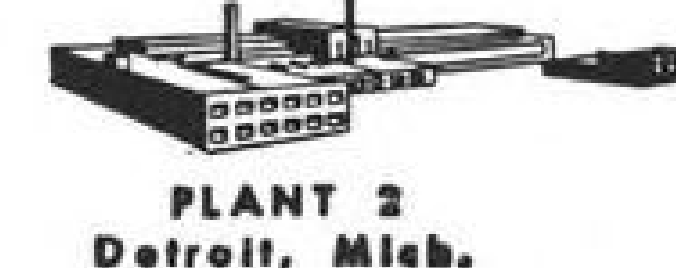
An unusual example? Not at all, for it is day-in and day-out procedure at Allied's Plant 3 to produce parts held to extremely close tolerances . . . with fine surface finishes . . . meeting rigid requirements for squareness and concentricity . . . and heat treated by the most accurately controlled methods.

Regardless of how many or what type operations are called for to produce your precision parts, Allied's Plant 3 has every facility—and the proven ability—to perform these operations . . . quickly . . . economically . . . and to your exact specifications.

A New 16-Page Brochure describes and pictures in detail the facilities of Plant 3, where Allied produces precision hardened and ground parts. Included is a complete listing of all equipment in use. A copy will be sent you immediately upon request—without obligation, of course.

ALLIED PRODUCTS CORPORATION

DEPT. D-20 12637 BURT ROAD DETROIT 23, MICHIGAN



each cylinder's intake valve. Keeping the nozzles out of the high pressures and intense heats of the combustion chamber means the system can operate at relatively low pressures and the nozzles themselves no longer need be high-priced components with carefully matched crack pressures.

Having a low-pressure system (nozzle crack pressure is approximately 60 psi., peak pressures run about 150-200 psi.) results in longer pump life, less fitting leakage, and greater system reliability, says Simmonds.

Ninety percent of S. U. pump parts are interchangeable. To modify a pump from a six- to a nine-cylinder engine, for instance, requires changing only four pump parts. High interchangeability cuts inventory requirements.

► **Easy Cold Start**—The Simmonds injection system allows engines to be started easily with no preheat in temperatures down to -65F; a little hand priming is all that is needed.

Simmonds engineers told AVIATION WEEK that in some cold weather starting trials, the only engines which completed all the tests successfully were equipped with their injection system.

Elimination of preheat requirements simplifies logistics and enables aircraft to become airborne faster.

The S. U. injection system does not require "tuned" discharge lines—all fuel

lines leading from pump to cylinders do not have to be the same length for even fuel distribution.

► **Saves Weight**—Continental Aviation and Engineering Corp. reports that in an installation on one of its 500-hp. aircooled engines, there was a saving of 30 lb. with the engine equipped with an S. U. fuel injection system as against the same model engine equipped with a carburetor. S. U. pump and nozzles in this installation weigh about 7 lb. ► **How It Works**—The pump needs to know three functions of the engine (unsupercharged): rpm., manifold pressure, and manifold air temperature.

The pump knows the engine's rpm., since it is connected directly to the accessory section. A connection between the engine's manifold and the pump's capsule chamber feeds manifold pressure to the pump at all times. A temperature-sensing bulb, located in the engine's intake manifold, translates temperature of air taken in by the engine to the pump through a sealed line containing dry nitrogen.

Specialized application pumps for supercharged engines are available in prototype.

► **Increase Power**—When the pilot calls for increased engine power, here is what happens:

As he opens the throttle, manifold pressure increases. This pressure tends

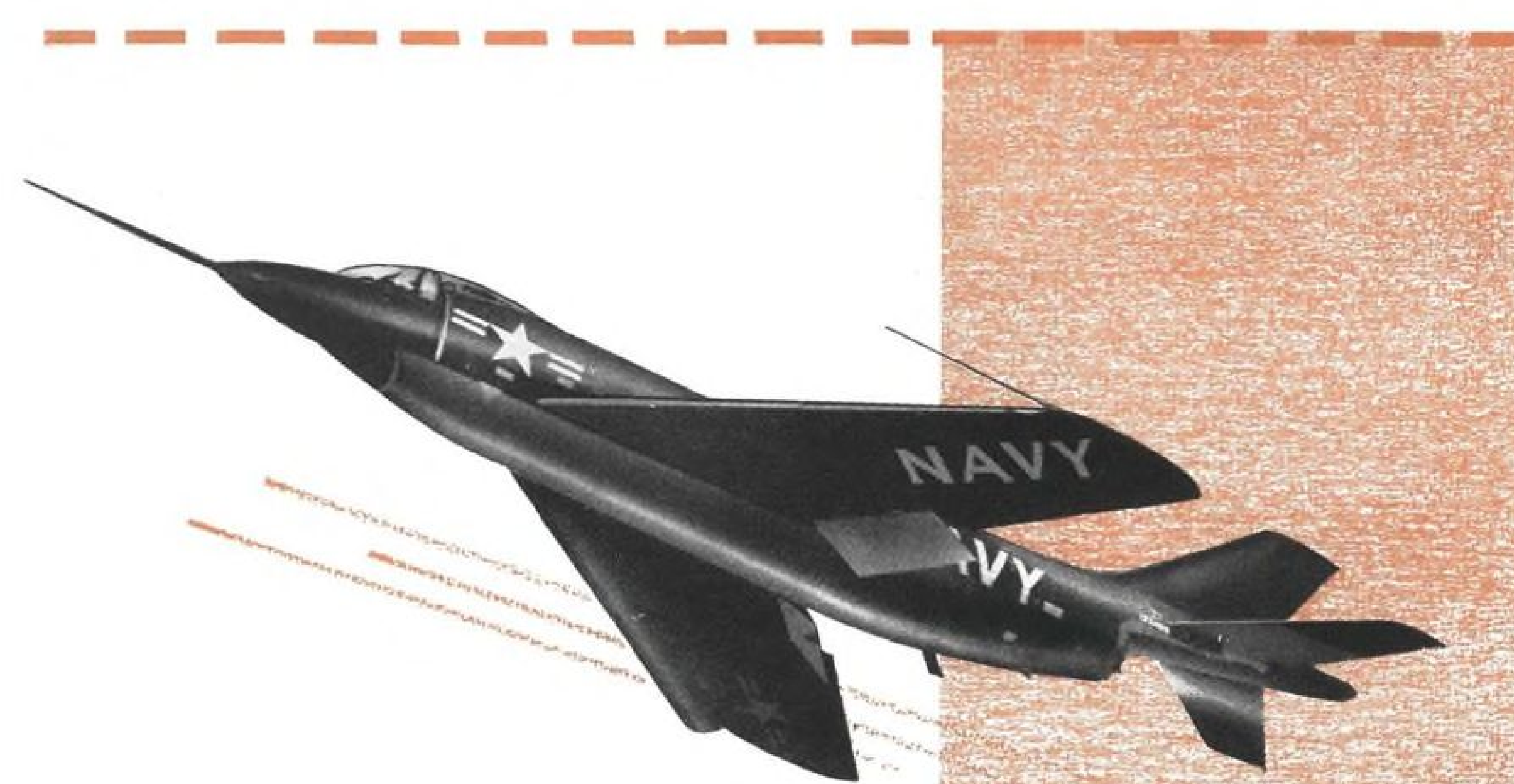
to compress the capsule in the capsule chamber which in turn moves the pin shaft up, allowing high-pressure oil to flow through a passage in the main shaft and dump into the servo oil chamber. Oil inflow exceeds oil outflow because of a restriction in the outlet passage.

Result is reduced differential pressure on both sides of the "Z" shaft, which allows "tuning springs" to move the Z shaft downward, increasing the angular displacement of the wobble plate, which lengthens plunger travel to increase pump output.

The Z shaft is a one-piece, machined Meehanite casting, composed of a servo cylinder on one end, which retains the tuning springs, a forked end to engage lobe of main shaft, and a central bore for main shaft. The wobble plate is mated to the eccentric Z shaft by means of a ball. Axial motion of Z shaft governs amount of fuel injected; rotation moves wobble plate radially so engine cylinders get fuel in proper succession.

► **Decrease Power**—As throttle is retarded, manifold pressure drops, which allows capsules in the pump to expand and move the pin shaft down. This results in the servo valve closing off high oil pressure, reducing pressure in servo oil chamber.

High-pressure oil moves the Z shaft upward against the tuning springs which reduces displacement of the wobble



Still another weapon from the spirit world...

McDONNELL SPEEDS **DEMON** PRODUCTION WITH A SUB-CONTRACT TO **TEMCO**.

First the *Phantom*, then the *Banshee*, now the *Demon* — and soon the *Voodoo*. If the names of McDonnell's sleek fighters aren't enough to haunt aggressors' dreams, their performance certainly will. The Navy, with twin-jet *Banshee* squadrons already in operation, saw the new F3H *Demon* design...liked it...wanted some quick. McDonnell sped the job by sharing the responsibility with TEMCO, giving sub-contracts for aft fuselages, inner and outer wings, flaps, and other components totaling 35 per cent of the airframe. McDonnell thus joined Boeing, Convair, Lockheed, Martin, and Republic — all of whom have found that TEMCO delivers a quality product, on schedule, at the lowest possible cost.

ENGINEERS... If you are interested in a position with a growing weapon systems organization, write full particulars to E. J. Horton, Jr., Engineering Personnel, TEMCO Aircraft Corporation, P. O. Box 6191, Dallas 2, Texas.



F3H aft fuselage sections on rotating circular jigs move down TEMCO-Dallas assembly lines. Elsewhere in the Dallas plant, a twin line is devoted to inner wings, while outer wings take shape at TEMCO's Garland plant.

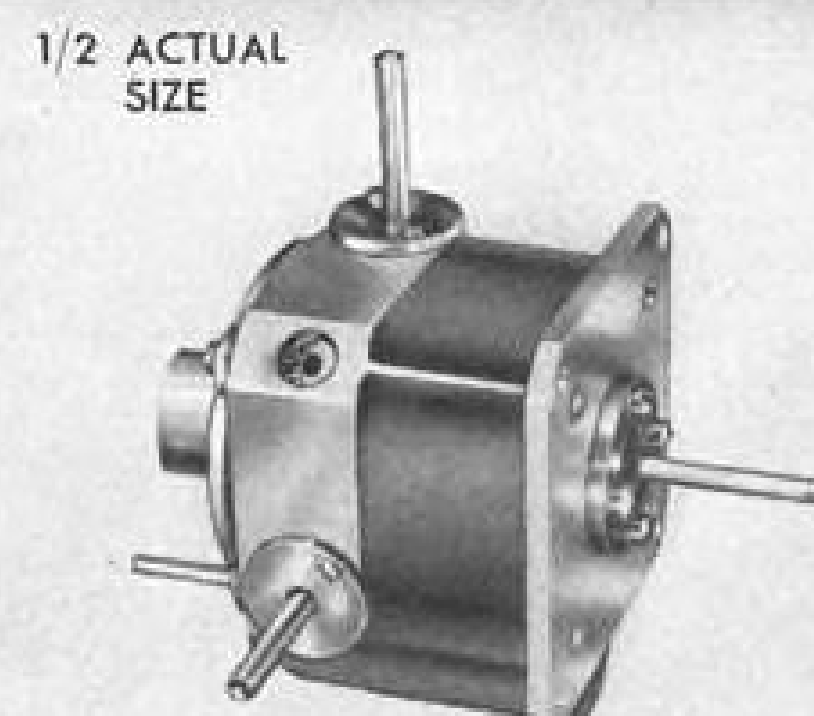


IN GOOD HANDS! From design to mass production, Security Parachute Company can provide automatic parachute systems for any purpose... for the smallest missile or the largest super bomber. Your correspondence regarding research or production is invited.

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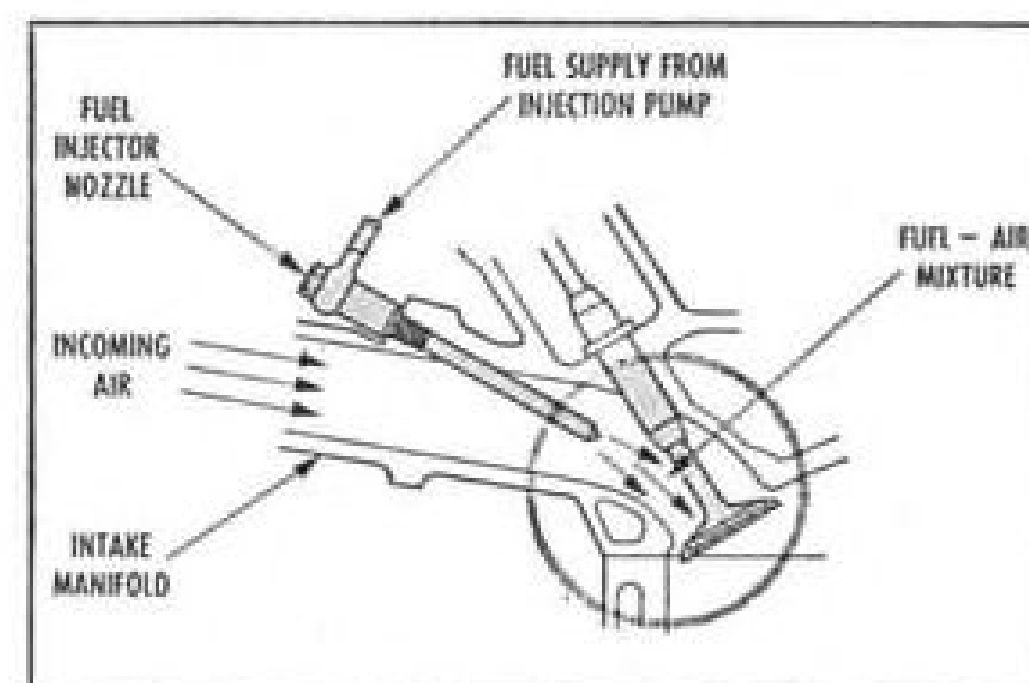
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Anti-Splash Valve Seals Tank Vents

A new anti-splash valve which prevents fuel from sloshing out of aircraft fuel tank vent lines is currently being used on the Avro CF-100 twin-jet in-

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VALVE ends fuel tank vent-line splash.

terceptor, according to the valve's manufacturer.

The Model 22-1349 valve is particularly useful in wing tanks, where tank geometry often requires that vent line inlets be installed almost at fuel level. The valve, through the action of two float-controlled, opposite-acting poppets and two governors, keeps fuel from escaping during aircraft maneuvers and periods of high acceleration.

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Manufacturer: Aero Supply Manufacturing Co., Inc., Corry, Pa.

New Generator Brush Better, AA Finds

Aircraft generator system life on American Airlines' Convair 240s and Douglas DC-6s has been increased at least 100% by installing a redesigned brush which performs well at low and high altitudes and a shielded bearing which will not rotate in its housing.

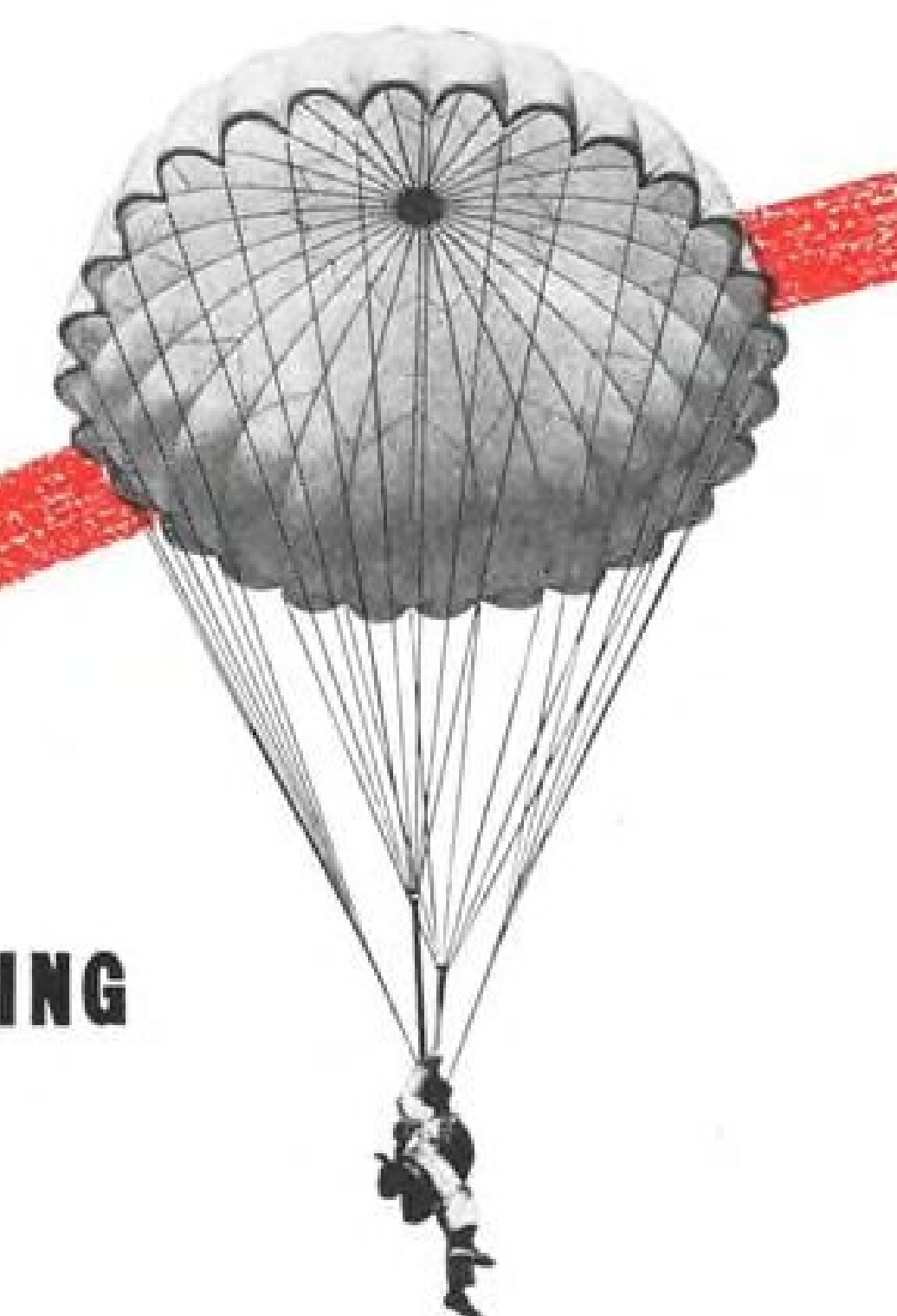
When originally installed in 1946, the equipment had an expected development life of 700 hr. This has been extended to 1,400 hr. on the 240s and to 1,800 hr. on the larger planes. The improvements on which General Electric Co. aided, allows AA to schedule electrical component overhaul in line with its engine overhaul schedules.

Platinum Electrodes Stretch Plug Life

Fine-wire-platinum electrode spark plugs are giving twice the life of massive electrode plugs when used in Wright Turbo Compound R3350 engines, according to AC Spark Plug. The fine-wire plugs show only slight gap wear and no carbon or lead deposits when removed from Turbo Compound engines after 400-500 hours of service, says AC. The plug uses a silver center electrode with a good-sized platinum tip, while side electrodes are all platinum.

AC says it has received substantial orders from two major commercial airlines and the USAF.

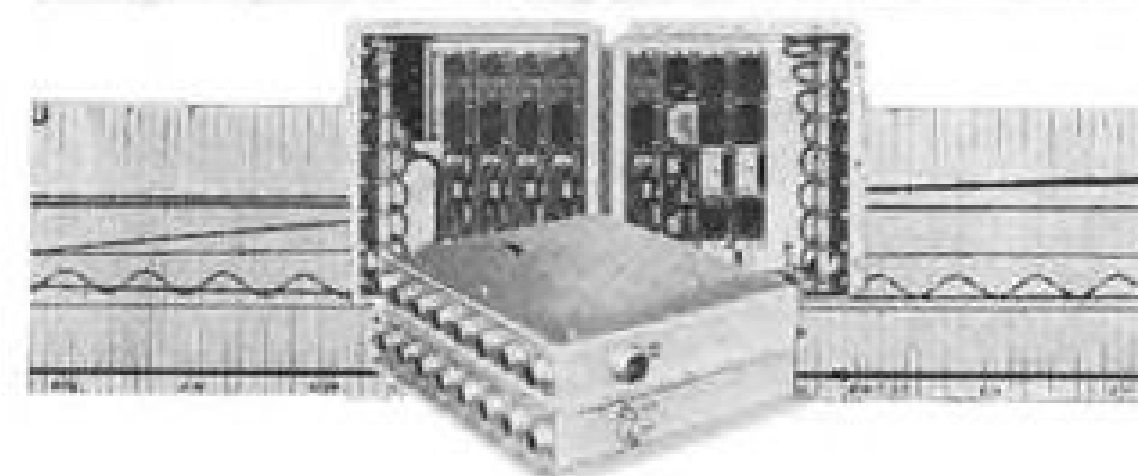
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AVIATION SAFETY

CAB Report on Great Lakes Airlines C-54 Accident

All Safe as Fire Burns Off Engine

A Douglas C-54-G, N 30070, operated by Great Lakes Airlines, Inc., made an emergency landing off the runway at the Gage Oklahoma Airport, at 0320 on June 15, 1954.¹ The emergency landing was made because of an uncontrollable fire in the Number 3 engine nacelle.

There were no injuries to passengers or crew. The aircraft was destroyed by fire.

HISTORY OF THE FLIGHT

Great Lakes Airlines' Flight 146, of June 14, 1954, originated at New York, N. Y., with its destination Burbank, Calif., and with intermediate planned stops at Chicago, Ill., and Kansas City, Mo. The segments of the flight to Kansas City were made without incident and the aircraft landed there at 0005, June 15, 1954.

THE ACCIDENT

At Kansas City, a routine crew change was effected and the aircraft was refueled. The new crew consisted of Capt. Charles F. Pedesky, First Officer Frank J. MacDonald, Jr., and Stewardess June E. Miller. No service was performed on the aircraft at Kansas City other than refueling.

According to company records the take-off weight of the aircraft was 71,143 lb., which was within the allowable limits and the load was properly distributed with respect to center of gravity of aircraft.

Prior to takeoff Capt. Pedesky made a preflight inspection and no discrepancies were noted. The flight normally dispatched, departed Kansas City at 0107 and was cleared IFR (Instrument Flight Rules) to Burbank, Calif. via Green 4 and Amber 1, to cruise and maintain 4,000 ft. The estimated en route time was 7 hr. and 40 min. and there was sufficient fuel for a flight of 11 hr. and 30 min. There were 75 adult passengers and 4 infants on board.

At 0213, when the flight was over Wichita, Kan., a routine position report was made in which it was estimated that the flight would be over Gage, Okla., at 0307. The crew testified that when the aircraft was in the vicinity of Gage radio reception was poor due to static caused by local thunderstorms in that area.

At approximately 0305, Gage INSAC, (Interstate Airways Communications) advised the flight that Albuquerque ARTC (Air Route Traffic Control) cleared it to climb and maintain 6,000 ft. Accordingly, Flight 146 began to climb.

Shortly thereafter the stewardess entered the cockpit and told the pilots that she had seen sparks trailing from Number 3 engine. The captain immediately requested the first officer to look out of his window and see if he could see anything wrong. This was done but nothing unusual was

seen. At the same time the captain checked the instruments and found their indications to be normal. The stewardess was then told to return to the cabin and to again advise the captain if and when she observed anything out of the ordinary.

At approximately 0308, when the aircraft was at an altitude of 5,500 ft. and in the vicinity of Gage, the Zone 2 fire warning light of the Number 3 engine came on. As soon as this was observed the first officer went to the cabin to make a visual check. He returned a few seconds later and reported there was a fire in the Number 3 engine.

The captain immediately returned the aircraft to level flight and feathered the Number 3 propeller. The firewall shutoff valve was then pulled, the CO₂ selector set for the Number 3 engine and the first bank of CO₂ bottles was discharged. As this application of carbon dioxide did not appear to put the fire out, the engine's cowl flaps were closed and the second bank of CO₂ bottles was discharged. Following this action the fire was seen to die down momentarily but almost immediately to flare up again.

The first officer called Gage INSAC at approximately 0312 while the captain was performing these duties and advised that the Number 3 engine was on fire and that its propeller had been feathered. The Gage INSAC communicator immediately turned on the airport runway lights for the north-south runway. There were no other radio contacts with the flight.

Capt. Pedesky, unable to extinguish the fire, began a left descending turn toward the airport. During this turn, the Number 3 engine fell from the aircraft, at which time a complete failure of the electrical system was experienced.

The captain testified that throughout the approach he was unable to see the runway lights on the airport and, not being able to use the aircraft's landing lights, he headed in the general direction of the airport beacon. Throughout the latter stages of descent the first officer used a flashlight so that he could observe and call out altimeter and airspeed readings. As the aircraft neared the ground the fire illuminated the surface, permitting the captain to see the ground and land the aircraft safely. After rolling a considerable distance the right main landing gear collapsed.

When the aircraft came to a stop all passengers were quickly evacuated. Fire eventually destroyed the aircraft.

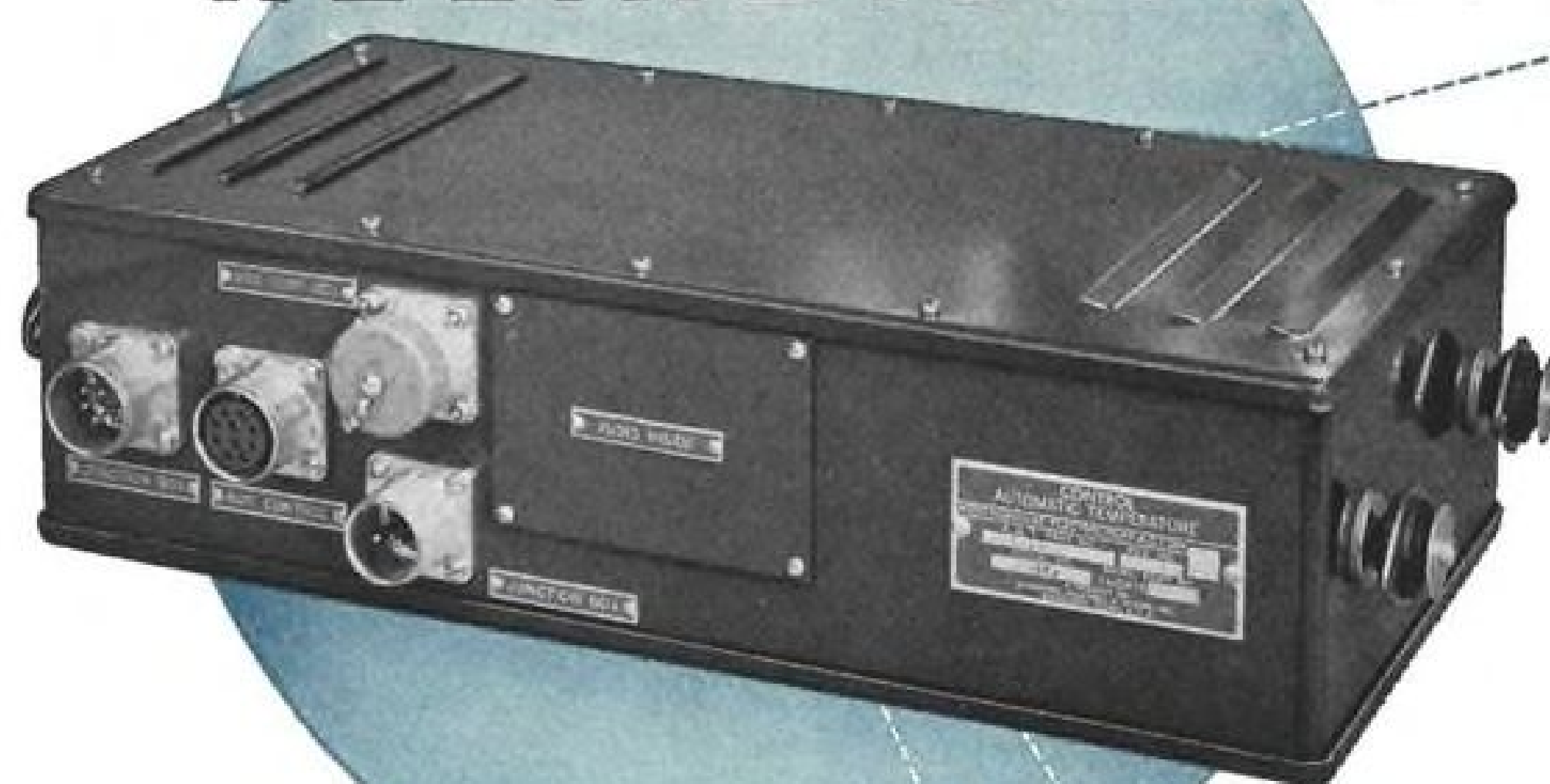
The Gage weather at the time of the accident was: ceiling estimated 12,000 ft., overcast, visibility 15 miles, thunderstorms, wind south-southeast 10 mph. Weather was not a factor in this accident.

INVESTIGATION

Investigation conducted at the scene of

¹All times referred to herein are Central Standard and based on the 24-hour clock.

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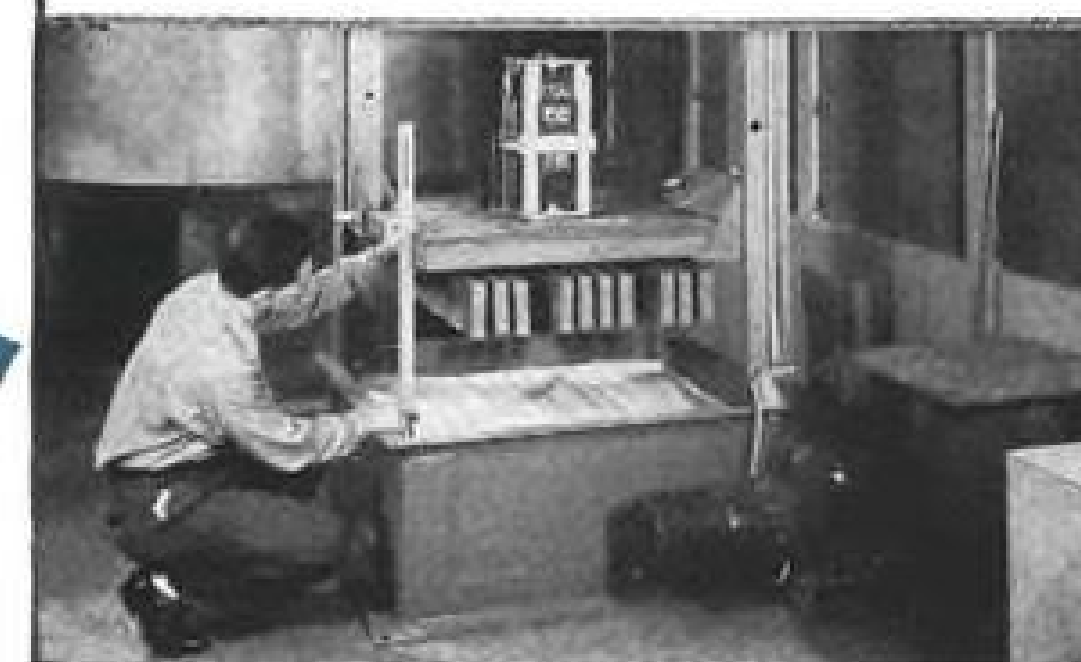
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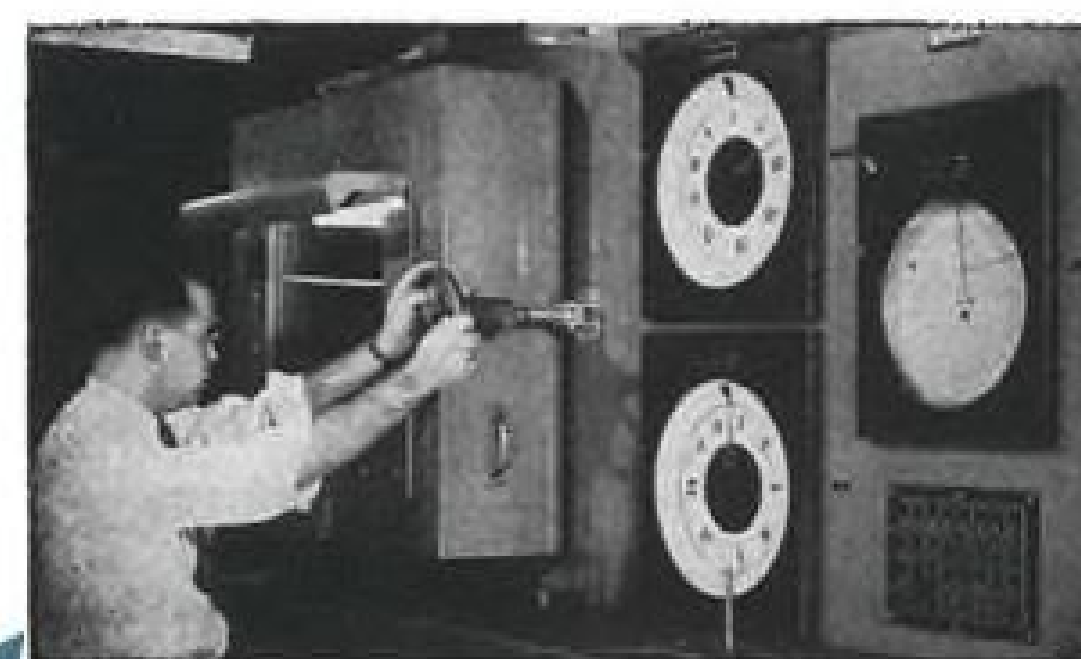
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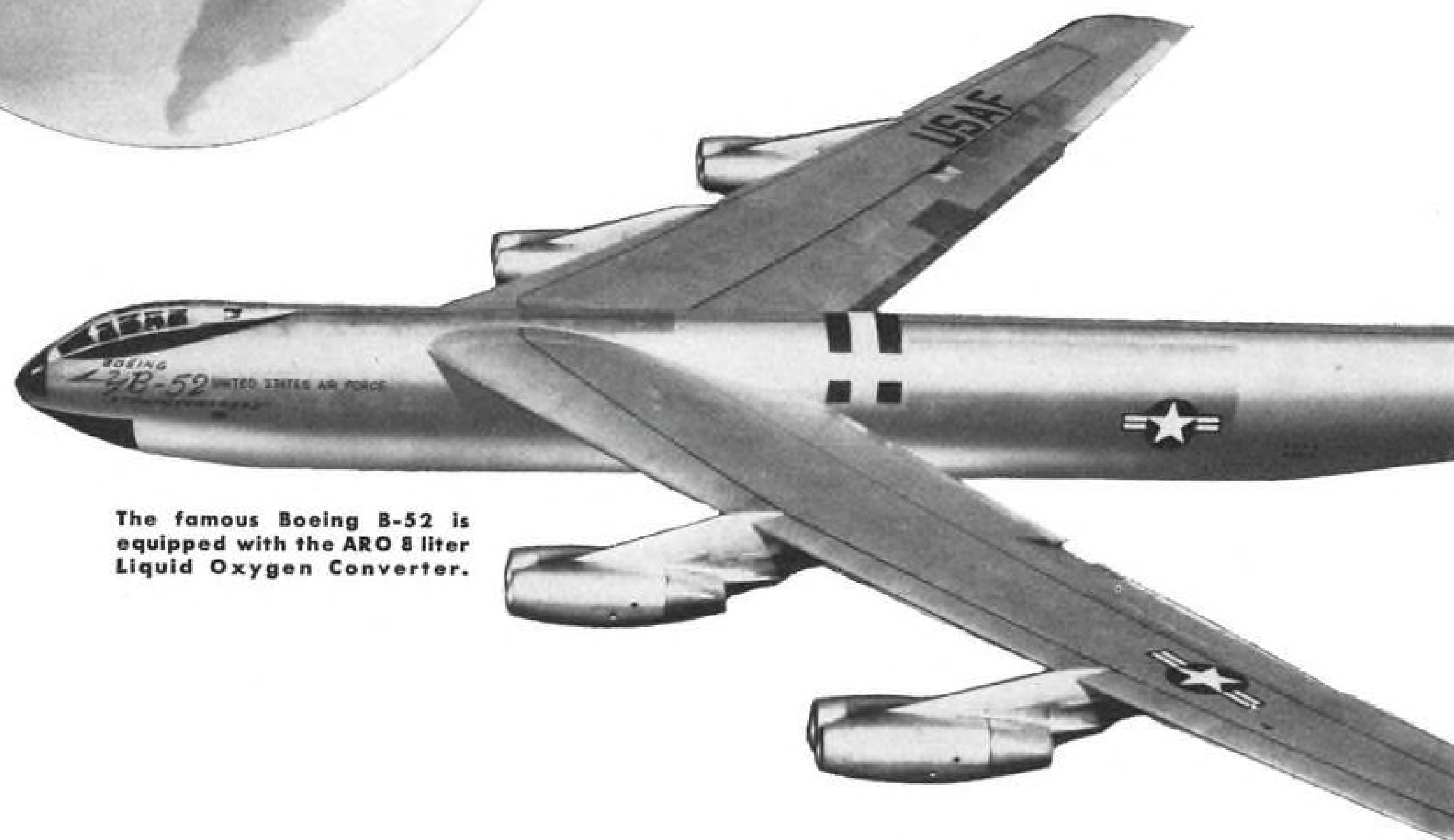
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SAFETY . . .

the accident disclosed that the aircraft first contacted the ground on a heading of 110° about 900 ft. to the left of Runway 4 (040°) and 1,000 ft. inside the airport boundary. After rolling approximately 1,100 ft., the right main landing gear collapsed because of fire damage and the aircraft then skidded sideways to the right, stopping 1,800 ft. from the first ground contact point.

The captain ordered an immediate evacuation of the aircraft, which was done quickly and in an orderly manner through the main cabin and pilot doors. Evacuation was accomplished in an estimated 1½ min., without serious injuries to any of the passengers or crew.

The intense fire in the Number 3 nacelle area continued to burn, spreading progressively throughout the entire aircraft with the exception of the left wing and empennage.

The INSAC communicator at Gage stated that at the time the aircraft reported to him he did not receive the information that the aircraft's engine was afire but only that a propeller had been feathered. Another flight operating in the range of Gage, however, heard the flight report the engine was also on fire.

When the operator learned that fire was existent the flight had already made its emergency landing. The communicator, alone on duty, was unable to leave his position to go outside because of his attention to radio operation. He was also unable to see the airport landing area from his position. Therefore, he did not see the aircraft coming toward the airport or see it land. He did not know that the aircraft had landed until the crew entered his office and advised that it was on the field and burning; also that the Gage Fire Department had been notified by the captain.

The fire truck arrived approximately 30 min. later. The equipment consisted of two CO₂ bottles and a water tank, operated by volunteer firemen, and was not designed for combating an aircraft fire but for the use of the small community of Gage, Okla.

The Number 3 engine, which fell from the aircraft was found 11 miles northwest of the airport. It, being the area of the origin of the fire, was given exhaustive examination.

The nose case of the engine was demolished by impact and Cylinders 8, 9, 10, 11, and 12 were severely damaged by impact and fire. The diffuser section and accessory case were destroyed. Only portions of the accessories normally installed on the rear case were recovered; all had sustained fire damage.

Disassembly of the engine indicated that there was no failure or malfunction prior to impact.

The generator for this engine, a Jack and Heintz Model JH 11300, Type R-2, Serial Number 772, was recovered. It was badly damaged by the intense fire and impact. Disassembly revealed that the inner and outer races of the front bearing were badly galled and distorted.

Three accessory case generator mounting studs were recovered. Two were 6½ in. long and were bent about five degrees at the point where they passed through the generator mounting flange. The third stud had failed in tension and bending at approximately the same place where the others were bent. Only the inner race of the gear generator

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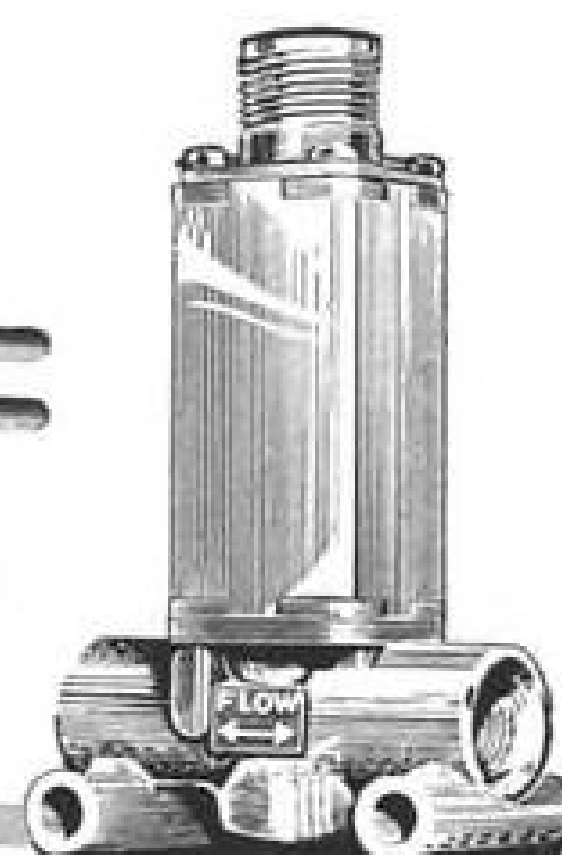
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V-8500.....	Normally Open.....	300 psig
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SAFETY . . .

bearing was found. It was still attached to the drive shaft and armature support tube. Approximately 1/4 of the circumference of the forward and rear edges of the bearing groove was cut, distorted, and rolled.

The generator drive shaft was broken just aft of the clutch assembly. The shear section of the shaft, designed to fail under excessive loads, was intact although bent one degree. The armature and commutator components of the generator were severely scored, distorted, and burned. The score marks on the armature matched similar ones on the coils and interpoles and were rotational in direction, which indicated they were made while the armature was still turning.

According to company records the generator had accumulated 550 flight hours since overhaul. The overhaul included replacement of the front bearing.

Investigation further disclosed that the Douglas C-54G electrical system originally consisted of four 100-amp. generators, one installed on each engine.

This system was subsequently modified on the subject aircraft by the carrier in favor of a two 300-amp. generator system, a generator mounted on Number 2 and Number 3 engines. The modification was made in accordance with a CAA-approved Delta-C&S Air Line engineering order Number 336, dated July 29, 1946. The modification was made to provide a more efficient generator system for the aircraft. In the specific instance of N 30070 the modification was completed and approved Nov. 15, 1953.

Generators specified by the engineering order were designated as Type G-27. It was learned through testimony of the manufacturer's representative that the R-2 generator, the type installed on the Number 3 engine, was identical with the generator specified in the engineering order issued by the airline.

After World War II, a surplus of R-2 generators, both new and used, were released by the Air Force. Jack and Heintz, therefore, in order to identify their own surplus stock from any other, both as to sales and warranty, designated theirs as the G-27 generator.

Exhaustive examination was conducted relative to the airframe, the other engines, and propellers, and although these components were badly damaged from impact and fire no evidence could be found of malfunction or failure prior to impact. The crew stated that prior to the fire they experienced no mechanical or structural discrepancies.

ANALYSIS

Investigation and examination of the wreckage definitely indicated that the failure of a generator bearing was the initial malfunction. This failure resulted in the generation of extreme frictional heat capable of weakening and burning through adjacent fluid lines causing the release of inflammable fluids which were ignited. The fire progressed so rapidly and became so intense that available CO₂ was insufficient to extinguish it.

The failure of the generator drive shaft to shear at its designed shear section after the bearing failure, permitted the generation of extreme friction heat and the re-



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SAFETY . . .

lease of inflammable fluids with consequent intense fire.

The loss of all electrical power at the time the engine separated from the aircraft was most probably caused by a ground fault on the power cables during the physical breakup of the nacelle installation. Further radio contact with the Gage INSAC and use of aircraft landing lights were prevented by electrical power loss.

The landing was made on the airport off the runways due to the surface-type runway lights being obscured by a growth of tall grass. This tall grass was normally mowed 5 ft. on either side of the runways and unless an aircraft, on approach, was lined up with a runway, the lights would not be visible from a low approach as in this incident.

The Gage INSAC communicator testified that he did not hear any mention of fire when the flight contacted him. It is probable that static and interference from other radio receivers prevented him from hearing the complete message.

Before further transmission from the aircraft could be made all electrical power was lost; consequently the Gage Fire Department was not at the airport when the aircraft landed. It is doubtful that the available fire equipment would have been able to extinguish the fire had it been alerted and present at the time of the landing.

The Board wishes to commend both Capt. Pedesky and First Officer MacDonald who, under the emergency conditions present, effected a safe landing at night, without aircraft lights and only the airport beacon as guidance. Miss Miller, the stewardess, is also to be complimented for the prompt and efficient manner in which she supervised the evacuation of all passengers from the burning aircraft without injury to any of them.

FINDINGS

Upon consideration of all available evidence the Board finds that:

1. The carrier, the aircraft, and the crew were properly certificated.
2. The flight was dispatched in accordance with company procedures.
3. The total weight at takeoff was 71,143 lb., which was less than the maximum allowable and the disposable load was properly distributed with respect to the center of gravity of the aircraft.
4. The flight was routine until, when in the vicinity of Gage, Okla., fire occurred in Number 3 nacelle.
5. A generator bearing failure resulted in extreme frictional heat which weakened or burned through adjacent inflammable fluid lines and ignited the fluid.
6. The intense fire caused the Number 3 engine to drop off in flight resulting in a complete loss of electrical power.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was a bearing failure of the Number 3 engine generator, causing extreme frictional heat and the release of inflammable fluid which ignited in flight.

By the Civil Aeronautics Board:

/s/ Chan Gurney
/s/ Harnar D. Denny
/s/ Josh Lee
/s/ Joseph P. Adams

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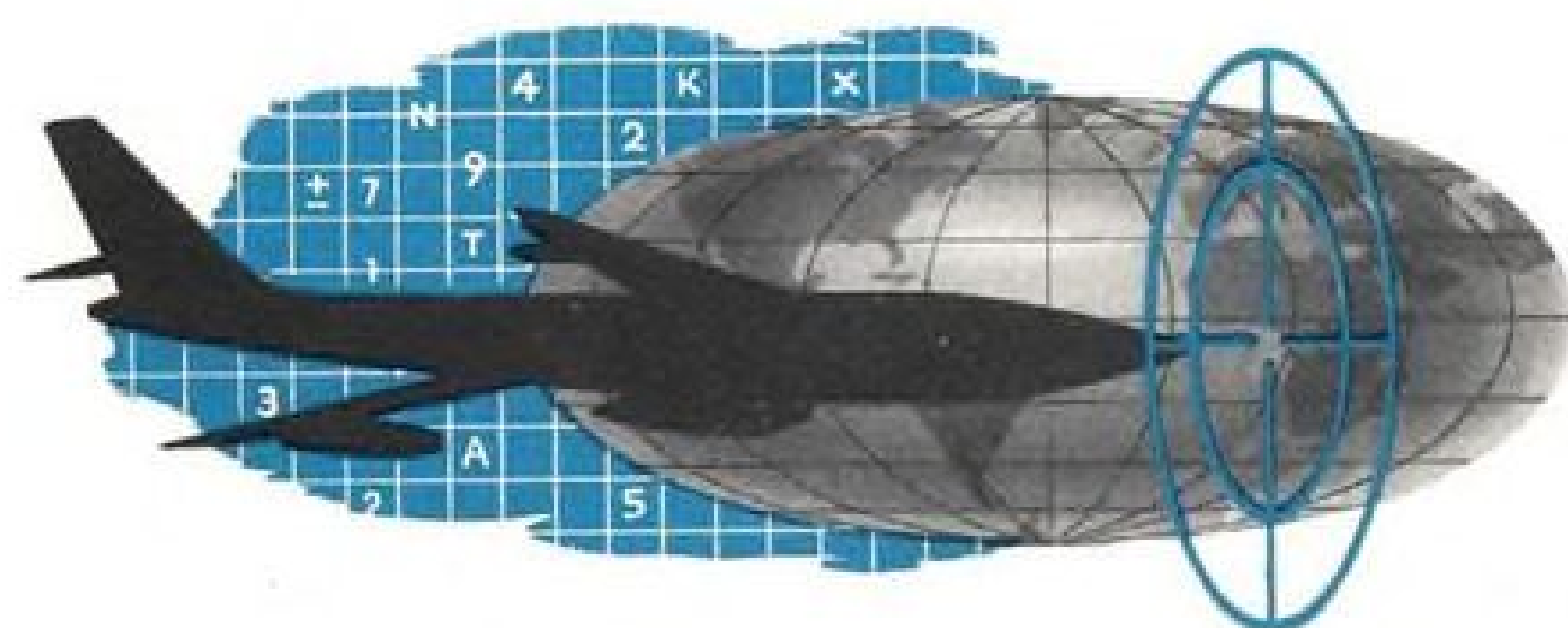
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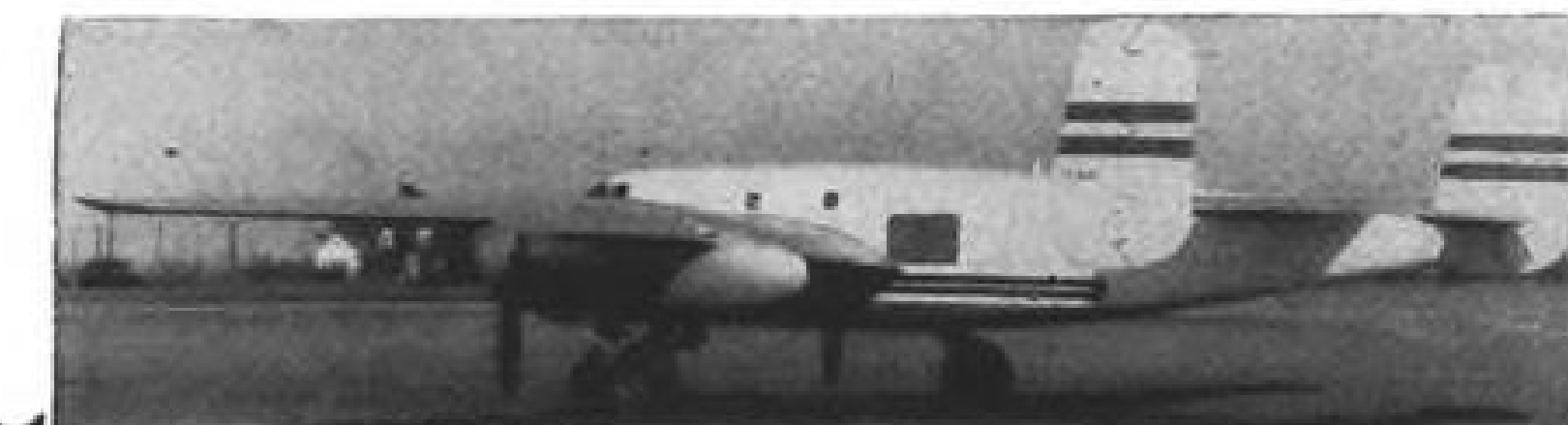
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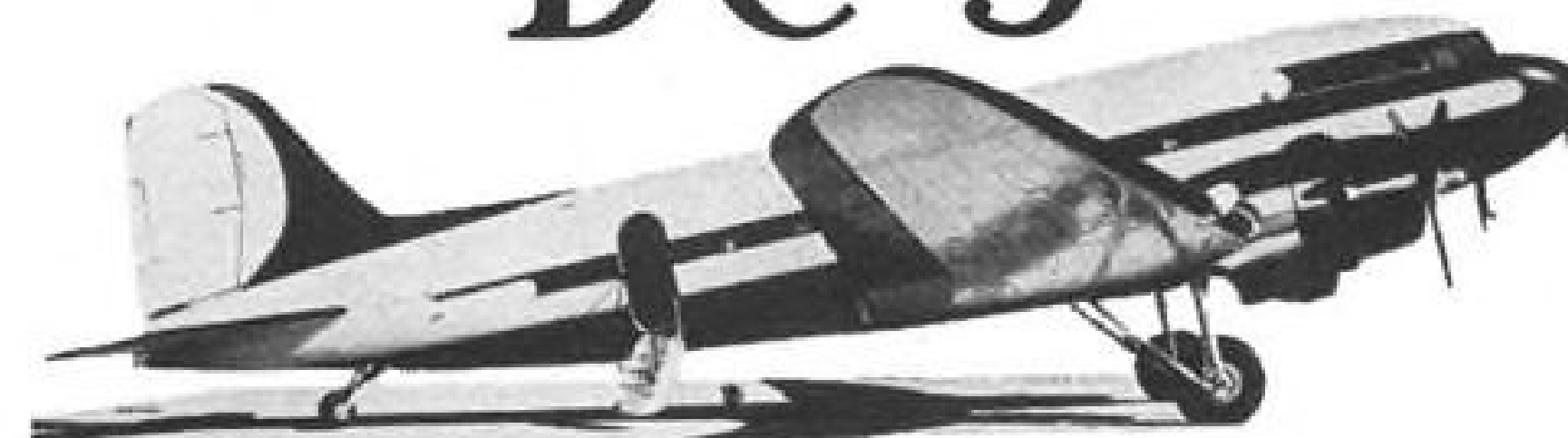
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Airline Business Continues Steady Rise

But annual reports pinpoint profit squeeze caused by higher costs; coach and credit plans boost traffic.

Annual financial reports of the nation's domestic airlines indicate that 1954 was generally a good year for the carriers. With few exceptions, statistics show increases in all categories—traffic, revenues and profits. Business was on the rise at the end of the year, and the companies predict this trend will continue in 1955.

American

American reports revenues of \$214,766,000 in 1954, an increase over 1953 revenues of \$208,306,000. Expenses were \$192,735,000. Earnings after taxes were \$11,431,000, down from \$14,100,000 for 1953. Preferred and common stock dividends totaled \$5,312,000.

Operations last year were affected by a pilot strike which grounded the airline for 24 days in August.

Delivery of 25 DC-7s was completed during the year, and orders have been placed for 14 more DC-7s and four DC-6As. Delivery of this order will bring the American fleet to 206 aircraft.

Aircoach flights accounted for 23% of the 3,457,000,000 passenger-miles. American added nine airplanes to aircoach last year and will add two more this spring.

C. R. Smith, American's president, told stockholders that fares remained stable during the year while costs increased. "Air fares, which remain at prewar levels, cannot long be continued on that basis if costs continue to rise," he said.

United

United Air Lines had revenues of \$200,719,000 and expenses of \$178,832,000 last year. Figures for 1953 were \$172,967,000 and \$153,941,000. Net earnings for 1954 were \$9,618,000, a 6% increase over the previous year. Earnings amounted to \$3.52 a common share.

Increased mileage through introduction of the DC-7 is viewed by United as a factor which contributed to increased revenues. At the end of the year, 93% of the carrier's services were flown by DC-6, DC-6B and DC-7 equipment.

United operated 33 aircraft in coach

service last year for 29% of total passenger traffic, an increase over 21% for the previous year. United says it will continue to expand aircoach to keep abreast of industry trends. But the report expresses concern with the spread between first class and coach fare and the diversion from first class to coach.

►DC-7 'Breadwinner'—Increased traffic during the American Airlines strike and profitable Hawaiian operations are noted as contributors to improved revenues. United's load factor dropped slightly from 68.4% in 1953 to 66.4% in 1954 in the face of a 25% increase in available seat-miles.

In his message to stockholders and employees, UAL President W. A. Patterson observed that the profit margin had narrowed and said he felt this would be a continuing problem in 1955, although he expressed a general optimism for the current year.

Patterson said that although United is keeping abreast of developments in the turboprop and turbojet field, it appears that such airplanes as the DC-7 "will be the airlines' 'breadwinners' for some years to come."

Colonial

Colonial Airlines had a profit of \$90,945 in 1954, compared with \$125,465 in the previous year. This is the first time Colonial has had a profit in two consecutive years, according to president Branch T. Dykes.

Colonial sent to its stockholders a recommendation that they approve the proposed merger with Eastern Air Lines. The sale is based on an exchange of two shares of Colonial stock for one share of Eastern.

Trans World

Trans World Airlines reports revenues of \$203,671,000, an increase of 9% over 1953. Domestic revenues were \$145,239,000 and international revenues \$58,432,000. Net income was \$10,336,000, more than double 1953.

TWA points out that 1954 operations were free of any subsidy in both divisions. The carrier had increases of 11.1% in revenue ton-miles last year while operating expenses increased 2.6%. Unit operating costs per ton-

mile of service were at the lowest level since 1945.

TWA expects 1955, its thirtieth anniversary, to show continued improvement. The Time Pay Plan and Sky Tourist services are viewed by the carrier as important tools in broadening domestic and international markets.

The report notes continued cooperation with the Post Office Department in the surface-mail-by-air experiment. "We are firmly convinced," said R. S. Damon, TWA president, "that the public interest requires dispatch of all long-distance domestic letter mail by air in the very near future."

Eastern

Eastern reported a net income of \$7,152,012 for 1954, compared with \$7,921,367 in 1953. Total revenues for last year were \$169,937,661, an 18% increase. Earnings in 1954 include \$176,221 for sale of equipment compared with \$2,028,825 from 1953 equipment sales.

Eastern attributed 1954 revenue gains to aircoach operations. Expansion last year increased coach revenues 77% to \$56,413,959, while a 96% gain was registered in passengers carried. First class passenger traffic showed a 7% increase, but first class revenues declined from \$101,280,275 in 1953 to \$101,134,180.

Favoring increases in fares, EAL's Captain Eddie Rickenbacker pointed out that fares have increased 3½% in 15 years while wages have increased 128%. "More than any other single factor," he said, "the CAB's resolution of this critical fare problem would accelerate the broad expansion of air transportation service to meet the increasing public need and, at the same time, greatly strengthen the air transportation industry as a vital arm in the cause of national defense."

Western

Western Air Lines listed total revenues of \$24,480,779 last year, compared with \$22,876,797 for 1953. Net income for 1954 was \$1,458,699.

Introduction of additional DC-6Bs to service, especially in the deluxe "Californian" flights, is viewed by Western as a key contributor to increased revenues. Another is WAL's new "Charge-A-Flight" plan which offers credit services to frequent users of the airline.

Western also is pleased with coach operations, which accounted for 31% of passenger revenues, compared with 23% in 1953.

Terrell C. Drinkwater, WAL president, told stockholders that importance of Western as a regional carrier becomes increasingly evident as the four transcontinental carriers concentrate on long haul business and minimize service to intermediate cities. He predicted gains in all types of traffic in 1955.

Continental

Continental reported revenues of \$12,119,884 and expenses of \$11,077,737 for 1954. Net income was \$530,916 or \$1.32 per share. Revenues increased 9.4% over 1953, while expenses rose 4.6%.

Continental integrated operations with Pioneer Air Lines Apr. 1, and the new company expects greater progress toward self-sufficiency with their newly combined facilities.

President Robert F. Six estimated that 1958 is "the probable year for the inauguration of some service with medium range turboprop aircraft that will operate at a lower cost per seat-mile than anything flying domestically today."

North Central

North Central had a net profit of \$111,707 in 1954, compared with a loss of \$114,588 in 1953. Last year's revenues amounted to \$5,824,042 and expenses were \$5,657,261.

The local carrier increased services 21% in 1954 while traffic rose 26%. Encouraged by traffic increases of 42% in January and February, 1955, the company expects substantial gains toward self-sufficiency this year.

Piedmont

Piedmont ended the year with net income for airline operations of \$198,792. Income from other divisions brings the net to \$283,139 before taxes and \$137,866 after taxes, compared with a loss of \$23,473 in 1954. Airline operating revenues were \$6,308,412.

Piedmont carried its millionth passenger in 1954 and carried 308,893 passengers during the year. Traffic gains for the year amounted to 14.5%.

Northwest

Northwest had a net income of \$2,203,144 on revenues of \$63,595,851 in 1954, compared with net income of \$1,339,503 in 1953. Revenues were down slightly from the 1953 figure of \$66,140,027. Northwest operated a military airlift in 1953 which made the

difference. Commercial revenue increased \$1,640,413 in 1954.

Northwest was free of debt at the end of 1954, although bank credit has been used since then for purchase of new equipment. The company acquired three DC-6Bs last year, bringing the total to seven. Four Super Constellations are being added to the fleet this spring for use in international operations.

The Northwest report shows that the carrier received \$381,000 in subsidy in December, 1953 and \$92,434 in December, 1954, a 76% decline. Increased

international mail volume enabled NWA to operate free of subsidy in February, 1955.

Allegheny

Allegheny Airlines reports revenues of \$4,797,854 and expenses of \$4,763,221 for 1954. Net income was \$40,875, compared with \$3,878 in the previous year.

Traffic increased 35% last year to 42,564,823 passenger-miles. Purchase of three Martin 202B's is expected to contribute to growth in 1955.

PAA's Trans-Atlantic Traffic Gains Credited to Super Stratocruisers

Trans-Atlantic nonstop capability of the Boeing Super Stratocruiser is giving the Pan American World Airways a significant edge in passenger appeal on this highly competitive route, PAA officials now claim.

The new service has come through the first winter of operation with a completion record of 70%.

Pan American has long sought a luxury airplane for first class service on the North Atlantic run that could fly the service nonstop. The Stratocruiser has been regarded as the airplane with the greatest passenger appeal from the standpoint of luxury service, so last year Pan American decided to modify its

377 fleet to give it nonstop capability. ►Modification Program—Last fall, modification was begun, and the job was completed in February. Ten airplanes were affected.

The modification covered two stages: •First was a pair of basic changes which called for Civil Aeronautics Administration approval. Pan American and the Boeing Airplane Co., engineered a modification of the outer wing panels to increase the fuel capacity by 360 gal.

•Second was an engine modification consisting of the installation of the CH-10 turbo-supercharger, which was developed in conjunction with Boeing



Lufthansa Resumes Operations

West Germany's Lufthansa became an operating airline for the first time since 1944 as the carrier's flag was raised Mar. 31 at Hamburg and one of its four Convair 340s took off on a special flight to Munich. ►Regular Hamburg-Munich service started next day.

and General Electric, (AW Dec. 6, 1954, p. 96) these changes were certified by the CAA.

In addition to these changes, PAA followed a program of minor modifications involving aerodynamic improvements, better engine cooling and more attractive interiors.

► **Range Extended**—The chief result of program: an extension of range to 2,960 nautical mi., an increase of 300 mi.

Modifications resulted in a net weight reduction of 500 lb., but increased fuel load more than absorbed that weight improvement, so there was no increase in gross takeoff weight. Speed was increased about three knots. A gain of 2,500 ft. was made in maximum initial altitude, increasing that factor to the 17-18,000 ft. range.

These modifications enable PAA to schedule 12 weekly eastbound non-stop flights between New York and London and Paris. Westbound flights are still one-stop.

Pan American figures its completion record would have been better if winter winds had held up, but they were about 10 knots under the seven-year average, an important factor in a long-range operation.

Such things as wind velocity and careful load balancing are vital in the success of the nonstop operation.

Modifications have also increased flying comfort.

Pan American calls the operation a success and is increasing flight frequencies this summer. Actual results are hard to assess, but figures for January and February this year show an increase of 24% in the company's first class North Atlantic traffic while competitors have risen 19%. The nonstop feature is given most of the credit.

TWA's Damon Predicts Higher Airline Profits

Reversal of the trend to narrowing airline profit margins this year is predicted by Trans World Airlines President Ralph S. Damon.

"My guess is that 1955 will result in higher net profit for the airline industry than did 1954, which was the first year to show a reversal of declining earnings since the peak year 1951," Damon told a meeting of the New York Society of Security Analysts.

Damon pointed to the growing air tourists market as the key factor in air transportation last year, and said it would continue to be in future years. "We believe the result proved where the traffic was, and is for the future," he said.

"Internationally, the story is even more pronounced, with tourist travel, in fact, the standard, and first class considered luxury travel.

CAB Equalizes Pacific Mail Pay

The dispute over the Great Circle route to the Orient has taken another turn, this time in a Civil Aeronautics Board order effecting trans-Pacific mail pay.

CAB has ordered Northwest Airlines and Pan American World Airways to show cause why a standard trans-Pacific mileage should not be established for mail pay purposes. The Board has decided that the Post Office Department should pay the carriers for trans-Pacific mail services on the basis of Northwest's Seattle-Anchorage-Cold Bay-Tokyo route of 5,078 mi.

This means that Pan American gets paid for a 5,078 mi. trip that actually takes 6,688 mi. on PAA's central Pacific routing. The rate of 50 cents a ton-mile is standard for both carriers.

► **Equalization Attempt**—The move is tied in with questions of Pacific subsidy and Pan American's fight for the Great Circle route. Earlier this year, it was estimated that Pan Am's Pacific subsidy would be eliminated and NWA's substantially reduced by increased volume when the Defense Department decided to ship its mail by commercial carrier. Later, President Eisenhower reserved decision on PAA's bid for the Great Circle route when he settled the trans-Pacific case (AW Feb. 14, p. 12).

In past weeks a heavy balance of mail has gone to Northwest because of increased capacity and the fact that it's cheaper to ship it by NWA. Since both carriers have the same rate, the one with the shortest route to Tokyo can offer the cheapest service. Northwest's route is 1,610 mi. shorter than Pan American's.

The CAB order is an attempt to equalize the two carriers so the Post Office will distribute mail "between the two carriers with the maximum flexibility for its operations, giving sole consideration to the service and capacity

offered by the carriers in determining the appropriate distribution of mail between them."

► **Congressional Aid**—The mileage standard applies to mail traffic between both San Francisco and Seattle and Tokyo.

Pan American's efforts to obtain Great Circle routing across the Pacific have received support from the California congressional delegation. Headed by Rep. Carl Hinshaw, the group has asked the President to give the route to PAA.

In a letter to the President, Hinshaw said: "We in California believe that with the great new long-range aircraft, we should have an opportunity to fly directly on the Great Circle route to the Orient and not be obliged, as we now are, to travel a needless and time-consuming extra 1,238 mi. over the central Pacific. This is not only an unnecessary imposition upon people in California, but constitutes a heavy burden upon the taxpayers of the nation when they are required to pay for the subsidy needed when passengers and mail are carried over the longer central Pacific route."

Tigers Ask Navy To Cut DC-6A Rent

A five-fold increase in air cargo ton-miles within two years would be possible if the Navy's program for leasing cargo transports to commercial carriers is adopted, L. C. Burwell, vice president of Flying Tiger Line, predicted.

Burwell's views were presented at a meeting of industry and government representatives held by Air Coordinating Committee. Purpose was to explore problems of implementing the Navy's program (AW Feb. 28, p. 86).

A rental of about \$15,000 per month for a DC-6A was proposed which would include insurance and maintenance. "If the Navy charges rentals comparable to those customarily charged in the open market where equipment is needed for special or stop-gap purposes the objective will not be realized because rates cannot be lowered sufficiently to start the magic spiral of lower costs, lower rates, greater traffic and more airplanes," Burwell said.

► **Reduction Reasons**—FTL's basis for seeking a \$5,000 per month reduction from the \$20,000 now being charged Slick Airways on an experimental Navy lease was limited to two factors: Increasing the write-off period from seven to 15 years and self-insurance by the Navy.

Burwell pointed out that the DC-6A actually is good for 10 to 15 years, not seven, and the charges should be based on the higher figure. He also said that

in view of the number of planes involved the Navy should be self insurers because the hazards would be less in civil operation. The costs of self-insurance would be less even if it is actually on a sinking fund basis, he said.

The fixed operating cost of a DC-6A for FTL is 2.5 cents per ton-mile at fixed charges of \$15,500 per month plus insurance of \$2,500, Burwell said. Assuming 250 hr. utilization month, direct flying costs bring the total to 6.2 cents per ton-mile, he added.

► **'Dilute the Purpose'**—The FTL official emphasized his opinion that the Navy should lease planes only to the certificated scheduled airlines. He said: "If the objective is to stimulate the growth of the whole cargo industry, we believe the airplanes should be leased only to certificated airlines running scheduled all cargo service. Any other criteria would dilute the purpose of the experiment and could have unintentional but grossly unfair economic impacts."

Industry's comments on the Navy program were also to be submitted in writing to the ACC working group, which plans an interim report by mid-April and a final report May 15. Specific questions relating to implementing the Navy program for which comment was solicited included:

Can need for additional cargo lift be justified?

What financial and lease terms would you recommend?

What cost can leased aircraft be operated and maintained by civil operators?

What reduction in freight rates might be made possible through the introduction of leased aircraft?

What is your recommendation for allocation of available aircraft?

Do you think this program would increase total demand for new aircraft?

DC-7 Gear, Boeing Nacelle Check Ordered

Recent accidents involving a Douglas DC-7 and a Boeing 377 Stratocruiser last week resulted in Civil Aeronautics Authority ordering an inspection of the DC-7 nose landing gear and installation of a nacelle vibration monitoring device on the Stratocruiser.

CAA investigation showed that the nose wheel failure on the right side was initiated by fatigue cracks in the radius of the spot facing of the forward and aft upper attachment bolts. A crack also was found in the radius of the spot facing of the forward upper bolt hole of the attachment on the left side.

In addition to the monitoring device, a hand magnetic inspection of each 2J17 Hamilton Standard propeller blade on Stratocruisers is required before

each departure from stations equipped to make the inspection or at 15-hr. intervals. A check of electrical leakage and resistance of de-icer elements is also required prior to the next departure and checks approximately every 65 hr. thereafter.

BOAC, Sabena, BEA Report Traffic Gain

Preliminary reports on 1954 operations of three foreign airlines—British Overseas Airways Corp., Sabena and British European Airways—indicate traffic increases and a very good level of profit.

BOAC

Preliminary figures show an operating profit, after interest, of more than \$3.8 million for British Overseas Airways Corp. for the year ended Mar. 31, according to Sir Miles Thomas, chairman of the corporation.

He also reported favorable progress on development of the Mark IV "droop snoot" Comet jetliner and the Britannia Mk. 100 turboprop airliner.

The "droop snoot" leading edge on wings, larger flaps, increased engine thrust and better specific fuel consumption are expected to improve performance in the Mark 4. Delivery is now being scheduled for approximately the end of 1958.

The Britannia Mk. 100 "has done very well on African trials," Thomas said, and BOAC expects to introduce it into service next year on the South African operations.

BEA

British European Airways anticipates that final figures will show that the year ended Mar. 31 will be "by far the best yet both financially and operationally."

Peter Mascfield, chief executive of the corporation, estimated a profit of over \$700,000 more than the previous year.

He also reported these increases: traffic, up 18%; revenue, up 14%; revenue passengers carried, up 12%; revenue passenger miles flown, up 20%; passenger load factor, up 3%. He said costs were down 10%.

Sabena

Sabena Belgian World Airlines announced a general traffic increase of 13% in 1954 over 1953.

The company reported these increases: 4.4% in the number of passengers carried; 10.3% in the passenger mileage; 13.3% in total ton-mileage; 23.8% in freight ton-mileage; 13.8% in mail ton-mileage.

7-Year Certificate Up For Local Texas Line

Renewal of the certificate of Trans-Texas Airways for seven years and adjustment of local service routes in Texas are recommended by Civil Aeronautics Board Examiner Walter W. Bryan.

"A long period of certification will not only enable Trans-Texas fully to develop the traffic in the area, but by constant, diligent efforts improve its financial position where it can replace or modernize its present equipment when required," Bryan stated.

Adjustments of Trans-Texas' route system would eliminate 1,100 certificated miles and add 300 new route miles, with a result of a 2,600-mile system.

The examiner estimates that changes in the carrier's route would cut break-even need \$630,000.

Bryan also recommends a new route for Continental-Pioneer Air Lines between El Paso and Dallas via Pecos, Marfa-Alpine, Fort Stockton, San Angelo, Brownwood and Ft. Worth, and that Kerrville be included between San Antonio and San Angelo.

Navarho Nav-Aid Will Undergo ARDC Test

Navarho, a low-frequency omnidirectional radio nav-aid system with a range of 2,500 to 3,000 mi., will have its first test installation at Camden, N. Y., under auspices of USAF's Air Research and Development Command. The Camden station will guide planes in an area bordered by the West Coast and the Azores, the Arctic Ocean and the Gulf of Mexico.

Navarho is a long-range navigation system which provides VOR-type bearing and DME-type distance information (AW Apr. 27, 1954, p. 52). If the Camden station is a success, according to USAF, it will be the first in a world-wide chain that will serve pilots anywhere on the surface of the globe. (Britain has developed competitive systems known as Dectra and Delorac.

Site of the new station is about 18 mi. from Rome (N. Y.) Air Development Center, where the device was developed. Its signals will be of special importance to pilots of high-flying and high-speed bombers, who have been handicapped in the past by the short range of conventional stations.

Instead of constantly tuning for a new beam as he progresses, the pilot or his navigator soon will be able to use Navarho for a flight of as long as five hr. at 600 mph. The Camden beam will provide continuous position information, accurate within 10 mi. even when the plane is 1,000 mi. from the station.

Wilson's News Freeze

A new effort to bring order out of the chaotic Pentagon information services has been made by Mr. Charles E. Wilson, Secretary of Defense, with his March 29 directive No. 5230.9 and its accompanying memorandum to the secretaries of the Army, Navy and Air Force. This is ironic because Mr. Wilson has long been recognized as the unofficial president of the Pentagon "Foot in the Mouth" Club. He has more public relations boners to his credit than perhaps any other inhabitant of that concrete maze.

Nobody, who has had experience in Washington, would argue with Mr. Wilson on the need for a more effective military security system, a more consistent Pentagon policy on new weapons information, and more speed and honesty in providing the press and the public that it serves with accurate information on military activities. There is not a single company in the aircraft industry that has not been penalized at one time or another by the lack of these characteristics in the Pentagon public information activities.

However, it seems unlikely that Mr. Wilson's directive will attain these desirable goals. Immediate effect has been to virtually freeze the flow of information through normal military channels to press and public. If these directives continue to be enforced it appears likely that the only emission from the Pentagon will be a "canned, pre-digested party line" more in keeping with the unanimity of a dictatorship than with the free-discussion of a democracy.

There appear to be three principle flaws in Mr. Wilson's approach to Pentagon public relations:

- The three-day cooling off period for all Defense Department information. This apparently is aimed at giving Mr. Wilson and his personal aides time to digest proposed releases but it is highly impractical since most news of any importance will not keep for three days on any government official's desk. Events move too fast for this proposed delay. Mr. Wilson would be better advised to accelerate the pace of his public relations department rather than try to retard the press.

- The "gag" provision slapped on all military civilian Defense Department personnel in their public writings. The directive states "such clearance and review (by the Secretary of Defense) shall be related not only to a determination of whether the release of material would involve any technical or substantive violation of security but also to a determination of whether release or publication of the material would constitute a constructive contribution to the primary mission of the Defense Department." Nobody in the Pentagon has yet ventured an official definition of what a "constructive contribution" actually is.

- Replacement of the military public information directors in each service with three \$14,800-a-year civilians. This appears to be adding an unnecessary link in the already complicated chain of communication between the military and the public. With few exceptions the civilians attracted to Pentagon public relations jobs are not top flight, and they know little of military affairs. There is strong indication that these new jobs would

be simply more political plums.

This action also implies that the military public information chiefs have been responsible for the rash of Pentagon publicity boners. This is hardly the case. Most of them can be easily traced to the doors of top level military and civilian Pentagon brass and not to official public information channels. Also it seems to be more important to have a small but effective group of military people educated on public information than to create a trio of political patronage jobs.

We predict that before long the Wilson directive will unofficially fade away in same manner that former Defense Secretary Louis Johnson's similar effort evaporated.

Any attempt to impose a gag on full and free discussion of American military policy and to prevent the public from receiving adequate information on the defense effort will not survive long.

In the meantime we recommend the aircraft industry to follow the gyrations of Pentagon public relations policy closely and to protest vigorously any cases where they are made victims of arbitrary or inconsistent rulings.

AVIATION WEEK would like to hear about any examples of unfair treatment of aircraft firms by Pentagon officials.

More California Coverage

AVIATION WEEK has enlarged its West Coast bureau, by the addition of Irving Stone, a veteran staff member and a senior engineering editor. He will work with William Coughlin, West Coast editor, who heads the AVIATION WEEK bureau in Los Angeles.

Irving Stone's assignment to the West Coast bureau will do two things for AVIATION WEEK readers:

- It will expand and improve the engineering coverage and technical news reports that are an outstanding feature of our editorial content.
- It will re-emphasize the importance of this major segment of the U. S. airframe, engine, missile and avionics business on the West Coast.

Stone has built a solid reputation for accurate technical reporting during the past decade with his published works in AVIATION WEEK and its predecessor, Aviation magazine. He holds an engineering degree from the Polytechnic Institute of Brooklyn and has a Doctor of Jurisprudence degree from New York University. For five years during World War II he held supervisory posts with the Army Air Force Technical Training Command, including supervisor of training literature at the AAF Technical School, Chanute Field, Ill.; assistant chief instructor, AAF Technical School, Seymour Johnson Field, N. C.; and administrator of plans and training for the AAF Engineering Cadet School at Yale University. He has been with McGraw-Hill Publishing Co. since 1944 when he joined Aviation magazine. He also was engineering editor of Air Transport magazine and has been technical editor of AVIATION WEEK since its founding in 1947.

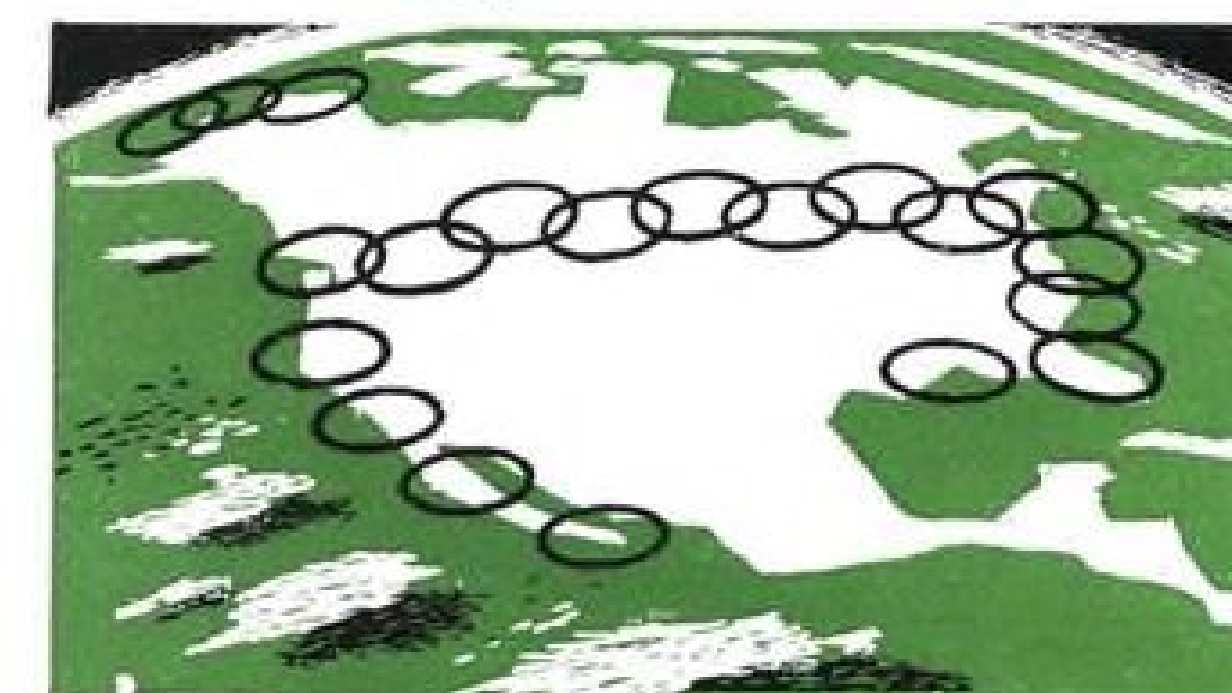
—Robert Hotz



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IN GUIDED MISSILES . . . Sperry's new Megawatt Klystrons make possible more accurate control of missiles permitting guidance over longer paths.



IN ATOMIC ENERGY . . . Sperry's new Megawatt Klystrons provide stable driving power for larger atom smashers and high energy X-ray devices used for scientific research.



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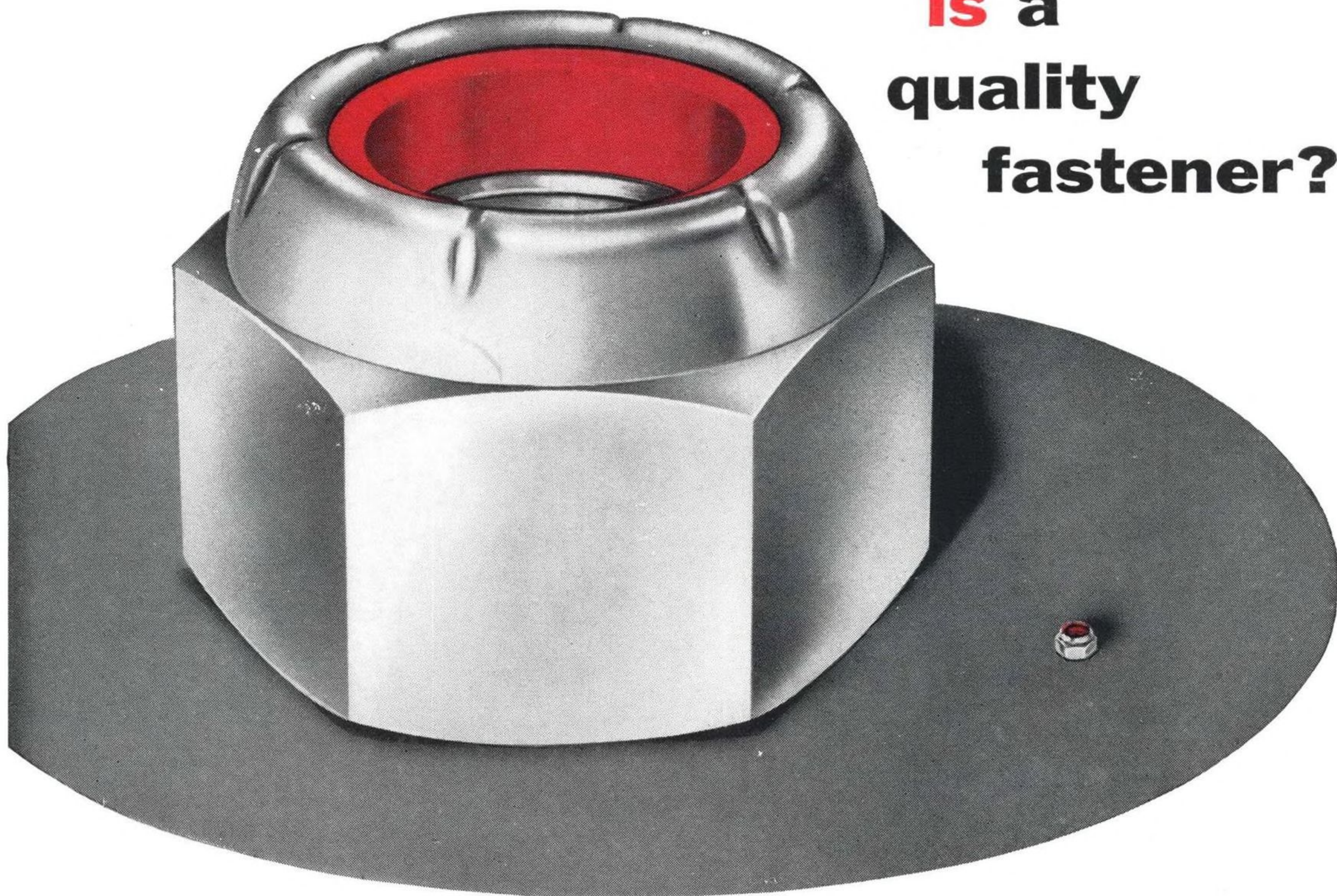
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