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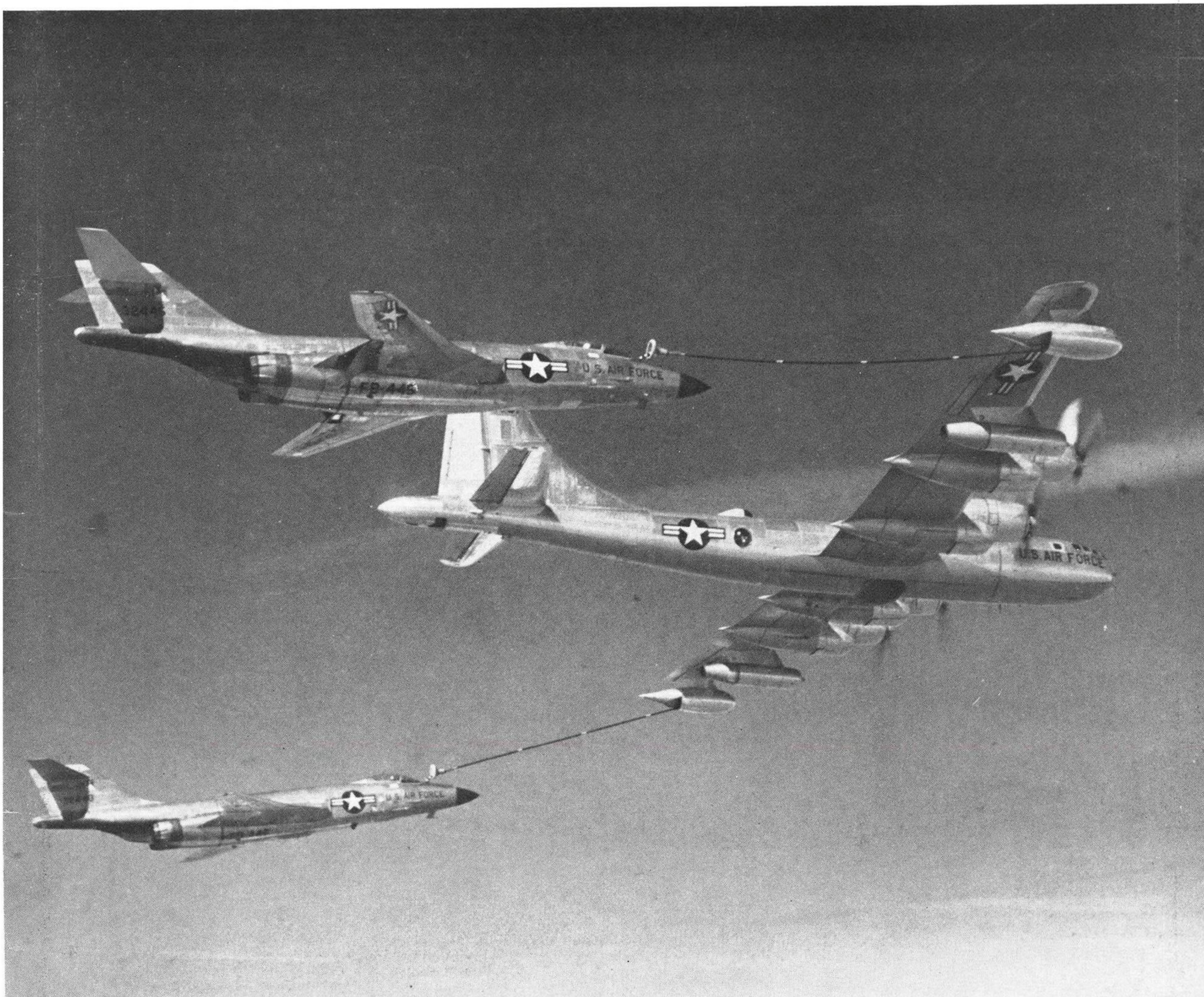
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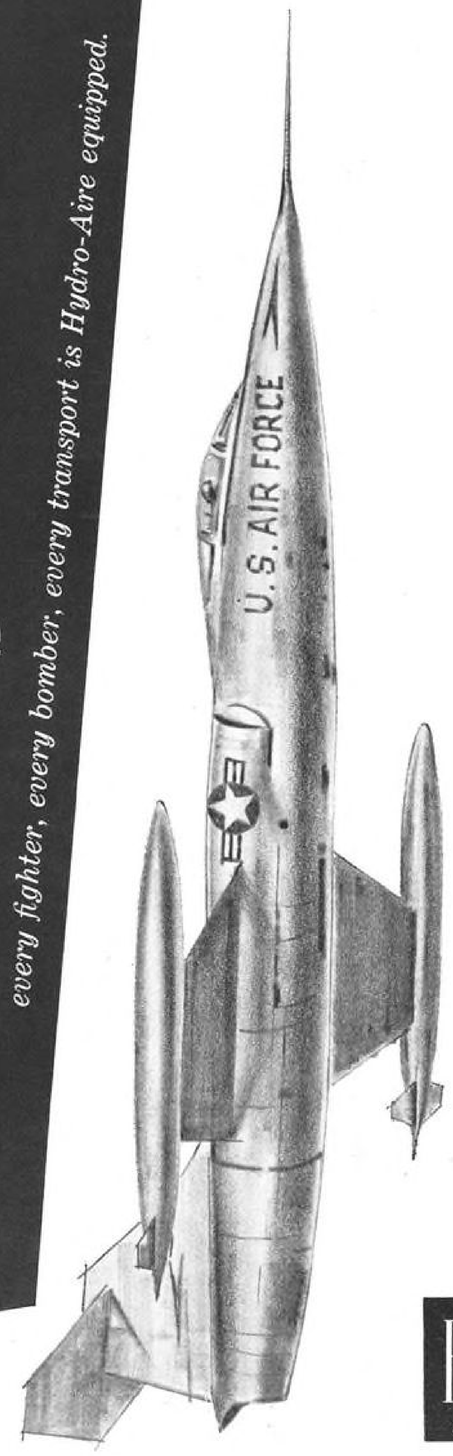
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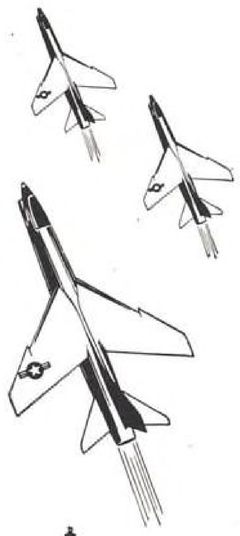
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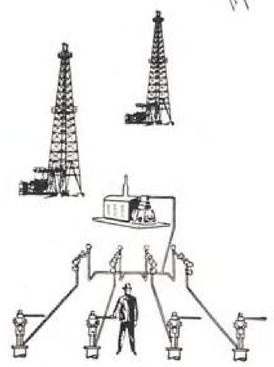


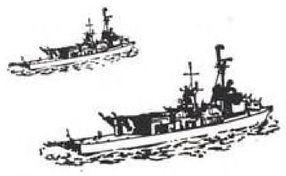
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Aug. 17—Open house for pilots and public, Piper Aircraft Corp., Lock Haven, Pa.
Aug. 19-21—Cryogenic Engineering Conference, Boulder (Colo.) Laboratories, National Bureau of Standards.
Aug. 20-22—Bendix-Scintilla International Ignition Conference, Sidney, N. Y.
Aug. 20-23—Western Electronic Show & Convention, Cow Palace, San Francisco, Calif.
Aug. 26-28—Gas Dynamics Symposium, Transport Properties in Gases at High Temperatures and Pressures, Technological Institute, Northwestern University, Evanston, Ill.
Aug. 28-30—Pacific General Meeting, American Institute of Electric Engineers, Pasco, Wash.
Aug. 31-Sept. 1—Midget Airplane Races, Ft. Wayne, Ind.
Sept. 1-15—Sixth International Aeronautical Conference, Royal Aeronautical Society and Institute of the Aeronautical Sciences, Folkstone and London, England.
Sept. 2-8—1957 Flying Display, Society of British Aircraft Constructors, Farnborough, England.
Sept. 3-14—11th General Assembly, International Union of Geodesy and Geophysics, in conjunction with International Geophysical Year, University of Toronto, Canada.
Sept. 7—Second Annual Convention of the OX-5 Club, Hotel Phillips, Kansas City, Mo.
Sept. 8-13—Second Annual Course on Investment Castings, Massachusetts Institute of Technology, Cambridge, Mass.
Sept. 14-15—Meeting of Antique Airplane Assn., Ottumwa, Ia.
Sept. 25—Pratt & Whitney Aircraft Engine Maintenance and Operation Forum, sponsored by Southwest Airmotive Co., Melrose Hotel, Dallas, Tex.
Oct. 5—First Annual Awards Banquet, Society of Experimental Test Pilots, Beverly-Hilton Hotel, Los Angeles, Calif.

(*Continued on page 6*)

AVIATION WEEK • AUGUST 12, 1957

Vol. 67, No. 6

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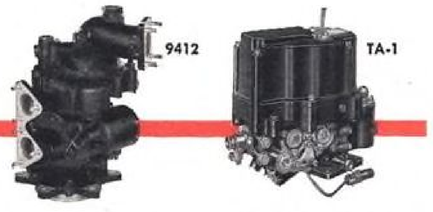
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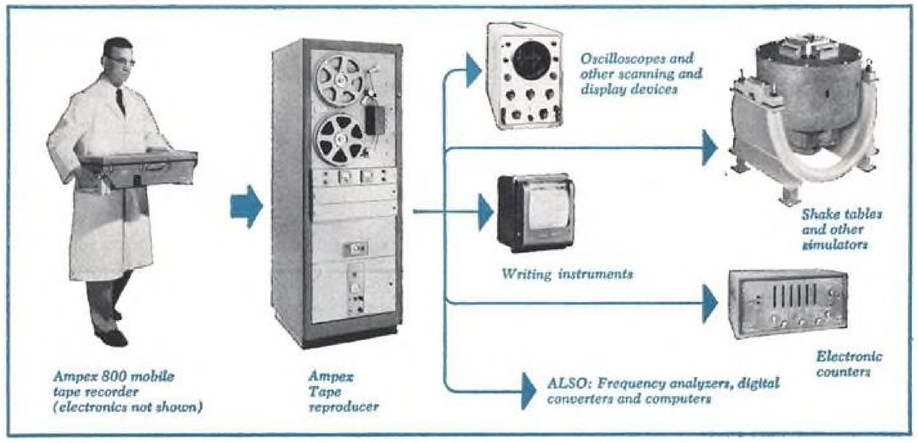
(Continued from page 5)

Sept. 9-13—Annual General Meeting, Interland Auditorium, Cleveland, Ohio.
Sept. 13—Third Pacific Area National Meeting, American Society for Testing Materials, Sheraton-Palace Hotel, San Francisco, Calif.
Sept. 15—1957 Garden Party and Flying Display, Royal Aeronautical Society, Wisley Aerodrome, Weybridge, England.
Sept. 23-25—Fall Meeting American Society of Mechanical Engineers, Statler Hotel, Hartford, Conn.
Sept. 26-27—Fifth Michigan Aeronautics Conference, jointly sponsored by University of Michigan Transportation Institute, Western Michigan University, and The Aero Club of Michigan, Alpena, Mich.
Sept. 28-29—North Central Regional Conference, Civil Air Patrol, Town House Hotel, Kansas City, Kans.
Sept. 30-Oct. 5—National Aeronautic Meeting, Aircraft Production Forum & Aircraft Engineering Display, Society of Automotive Engineers, Hotel Ambassador, Los Angeles.
Oct. 2-4—Tenth Annual Meeting and Forum, National Business Aircraft Assn., Cosmopolitan Hotel, Denver, Colo.
Oct. 7-9—13th Annual National Electronics Conference, Chicago, Ill.
Oct. 7-10—Triennial Inspection, Lewis Flight Propulsion Laboratory, Cleveland.
Oct. 7-12—Eighth Annual Congress, International Astronautical Federation, Barcelona, Spain. For details write: IAF, 35 Lowell Rd., Concord, Mass.
Oct. 9-11—National Fall Convention, Society for Experimental Stress Analysis, El Cortes Hotel, San Diego, Calif.
Oct. 10-11—National Noise Abatement Symposium, Sherman Hotel, Chicago, Ill.
Oct. 21-22—Canadian Aeronautical Institute-Institute of the Aeronautical Sciences Meeting, Montreal, Canada.
Oct. 21-23—Conference on new developments in the field of power, American Society of Mechanical Engineers, Americus Hotel, Allentown, Pa.
Oct. 24-25—Fourteenth Annual Display, Aircraft Electrical Equipment, Aircraft Electrical Society, Pan Pacific Auditorium, Los Angeles, Calif.
Oct. 28-31—Second Winter Meeting, American Nuclear Society, Henry Hudson Hotel, N. Y.
Oct. 28-29—Third Annual Meeting, Association of the U. S. Army, Sheraton-Park Hotel, Washington, D. C.
Oct. 28-30—Annual East Coast Conference on Aeronautical and Navigational Electroncis, Fifth Regiment Armory, Baltimore, Md.
Oct. 28-31—National Industrial Packaging & Handling Exposition, Atlantic City, Convention Hall, N. J.
Oct. 30—Aviation Electrical Equipment Display, U. S. Grant Hotel, San Diego.
Nov. 5-7—Joint Military-Industry Guided Missile Reliability Symposium (limited to those with Secret security clearance), Naval Air Missile Test Center, Pt. Mugu.
Nov. 6-8—Third Annual Symposium on Aeronautical Communications, Hotel Utica, Utica, N. Y.
Nov. 18-29—International Air Transport Assn., Technical Conference, Miami, Fla.

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The equipment stands shock, vibration and noise. In a shipboard installation, the Ampex 800 gathers data on closeby underwater explosions, enduring shocks transmitted through the ship. At an eastern jet-engine test facility, dolly-mounted Ampex 800s are wheeled out to the cells and get accurate data in an area of intense noise.

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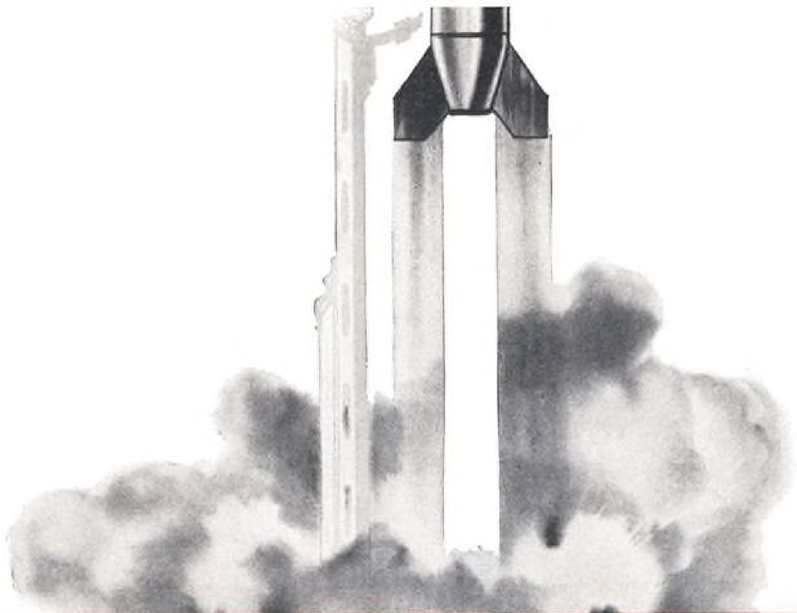

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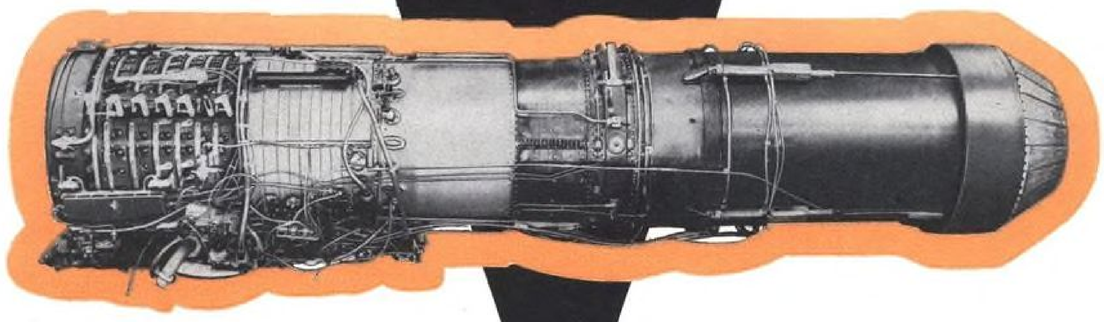
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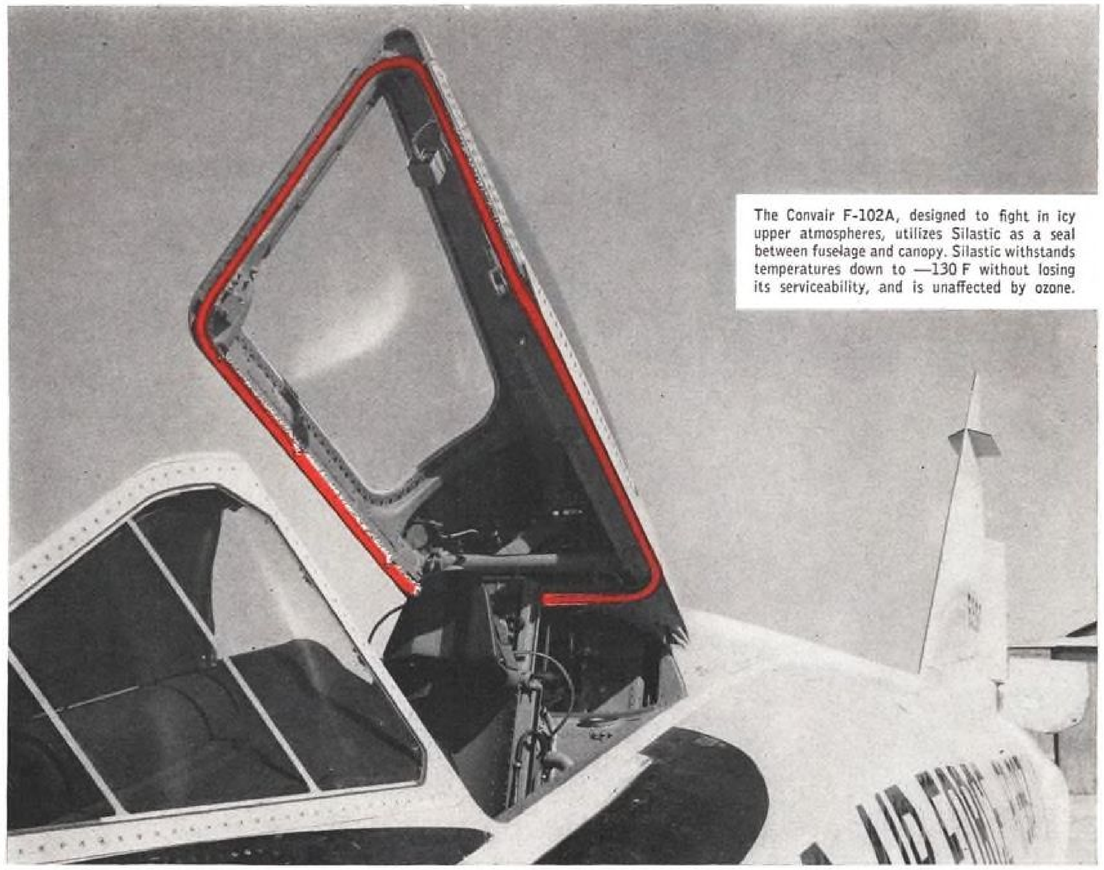
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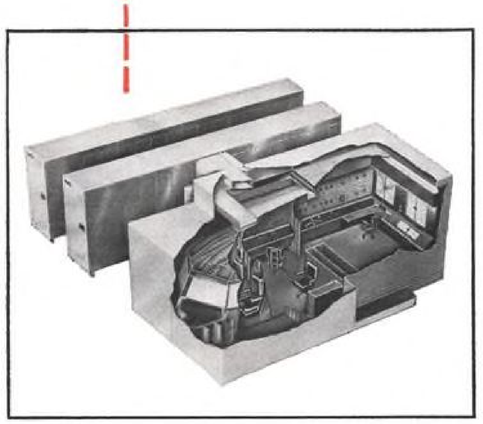


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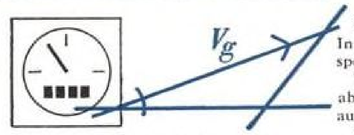
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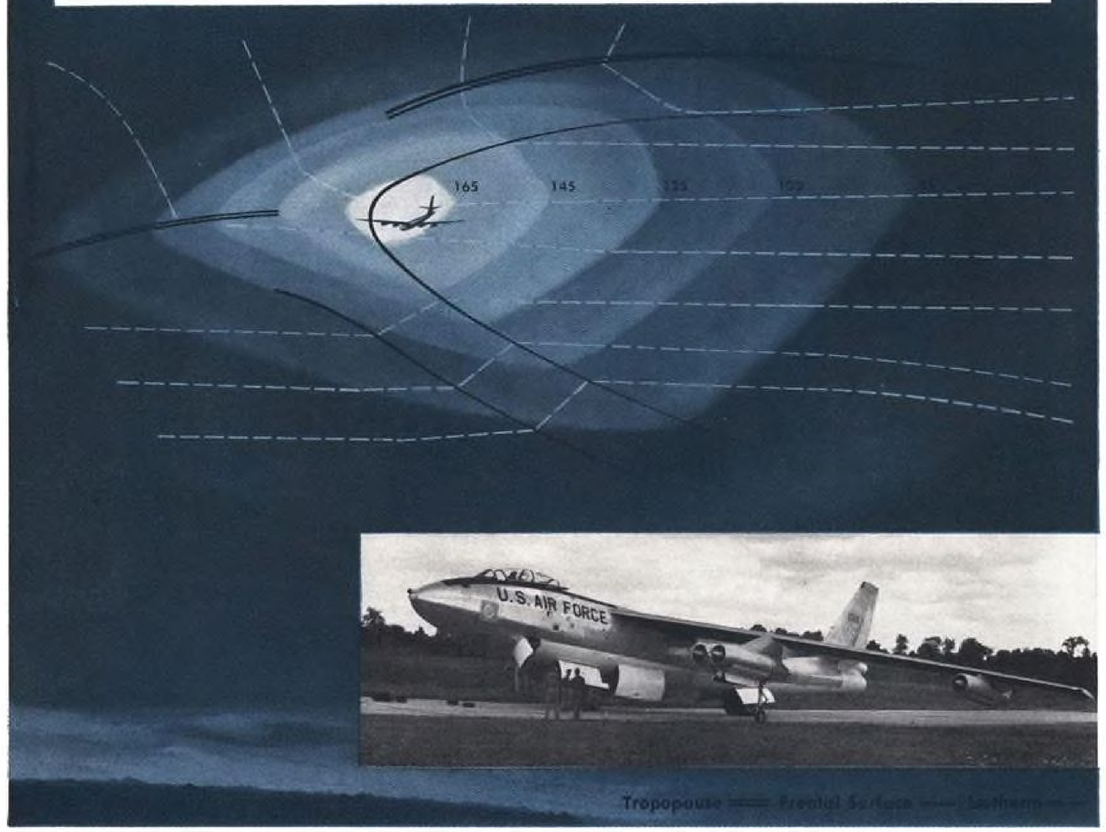
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August 12, 1957

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RESEARCH AND MARKETING

Mary Whitney Fenton, Judith P. Wheeler

Services to Get Fiscal Ceilings..... **26**
▶ Wilson concedes requirements secondary to dollar, says 'penalty for saving isn't as great this year.'

Emergency Fare Increase Plea Denied..... **38**
▶ Raise in passenger rates now called unjustified; airlines criticize Board's action as too quick.

Delay, Stretchout Plague Vautour..... **50**
▶ First operational aircraft, fitted as all-weather fighters, are being delivered to French Air Force.

MISSILE ENGINEERING

New Area Rule Concept..... 29
Rascal Goes to SAC..... 31
Navy Airs Needs at IAS Meetings.... 32
Project Far Side May be Expanded.. 34
Nose Cones Survive X-17 Program... 69
Satellite Will Be Ready..... 72

AERONAUTICAL ENGINEERING

Delay, Stretchout Plague Vautour... 50
Yak-25 Carries Big Radome..... 27
New Kamov Helicopters..... 33
C-130B to Have More Range..... 37
T-33 Simulates Any Jet Plane..... 63

AVIONICS

Infrared to Get Warning Trial..... 77
'Side-Looking' Radar Will Map Terrain 29
Changes in Avionics Industry..... 84
Filter Center..... 88

EQUIPMENT

How F8U-1P Photographed U. S.... 102
30 MM. Vulcan Hard Hitting..... 108
Control Area Plastic Display..... 108
What's New..... 92

PRODUCTION

Ceramic Aids Aluminum Resistance.. 95
Milling Units into Duplicators..... 97
Production Briefing..... 99

AIR TRANSPORT

Emergency Fare Increase Denied.... 38
Russians Spotlight Transports..... 40
Northwest Gets Tokyo Route..... 43
Airline Traffic—June 1957..... 44
Airline Observer..... 45
Shortlines..... 45

BUSINESS FLYING

Contract School Evaluates T-37..... 111
Private Lines..... 112

FINANCIAL

Defense Appropriations..... 28
USAF Contracts..... 109
Army Contract..... 116
Certificates of Necessity..... 116

SAFETY

Failures Indicate Ditching Cause..... 117

MANAGEMENT

Fiscal 1959 Service Ceilings..... 26
Work Bill Includes Bomarc Sites..... 28
Administration Split on Financing... 30
McElroy Nominated Defense Secretary 31
Who's Where.....23, 132
Industry Observer..... 23
Washington Roundup..... 25

Calendar..... 5
Letters..... 146

EDITORIAL

Swinging Around the Circuit..... **21**

COVER: Additional power and speed for refueling fast jet aircraft and for takeoffs from short runways are provided Tactical Air Command's Boeing KB-50 tankers by two General Electric J47 engines. Modification is handled by Hayes Aircraft Corp., Birmingham, Ala., which originally converted bomber to tanker. Engines providing total of 12,000 lb. thrust are pod mounted midway between the outboard engines and the wing tips. Designation of modified version, shown refueling two McDonnell F-101 Voodoo fighters, is KB-50J.

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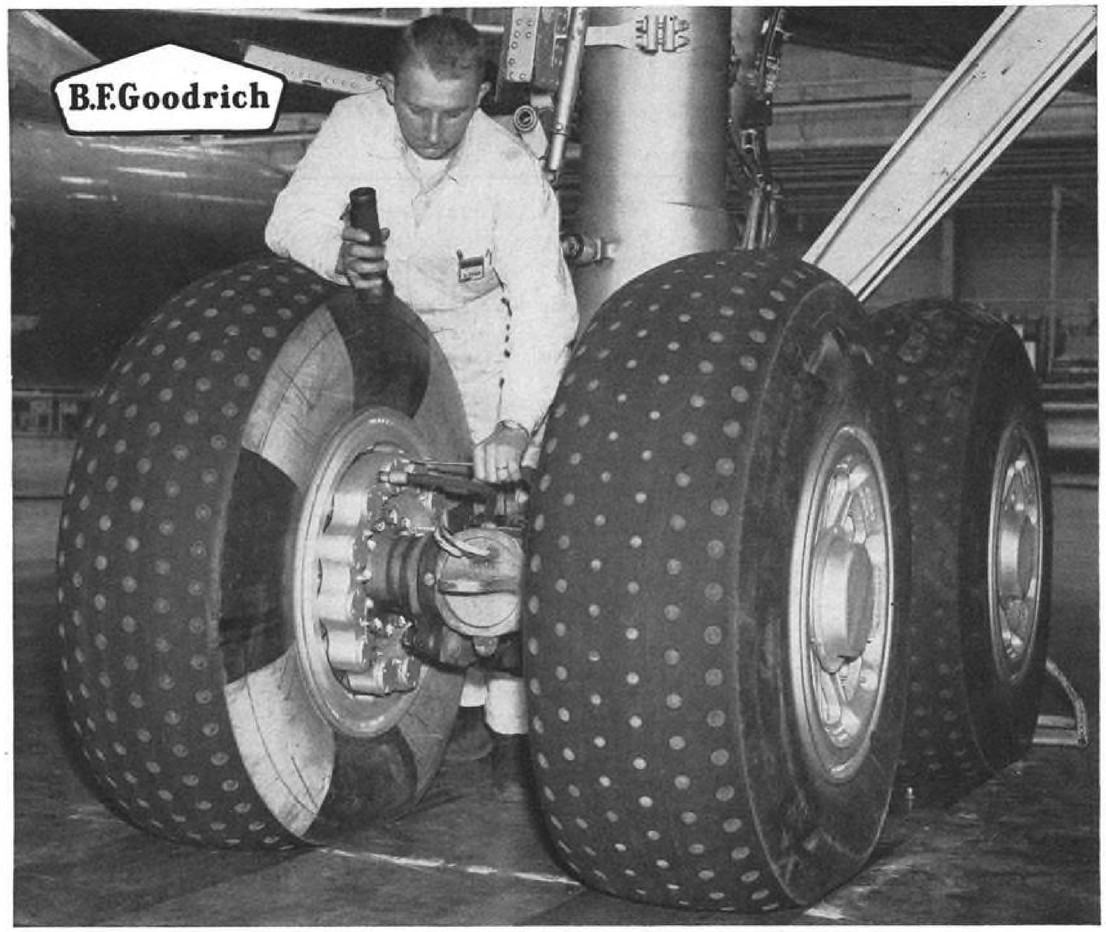


Photo shows complete assembly of BFG Disk Brakes, Wheels and Dimpled Tires

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EDITORIAL

Swinging Around the Circuit

Washington continues to buzz as summer wanes with actions of major import to aviation. Neil McElroy, the Cincinnati soap magnate nominated to succeed Charles E. Wilson as Secretary of Defense, is best known to date for his sponsorship of the radio and television "soap opera." In his new Pentagon post he will get a chance to write the script for a new chapter in the unification serial that has been unfolding since the end of World War II.

Unification of the military services and elimination of triplicate weapon development will be one of the major issues at the next session of Congress. Congressional leaders, such as Rep. George H. Mahon (D.-Tex.), chairman of the Military Subcommittee of the House Appropriations Committee, are making it crystal clear that Congress and the taxpayers are no longer willing to "equip all the services to fight the whole war by themselves." Rise in military procurement expenditures that helped cause the federal debt limit crisis is due almost entirely to triplification in the missile program where USAF, Army and Navy are all developing a complete arsenal of missiles for every military job from a few miles to intercontinental range. Congress is also losing its taste for supporting obsolescent elements of the military structure.

Realistic Evaluation

Watch for increasing emphasis on realistic weapons system evaluation before new weapons are committed to multi-million dollar production programs. Congress is also becoming aware that many new weapons systems hastily rushed into production are of dubious military value and were really supported only to bolster the position of an individual service. So far Weapons System Evaluation Group in Pentagon has had little influence.

Some kind of realistic weapon system appraisal is vitally necessary to knock out inferior and duplicating weapon production programs. Good example of saving that could be accomplished by this type of realistic evaluation is the Army's multi-billion dollar Nike-Ajax program which is designed to operate against World War II type bombers but was essential to bolster the Army's political position in the missile race.

Civil Aeronautics Board moved boldly in the right direction by exercising its legal authority for airspace control and assigning this responsibility to the Civil Aeronautics Administration. This action follows the principle recommended by Edward Curtis, former special aviation adviser to President Eisenhower. Old Airspace Use Panel of Air Coordinating Committee proved totally inadequate to cope with growing conflicts of airspace use between military and civil aviation.

CAB's move to deny major airlines a 6% fare increase is puzzling not so much because of the decision but because of the scant consideration paid the airlines case presented in favor of the raise.

Airline fare levels are certainly the major issue facing the air transport industry today and also have a vital bearing on the health of the aircraft manufacturing business.

Airline Effort Needed

If the airlines are to get a reasonable adjustment of their fare structure they must make a far more intensive effort than they did in the recent case. This effort must be aimed at the traveling and taxpaying public as well as at CAB and its musty staff. In considering the general fare investigation CAB should place more emphasis on the dynamic growth requirements and economic necessity of a modern air transport system rather than on applying a narrow public utility type of rate of return viewpoint.

Never before have government-industry relations been so important for the future of aviation. We are in the midst of a period of dynamic change where reliance on past performance and patterns is no longer sufficient to plot the progress for the future.

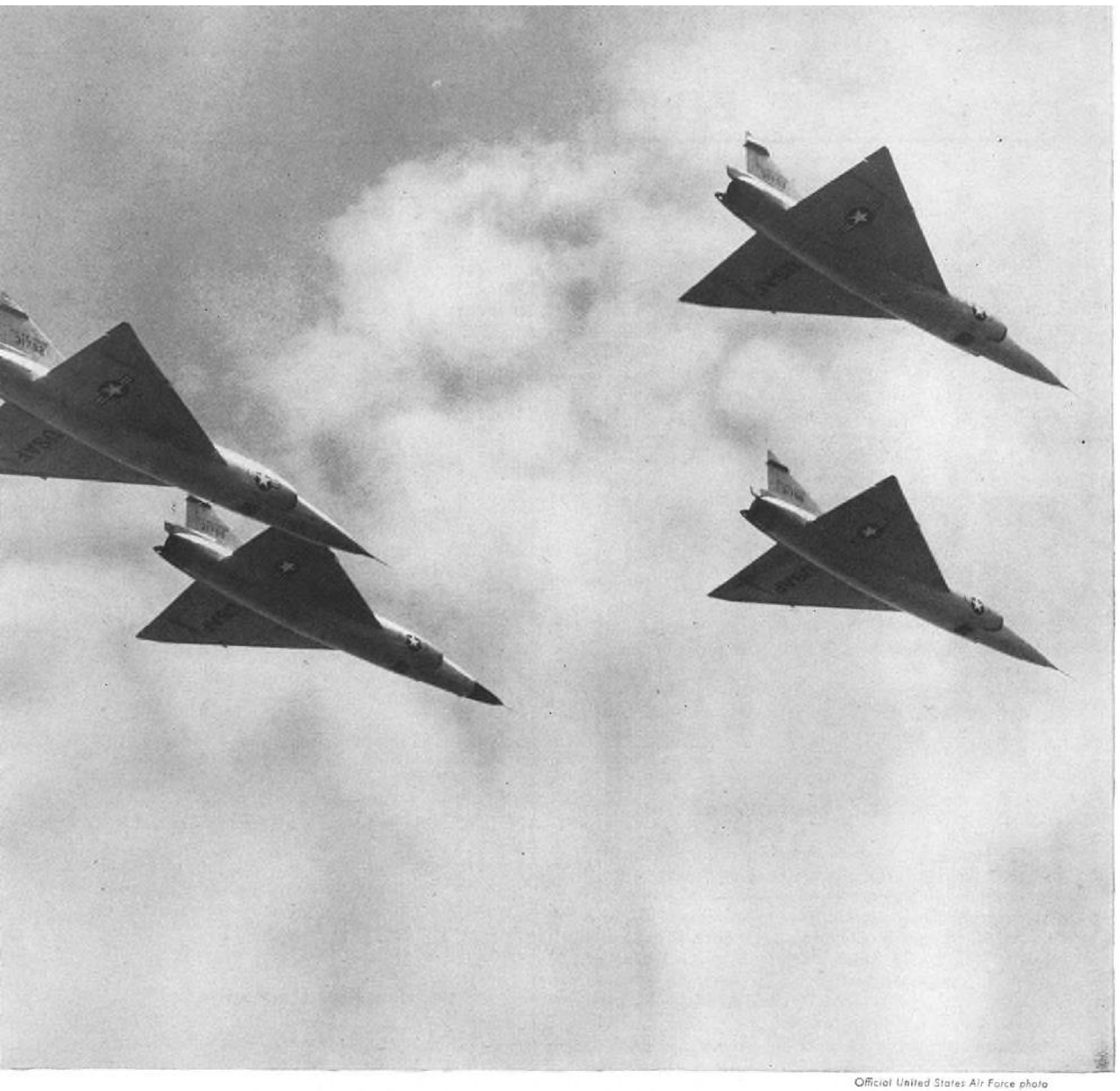
In this atmosphere we sense a reluctance on the part of industry leaders both in manufacturing and air transport to come to grips with the government leaders charged with providing defense and regulating transport. It is no longer sufficient to grouse in the security of corporate headquarters and hire lobbyists to carry the ball in Washington.

Leadership Demands

Many of the great pioneers who built the aviation industry are still actively directing their industrial enterprises. Many capable younger leaders are also rising in the industry. Their public reputations and technical experience eminently qualify them as spokesmen for aviation before both public and government. Yet there appears to be a growing reluctance to discharge this responsibility. Aviation leaders tend to appear in Washington only when summoned by a Congressional investigating committee or to plead a special case before a regulatory agency.

Aviation needs vigorous, experienced spokesmen to present its case for what it can contribute to the future growth of this country. This is a case that needs to be presented to both the public that will benefit and to the government that must of necessity regulate its activities.

—Robert Hotz



Official United States Air Force photo

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Howard C. Briggs, director of government relations-Washington, D. C. office, Collins Radio Co., Cedar Rapids, Iowa.

Dr. Felix A. Kalinski, assistant to the president for long-range planning, Vertol Aircraft Corp., Morton, Pa.

Honors and Elections

The Air Force Assn. for the first time presented special plaques to individuals of the Air Materiel Command in recognition of their contributions to airpower during the year. The recipients were: **Maj. Gen. William F. McKee,** Vice Commander of AMC; **Gordon H. Tyler,** Deputy Director of Procurement and Production, Brooklyn AFB, Ala.; **Col. Joseph O. Fitzgerald,** Director of Supply and Services, Tinker AFB, Okla.; **Maj. Phillip G. Nickell,** Director of Quality Control, Rushmore Air Force Station, S. D.

L. P. Twiss of the Fairey Aviation Company Ltd., received the Federation Aeronautique Internationale Gold Medal for having broken the World Air Speed Record, at the 50th General Conference of the F.A.I. Mr. Twiss also received the De La Vaulx Medal which is awarded to those pilots who break world speed records.

Changes

Richard E. Stockwell, management information analyst, Aircraft Gas Turbine Division, General Electric Co., Cincinnati, Ohio.

Dr. Ernst A. Steinhoff, director-Air Force Missiles Department, Aerophysics Development Corp., Santa Barbara, Calif.

Larry S. Winstone, sales engineering manager, Test Equipment Division, Greer Hydraulics, Inc., Jamaica, N. Y.

Chester C. Utz, executive engineer, Defense Operations Division, Chrysler Corp., Detroit, Mich.

Robert C. McNeill, chief engineer, Martin-Decker Corp., Long Beach, Calif.

(Continued on page 132)

INDUSTRY OBSERVER

► **North American Aviation's Rocketdyne Division is doing research and development on nuclear powered rocket engine.**

► Convair B-58 bomber has surpassed 1,132 mph., official world's speed record held by Britain's Fairey Delta FD-2 fighter-type rocket research plane.

► **Bell Aircraft Corp.'s AN/SPN-16 Automatic Carrier Landing System (AW Mar. 4, p. 32) is getting sea tests aboard Navy's carrier Antietam. Evaluation will be without deck tilt or wave-off computers, but in conjunction with Antietam's mirror landing system.**

► North American Aviation Inc. probably will get nod from USAF for development of an advanced strategic missile to be carried by the B-52 for air-to-ground operations with nuclear warhead. Some 30 firms were in original USAF competition, with Bell Aircraft Corp. and Chance Vought among North American's stiffest competitors. New missile would be essentially a simpler, longer range vehicle to perform for the B-52 the function now performed for the B-47 by the Bell Rascal.

► **Development of the missile version of the Convair B-58 pod has been temporarily abandoned. Missile pod powered by a Bell three-barrel rocket motor was considered too short in range for Strategic Air Command requirements, which now demand an air-to-ground missile range of several hundred miles to counter ground-to-air missile defenses.**

► Dassault Super Mystere has been flying with a pair of Matra 510 air-to-air missiles under its wings. Plane also appears to have slightly modified vertical tail with increased leading edge sweep and altered fuselage lines at the jet exhaust.

► **Grand Central Rocket Co.'s Arrow II rocket motors have achieved Mach 7 in two seconds on USAF hypersonic test vehicle. Considered an off the shelf item, they are modification of Loki, developed by California Institute of Technology's Jet Propulsion Laboratory. Arrow II motors power third and fourth stages of USAF's Project Far Side balloon-launched rocket.**

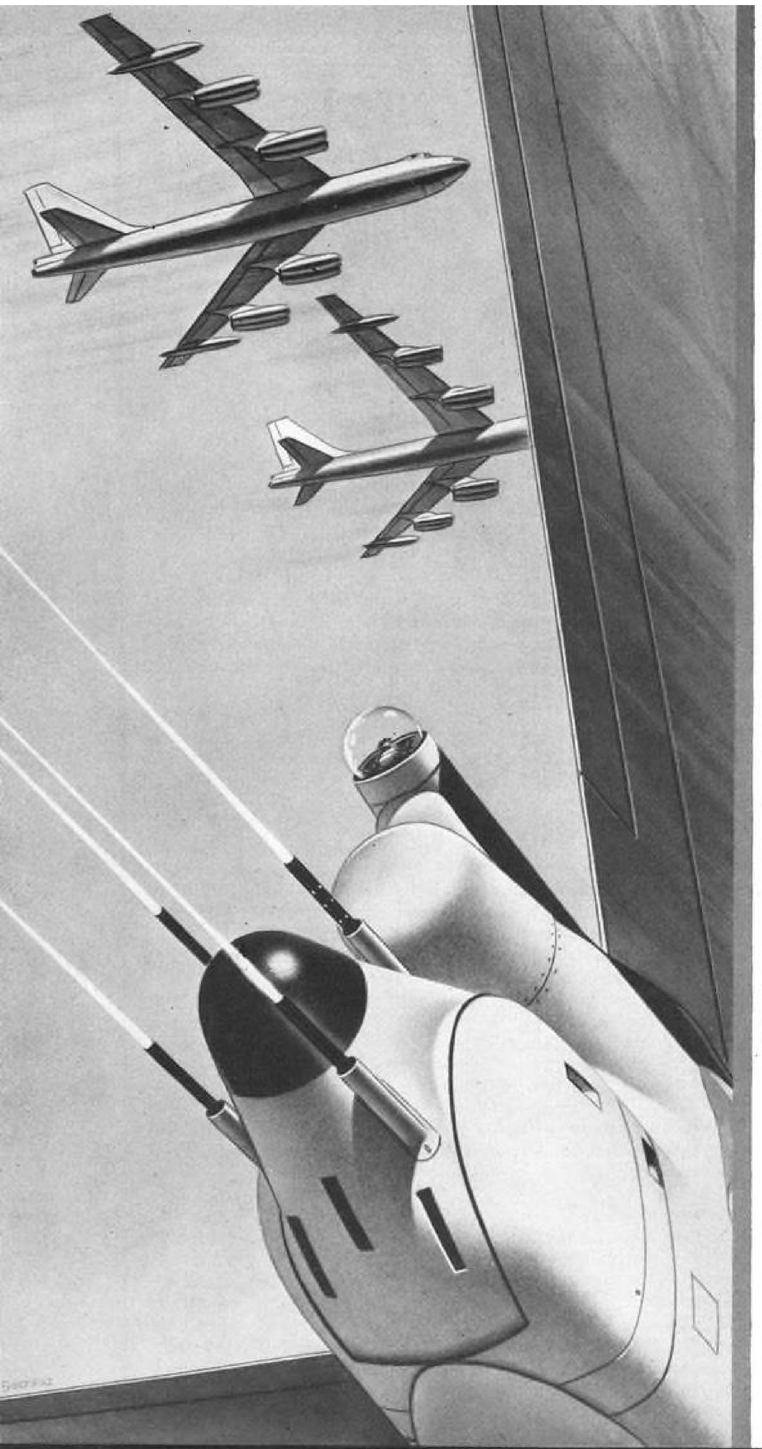
► Steam pressure on Navy's proposed nuclear-powered aircraft carrier will be so far below the 800 psi. required to operate plane launching catapults that an independent power source will be required. Reaction Motors, Inc., is developing an internal combustion catapult powerplant, which uses compressed air, jet fuel and water to power the catapult tubes. Navy is testing the prototype.

► **Mach 5 blowdown tunnel with 6 x 6 ft. test section is scheduled for early construction at Douglas Aircraft Corp.'s El Segundo Division. Pilot model already is operating.**

► Time for one problem at Atomic Energy Commission's Livermore, Calif., laboratory was cut from six weeks to two days by ability of computer to do some of its own programming.

► **Disagreement over how much improvement in efficiency is offered by exotic fuels, plus severe logistics problems of these fuels and expense of engine development projects, could keep USAF's chemical bomber from materializing. Some observers believe emphasis will be put on developing additives for current fuels to boost efficiency, without radically changing fuels themselves.**

► Decision on whether 1,500 mph. delta-winged Avro CF-105 Arrow will be produced will be reviewed later this year as part of close scrutiny new Canadian government is giving defense program. Arrow is slated to be test flown in December. Development is reported to be costing about $200 million. If Arrow, powered by Orenda Iroquois engine (AW July 29, p. 26), is not built, Royal Canadian Air Force might use U.S.-developed aircraft instead.



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Reliable protection is a *must* for Boeing's giant B-52, operational weapon of the Strategic Air Command. A Crosley-manufactured MD-9 fire control system—with dual radar and multi-weapon turret—provides deadly and almost completely automatic protection for the B-52.

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Washington Roundup

Hebert Hearings Off?

Outlook now is that hearings on aircraft engine profits and procurement by the House Armed Services Investigating Subcommittee, headed by Rep. Edward Hebert (D.-La.), will be postponed until next January.

Hearings were launched after much fanfare, but so far only one manufacturer—Roy T. Hurley, chairman and president of Curtiss-Wright Corp.—has been heard (AW July 29, p. 38).

Navy's Challenge

Caught in the budget pinch, Navy now has joined USAF in a blunt declaration that competition will be increased in the procurement field. Navy Secretary Thomas S. Gates, Jr., addressing the Institute of the Aeronautical Sciences in San Diego (see p. 32), said "the producer who reduces his costs is the one who will survive."

To the sound, heat and energy barriers, Secretary Gates added "the cost barrier" and challenged the aircraft industry to break it.

Gates called for "careful, ingenious design, advanced technology and down-to-earth common sense that yields the lightest, most reliable weapon to do the job." He called dollars the "best measure of manpower, material and effort" and warned that the Navy will not buy if the value is not good.

Russian Information

House Information Subcommittee, headed by Rep. John E. Moss (D.-Calif.), is prodding Commerce Department to activate a program of dissemination of technical information from Russia—but so far without results.

"More than four months ago, I wrote you asking how the department was carrying out the congressional mandate to act as 'a clearing house for the collection and dissemination of scientific, technical, and engineering information'," Moss wrote to Commerce Secretary Sinclair Weeks. "At present," Moss said, "the Library of Congress receives each year about 20,000 documents, scientific and engineering papers and journals from Russia. The vast bulk of these are gathering dust on the shelves. . . . They have not been translated and the average scientist and businessman are unaware of their existence."

Army Concern Over Reds

Concern of the armed services over growing Soviet capability is not confined to Air Force and Navy. Army realizes that increased Russian air and submarine power has been accompanied by marked improvement in ground equipment, with the most significant change coming in Red Army mobility.

Armored personnel carriers, amphibious vehicles and self-propelled guns have added new power and agility to Soviet forces. Credit for the advances is given to superior research and development effort, just as it is in the march of Red airpower. Army also takes seriously Red threats to use rockets and missiles.

On top of this, vast improvement in education and training of Russian ground forces is expected, steadily narrowing the advantage once held by other nations. Like USAF, Army is getting worried over public complacency about Soviet power, which is blamed in part for current U. S. economy drive.

Loan, Capital Gains Bills

Chances looked better last week for congressional action on the Government Guaranteed Loan Bill, which is sponsored by the Civil Aeronautics Board and has solid backing of the Association of Local and Territorial Airlines. The bill has been approved by both the Senate and House Commerce Committees. Time now appears to be the only major obstacle to floor action this session.

Meanwhile, the House Commerce Committee will endeavor to get full House approval of the Capital Gains bill. If this bill is passed by the House it is not expected to run into serious difficulty in the Senate, since Senate passed a similar bill last session.

New D. C. Airport

House approval last week of $12.5 million to start construction of a second National Airport at Burke, Va., has raised hopes that the project might soon get underway. For the past seven years the project has been blocked successfully by the Maryland congressional delegation. Senate approval is expected now that the House has acted.

Employment Security

Thousands of aircraft workers already affected by job reductions resulting from defense spending cutbacks could be expected to disagree with Labor Department statement issued July 31:

"Only a fractional increase in employment was anticipated in the aircraft industry."

Statement was included in a press release announcing results of surveys of all types of employment conducted in 149 areas by Bureau of Employment Security and by state employment security agencies. Four of every five areas surveyed anticipated job gains.

AVIATION WEEK survey (Aug. 5, p. 26) indicated aviation industry job reductions will total at least 40,000 by end of year. Four and a half page Labor Department press release devoted only one sentence to aircraft industry—the sentence quoted above.

Nuclear Plane Scrutiny

Apart from regular USAF procurement cutback and stretchouts, there is a separate aircraft project that may be hit by the Pentagon budget pinch—nuclear aircraft development. Despite earlier assurances that the program had been given a firm schedule (AW Apr. 22, p. 29), USAF and the Atomic Energy Commission last week were giving it a close look and there is a possibility the A-plane will make a contribution to the current economy effort.

Airline Stocks React

Denial of a 6% passenger fare increase by the Civil Aeronautics Board depressed most airline stocks the first full day of trading following the announcement. Biggest drop noted were Eastern Air Lines, down 1¼; United Air Lines, down 1⅛ and Capital Airlines, down 1.

—Washington staff

Services to Get Fiscal 1959 Ceilings

Wilson concedes requirements secondary to dollar, says 'penalty for saving isn't as great this year.'

By Claude Witze

Washington—Charles E. Wilson, defense secretary, has divided a Fiscal 1959 "paper budget" of $38 billion into service allocations and soon will tell Army, Navy and Air Force how much they can plan on spending in the year starting next July 1.

Wilson's concession that military requirements are secondary to Treasury Department considerations both confirmed what his critics have been saying for months and marked a sharp reversal in his department's contentions before recent Congressional hearings. The change, he indicated, came because "we think the penalty for saving money isn't as great this year as it was in the past."

Fiscal 1958 Plans Due

Actually, Wilson said, the monetary ceiling is forcing further cuts on the Defense Department—Navy announced inactivation of 60 ships last week—and he hopes to have final plans for Fiscal 1958 stretchouts ready for announcement in two or three weeks.

A USAF spokesman told AVIATION WEEK he believes the bulk of Air Force stretchouts already have been disclosed with earlier announcements that the F-101B, F-105, F-104 and F-106 face slower production schedules. A new and final program to meet USAF's economy effort, which is designed to slow down the rate of current spending, was sent to Wilson's desk last Thursday.

Once it is approved, USAF expects contractors will start getting paid for a substantial amount of work already billed for the first quarter of Fiscal 1958. Payment has been held up in Wilson's office pending approval of the final USAF program. There are reports that a few major contractors have been forced to borrow money because of the delay in Pentagon payments both for this year and for carryovers dating back before June 30.

Wilson blamed the necessity for cutting $2 billion off the Fiscal 1958 outlay as well as the new before-the-fact ceiling of $38 billion on Fiscal 1959 expenditures on Congressional insistence that the taxpayers demand economy.

His contention was supported by Rep. George H. Mahon (D-Tex.) chairman of the Defense Subcommittee of the House Appropriations Committee.

Mahon told the 11th annual convention of the Air Force Association that neither Congress nor the administration will tolerate an increase in the $38 billion spending rate, and said a ceiling will be imposed. "In fact," he said, "that is what we have now."

Mahon further made it clear, despite Wilson's firm stand against further unification of the armed forces, that he sees strong sentiment on Capitol Hill for a radical change.

More Unification Urged

"A degree of unification never heretofore achieved in peace time is mandatory," Mahon said. "The time has come to tear down the costly Iron Curtain which separates the services."

He blamed the missile program for a good deal of the confusion and controversy. A few days later, Army acknowledged publicly that it has been conducting feasibility studies on missiles with range greater than 200 miles.

Asked if he had rejected the Army's idea of having an 800-mile missile, Secretary Wilson told a reporter such an idea "is about like Ivory Soap, you know, 99 and 85/100% out."

In his endorsement of further unification, Mahon backed earlier statements by both AFA and Gen. Thomas D. White, new USAF Chief of Staff.

AFA had demanded a single service in its statement of policy at the 1956 convention. In an address to this year's meeting, White acknowledged that USAF must conform to the general paring down of expenses and indicated that the Tactical Air Command, already cut, will suffer further reductions.

Then General White continued:

"The other services have some rigorous self-examination to do and face still more in the future, just as we do. I cannot say with candor that an overall adjustment to the present era, equivalent to the Air Force adjustment, has been made . . . the direction this adjustment should take is clear."

Part of this self-examination, it was indicated, will include a more potent evaluation of weapon systems—including the aircraft carrier, backbone of Naval aviation.

AFA called on Congress to set up a commission to conduct "objective evaluation" of systems (AW Aug. 5, p. 33). Rep. Mahon added strength to the proposal by criticizing Defense Department's existing Weapons System Evaluation Group. He said the group has been given money but "has had little impact on important decisions." Mahon urged WSEG to challenge the concepts behind assignment of roles and missions and the employment of specific weapons systems.

Gen. White was specific in listing the problems needing examination, evaluation and "resulting action to tailor the military establishment to the needs of the present and the future." Some of them involve the inter-service rivalries that have dominated Pentagon thinking and impeded progress for the past few years.

USAF's Chief of Staff listed these areas:

- **Ballistic missile vs. manned** bombers.
- **Point defense vs. area defense.**
- **Carrier aviation vs. land-based** aviation.
- **Ready reserve forces vs.** mobilization reserve forces.
- **Adequate compensation** for competent personnel.
- **Realistic military** assistance programs.

His reference to compensation indicated a continuing determination to press for adoption of the Cordiner Committee recommendations that would reward military personnel for their contribution instead of their length of time in the service. During the convention, USAF's Strategic Air Command demonstrated that SAC alone could effect savings of $2.4 billion a year if the Cordiner program were carried out. It has been sidetracked by the administration as "inflationary."

Behind all the discussion about the defense budget last week there appeared to be increasing concern over Eisenhower administration monetary policies.

Strongest challenge came from economist Eliot Janeway, who told AFA the rising rate of interest and higher cost of financing will more than eat up what can be saved by Defense Department economies.

Janeway said the administration's major error is keying of defense to monetary requirements instead of to military requirements. He said there may be an improvement in this area with the appointment of Robert Anderson to succeed George Humphrey as Secretary of the Treasury.

"At the moment," Janeway said, "U.S. defense and U.S. monetary policy are out of step with each other. It takes approximately eight years, for example, to get a modern air weapon off the drawing boards and into the air. . . .

"By contrast, the basic premise on which our monetary policy is based is the assumption that it will change with every economic gust of wind. . . . It is precisely this kind of monetary thinking that is responsible for both the delay and the cost inflation to which our defense program is now being subjected."

Janeway said the urgent pressure on the Defense Department is financial and not the arms requirement, a situation admitted by Secretary Wilson.

"The cost of understating long term defense requirements during any short term money squeeze will more than offset any genuine economies achieved by better administration," Janeway said. ". . . The more quickly and continuously we are able to arm competitively, the less our defense program will cost."

It was pointed out by Janeway and other observers that under Humphrey and recent Federal Reserve policies, the cost of Treasury financing has increased sharply. Short term loans are most popular, but they are not the most economical for financing what should be long term defense planning, observers said.

Altitude of 90 Miles Simulated

Washington—Man has reached a simulated altitude of 90 miles in a high vacuum chamber being developed by Litton Industries, Beverly Hills, Calif. Previous record was approximately 38 miles, reached in a pressure chamber at Wright Air Development Center last December (AW Dec. 24, p. 26).

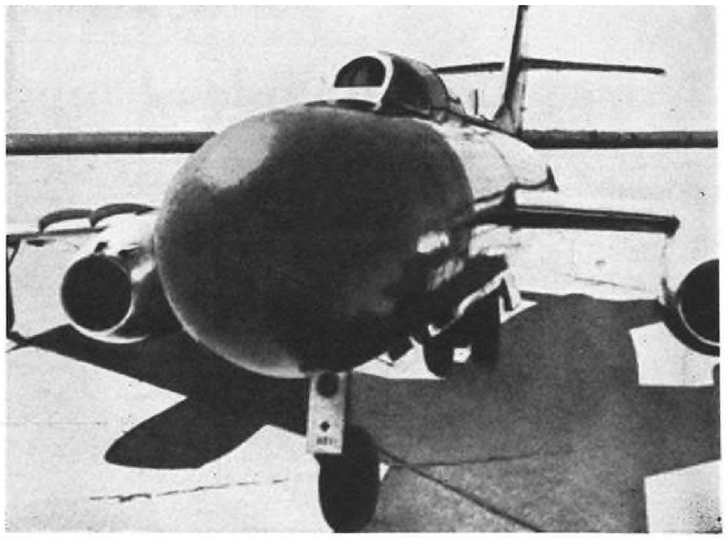
Existence of the Litton project was first revealed in Aviation Week last Oct. 22 (p. 31).

New record was set in a test run last July 31. Ultimate goal of the Litton project, sponsored by the Air Force Office of Scientific Research, is to simulate an altitude of 160 miles.

Subject in the chamber during the 90-mi. altitude run was fitted with special suit, not a flight garment, specifically designed for the project. Oxygen and pressure were piped into the garment from outside the chamber.

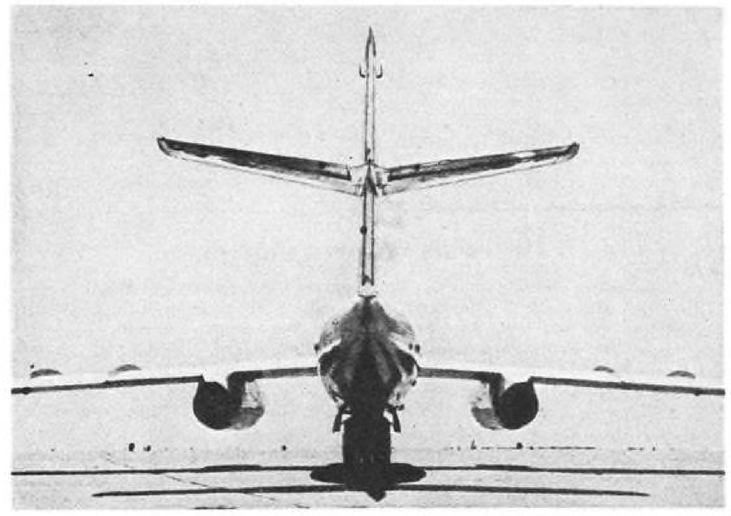
Trouble has been experienced in sealing the chamber, a critical problem considering the high vacuum conditions involved.

One major objective of the program is to study the way materials react under very low pressure found at the high altitudes involved. Surface friction of materials, for example, is believed to be considerably different at high altitudes than at sea level, and test information could be extremely valuable for future developments.



Yak-25 Carries Big Radome

First ground pictures of the Yak-25 (NATO code Flashlight) all weather interceptor to come from Russia show details of the huge airborne radar installation and bicycle type landing gear. Large diameter of the nose radome indicates search and tracking radar with extremely wide angle coverage and longer range than U.S. night fighters of similar vintage. Sweptback wings utilize two fences outboard of the engine nacelles to prevent spanwise flow. Wing has pronounced anhedral, a characteristic of most Soviet designs of this vintage. Cockpit houses pilot and radar operator. Main landing gear retracts into fuselage belly with outriggers retracting rearward into wingtip fairings. Horn type navigation antenna is visible high on vertical tail fin. Yak-25 has been operational in Red Air Force for about two years and was first Soviet night fighter to carry airborne search, tracking and fire control radar. Newer version with pointed radome was flown at 1956 Tushino Air Show.





Works Bill Includes Four Bomarc Sites

Washington—The $1.5 billion in new funds for military public works construction in Fiscal 1958 approved by House Appropriations Committee last week includes $43 million for four locations for USAF's Bomarc area defense missile squadrons.

Total is divided: USAF, $900 million; Army, $351 million; Navy, $265 million. In addition, $5.5 million is provided for new Loran stations. House committee cuts, totaling $240 million, were made largely because stretchouts in military construction will make available larger carry-over funds than anticipated. A major single cut was $8.3 million for an airfield at the Air Force Academy, which the committee said "is certainly not an urgent item. . . . Peterson Field now used is within 20 miles of the Academy. . . . Members of the committee are disturbed by what appears to be a lack of concern for cost factors by the Air Force in the planning, construction and furnishing of the Air Academy." The committee approved $20.8 million for other academy construction, but added:

"In keeping with the academies of other services the purpose of the USAF Academy is to train officers. The academy should be a first-class facility in which the American people can take pride; but it should not be a monument to governmental extravagance."

Key projects of over $1 million approved, included:

Air Force-Continental

● **Air Defense Command** Duluth, Minn., municipal airport, $5.1 million; Geiger Field, Spokane, Wash., $2.7 million; Glasgow AFB, Mont., $3.7 million; Grand Forks AFB, N. D., $9.5 million; Hamilton AFB, Calif., $1.6 million; K. I. Sawyer Airport, Marquette, Mich., $2.4 million; Kinross AFB, Mich., $1.6 million; Klamath Falls, Ore., municipal airport,, $1.7 million; Minot, AFB, N. D., $10.9 million; Niagara Falls, N. Y., municipal airport, $2.5 million; Otis AFB, Falmouth, Mass., $10.9 million; Oxnard AFB, Calif., $2.5 million; Portland, Ore., airport, $3.8 million; Presque Isle AFB, Me., $4.5 million; Richard Bong AFB, Wis., $23.8 million; Richards-Gebaur AFB, Belton, Mo., $1.2 million; Selfridge AFB, Mich., $8.3 million; Sioux City, Ia., airport, $1 million; Suffolk County, AFB, N. Y., $1.1 million; Truax Field, Madison, Wis., $7.8 million; Tyndall AFB, Fla., $3.2 million; Wurtsmith AFB, Mich., $4 million; Youngstown, Ohio, airport, $1.8 million.

● **Air Materiel Command.** Brookley AFB, Mobile, Ala., $2.9 million; Griffiss AFB, Rome, N. Y., $13.3 million; Hill AFB, Ogden, Utah, $3 million; Kelly AFB, San Antonio, Tex., $1 million; McClellan AFB, Sacramento, Calif., $6.5 million; Olmstead AFB, Middletown, Pa., $5.7 million; Robins AFB, Macon, Ga., $7.5 million; Tinker AFB, Okla., $8.7 million; Wright-Patterson AFB, Dayton, Ohio, $10.9 million.

● **Air Research and Development Command.** Arnold Engineering Development Center, Tenn., $7 million; Edwards AFB, Calif., $5.1 million; Holloman AFB, N. M., $12.5 million; Kirtland AFB, N. M., $2.9 million; Laurence G. Hanscon Field, Mass., $8.4 million; Patrick AFB, Fla., $2.8 million.

● **Air Training Command.** Amarillo AFB, Tex., $9.6 million; Craig AFB, Ala., $2.2 million; J. Connally AFB, Tex., $2.7 million; Keesler AFB, Miss., $2.2 million; Lackland AFB, Tex., $3.4 million; Luke AFB, Ariz., $4 million; Mather AFB, Calif., $9.6 million; Moody AFB, Ga., $3.5 million; Perrin AFB, Tex., $2.6 million; Randolph AFB, Tex., $2.8 million; Reese AFB, Tex., $7.6 million; Scott AFB, Ill., $2.7 million; Sheppard AFB, Tex., $7.9 million; Stead AFB, Nev., $2.7 million; Vance AFB, Okla., $2.6 million; Vincent AFB, Ariz., $3 million; Webb AFB, Tex., $4.2 million; Williams AFB, Ariz., $2.6 million.

● **Military Air Transport Service.** Aero Chart Information Center, Mo., $1.2 million; Andrews AFB, Md., $5.8 million; Charleston AFB, S. C., $3.3 million; Dover AFB, Del., $2.4 million; McGuire AFB, N. J., $1.3 million.

● **Strategic Air Command.** Altus AFB, Okla., $1 million; Barksdale AFB, La., $3.8 million; Beale AFB, Calif., $9.6 million; Bergstrom AFB, Tex., $1.5 million; Biggs AFB, Tex., $5.8 million; Blytheville AFB, Ark., $11.8 million; Bunker Hill AFB, Ind., $10.6 million; Carswell AFB, Tex., $3.4 million; Castle AFB, Calif, $3 million; Clinton-Sherman AFB, Okla., $3.6 million; Columbus AFB, Ohio, $2.8 million; Davis-Monthan AFB, Ariz., $6.2 million; Dow AFB, Me., $17.5 million; Ellsworth AFB, S. Dak., $2.5 million; Fairchild-AFB, Wash., $2 million; Forbes AFB, Kans., $2 million; Greenville AFB, Miss., $20 million; Homestead AFB, Fla., $2.4 million; Hunter AFB, Ga., $2.4 million; Larson AFB, Wash., $13 million; Lockbourne AFB, Ohio, $11.4 million; Loring AFB, Me., $9.8 million; MacDill AFB, Fla., $3.5 million; Malmstrom AFB, Mont., $5.6 million; March AFB, Calif., $4.9 million; Mountain Home AFB, Ida., $4.4 million; Offutt AFB, Nebr., $10.7 million; Plattsburgh AFB, N. Y., $2.6 million; Portsmouth AFB, N. H., $2.4 million; Schilling AFB, Kans., $3.4 million; Travis AFB, Calif., $3.1 million; Turner AFB, Ga., $9.3 million; Walker AFB, N. M., $13.9 million; Westover AFB, $2 million.

● **Tactical Air Command.** Clovis AFB, N. M., $3.2 million; Donaldson AFB, S. C., $5.4 million; England AFB, La., $3.1 million; Foster AFB, Tex., $1.4 million; George AFB, Calif., $4.3 million; Myrtle Beach AFB, Calif., $1.6 million; Sewart AFB, Tenn., $1.6 million; Seymour Johnson AFB, N. C., $10.7 million; Shaw AFB, S. C., $2.8 million.

● **Aircraft Control and Warning System:** $81.2 million.

Air Force—Overseas

● **Alaskan Air Command:** $22.8 million.
● **Far East Air Force:** $11 million.
● **Military Air Transport Command.** Azores, $9.7 million; Bermuda, $7.2 million.
● **Strategic Air Command.** Canada, $67.5 million; Greenland, $15.8 million; Guam, $9.3 million; Morocco, $1.1 million; Puerto Rico, $6.3 million; Spain, $11.2 million; United Kingdom, $2 million.
● **U. S. Air Forces.** Europe: $27.7 million.
● **Aircraft Control and Warning:** Greenland, $20 million.

Naval Aviation

● **Training Facilities.** NAAS, Meridian, Miss., $13.4 million; NAAS, New Iberia, La., $4.2 million; NAS, Pensacola, Fla, $2.7 million.
● **Fleet Support Facilities.** NAS, Cecil Field, Fla., $5.2 million; NAAS, El Centro, Calif., $4.8 million; NAAS, Fallon, Nev., $9.2 million; Naval seaplane facility, Hertford, N. C., $8.5 million; NAS, Lemoore, Calif., $29 million; NAS, Miramar, Calif., $3.6 million; NAS, Norfolk, Va., $1.7 million; NAS, North Island, Calif., $9.4 million; NAS, Oceana, Va., $7.5 million; NAS, Quonset Point, R. I., $2.7 million; landing field, San Clemente Island, Calif., $9.4 million; NAAS, Sanford, Fla., $2.9 million; NAS, Whidbey Island, Wash., $9.3 million; Whitehouse Field, Fla., $1.5 million.
● **Special Facilities.** NAS, Patuxent River, Md., $2.2 million; Air Missile Test Center, Point Mugu, Calif., $3.8 million.
● **Overseas Facilities.** NAS, Argentia, Canada, $1.8 million; NAAS, Barbers Point, T. H., $2 million; NAS, Guantanamo Bay, Cuba, $6.4 million; NAS, Roosevelt Roads, P. R., $15.5 million.

Army

● **Ordnance Corps.** Aberdeen Proving Ground, Md., $2.3 million; Anniston Ordnance Depot, Ala., $2 million; White Sands Proving Ground, N. M., $16.5 million.

Defense Appropriations

The Fiscal 1958 defense budget, finally approved by Congress and signed by the President, provides $33.7 billion in new funds. This compares with the $34.7 billion allowed for Fiscal 1957. In January, the Administration originally requested $36.1 billion. Key allowances in the aviation field included:

	Appropriation FY 1957 (in millions)	Original Request FY 1958 (in millions)	Finally Approved FY 1958 (in millions)
AIR FORCE			
Aircraft and Related Procurement	$6,848	$6,200	$5,886
Research and Development	710	661	661
NAVY			
Aircraft and Related Procurement	1,733	1,932	1,837
Research and Development	492	505	505
ARMY			
Research and Development	410	400	400

Harmon Trophy Winners

Harmon Trophy winners for 1957 are Lt. Col. Frank E. Everest, USAF, for the Aviator Award, and Malcolm D. Ross and Lt. Cmdr. Morton L. Lewis, U.S.N., for the Aeronaut Award.

Harmon Trophy is one of the top honors given on an international basis for outstanding piloting skill.

Lt. Col. Everest was cited for his work as project officer on the Bell X-2, during which he made 13 of the total of 18 flights made by the aircraft. He established flight procedures to study aerodynamic heating, stability, etc., which resulted in reaching a speed over 1,900 mph.

Ross and Lt. Cmdr. Lewis piloted a balloon to more than 76,000 ft. during 1956 as part of a program to study the physical and physiological effects of the upper atmosphere on men and materials. They also subjected themselves to a long series of other hazardous conditions during the study.

'Side-Looking' Radar Will Map Terrain

Dallas—Texas Instruments, Inc., has received a $1,394,318 order from Air Materiel Command for a newly-developed photographic mapping radar system.

System produces a continuous strip photograph of the picture appearing on its radar scope, covering a broad corridor of terrain below and to each side of the aircraft. System is called a "side-looking" radar because the corridor pictured extends out on each side of the mapping aircraft's path.

Texas Instruments reports that even comparatively small objects on the terrain are reproduced sharply and clearly on the photographic map. Company points out that to picture an equally wide corridor by conventional aerial photography would require operations at extremely high altitudes with resultant loss in detail and clarity.

System's bulk and weight will be reduced in forthcoming units through use of transistors in circuitry to the point where it can be installed in comparatively small aircraft. It is effective in both day and night operations and can be adapted to perform missions for all the services. Coast Guard has already used the system to locate and track icebergs in the North Atlantic. Army also has shown interest in side looking radar.

Number of units in the AMC order was not disclosed, but company Vice President W. F. Joyce predicts a great demand for the system because of its broad potential application. Company's Apparatus Division designed and developed the new mapping system and will manufacture it.

New Area Rule Concepts May Give Jet Airliners 50 Mph. Speed Gain

By J. S. Butz, Jr.

Langley Field, Va.—Cruise speed of jet airliners designs may be increased 50 mph. through new area rule concepts developed at the National Advisory Committee for Aeronautics' Langley Laboratory.

Experimental data recently obtained in the NACA transonic tunnels have indicated that the compressibility drag rise of jet transports can be delayed approximately .07 Mach number by reshaping the fuselage and wing at appropriate points. To date the reshaping has consisted of a "bulge" on the upper part of the fuselage ahead of the wing, and a series of small nacelle-like fairings located along the aft portion of the upper wing surface. The portions on the fairings which rest on the wing are half-bodies of revolution and the parts that trail slightly behind the wing are full-bodies of revolution.

Conflicting Factors

In disclosing the preliminary results from this work, the NACA pointed out that the many other factors involved in aircraft design such as stability, control, flutter, landing and takeoff characteristics, etc. must be considered before the benefits of the new area rule concepts can be fully realized.

The present experiments are being conducted by the same group under Richard T. Whitcomb that provided timely aid to military designers several years ago by developing the first area rule.

This new area rule development differs from the original concept in several ways.

● **Mach 1** was the design point for the first area rule and maximum drag reduction came at that speed. Although area redistribution was beneficial throughout the transonic range, economical flight was not the primary consideration.

● **Present task** is to delay the drag rise which begins about Mach 0.8 for the jet transports now being built. Today's transports are not designed to fly at speeds approaching that of sound where the drag rise becomes very large and the lift-drag ratio very small, increasing the cost of operating the aircraft.

● **Original area rule** reduced the energy losses in extensive shock waves which form about the airplane at sonic speeds. The present concept reduces the energy losses associated with boundary layer separation produced by shocks across the wing.

Drag rise which clean aircraft experience near sonic speed usually begins because of a weak shock wave which forms suddenly on the wing around the point of maximum thickness. This weak shock causes the boundary layer to separate and in effect gives the wing a large blunt base and greatly increases its drag. The change in drag is so large and so rapid that the Mach number at which it occurs is the limiting economical operating speed of the aircraft.

Whitcomb has succeeded in delaying the formation of the weak shock on the wing by carefully readjusting the aircraft area distribution. This is done by adding bulges in accordance with his experimental work.

A primary consideration in the design of commercial aircraft is the cost of operation. Operating cost depend to a large degree on lift-drag ratio and speed.

● **Lift-drag ratio** is a gage of aerodynamic efficiency and a high value means good mileage per gallon of fuel.

● **Higher speed** gives greater utilization or more seat miles per flight hour.

In the past when lift-drag ratios remained fairly constant with speed, an increase in aircraft size or speed meant lower operating costs per seat-mile.

Speed of the new jet transports is such that this is no longer true. Since drag rises sharply around a Mach number of 0.8 (about 550 mph. at their cruise altitude of 30,000 ft.) the lift-drag ratio begins to drop rapidly. Flying above that speed is costly. Cruise speeds on these aircraft would then stay around 550 mph. in normal use.

L/D Radios High

The value of Whitcomb's work lies in the fact that he has kept lift-drag ratios high while increasing the economical cruise speed, as limited by drag rise, by 50 mph. His experimental results have been obtained from use of models having wing-fuselage characteristics similar to current U. S. jet transport design practice.

It remains to be seen, however, whether it will be possible for designers to incorporate economically Whitcomb's findings into an actual design. Much time will be required to determine the effect of the prescribed bulges on structural weight, flutter characteristics, air load distribution, the efficient operation of high-lift devices, etc.

In the meantime, the aerodynamic aspects of the problem of delaying drag rise are continuing at Langley Field and the backlog of experimental information is growing.

Administration Split on Financing Bill

By Katherine Johnsen

Washington—President Eisenhower is pressuring the Defense Department to accede to legislation—now on the verge of enactment—which would throw the financing of military aircraft contracts into confusion.

The measure, which last week had passed the Senate and was awaiting action on the floor of the House, would do two things:

• **Expenditures.** All appropriations by the Congress would be put on an annual expenditure basis. Congress would simply appropriate only the actual amount to be expended in a year. Under the present system, Congress appropriates new funds to cover completely all contracts let during the year—whether the funds are actually to be spent in that year or not. For military aircraft procurement the proposed new "annual expenditure" plan might mean one of two things. If a program entailed more cash outlay than anticipated, during the closing months of the year, payments would have to lapse. On the other hand, if the program lagged because of strikes, technical difficulties or other causes, and the payments contemplated in the current year were not made, congressional action would be required to appropriate expenditures to cover the costs in the next year.

• **Contract Authority.** In recognition of the fundamental fact that aircraft—as well as many other types of defense contracts—involve expenditures overlapping the years, the legislation proposes that the military services be given "contract authority" for procurement purchases beyond one year.

However, under the legislation, even though the military services might have a firm contract with an aircraft company, the portion financed by "contract authority" would be subject to congressional approval year by year before "expenditure" allocations would be made.

McNeil Strongly Opposed

Officially representing the Department of Defense, Assistant Secretary of Defense W. J. McNeil, comptroller, made an "urgent plea" against the legislation "that we never get into this trap of providing the first year's cash and the balance in contract authority. That is a mess and you get into trouble and you even encourage some of the most wasteful practices possible."

Despite the strongly favorable testimony of the Treasury Department and the Budget Bureau, which prefer clear-cut year-end expenditure reports, outgoing Secretary of Defense Charles E. Wilson later supported McNeil's position.

Noting the Defense Department's problem in attempting to hold Fiscal 1958 expenditures to the $38 billion estimated in January—while procurement programs, particularly in aircraft, now indicate $40 to $42 billion in expenditure—Wilson explained it to the House Appropriations Committee this way: If Defense Department had submitted a $38 billion expenditures estimate to the Congress in January, the Congress probably would have reduced it to $36 billion. "Then, we would be in trouble $2 billion more," Wilson said. "That would just cause one of those big shifts in the military program which have been so expensive in the past and waste so much money and possibly risk the security of the nation."

After Wilson's comments against the legislation were made public, White House Press Secretary James Hagerty announced: "We are strongly for the bill.

"The President is on record and the President has so informed the Defense Department." Nevertheless, the convincing testimony of McNeil against the measure already was in the record.

White House Stand

"The Department of Defense, after long discussion of this subject by the Secretary of Defense, the Deputy Secretary of Defense, the Secretaries and Under Secretaries of the Army, the Navy, and the Air Force, is deeply concerned and has concluded that it would be found costly and a real obstacle to sound programming, budgeting and effective operation unless obligational authority for long lead-time programs were on a no-year basis as at present," McNeil testified to the House Committee on Government Operations. "We believe the present basic system of appropriating obligational authority . . . is in the best interest of the taxpayer . . ."

The bipartisan leadership of House Appropriations Committee is attempting to stave off enactment of the measure at this session. It includes Chairman Clarence Cannon (D.-Mo.), Rep. John Taber of New York, ranking Republican, and Rep. George Mahon (D.-Tex.), chairman of the Armed Services Subcommittee.

They feel that the measure slipped through the Senate because of a membership uninformed as to its implications, and they fear that an uninformed House membership might also go along with the measure.

Key points of McNeil's testimony before the Government Operations Committee were:

• **On contract authority.** "I don't want the job of trying to finance things started under contract authority easily obtained. . . . While it would be easier to come up here and sell new ideas under the contract authority basis, it is not a good idea when you have to live with it over the years."

• **On "expenditure" appropriations.** These, McNeil emphasized, are absolutely impossible to calculate "in a detailed scientific way." McNeil theorized Defense Department's problem: "On the B-52—Boeing Co. can well have a strike. We won't spend the money. The F-107 which we might think would start at one a month and two a month in the Fall, may have a bug in it. The tail could flutter or some other thing, that could mean it wouldn't start production until April."

'Economy' Tag Challenged

Challenging the "economy" banner under which the legislation slipped through the Senate, McNeil declared: "No saving is going to be made by any accounting system. . . . Not one nickel."

McNeil said a yearly cutoff of procurement appropriations would encourage last minute rushes to use up funds. He commented: "When you have continuing authority, and wash out June 30 as a critical date in the bureaucrat's life, he will wait from June until he can buy what he wants and do so smartly rather than rushing out madly with wires to contractors on June 30 for things he doesn't need."

Percival F. Brundage, Director of the Bureau of the Budget, justified his support of the year-to-year expenditure legislation with the theoretical example of a $15 billion, five-year aircraft program.

"In the initial budget submission the expenditure appropriation request would be for $3 billion, together with a contract authority request for $3 billion needed for forward contracting in the budget year . . . ," Brundage said.

"The budget submission for the second year of such a program might reflect a revised estimate of performance in the current year, showing deliveries of $2.5 billion and contracts awarded in the amount of $3 billion. . . . The Appropriations Committee might feel it appropriate to cut back the (next year) expenditure request on the basis of the revised current year expenditure."

Brundage noted these objections to the year-to-year expenditure basis, and made these replies:

• **That contractors on long** lead time programs such as aircraft, would be reluctant to enter into contracts officially financed for only one year. From past experience, Brundage declared, "no unusual difficulties were encountered in arriving at mutually satisfactory contractual arrangements in carrying out these programs."

• **Payments for delayed deliveries** would be subject to new expenditure appropriations by the Congress. "It is conceivable in some cases that this situation might result in requesting a supplemental appropriation since the delay in the delivery was not contemplated when the budget estimates for that year were prepared," Brundage admitted.

• **Delivery of procurement items** earlier than anticipated would mean there would be no funds to finance the deliveries. "In such cases," Brundage replied, "if funds are not available in the current appropriation, it would be necessary to re-schedule other deliveries to keep expenditures within the sum appropriated—or else to get authority in a supplemental appropriation act to transfer a portion of the following year's appropriation to cover the excess of deliveries in the current year."

"In any event," Brundage said, the Defense Department "would have to keep expenditures within the sums set in appropriation acts year by year.

He emphasized that "any excess would be a violation of the Anti-Deficiency Act and would require congressional approval. . . ."

Rascals Go to SAC For Use on B-47s

Buffalo—First production quantities of the Bell GAM-63 Rascal, rocket-powered air to surface guided missile, will be delivered to USAF's Strategic Air Command for arming of a B-47 bomber squadron in the near future. SAC has announced that the squadron will be activated this year.

Early production models will be used to train SAC crews in use of the Rascal and to prepare for immediate incorporation of the weapon into the B-47 weapon system as production continues and other squadrons are activated.

Starting in October, all Rascal launchings will be from the B-47.

Bell Aircraft Corp. has designed flight simulators and other training equipment that the company says it expects will be used by SAC personnel learning to maintain and launch the new weapon.

In addition to the Rascal, Bell has designed an air to surface missile for the larger Boeing bomber, the B-52. Other prime contractors also are in this USAF competition (see p. 23).

McElroy of Procter & Gamble Nominated Secretary of Defense

Washington—Neil H. McElroy, 52-year-old president of Procter & Gamble Co., Cincinnati soap manufacturers, has been selected by President Eisenhower to replace Charles E. Wilson as Secretary of Defense (AW Mar. 18, p. 25).

His nomination was sent to the Senate less than five hours after the President said that McElroy was his choice, but that he still had to go through an extensive investigation of his fitness for the cabinet post.

Eisenhower described McElroy as "one of the most capable men and the highest type of people that I know in the country."

Secretary Wilson is scheduled to leave the Pentagon late this month. He told a press conference less than a week before McElroy's nomination that he plans to join his wife at their summer home in Northern Michigan.



NEIL H. McELROY

Chrysler, GE Holdings

As in the case of Wilson's nomination to head the Defense Department, choice of McElroy raised the question of "conflict of interest" because of his stock holdings in companies that do business with the armed forces. He was reported to have more than 12,000 shares of Procter & Gamble stock. The company sold soap to the Army as far back as the Civil War.

McElroy also is a director of both the General Electric and Chrysler Corporations.

What changes can be expected in Pentagon administrative policies were a subject of immediate speculation in Washington. Biographies of McElroy say that his soap company, under his leadership, has developed an intense interest in research, with six out of every 100 employes engaged in this work.

The firm has a $5 million laboratory with 100 scientists employed on Procter & Gamble projects, most of which are designed to develop new consumer products and help the advertising department win the interest of America's women.

McElroy himself has been described as "handsome, ruddy-faced and well-scrubbed as one of his own radio heroes." Procter & Gamble is a major sponsor of radio and television soap operas.

At the same time, even McElroy's high-pressure soap selling has been based on hard facts alone. "If you want to tell him something," said one of his associates, "you have to have complete support for your statement. Don't guess and don't give him your opinion."

McElroy, six feet four and a Harvard University graduate, is a strong believer in competition. He has favored it both against other soap manufacturers and inside Procter & Gamble, where soaps fight with detergents and detergents fight with each other for a share of the market.

With the company for his entire business career, which began in 1925, he is considered an expert on marketing and promotion, a fact that leads to some speculation that he will be adroit in handling public opinion and the press.

In Washington last week for a quick visit to the White House and Pentagon, he was unaware that the Defense Department had denied his presence in the building until it became more ridiculous to continue denying it than to admit that he had lunched with Wilson.

As he left the capital, McElroy told reporters at the airport: "I'm still in the soap business. Let me run and peddle soap." Then he added: "I'm sorry, fellows, you'll find me more cooperative when I have something I'm permitted to say."

Wilson's Friends

Wilson's formal letter of resignation is at the White House, marking the end of his colorful career in the cabinet. The former president of General Motors Corp. had been expected to retire soon after Congressional action on the Fiscal 1958 budget.

Wilson will leave the Pentagon with a good many friends in its corridors, in spite of his unhappy moments over the budget, interservice rivalries, dogs and politicians. At his most recent press conference he displayed new additions

to his extensive collection of newspaper cartoons with obvious pride.

One depicted two dog houses, one labeled "Against Defense Cuts" and the other "For Defense Cuts." Wilson was running around between them.

"It's the first time I have ever seen a man with two dog houses," he said.

Another cartoon was captioned "If Zhukov Comes to Visit." Wilson appeared in it with the Russian Defense Minister, telling the guest: "But being in the dog house is not like being in Siberia."

His successor, McElroy, will take a salary cut of about $260,000 a year when he assumes the $25,000 a year Pentagon job. A strong supporter of the Eisenhower administration, he first came to the President's attention when he was chairman of the White House Conference on Higher Education, starting in 1954. His friends said he handled the job adroitly. Others said he was somewhat dictatorial and refused to permit motions from the floor. He is a competent bridge player and paid part of his expenses at Harvard from his poker winnings.

McElroy was born in Berea, Ohio, Oct. 30, 1904. He was married in 1929 to Mary C. Fry. They have two daughters and a son.

Navy Indicates Need for 'True' Seaplane

By Richard Sweeney

San Diego—Industry approaches to meeting Navy requirements in sea-based and VTOL-STOL aircraft were outlined here last week at the Institute of the Aeronautical Sciences national Naval aviation meeting.

Highlight of the meeting was sharp definition by top Navy officers of thinking concerning their service's future in aviation, covering Navy's roles and missions, new naval air weapon systems concepts, long range planning and research and development philosophy. Presentation was made at secret opening day sessions of the five-day meeting, attended by 800 to 1,000 engineers and scientists.

True Water Aircraft

In a speech at the open meeting, Coast Guard Capt. Donald Macdiarmid urged that first priority be given to development of a "true sea-based aircraft, one capable of landing on, living on and taking off from the open sea."

Urging absolutely "no compromise" on these requirements, Macdiarmid said the airplane should be able to land on all headings, regardless of sea direction, in waves at least 6 ft. high, be capable of being loaded and unloaded in 6 ft. waves anywhere in open ocean, and take off again.

Noting that meeting these requirements might yield an airplane of very short range or with other drawbacks from conventionally desirable characteristics, he said the plane at least would be truly sea-based, and provide a "jumping off spot, a point of departure" from which refinements and developments could be effected to overcome other deficiencies in the mission profile.

Calling for basic research starting with oceanography, Macdiarmid said all tradition regarding sea-based planes should be scrapped, and fresh approaches made. He urged designers to get closely acquainted with open sea pilots as a starter, and see what they need most in plane characteristics to make open sea operations a reality.

Biggest problems in the way of true open sea operations today, possible avenues of solution and some of drawbacks, Macdiarmid said, are:

- **Getting off the water,** possibly using a helicopter approach despite danger of rotors dipping in water in rough sea; or perhaps a vertical thrust jet, although it would create a spray situation.
- **Control of the aircraft** on the water through water brakes, which would need a load relieving provision for complete control without danger.
- **Some means of eliminating** or overcoming the period of instability which exists between the time the plane first touches water and the time it becomes controllable on the water. Using auxiliary jet thrust controls like those in VTOL applications, operated by conventional movements of the flight controls, might be indicated.
- **Impact load reduction,** on both airplane and pilot. Although plane loads are high, pilots sometimes are subjected to much heavier accelerations due to cockpit location, and a dangerous situation is created with the pilot unable to fulfill his function temporarily. Hydrofoils, hydroskis or some other shock absorbing system is needed.
- **Up and down motion** of airplane at rest in a heavy sea, called "heaving," which makes contact between plane and anything else hazardous if not impossible, must be restricted. Possibly a flat plate of sufficient area, positioned horizontally and deep enough to rest in the calm sea which always exists a short distance below the surface disturbances, would be the answer. Provisions to prevent submerging the plane in an exceptionally high wave or overstressing structure would have to be incorporated.
- **Self contained equipment** for loading and off loading heavy and bulky stores would be necessary, and here the field is wide open.

Promising avenue for solution to some water-based problems was indicated in paper on hydrofoils, prepared by William Carl of Dynamics Development, Inc., and H. B. Suydam of Grumman Aircraft Engineering Corp.

The hydrofoil, the paper noted, is capable of great reductions in landing impact loads, improvement of stability during the transition from flight speeds to water control velocities, and greatly enhances takeoff characteristics.

Hydrofoil dynamics utilize two methods of gaining effectiveness and maintaining stability and control across the speed spectrum. The surface piercing method varies wetted area, while the other approach varies angle of incidence of a constantly submerged foil.

Both approaches present problems, the paper pointed out. The variable wetted area system encounters surface phenomena which cause lift discontinuity, while the variable incidence method has higher drag, mechanical complexity and its attendant weight problems for aircraft.

Sea Tests, No Air Tests

Both approaches have had extensive tests with sea craft, none yet with airplanes, although one test vehicle uses aircraft engines and propellers for propulsion. Variations in foil locations and geometry have been tried, including a surface piercing system with main lifting foil ahead of center of gravity and a smaller stabilizing foil near the tail—a variable wetted area system with inverted Christmas tree (shortest span down) foils, located equidistant fore and aft of CG and a planing structure system with main lifting foil slightly aft of CG and a planing structure which provides forward support and automatically controls incidence angle, ahead of the test bed's prow.

Grumman elected to develop the surface piercing, variable wetted area approach using a main lifting foil forward of CG with stabilizing foil near the tail.

To defeat surface phenomena of cavitation and ventilation which produce unacceptable irregularities in the lift curve, aerodynamic techniques were applied in the form of sweep, dihedral and taper. Cavitation is the situation wherein water flow rates over the foil top surface generate pressures approximating the vapor pressure of water, resulting in water vapor bubbles. Ventilation is filling of the low pressure void behind a moving shape by an air bubble.

Tank Tests

Grumman ran tank tests on a model using its hydrofoil configuration, with the model free in pitch and with limited freedom in roll. Using the Stevens Institute of Technology tank, tests were run in conditions approximating sea state 5, waves 10 to 12 ft. high. Motion pictures of the tests showed the model stable in roll, with a great reduction in impact and pitch on landings.

Foil as used on the model had a cross section with a flat undersurface and the arc of a large circle as top surface. From a side view, foil attached to hull sides and extended straight down for a distance below the keel line, then raked forward and downward to get dihedral and sweep. Front view shows vertical portions extending down the model side the distance below the keel, then the downward slope to the point where sections joined at aircraft centerline under the keel. Rear stabilizing foil was of same configuration, only smaller.

Model injected into tank without hydrofoil illustrated high impact accelerations plus pitch which produced greater accelerations in the pilot compartment area, and at the third wave, bow was buried in water.

Using hydrofoil, impact accelerations were greatly reduced, pitch remained stable and values were established which showed that whereas the ordinary hull produced 3.7 Gs at impact point and 13.5 Gs at pilot station, hydrofoil reduced these to a 1 G hull impact acceleration and 2.5 G acceleration at pilot station. Similar gains were obtained in takeoff tests with hydrofoil requiring less power to lift the hull clear and lower drag yielded shorter takeoff run.

R. H. Oversmith, of Convair Division of General Dynamics Corp., delivered a paper on the use of analog computer to determine hydrodynamic characteristics, showing the results obtained in R3Y computations and flight tests. Work so far, the paper stated, indicates a promising future for this type of determination as part of the development cycle, although it does not replace any former parts of the loop such as wind tunnel, flight test. Rather, it complements them.

Aerodynamicist J. L. Decker of the Martin Co. delivered a paper outlining what had been determined from P6M SeaMaster crash investigations.

Citing failure in compression of stabilizer actuator when modified second plane made last flight with elevators fixed instead of movable (AW May 6, p. 31), Decker said Martin has now established criterion that power flight control pilot "feel" must have the same reliability as the aircraft structure, since company investigation committee deduced that failure loads were applied in the system because pilot's "feel" was gone and he had no criteria upon which to base control displacement.

Decker also pointed out that investigation disclosed that in the second P6M mishap, accelerations on the inside loop approximated 9½ Gs of which 6 Gs were due to hull drag when the airplane had an angle of attack of 60 deg., and said the airplane stayed together through the worst of the strains.

Changes in Martin philosophy in addition to the feel reliability, Decker said, include a closer monitoring of the telemeter readouts during a flight since the pilot cannot sense a failure in the feel system, hence may induce excessive accelerations at high dynamic pressures, since he cannot sense hinge moments.

Another change involves making pilot feel force proportional to airspeed and elevator-stabilizer deflection so that feedback in the loop will constitute accurate information on which to base judgement.

Decker added that reduction in horizontal stabilizer area achieved with geared elevator over the slab tail indicates that Martin will retain this feature in production P6M planes, which will be powered with Pratt & Whitney J75 turbojet engines instead of Allison J71s. He also reiterated that the operational envelope of the SeaMaster dictated that the plane undergo higher dynamic pressures than any airplane of comparable size, that aeroelasticity will continue to be present and have effects, that the plane's margin of safety due to its operational envelope is smaller than that of other military planes.

Ryan, Bell VTOLs

Papers on tail-sitter and horizontal attitude VTOL aircraft were presented by Ryan Aeronautical Co. and Bell Aircraft Corp. respectively.

The Ryan paper was prepared by H. L. Braasch and R. A. Fuhrman, and

X-14's Thrust

San Diego—Using a conventional takeoff roll, 15% of the Bell X-14 VTOL aircraft's weight is supported by jet thrust from exhaust diverters, which yield a downward thrust vector even when in horizontal flight attitude.

Variable JATO

San Diego—Navy Bureau of Ordnance is developing a variable thrust JATO unit, capable of generating 2,300 lb. thrust/sec. for 10 sec. Controllability is based on the jet reverser theory in that goal is a zero thrust vector although unit is firing continuously.

Nuclear Powerplants

San Diego—Aircraft nuclear powerplants will pay off in either very high performance, short term turbojets or subsonic, extended range turboprop applications, according to a paper delivered at the Institute of Aeronautical Sciences meeting by R. Zirkind of the Research Division, Bureau of Aeronautics.

Studies indicate that atomic turbojet specific weight is a factor, and needs a high value of horsepower generated for a given shielding weight, indicating good supersonic performance. On the other hand, a lower specific weight value of horsepower to shielding is tolerable, and very long ranges can be built into a turboprop powerplant which utilizes propeller efficiency.

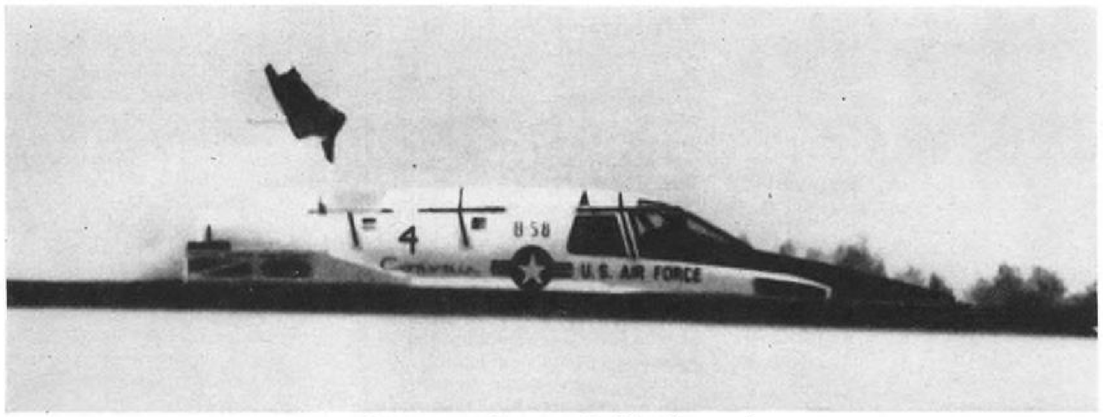
Also indicated, in about eight years, is a nuclear rocket engine, the paper said. However, it pointed out, nuclear efficiency will lag behind conventional system efficiency for quite some time until materials problems are solved and wide applications of such propulsions systems are required.





Russians Add Coaxial Design

Soviet helicopter designer Nikolai I. Kamov has two new designs featuring his dual coaxial rotor philosophy. The Ka-15 (left) is now in production as a rescue and agricultural pest control vehicle carrying two persons plus about 200 lb. of cargo. The larger Ka-18 (right) is designed to carry four people and is still in early flight test stage. Kamov has indicated his next helicopter design will utilize gas turbine powerplants.



Ejection From B-58 Tested

Rocket sled tests firing of rocket propelled ejection seat from third station of mockup of Convair B-58 Hustler bomber. Testing of system, carried out at Supersonic Naval Ordnance Research Track, China Lake, Calif., is to study problems presented by possible supersonic ejection of a three-man crew.

outlined some features of the X-13 Vertijet, including the fact it has a 45 deg. rotation of the pilot seat in transition from vertical to horizontal flight. The plane uses reaction controls for vertical flight, conventional elevons of delta configuration in horizontal flight.

Citing the combat potential of the tail-sitter which lands on ground equipment, the paper noted that the power required for the VTOL capability also gave the plane excellent combat and high speed capabilities.

Ryan will stay with its trailer system, holding to the belief that all "dead weight" possible should remain on the ground.

Ryan has made a study of multiple power packages for a tail-sitter VTOL fighter. Multiple units would be of low weight, high thrust type, and all units operated for vertical flight. Then some of them shut down or reduce to zero thrust, zero drag condition for cruise, which demands much less power than vertical takeoff. Idle powerplants could be brought into play for combat maneuvering, supersonic operation. Overall weight saving in fuel would be worth effort, company feels.

Concerning the X-14, the Bell paper, prepared by C. D. Ray and J. J. O'Malley, said certain advantages accrue to the horizontal attitude plane during critical takeoff and landing, when crew escapes in case of engine failure are marginal. The plane, even with reduced or completely lost power, still can glide to earth in conventional manner. In addition, this philosophy makes the plane inherently usable as a STOL vehicle, with rolling takeoffs possible in overload conditions.

Problem of recirculation air, that is jet exhaust which is sucked back into the engine through intake vortices, can be solved, Bell feels.

On the question of whether a better type of engine can be developed for this type aircraft, the paper said the pattern in the past has been that when a vehicle appears using a new approach, powerplants to optimize the approach seem to follow.

Project Far Side May Be Expanded

Washington—Second phase now is being considered for Project Far Side which would extend target altitude drastically beyond the 4,000-mi. figure for phase one (AW July 22, p. 29; Aug. 5, p. 76).

Some equipment for phase one firings already has left by boat for Eniwetok Atoll. Observers and supervisors of the firings, scheduled to begin Sept. 15, will be flown to the island firing site along with remainder of the equipment. Tentative timetable is to fire one rocket a day for six successive days.

Rocket contemplated for phase two would be a three-stage unit comprised of rocket motors now in existence to insure reliability, minimize development costs. They would be considerably heavier than those used in the four-stage phase one Far Side rocket, and would be ground-launched, since no balloon could support their weight and that of the associated launching crib. Phase one rockets will be launched from a balloon at about 100,000 ft.

Aeronutronic Systems, Inc., a Ford Motor Co. subsidiary, is prime contractor for Project Far Side, conducted under cognizance of Air Force Office of Scientific Research.

ASI is supplementing the $750,000 contract figure by investing approximately $300,000 of its own money, indicating the importance it places on the project as a program in the missile field. Aim of the project is to gather data on natural phenomena far out in space and lay the groundwork for future space exploration.

North American Aviation, Inc., which showed an interest in the project when it was originally advanced by AFOSR, was willing to conduct a preliminary study on its own, but was not willing to invest its own funds in the research, Aviation Week has learned. Also, NAA thought a 1,000 mi. altitude was a more feasible goal than the 4,000 mi. contemplated.

Pan American Names Public Relations Head

H. B. "Min" Miller will join Pan American World Airways as director of public relations succeeding John Creedy, who recently resigned to join a management consultant firm. Miller is a retired rear admiral in the U. S. Navy and headed Navy public relations during the closing years of World War II. His closing years of World War II. His postwar career included posts with Trans World Airlines where he was director of public relations and a similar post with the American Petroleum Institute.

Lockheed Will Close Plant at Bakersfield

Burbank—Lockheed Aircraft Corp. will close its feeder subassembly plant at Bakersfield, Calif., before the end of the year and transfer remaining work to Burbank and Maywood, Calif., plants.

Bakersfield plant, now employing about 500, is working on subassemblies for 1649A Starliner, Super Constellation transports, and military versions of Super Connies, including radar planes.



1907 1957

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In helicopters, lower weight means greater load lifting ability. Kaman Aircraft Corporation achieves this with extensive use of Torrington Needle Bearings in HOK-1 Helicopters.

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FOUR-BLADED propellers, similar in appearance to those of Lockheed Electra transports, are used on new C-130 B Hercules.

C-130B to Have More Range, Payload

Marietta, Ga.—An improved Hercules turboprop transport—the C-130B, designed to provide greater payload and range—will replace the earlier USAF model soon at the Georgia Division plant of Lockheed Aircraft Corp.

New version of the cargo and troop carrier will have the more powerful Allison T56 A-7 engine, higher takeoff weight, additional fuel tanks, stronger landing gear and four-bladed propellers.

Noise Level

Shift from a three-bladed propeller along with increased engine-prop gear ratio is expected to reduce the noise level inside the aircraft. The changes have made it possible to increase clearance of the prop from the fuselage and reduce the tip speed.

Rest quarters have been provided on the flight deck, to permit use of a relief crew on long range flights.

Both landing gear and the aircraft structure have been beefed up to take care of a takeoff weight of 135,000 lb., up from 124,000 in the C-130A. Range increase will result from addition of an extra 1,820 gallons of fuel with tanks in the wings.

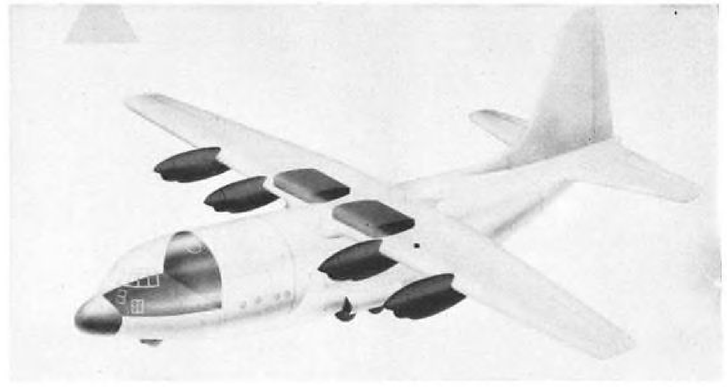
Wing-span, height and overall length of the C-130B are the same as in the earlier model, first delivered to USAF last December (AW Dec. 3, p. 50).

Smaller Propeller

In addition to the engine change, diameter of the propeller has been reduced from 15 ft. to 13.5 ft. Distance between the main landing gear and nose wheel has been increased a few inches. Ceiling windows have been eliminated and one window added on the side of the aircraft.

Successful tests have been completed on a ski version of the C-130 and Navy currently is testing a Hercules as an inflight refueling tanker for Marine jet fighters.

Four-bladed propellers are manufactured by Aeroproducts.



SHADED AREAS in drawing indicate changes in C-130B: more powerful engines, additional fuel tanks, flight deck rest quarters, stronger landing gear. Cargo capacity of USAF airplane, being loaded below, will be increased.



Emergency Fare Increase Plea Denied

Raise in passenger rates now called unjustified; airlines criticize Board's action as too quick.

By Ford Eastman

Washington—Domestic trunk airlines' bid for a 6% passenger fare increase was voted down by the Civil Aeronautics Board by a four-to-one vote last week. Airlines had sought the increase as an emergency relief measure pending outcome of the General Passenger Fare Investigation.

The Board's action was announced through a press release and did not constitute an official decision, which will be entered and issued at a later date, the CAB said. An airline spokesman said this procedure probably would delay the filing of appeals until the official decision has been issued.

In turning down the increase, the CAB said that on the basis of the record before it, the requested emergency relief is not justified. The Board added that the General Passenger Fare Investigation, interrupted by the current case, would be resumed promptly and directed that the case be processed on an expedited basis.

In the General Passenger Fare Investigation Case, the Board will consider the entire domestic trunkline fare level. Initial exhibits already have been exchanged and hearings will be held before an examiner this fall. It is anticipated the case will reach the Board for decision sometime next year.

Airlines in Case

The 6% emergency increase was requested last March by Braniff, Capital, Delta, Eastern, Northwest, United and Trans World Airlines. American Airlines also applied for the increase late last month. Following hearings, oral arguments were held before the Board July 31 and Aug. 1.

Only dissent to the Board's denial of the increase was made by Vice Chairman Chan Gurney.

"I thoroughly believe the requested increase of 6% in present airline fares is mandatory under the Board's responsibility to develop, maintain and keep a healthy civil air transport industry, not only to meet the ever increasing needs of the traveling public and air mail, but also in the vital interest of national defense," Gurney said.

"Increased operating costs, lowering margins for legitimate return on investment, make it impossible for the air industry to compete with other important industries for necessary capital to complete its requirement program, totaling in excess of two billion dollars," Gurney added. "The situation created by this denial of the small 6% increase puts United States civil aviation in a critical financial position. The majority has not, in my opinion, met its responsibility; in fact, the overall need is so urgent, their decision may be calamitous to the industry, some parts of which may be damaged beyond repair because of further delay in meeting this emergency problem head on."

Airlines expressed bitter disappointment at the Board's decision. One spokesman said the Board had taken "the easy way out," by turning down the increase. Some opposition to the increase had been expressed in Congress earlier, and airlines said this may have had some bearing on the Board's decision.

Airlines also charged that the Board might not have made a thorough study of the record in the case before taking the vote. Oral arguments were concluded Aug. 1 and the decision announced Aug. 6, with a week-end in between, they pointed out. "It is hard to see how the Board could possibly study the voluminous record thoroughly within that time," one spokesman said.

If the Board turned down the increase merely to await the record in the general investigation, airlines said, then the decision was ill advised because it will prejudice the general fare case.

The airlines' case in the emergency proceedings was based on sharply dwindling profits caused by costs rising at a greater rate than revenue, and lower load factors (AW Aug. 5, p. 39).

Donald W. Nyrop, Northwest Airlines president, explained it this way:

"The reason for the airlines' declining profit margin lies in the fact that the price we may charge for our product is strictly regulated, while our costs of doing business, wages, parts, fuel and even for the landing fees and other charges assessed for the use of the nation's airports, are not regulated and are increasing, year by year if not actually month by month."

Rising Costs Cited

C. R. Smith, American Airlines president, said that airline fares are at approximately the same level of 1942—15 years ago. "They have been held at that level," he said, "because the airlines have absorbed the cost increases brought about by inflation and other causes. Yet the product itself is far superior in safety, speed, comfort, convenience and dependability."

Smith also said that while airline fares have remained about level the Consumer Price Index has increased more than 66%, rail fares about 40% and bus fares more than 25%.

In arguing for the increase before the CAB, airlines pointed to operating results for the first half of 1957.

Eastern Air Lines, for example, reported an increase in operating revenues for the first six months of 16% over the same period a year ago. However, the airline said, expenses rose 30% and net earnings dropped 52%. Eastern's load factors dropped from 64.49% for the first six months last year to 61.03% this year.

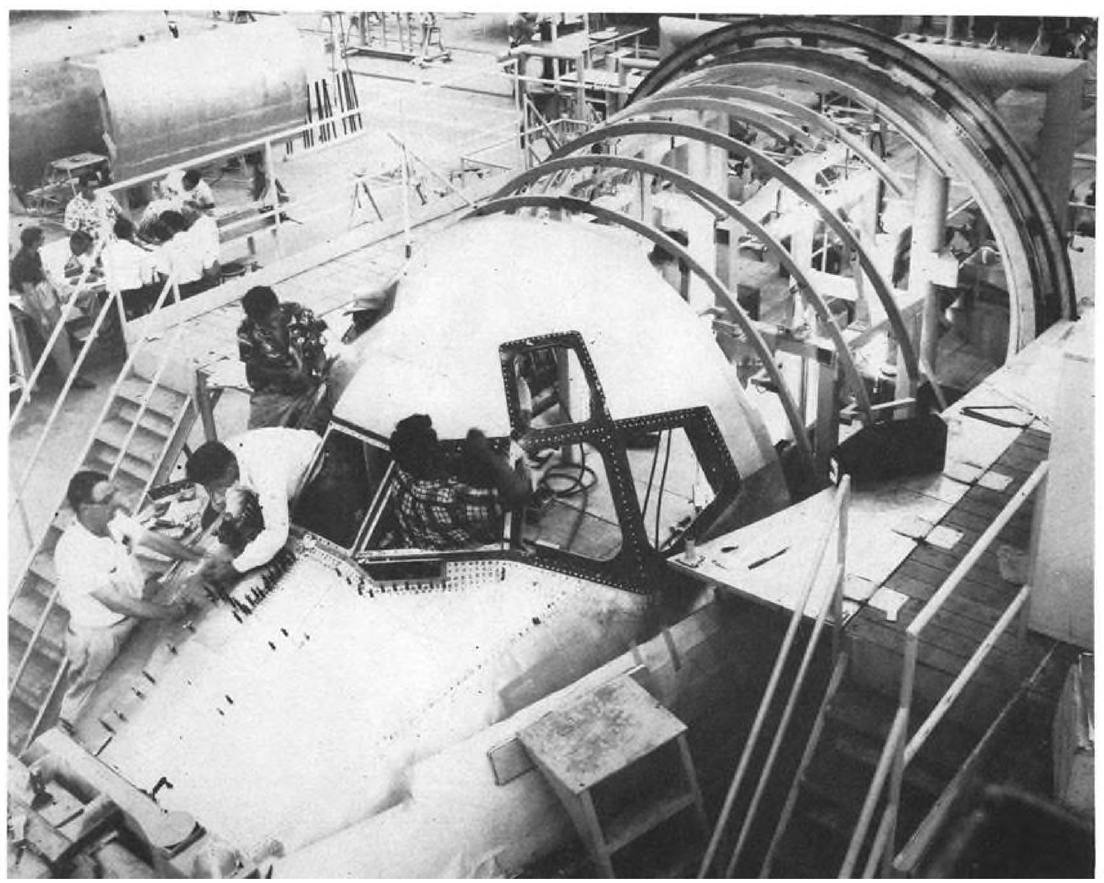
United Air Lines reported a 65.1% drop in net profit this year as compared with the first six months of last. Operating revenues increased 5% but operating expenses went up 11.8%.

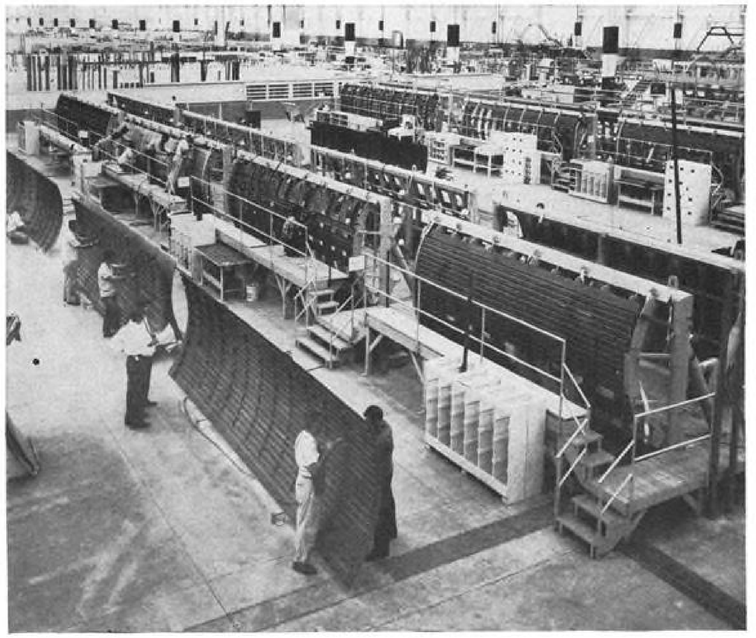
American Airlines recorded a 36.1% drop in net profits. Revenues increased 8.3% and expenses went up 12.3%.

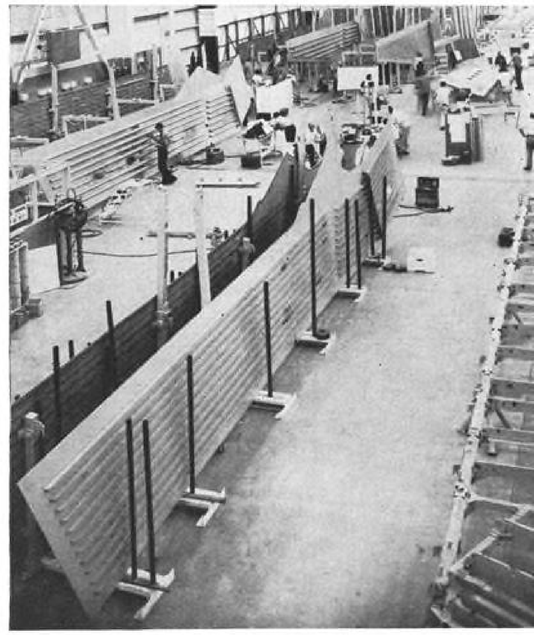
Two airlines, TWA and Capital, reversed the industry trend by reporting better operating results during the first half of 1957 than in the first six months of 1956, although neither showed any profit. Capital's loss amounted to $769,941 as compared with a $934,587 loss for the first half of last year. TWA reported losses of $1,114,000 for six months this year as compared with a $1.7 million loss last year.

Air Transport Association President Stuart Tipton said the Board's action "is, I am sure, deeply disappointing to the airlines. At the head of the airlines proposal was their desire to take every possible step to meet the critical financial problems arising out of their coming equipment revolution.

"Unfortunately the majority of the Board, although willing to 'maintain continuing surveillance,' is not yet convinced of the seriousness of the problem or the urgency of solution. We are certain in the weeks and months ahead the need for a fare increase will become more and more obvious. . . ."







DC-8 Assembly Is Underway

First photographs of the Douglas DC-8 jet transport under construction in Long Beach, Calif., show fuselage and wing skin sections near completion. Nose section (opposite page) is also taking form. Extra window on top on each side of the cockpit is for improved upward vision. Early drawings of the airplane showed it as a triangular shape.

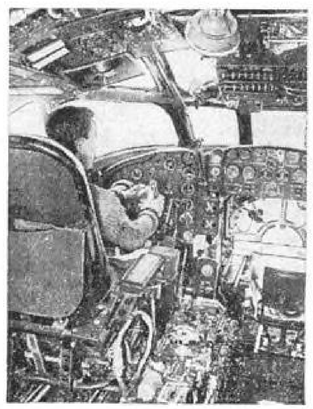


ILYUSHIN designed turboprop Il-18 Moscow airliner in flight over Moscow University.

Russians Spotlight Transports, Credit Designers



TEST PILOT V. K. Kokkinaki (left) confers with Sergei Ilyushin (center), head of the design bureau that created the Il-18 transport and V. N. Bugayevsky, project engineer for this plane.





COCKPITS of the Tupelov 110 (left) and Ilyushin 18 (right) show instrument groupings and control locations. Turboprop engine designer E. I. Kusnetzov is sitting in the co-pilot's seat of the Il-18.



OLEG ANTONOV (left), design bureau chief, and Alexander Eskin, project engineer for the An-10 turboprop transport, pose with their new aircraft in Moscow.



INTERIOR of the An-10 Ukraina turboprop transport shows three abreast seating on each side in spacious cabin. Note individual loudspeakers for music and public address system on headrest of seats. Overhead baggage rack appears extremely high.



SPECIAL corner is furnished for children's lounge in Ukraina turboprop transport.



GALLEY of the Tu-110 jet transport is supposed to have capacity for serving up to 100 passengers with hot meals in flight. Tu-110 is one of first Soviet transports to be equipped for inflight meal and beverage service.



NEW HIGH density seating interior of Tu-104A shows lightweight seats replacing heavy furniture of original Tu-104 interior to increase seating capacity from 50 to 70 passengers. Interior also eliminates old-fashioned furnishings used on Tu-104.

GREETINGS

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ON ITS 50TH ANNIVERSARY

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RADIO CORPORATION of AMERICA

Northwest Gets Permanent Tokyo Route

Washington—President Eisenhower has settled the long standing dispute over commercial air routes across the Pacific at least temporarily by approving Civil Aeronautics Board recommendations in two transpacific route cases.

The two separate but related cases involved Northwest Airlines' application for permanent authority to fly the Great Circle route to Tokyo and Pan American World Airways' application to parallel Northwest's route.

Specific CAB recommendations approved by the President are:

- **Permanent authority** for Pan American to provide direct service between its California terminals and Japan with operational stops as desired.
- **Denial of Pan American's** application to parallel Northwest's Great Circle route to Tokyo via Portland and Seattle.
- **Permanent authority for Northwest** to conduct operations between Portland and Seattle and Tokyo via the Great Circle route.

Pan American's present temporary authority to fly from Los Angeles and San Francisco to Tokyo via Hawaii and the Central Pacific was not an issue in either case. This authority expires in 1960. Hearings will be held then to determine the future pattern of operation.

President's Changes

With the exception of authorizing Pan American to fly direct from the U. S. to Japan, the President approved recommendations similar to those presented him by the CAB in December, 1954. At that time the President modified the Board's recommendations and ordered that Northwest be awarded a temporary certificate instead of permanent authority, and held in abeyance the Board's recommendation that Pan American be denied authority to parallel Northwest's route.

Last year the President asked the Board to review Pan American's application to fly the Great Circle route. At the same time, the Board also acted on Northwest's request that its application for a permanent certificate be resubmitted to the President.

Although the President settled the issues by approving the CAB recommendations he left the door open to renewed battles between Northwest and Pan American by asking for a review of U. S. Tokyo traffic. In a letter to the CAB, the President said it is the Administration's objective wherever traffic justifies to provide competitive U. S. service on all international and overseas routes from all gateways. He asked the Board to review U. S.-Tokyo traffic as soon as possible, and to report the situation to him at least once a year.

During hearings in the reopened transpacific case, Pan American claimed it needed authority to serve Portland and Seattle over the Great Circle route in order to compete with Northwest for transpacific traffic and to maintain its economic stability in that area.

The company said its longer central Pacific route via Hawaii placed it at a competitive disadvantage. Pan American also contended that granting it equal access to Northwest's Oregon and Washington terminals would leave the economic soundness of Northwest's transpacific operation unimpaired.

PAA Arguments Rejected

The CAB, in its decision, said, "We find that these propositions have no greater validity today than they had three years ago when they were last rejected by another hearing examiner and a differently composed Board. We are convinced that there are no new circumstances or developments which warrant granting PAA's application insofar as it requests service rights over the Great Circle route from the Pacific Northwest.

"We find that PAA does not need to duplicate Northwest's Tokyo service to maintain its competitive position in the transpacific traffic market; indeed any such grant would necessarily lead to unwarranted domination by PAA in that market."

The Board said its earlier conclusions rejecting PAA's claim that its Pacific routes needed strengthening were based in substantial part upon PAA's undoubted competitive advantages over Northwest, flowing from its greater size, more extensive Pacific routes, established market and sales position in the Pacific, and its premier identity in international travel due to its worldwide international route system.

PAA's Strength Cited

"There is nothing in this record," the CAB said, "which indicates that these PAA advantages have lost their significance, and that PAA now needs additional route strength to maintain itself in the competitive struggle with Northwest.

"In fact the record shows that, since the close of the earlier hearing in this proceeding," the Board added, "PAA's Pacific division has developed into one of the strongest international routes in the world. It generated the highest transportation revenues per plane-mile of any of the 17 United States foreign and overseas routes. In terms of revenue passenger-miles and revenue ton-miles, it ranked third. . . . In fact, PAA has several route segments which have greater density than Northwest's entire Pacific route.

"Thus, PAA's California-Hawaii segment alone generates more than four and one-half times as much traffic as Northwest's entire North Pacific route, and constitutes a vital part of the strength of the Central Pacific routing. In addition, PAA has almost twice as much traffic over its Hawaii-Tokyo



American to Expand Tulsa Base

American Airlines will begin a $20 million program to expand its Tulsa, Okla., overhaul base for its fleet of Lockheed Electra turboprops and Boeing 707 jet transports. Base, financed through bonds issued by city, will be ready for jet introduction in 1959.

Airline Traffic — June, 1957

	Revenue Passengers	Revenue Passenger Miles (000)	Load Factor	U. S. Mail	Express	Freight	Total Revenue Ton-Miles	Per Cent Revenue to Available Ton-Miles
DOMESTIC TRUNK								
American	708,331	503,285	74.9	1,617,823	503,938	7,159,028	57,673,567	65.1
Braniff	177,423	79,997	62.9	249,231	74,281	551,948	8,562,018	50.1
Capital	371,659	145,437	64.5	408,517	130,715	480,685	14,953,473	51.5
Continental	74,605	35,117	61.4	85,568	29,001	148,716	3,632,119	50.4
Delta	231,249	113,873	64.8	323,797	158,946	806,297	12,242,819	60.7
Eastern	672,338	365,739	64.24	971,156	375,000	1,582,497	38,087,821	47.34
National	114,287	69,850	66.0	242,931	41,984	459,869	7,473,522	55.5
Northeast	71,256	20,502	57.7	23,287	16,265	51,777	2,055,423	49.5
Northwest	136,560	102,515	69.9	401,161	163,843	810,883	11,243,079	59.7
Trans World	435,712	368,118	75.3	922,763	360,164	2,534,233	39,122,149	65.5
United	594,131	465,596	74.6	2,247,246	445,301	5,185,828	52,608,031	63.5
Western	124,455	66,023	67.1	234,652	66,043	259,533	6,880,489	60.2
INTERNATIONAL								
American	11,921	8,332	60.6	149,952	441	296,842	1,195,324	64.8
Braniff	4,148	9,138	58.2	12,077	.....	80,567	1,087,877	50.2
Caribbean-Atlantic	16,750	1,177	52.90	1,382	.....	2,321	126,635	57.32
Delta	5,769	7,580	68.5	6,517	.....	49,250	904,020	59.5
Eastern	31,845	42,642	78.21	81,741	.....	102,637	4,567,624	58.98
National	6,497	4,563	45.4	7,694	3,769	33,766	525,269	45.5
Northwest	11,786	25,862	62.2	961,393	16,668	658,304	4,347,026	73.6
Pan American								
Alaska	9,355	10,190	71.0	42,867	.....	295,773	1,382,356	57.1
Atlantic	115,076	168,274	72.6	999,700	.....	1,917,231	20,452,052	65.5
Latin America	107,099	122,772	69.5	370,465	.....	3,411,569	15,261,432	63.5
Pacific	1,992	5,542	56.2	28,710	.....	18,514	607,530	48.1
Panagra	11,489	14,329	58.6	58,154	.....	291,472	1,891,054	57.4
Trans-World	31,868	87,537	72.7	756,613	.....	698,380	10,489,107	69.6
United	11,897	29,543	77.4	97,710	.....	70,321	3,174,288	69.3
LOCAL SERVICE								
Allegheny	45,153	7,721	52.01	8,072	13,416	18,851	777,181	47.20
Bonanza	12,235	2,672	47.1	4,101	1,895	6,584	268,930	45.5
Central	11,634	2,340	40.2	3,968	1,395	7,133	236,851	35.6
Frontier	19,855	5,256	*	15,037	6,884	66,527	593,176	*
Lake Central	*	23,411	39.3	29,428	153,254	.....	2,372,058	39.9
Mohawk	38,646	7,304	50.4	66,141	100,108	249,890	742,890	51.3
North Central	63,979	10,581	50.2	21,387	25,873	.....	1,065,927	50.6
Ozark	38,195	6,289	44.2	11,257	13,948	20,524	646,763	46.1
Piedmont	39,854	8,524	61.6	13,185	8,281	13,185	855,694	60.7
Southern	19,277	3,479	40.8	8,865	10,388	.....	352,587	40.1
Southwest	27,900	5,926	51.4	9,683	4,542	8,004	587,354	49.7
Trans-Texas	21,718	5,083	45.2	13,142	6,234	22,330	526,783	41.2
West Coast	24,551	4,358	55.02	4,270	1,984	5,186	428,035	51.80
HAWAIIAN								
Hawaiian	41,737	6,304	63.4	3,563	.....	114,875	669,126	60.7
Trans-Pacific	23,549	3,028	60.0	1,180	.....	11,381	252,343	61.9
CARGO LINES								
Aerovias Sud-Americana	.....	.....	.....	.....	.....	723,357	723,357	83.0
Flying Tiger	13,700	61,498	98.6	29,490	9,232	5,755,649	11,944,145	83.7
Riddle	*	.....	.....	.....	.....	.....	.....	.....
Seaboard & Western	4,206	24,871	100.0	.....	.....	1,672,884	4,160,144	79.8
Slick	8,819	36,420	99.99	83,159	27,908	4,615,169	8,368,194	86.49
HELICOPTER								
Chicago Helicopter	5,405	79.9	35.1	2,549.8	.....	.....	10,200.9	34.1
Los Angeles Airways	2,805	162	56.66	3,582	1,279	.....	14,558	62.76
New York Airways	7,214	131	39.1	1,626†	1,216	553	15,927	43.6
ALASKA								
Alaska Airlines	707	1,170	30.2	12,868	.....	175,415	314,636	41.9
Alaska Coastal	5,865	499	.....	3,410	.....	4,534	58,638	.....
Cordova	*	.....	.....	.....	.....	.....	.....	.....
Ellis	7,247	380	56.1	1,900	.....	3,231	43,594	64.8
Pacific Northern	12,733	13,598	64.6	94,435	.....	324,571	1,886,684	67.6

*Not available.
†Mail transferred in bulk.
Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board.

segment as Northwest had over its North Pacific route. And the Honolulu-Manila segment of PAA's Central Pacific route generates as many passengers as Northwest did over the entire North Pacific."

In this setting, the CAB said, it would be inconsistent with established National policy favoring balanced competition between United States flag carriers to grant PAA a new and additional competitive routing across the Pacific in the absence of compelling reasons.

"As to the Great Circle award from the California Gateway," the CAB said, "we agree with the Examiner that PAA, as the carrier primarily responsible for serving the California gateway traffic, should be afforded the necessary flexibility to improve its service to these points to the full extent possible where that can be done without serious adverse consequences to another carrier."

On duration of operating rights, the CAB said it was inconceivable that the United States would at any time in the foreseeable future terminate the right of either Northwest or PAA to serve Tokyo, and thereby grant the other carrier an exclusive right to such service.

"Under such circumstances," the CAB said, "it is patent that both carriers are entitled to and can receive permanent authority for Tokyo service without adversely affecting any needed flexibility in further adjustment of the transpacific route structure which we might find in the public interest when we next review operations in this area."

The Board was unanimous in its opinion in both cases inasmuch as there were only four members on the Board when oral arguments were held.

SHORTLINES

► **Iberia (Airlines of Spain)** will begin a fourth transatlantic service on Aug. 30 with the idea of getting in on the westbound rush of tourists from Europe. The flight, a Lockheed Constellation transferred from the Spain-Caribbean route, will leave Madrid on Fridays and arrive in New York on Saturdays, turn around and depart for Madrid the same day, arriving there Sunday.

► **American Airlines** will begin non-stop Douglas DC-7 "Royal Coachman" service between Chicago and Los Angeles on Aug. 20. One flight daily, in each direction, is scheduled for the 85 seat aircraft. On Aug. 30, American will begin daily DC-7 "Royal Coachman" between Chicago and San Francisco.

► **Airline Clearing House** reports that airline business transactions during June

AIRLINE OBSERVER

► Pan American World Airways and Northwest Airlines are not expected to lose any time preparing for another big battle over air routes, now that their long struggle over transpacific routes has been settled (see p. 43). Next clash will be over renewal of certificates to fly between Seattle, Portland and Honolulu. Both have suffered heavy losses on the route since inauguration of service in 1946, but each will go all out for renewal of their rights or to get the route on an exclusive basis. Present authority of both airlines expires next February.

► **Eight-year-old regulation requiring jet aircraft to have prior authorization for landing at the Seattle-Tacoma International Airport has been removed. Restriction was adopted when the airport was opened in 1949 and little was known about effects of wheel loadings, jet blast and other factors affecting commercial runways. Similar restriction still is in effect at New York's Idlewild International Airport, where the Boeing 707 was refused permission to land on a recent transcontinental flight. Smaller Sud Aviation Caravelle, French commercial jet, was permitted to land there, however.**

► Egypt and the United States have agreed to a new air route between the two countries. The route, to be operated by TWA, will be through Ireland, the United Kingdom and Germany and intermediate points. But authority first must be obtained from the U.K. for TWA to fly beyond Frankfurt before service can begin. TWA currently operates to Egypt via France and intermediate points and via Portugal and intermediate points.

► **Capital Airlines will proceed with plans to provide reduced excursion fares for groups of persons of 25 or more traveling between specified points and originating or resuming their journeys on Saturdays or Tuesdays. The plan originally specified student groups, but Civil Aeronautics Board recently turned this down as discriminatory. However, CAB said if Capital refiles its tariff without the student restriction within 15 days, the case will be remanded to the examiner for further proceedings. Purpose of the plan, according to Capital, is to generate additional traffic on days in which Capital's traffic is historically low.**

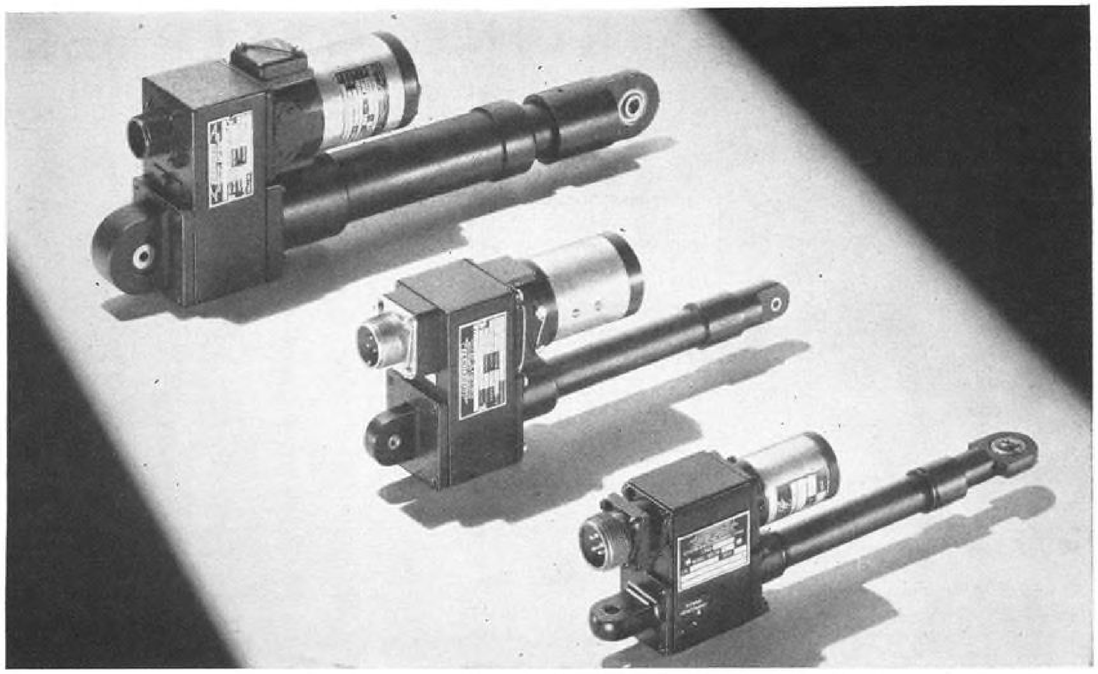
► Scheduled airline service has been inaugurated by Apache Airlines in Arizona with five daily round trips between Tucson and Ft. Huachuca, a distance of about 100 miles. Equipment used on the route are Beechcraft Bonanzas.

► **Canadian Pacific Airlines will add two new foreign cities to its international service. CPA Canada-Lisbon service will be extended to Madrid on Sept. 5 and Santiago, Chile, will be added to the airline's South American service on Sept. 23. CPA points out that traffic rights have been granted from Santiago to all points North, but not between Santiago and Buenos Aires, the present South American terminus of the carrier.**

► Non-scheduled airlines have stepped up competition for passenger traffic between the West Coast and Hawaii. Great Lakes Airlines has offered a $99 fare on 60-passenger Douglas DC-4s. Transocean Airlines has held to its $109 fare, but is now using Lockheed Super Constellations between the mainland and Hawaii, to cut flying time. Scheduled airlines offer a tourist fare of $125.

► **Thai Airways officials have been looking over plans of future facilities at Los Angeles International Airport with a view to inauguration of service between Bangkok and Los Angeles under the U.S.-Thailand air transport agreement. Thai Airways recently took delivery of the first of three Lockheed 1049G Super Constellations which are expected to be used for the international route.**

► Itinerant commercially operated aircraft weighing more than 12,449 pounds and which are revenue producing, are now being charged airport user fees ranging from $7 to $20 at the state-owned airport in Lansing, Mich. But aircraft which are assessed the landing fees and which purchase gasoline from the State of Michigan pumps, are entitled to a rebate of two cents per gallon, applicable to but not exceeding the amount of landing fee.



These new Airborne modular actuators—rated 2500, 650 and 350 lb., top to bottom—are not standard in the usual sense. Rather, they are merely three examples of the hundreds of different linear actuator packages that can be made up from Airborne's new line of standard, interchangeable actuator components.

New Airborne modular design concept simplifies actuator selection

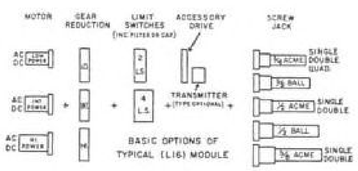
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were up 10.46% over June of last year. Total interline business transacted was $64,927,606 as compared with $58,774,928 in June, 1956.

► **Pan American World Airways** will begin non-stop first class tourist Douglas DC-7C flights to Rome from New York on Oct. 27. New service will be on a basis of three flights a week. PAA also will begin daily non-stop DC-7C flights to Frankfurt also on Oct. 27.

► **Pan American** will begin service to the major capitals of Europe using the Polar route short cut on Sept. 10. Four flights weekly will use Douglas DC-7Cs from Los Angeles and San Francisco. Direct flights to Europe from Seattle-Portland will be started later in the year. Trans World Airlines has not yet announced plans for its flights over the Polar route to Europe.

► **Deutsche Lufthansa,** the West German airline, will add eight additional passenger flights between Hamburg and New York during August and September to handle unexpectedly heavy traffic. Outbound flights from Hamburg via Frankfurt and Shannon will depart Aug. 19 and Sept. 2 and 9. Return flights from New York will depart on Sept. 3 and 10. Lufthansa already has flown one westbound flight on Aug. 5 and two eastbound flights on Aug. 6 and 10. In the first six months of 1957 Lufthansa carried 16,456 passengers on its North Atlantic service.

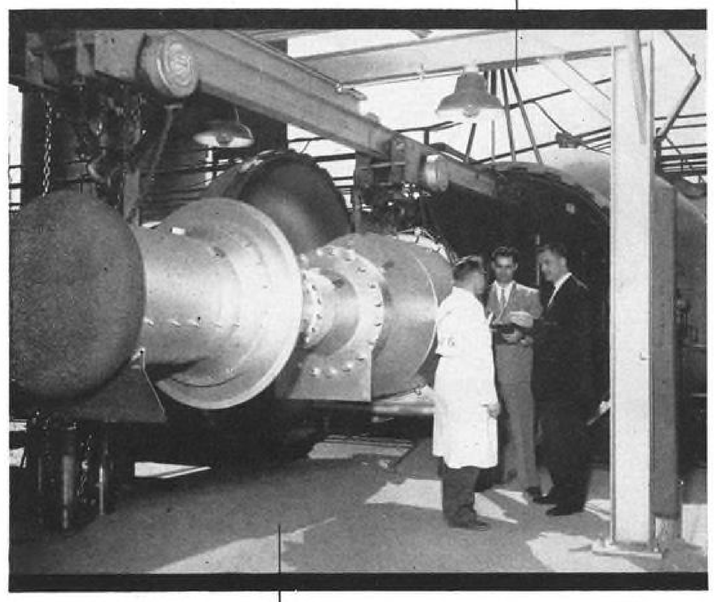
► **British Airlines** carried nearly 3.5 million passengers during the financial year 1956-57, government figures show. This is an increase of 12.9% over the previous year. British Overseas Airways Corp. carried 399,000 passengers, 7.5% more than last year and British European Airways carried 2,461,000 passengers, 10.6% more than the previous period.

► **Slick Airways** has sold a Douglas DC-6A aircraft, subject to CAB approval, to Alaska Airlines for delivery on or about Aug. 15. Slick has five new DC-6A aircraft on order with Douglas Aircraft Corp. for scheduled delivery in spring and summer of 1958.

► **Northeast Airlines** carried 93,383 revenue passengers during July as opposed to 69,330 for the same period in 1956.

► **Pacific Northern Airline's** common stock has been listed on the Pacific Coast Stock Exchange in both Los Angeles and San Francisco. The carrier's common shares will continue to be traded on the American Stock Exchange in New York where it first appeared in 1953.

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8 passengers—2 crew
Gross Weight: 26,000 lbs.



Two Small Jet Engines

4 passengers—2 crew
Gross Weight: 16,000 lbs.



SMALL JET ENGINES...

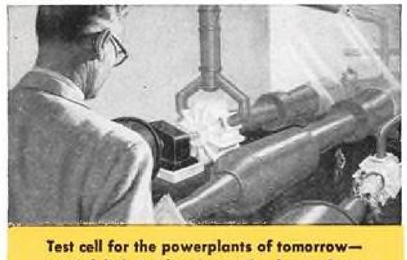
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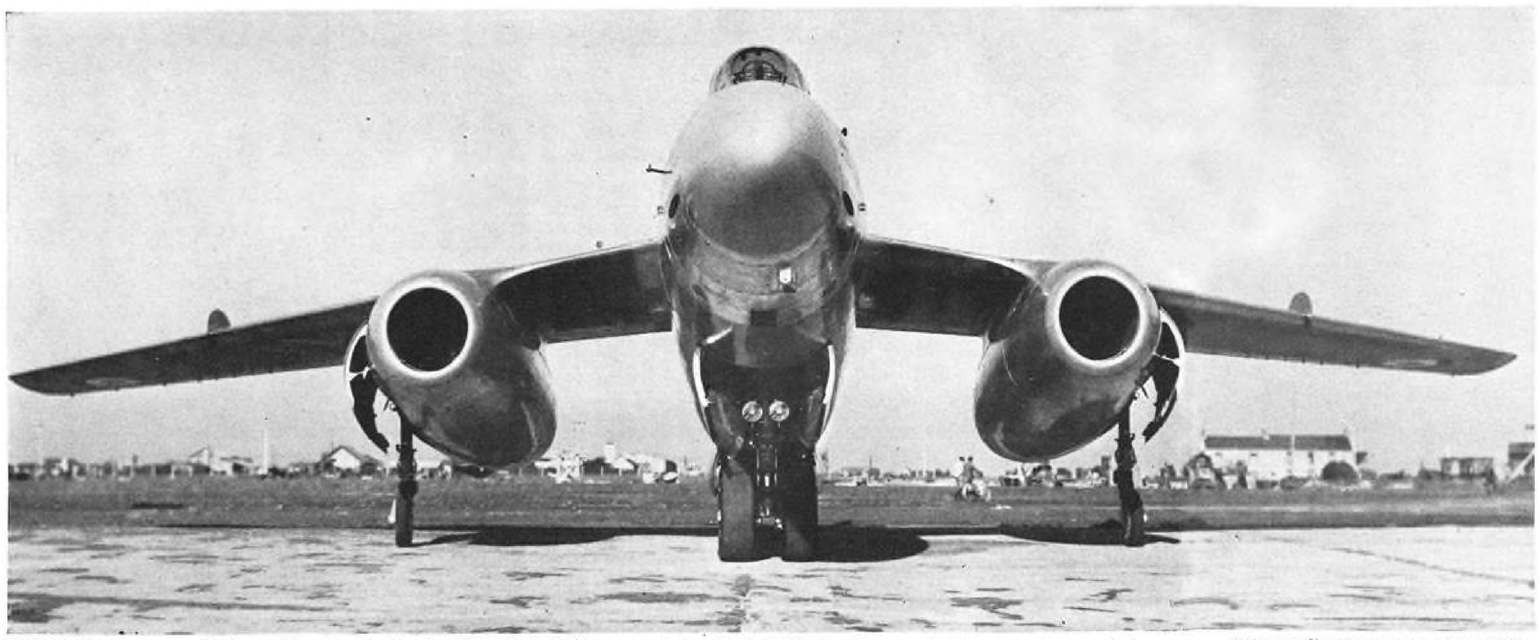
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Delay, Stretchout Nibble at Technical Life of Vautour

By David A. Anderton

Paris—Sud Aviation's SO. 4050 Vautour, the nucleus of France's jet bombing and all-weather force, now is being delivered to squadrons of the Armée de l'Air.

The twin-jet Vautour was developed to the general concept of one airplane capable of doing three different missions: ground attack, bombardment and all-weather fighting. Ordered in quantity, the Vautour has been bedevilled by requirement reversals forced on it by successive changes in Army staff and leadership. Today it is the only jet bomber available to the French. It is also the only relatively contemporary all-weather fighter, and is replacing the weary Gloster Meteor variation that has served for so long.

How Many Dozen?

Figures on production rate and numbers in service have not been made available. But many observers claim that the total force of Vautours in the Armée de l'Air was required to make the flyby of 12 that was one feature of the recent 22nd Salon de l'Aéronautique.

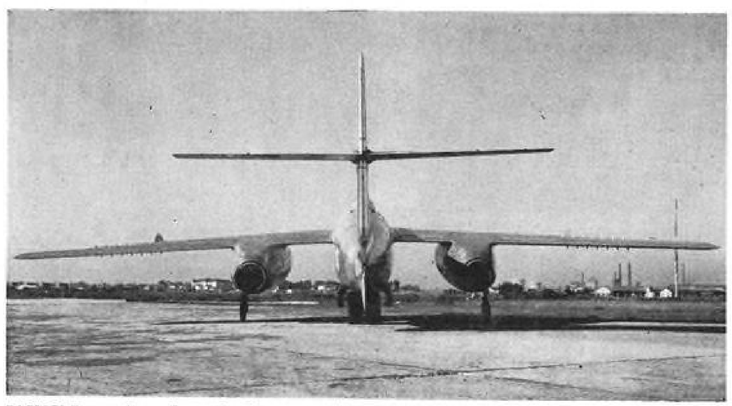
Sud Aviation says that production of the airplane can be measured in dozens, but whether two or ten Sud doesn't say.

Production is about evenly divided between the all-weather version and the bomber. Only a handful of the ground attack version is to be built.

Basic layout of the Vautour is to the aerodynamic formula of 35 deg. of sweep in wing and tail. The wing is mounted at shoulder-height and has a slight negative dihedral. Engines are pod-mounted, flush with the undersurface of the wing.

Weight of the Vautour at takeoff varies between 33,000 and 44,000 lb. with the mission. Wingspan is 50 ft., overall length 50 ft. and maximum height 14.7 ft.

Performance is subsonic, with a sea level maximum speed around Mach 0.9. Rate of climb after takeoff for a production Vautour at normal gross weight is about 11,800 fpm. Takeoff and landing requires a normal run of about 2,600 ft. on hardtop runways, more on pierced steel planking or other makeshift surfaces. Ceiling is more than 50,000 ft., but operationally the airplane works better at lower altitudes, probably not exceeding 45,000 ft.



BICYCLE gear is used on the Vautour with outriggers in each engine nacelle. In spite of such gear, takeoff distance is relatively short: about 2,600 ft. at its normal gross weight.

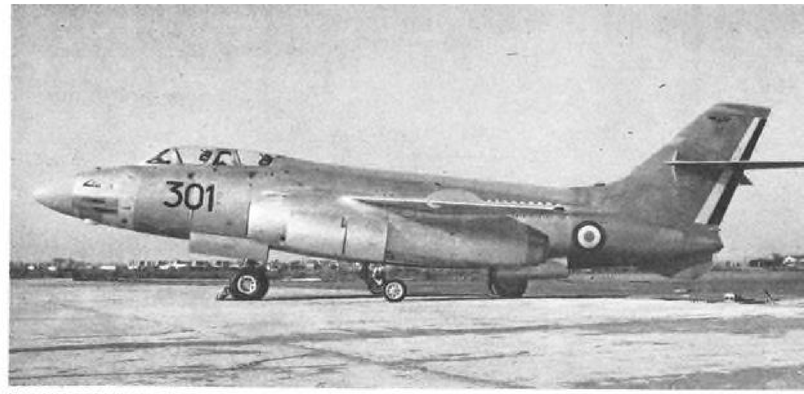
Three Noses, One Body

Essentially the Vautour is an airframe-power-plant combination that can have a variety of armament arrangements plugged into it to match its mission. It's not quite that simple; actually production airplanes are being turned out in batches of each type because there is a little more difference between the planes than armament. But there is a very high percentage of parts common to all three—perhaps 95% or more of the structure is the same.

- **Vautour N** is the all-weather fighter. Nose layout carries a crew of two in tandem sitting behind the packaged radar and over the gun battery.
- **Vautour B** is the light bomber. This also is a two-seater, but the bombardier sits in the conventional glassed-in nose behind the bombing sight and computers.
- **Vautour A** is the ground attack aircraft. It is a single-seater, with the pilot's position above the gun battery.

A large bomb bay is retained for all the versions, and carries a variety of weapons depending on the mission.

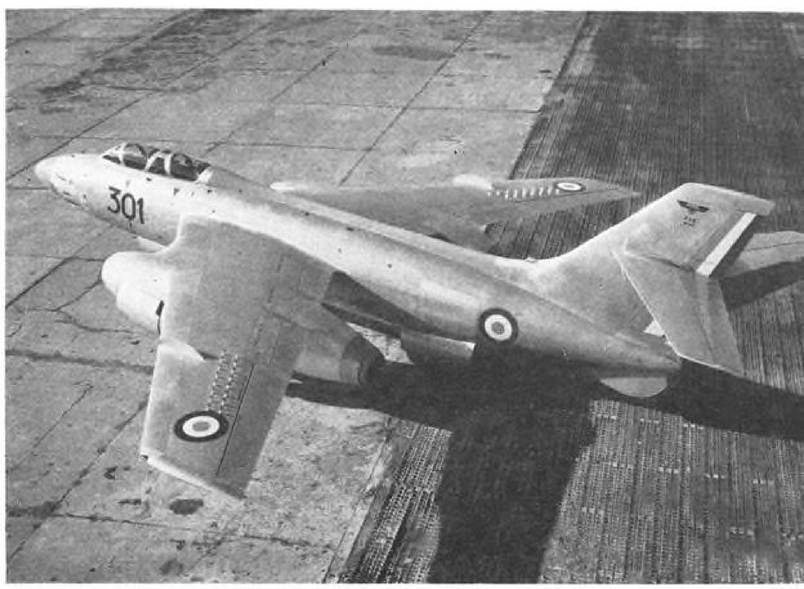
Powerplants for the Vautour are a pair of Snecma Atar 101 E3 turbojets



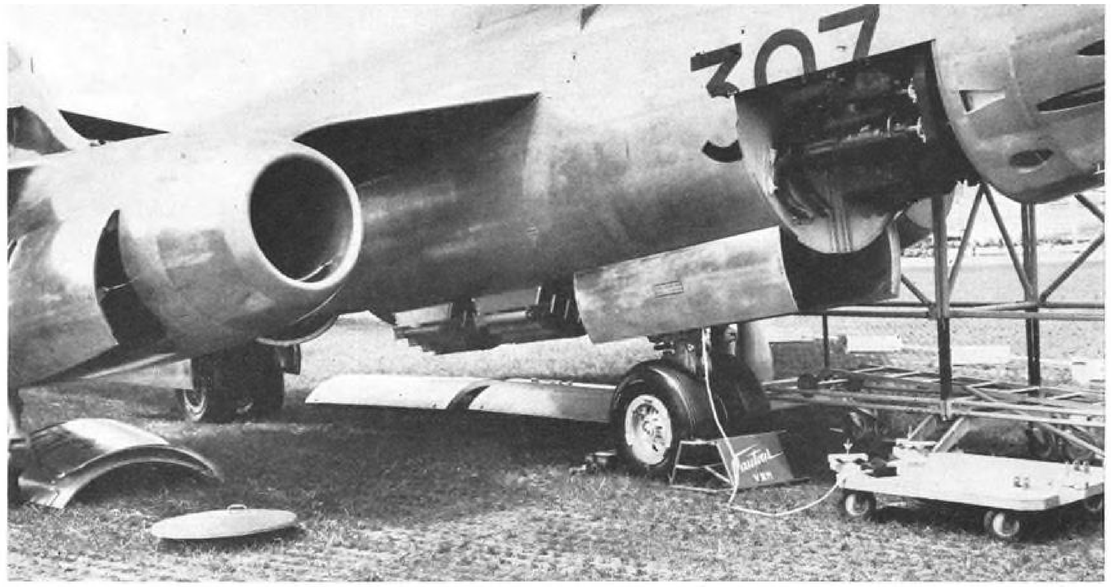
NIGHT-FIGHTER Vautour makes up first batch of the twin-engined craft off the Sud Aviation production lines. Armament is extremely heavy: total is four 30-mm. cannon with 400 rounds; 240 rockets in the fuselage bay and 76 rockets under the wing in pods.



VAUTOUR is shown here in clean version with no armament except fuselage gun pack.



VORTEX generators and wing fences help the transonic performance of the Vautour. With its 35-degree swept wing, Vautour is capable of speeds near 700 mph. on the deck, is slightly supersonic in a dive. Variable-incidence tail will be replaced on later production planes by a slab tail, now being installed on fourth production ground attack airplane.





All-weather fighter

GUN PACK and rocket pack in bomb bay are two standard items of night fighter version armament. Number of seven centimeter rockets can be varied to a maximum of 240. Complete 30 mm. gun package (below) is ready to be winched into place. Four curved pieces on rear bulkhead are shell case deflectors. Intake ventilates bay.



rated at 3,500 kg. thrust (7,740 lb.) at 8,400 rpm. for takeoff. Engines in later Vautours may be the Atar 101 E4 with an increased thrust rating of 3,700 kg. (8,180 lb.).

Sud Aviation designer Parot, responsible for the Vautour line, figures the plane has considerable growth potential and could be a first-line inventory item for another four years or so. Increased power could improve the altitude and rate of climb performance, although high-speed performance is drag-limited.

New Modifications

Troubles in flight with the horizontal tail led to a careful investigation and replacement of the variable incidence, "all-flying" tail with a slab surface, or "monobloc" as the French designate it. The fourth production ground-attack aircraft is being fitted with the monobloc tail now at Melun-Villaroche. Even though the trouble has since been licked in the original tail layout, Sud engineers will make the shift on the production line to the slab surface.

Wing drop and pitch-up problems, encountered in early flight tests of the Vautour, led to the usual aerodynamic modifications of wing fences and vortex generators. Those troubles have been cured, but a further aerodynamic change is in the works. A cambered, extended leading edge has been designed and flight tested on the seventh pre-production airplane in order to increase the takeoff and landing lift coefficients and to improve the turning ability—by increasing available lift coefficient—in maneuvering flight at high altitudes where the plane is at a high angle of attack.

For this change, which will be fed into the production line and made a retrofit through the use of field service modification kits, the wing fence has been moved inboard almost to the nacelle. The leading edge extension runs from there to the wingtip.

Vautour Armament

Versatility of heavy armament is one of the basic design concepts developed in the Vautour. Starting at the nose with the punch of a quartet of 30-mm. cannon, the Vautour mounts a startling array of rockets, bombs and other stores, carried internally or slung externally in pods or on Christmas-tree rigs.

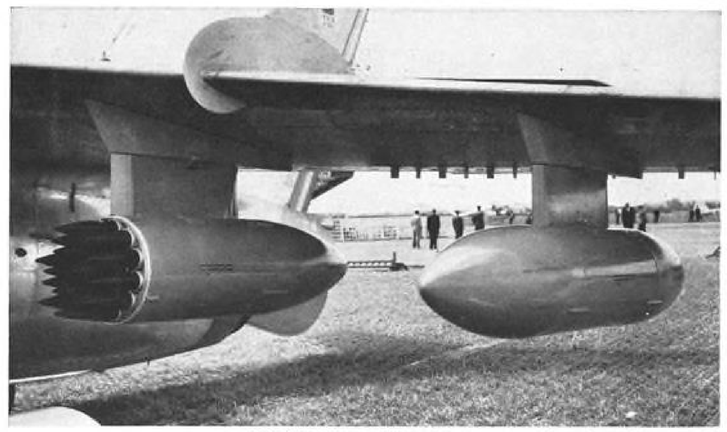
Standard armament arrangements for the three basic model variations of the twin-jet plane are these:

• **Vautour N** all-weather fighter carries 4 x 30-mm. DEFA cannon with 100 rounds per gun in a nose package. The bomb bay holds a rocket tray that mounts a maximum of 240 SNEB air-to-air unguided rockets. Underwing rocket pods can be fitted; these Matra Type 116 launchers load 19 SNEB rockets in the familiar honeycomb pattern. Four such pods can be carried for a total of 76 rockets. Auxiliary fuel can be carried either in the bomb bay or under the wings; if so, the rocket armament must be proportionally reduced.

• **Vautour B** light bomber does not have guns, but carries up to about five tons of bombs. The major portion is carried in the long bomb bay, which can accommodate a 5,000-lb. bomb. Four 1,000-lb. bombs can be carried under the wings on pylons. The usual variations on these internal and external stores—fuel, napalm, air-to-ground missiles—can also be fitted, depending on the mission.

• **Vautour A** ground attack aircraft is armed with the same 30-mm. cannon pack used in the all-weather version. The rest of its armament can be varied for the specific mission, but normally would include air-to-ground unguided rockets in bomb bay trays and under the wings.







Ground attack

CHRISTMAS TREES of air-to-ground rockets festoon the under surface of the Sud Vautour. Note vortex generators on upper and lower surfaces and the large wing fence protruding from the upper surface between the pylons. Rocket pods containing 19 rounds each are part of the armament for the night-fighter version. Package is Type 116 unit built by Matra, French missile and armament firm.

Fire Control Radar

The Vautour N is not yet a completely automatic night fighter. In combat, the plane would be vectored towards the target by ground control. Its own radar would perform the next step of target acquisition. But because the autopilot is not yet tied in to the control loop, the pilot must fly on the visual presentation in the cockpit. The radar determines the range and fires the guns or missiles.

The radar system for the Vautour has been developed in France by the Compagnie Générale de Télégraphie sans Fil (CSF). Complete automaticity of the fire control system is under development and will be installed in later production Vautours.

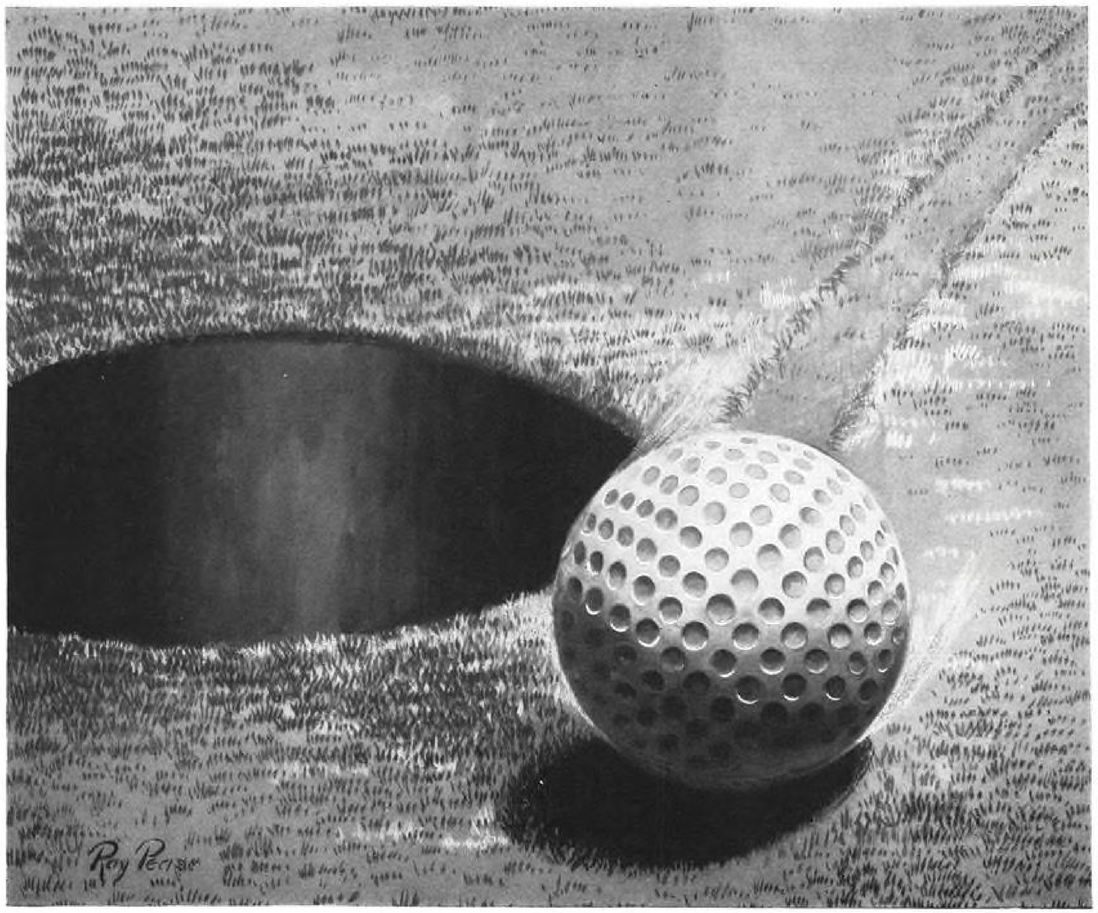
Tests of the radar system in the Vautour began in 1954 and have continued since then. Parallel to that work, firing tests were made with all the standard armament arrangements. Full fire-outs of the cannon battery were made in normal flight, maneuvering and inverted flight attitudes. Rockets also were launched in similar tests. Sud Aviation says that all of the armament trials were highly satisfactory. No problems were encountered with collection of gun gases in the bay. But at Melun-Villaroche, one airplane, which had obviously been used for firing tests, showed weld repairs of large cracks





Bombardement Bomber

GUIDED BOMB B. 10 is Sud Aviation development, was displayed at 22nd Paris Air Show as part of the Vautour armament although the bomb is not yet an operational weapon. Configuration is reminiscent of Azon and Razon bombs used operationally with some success by USAF during World War II.



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in the stainless steel plate surrounding the gun ports.

Bomb runs up to the maximum permissible speed of the Vautour have produced no aircraft buffeting with the bomb bay open, regardless of the type of stores carried. There has been no case of bomb hang-up.

Production Plants

Vautour production is divided among three of the Sud Aviation plants:

• **Saint-Nazaire, near Nantes** on the Bretagne peninsula, is the key plant. Final assembly of the Vautour is done here, and, in addition, the factory makes the forward and mid-fuselage sections. The adjacent airfield at Gron is the flight-test center for the Vautour production program. Factory has about 2,500 employes working in about 750,000 sq. ft.

• **Bouguenais, also near Nantes,** is the source for wings and nacelles. This shop is especially well equipped with machine tools, including spar millers and other heavy production machinery. More than 2,400 people work here and the plant area is about 860,000 sq. ft.

• **Rochefort, farther south** on the Gascony Gulf, produces tail surfaces and aft fuselages. Primary task of this plant is the production of the Djinn helicopter. Factory employs about 800 people, occupies about 280,000 sq. ft. of enclosed surface.

In addition to the three plants of Sud Aviation, subcontractors are also brought into the Vautour program.

Structural Makeup

The bomb bay of the Vautour was probably the deciding factor in laying out the structure of the airplane. The size of this cutout, plus the loads imposed on a light bomber or ground attacker during maneuvering at low altitudes, meant that an exceptionally rugged structure had to be planned.

Consequently the fuselage structure can be visualized as a shell with a flat bottom which forms the upper floor of the bomb bay, wheel wells and armament pack. To this flat bottom are attached the necessary fairings and doors to cover the wheels and bomb bay.

Only four longerons support the shell internally; there are no intermediate stringers.

Wings and tail surfaces are made from large panels of thick skin with stringers attached by metal bonding.

The bicycle landing gear is made by Hispano-Suiza. It retracts fore and aft of the bomb bay. Twin landing lights are mounted on the nose gear. Outrigger gear is mounted in each nacelle. Main gear tires are made by Dunlop, size 32 x 10.00. Tire pressure is 6 kg./sq. cm. or about 83 psi.

Original order for the Vautours was several hundred, but recent economy drives have reduced this number sharply. Observers expect the total order not to exceed the 140 requested in the first production batch. Sud Aviation says that the potential production rate is 15 per month, that the factory is now capable of turning out 12 per month, and that both those numbers are considerably higher than the current required delivery rate.

The Vautour—the name meaning Vulture—started life as a design study in 1951. One of the predecessor firms of Sud Aviation, Sncaso, was the responsible company.

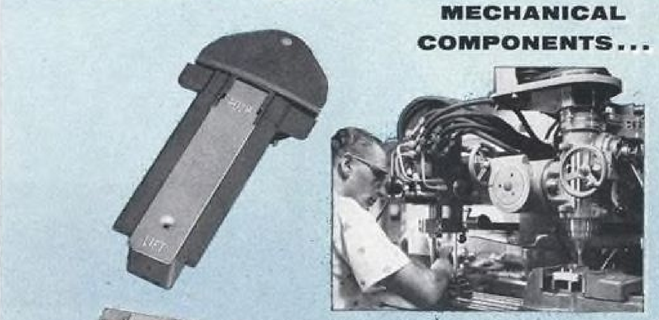
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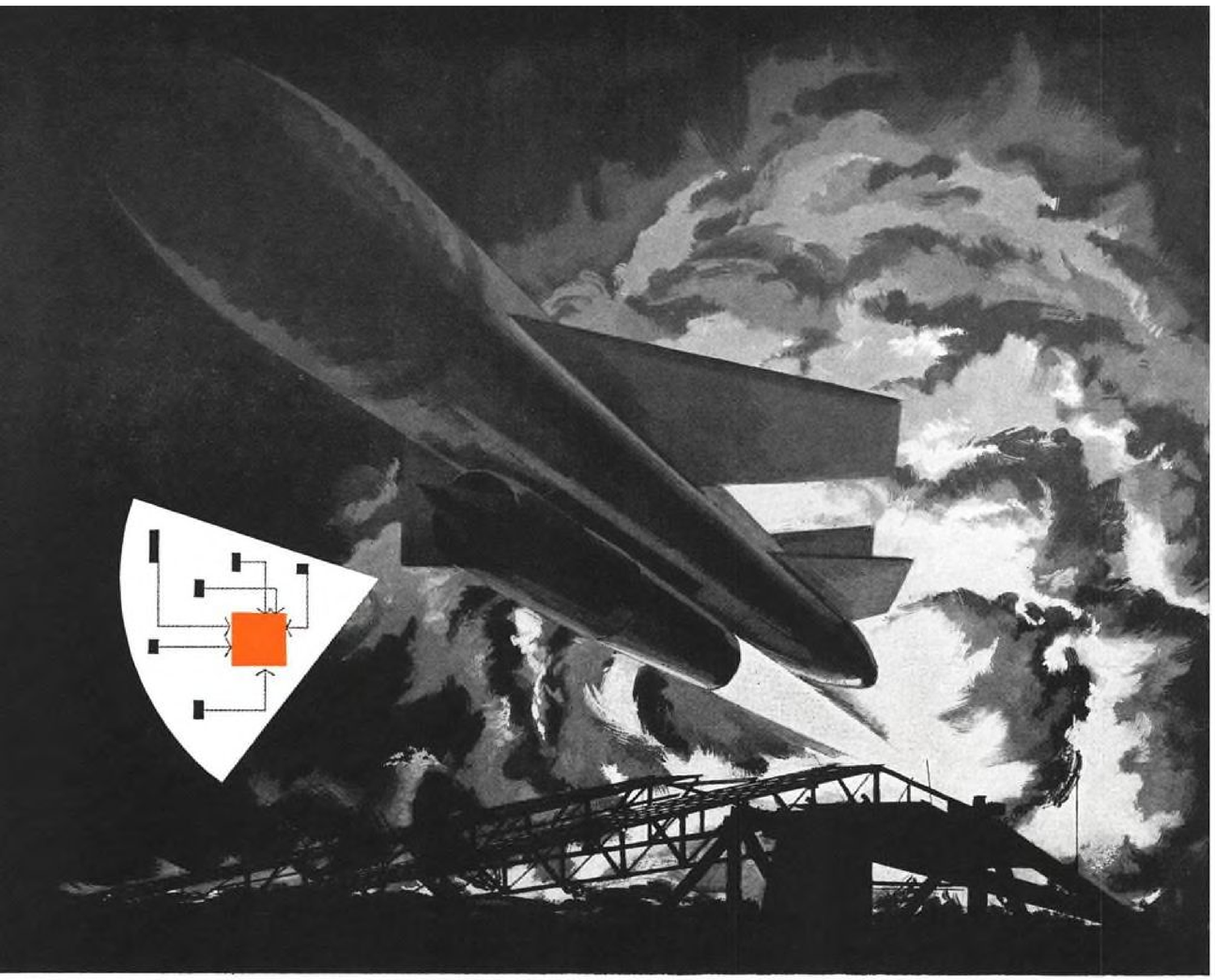
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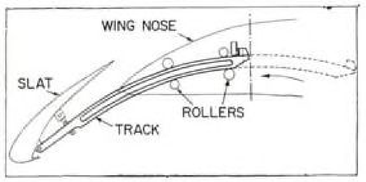
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Titanium Track

Slat track for wing leading edge which Douglas Aircraft, Inc., El Segundo, Calif., Div., engineers designed out of titanium. Compared to the steel part which it was intended to replace, the forged titanium track weighed 44% less, minimized compass deviation, and cost less to produce. The lighter weight reduced the inertia loads on the slat and 20,000 cycles of repeated impact loads showed no cracks or failures. The titanium alloy used was 6A1-4V (six per cent aluminum and four per cent vanadium). It developed a minimum of 150,000 psi. ultimate strength at 13% elongation.

France had no modern bomber force and none was in the offing. There were bomber squadrons which later were to see service in Indo-China, but these were equipped with rapidly aging Douglas B-26 piston-engined bombers.

There had been an abortive attempt to design a jet bomber. The SO. 4000 was France's first postwar jet bomber and it flew just once, on March 16, 1951. It never got off the ground again. Its powerplants were a pair of Rolls-Royce Nenes built by Hispano-Suiza and developing 5,000 lb. thrust each. But the intake ducts were long and the thrust losses were high. Besides, the airplane weighed close to 50,000 lb.

One of its test vehicles, the half-scale SO. M. 2, did fly well. It was supersonic on the power of its single Rolls-Royce Derwent engine rated at around 3,500 lb.

These attempts produced nothing, but were the direct antecedents of the Vautour.

Design studies began in June, 1951, on the Vautour, less than three months after the first-and-only flight of the SO. 4000. The original program for the plane called for delivery of production aircraft starting in the spring of 1956. The schedule, incidentally, was kept.

Construction of the first prototype took 14 months, and it flew for the first time on October 16, 1952. Three prototype aircraft were built, one of each type. These were followed by six preproduction aircraft, of which the first took the air March 18, 1955.

The intervening time was spent in flight testing and in coping with the changes in planned uses of the Vautour. "Every time the Army got a new chief of staff we changed the design," one engineer related.

On schedule, the first production air-

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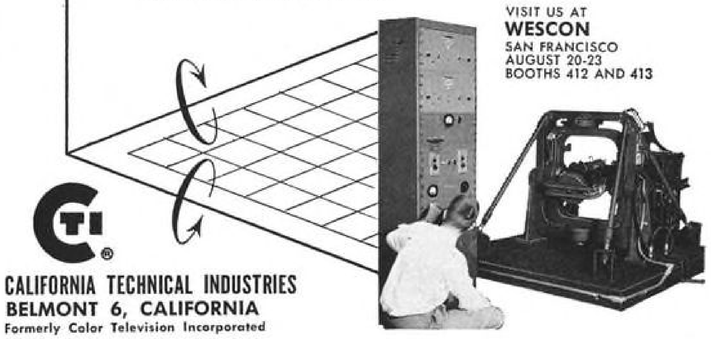
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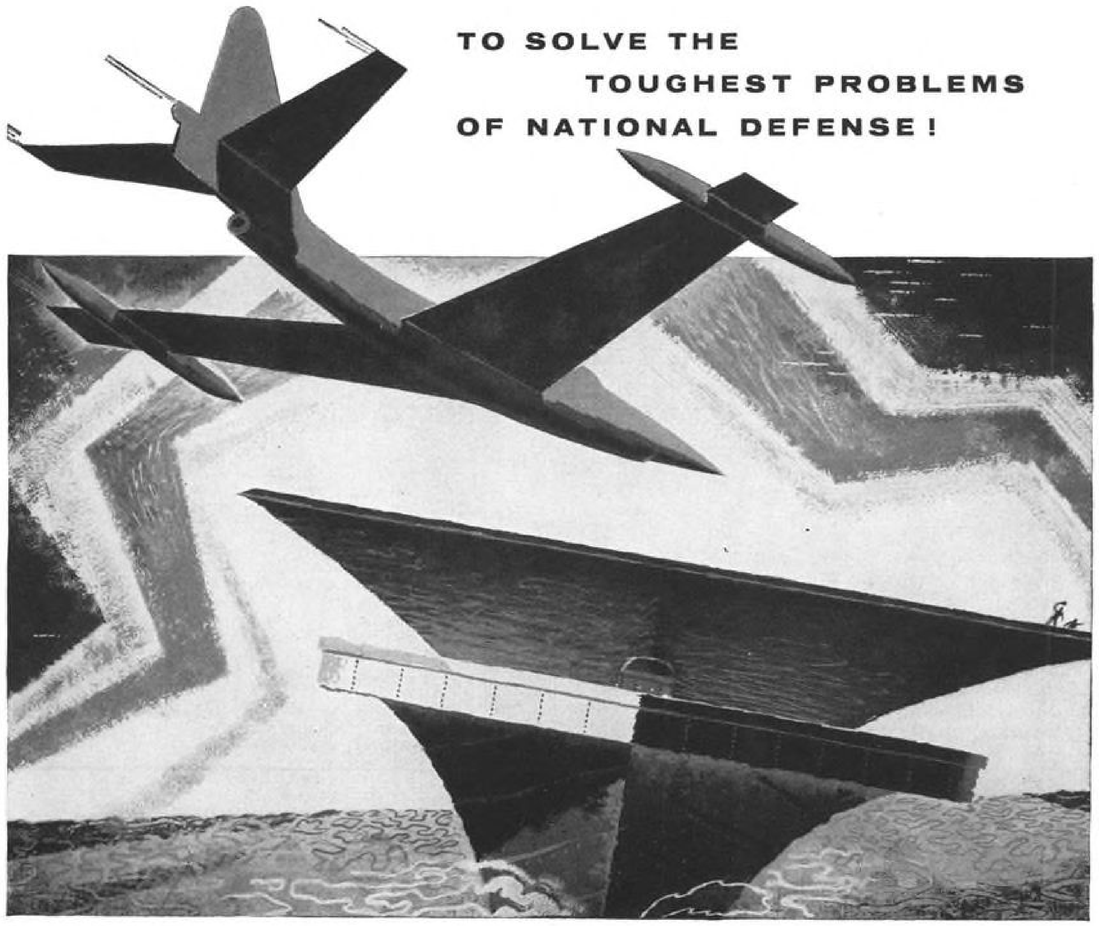
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craft flew a little over one year ago, on April 30, 1956. It was delivered to the military during that spring.

By the beginning of January this year, only nine Vautours had left the factory for the military. The slippage has been attributed to a lot of things: contract stretchout, teething troubles, changes in requirements, changes in the order of delivery of the various types. Whatever the cause, the effect is obvious. France still has no jet bomber force, and its all-weather capability is very low.

Future Versions

Future plans for the Vautour include a missile carrying development and the SO. 4060 Fonceur, sort of a "Super-Vautour." But time is running out fast for the Vautour. Its performance is comparable to the thousands of Russian Ilyushin 28 light bombers now in service all along the hem of the Iron Curtain. By the time it is in full squadron service, it will be obsolescent technically, even though it could make a good showing for itself if war came.

Only two things can now save the Vautour program: A tremendous increase in production rate, or a changeover to a new and more contemporary design. The first depends on funds, like everything else in France. The second depends on funds also, but it is more tied to the political future of France.

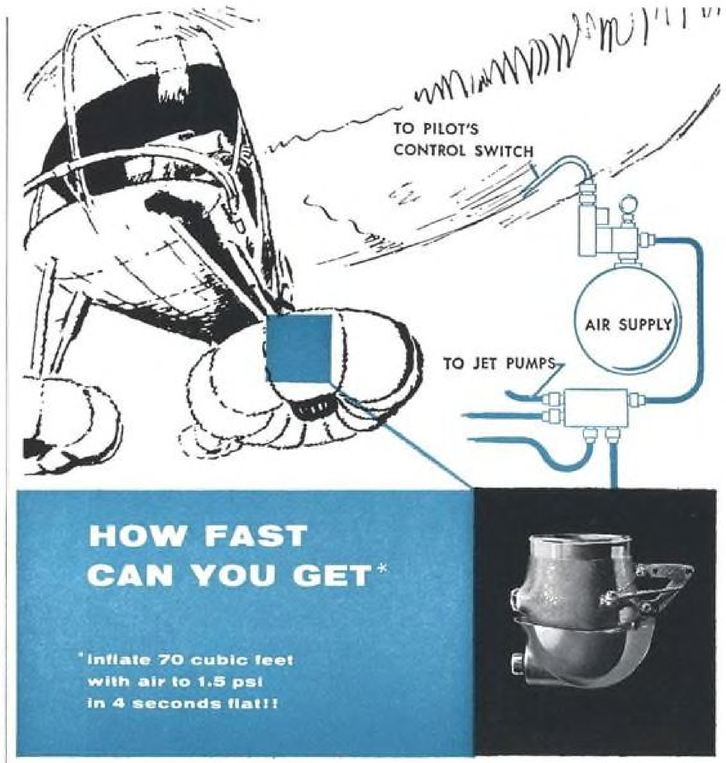
Should the French decide to speed up production, Sud has the capacity. Should they decide to order a new prototype and launch a new program, Sud has the technical ability and the designers to do the job.

Four New A3D Types Planned By Douglas

Los Angeles—Four new versions of the A3D Skywarrior twin-jet attack bomber to extend versatility of this carrier-based plane were discussed by E. H. Heinemann, chief engineer of Douglas Aircraft Corp.'s El Segundo Division, at a meeting of the division's management club. These A3D variations include:

- A3D-2Q fitted with countermeasure equipment and accommodating crew of seven. AVIATION WEEK first revealed plans for this and the A3D-2P (see below) on Apr. 16, 1956 (p. 23).
- A3D-2P photographic plane fitted with 12 cameras and carrying crew of three.
- A3D-2T bombardier trainer fitted with radar bomb sights and navigation gear. Plane will accommodate five trainees and one instructor.
- A3D tanker, which will be a regular production A3D fitted with a special large refueling hose in its bomb bay.

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trainer versions will be production models, with fully pressurized fuselage for high altitude flight. They are scheduled for first flight next year.

Douglas El Segundo's most recent development in bomb racks is the Aero X67A, on which test firings were completed in 26 working days from first drawing release. Rack is to be used with a new 3,200-lb. weapon to be carried in the A3D and other aircraft.

Another development for the A3D is a single-hook 8,600-lb.-capacity shackle, Aero 2A, capable of carrying large atomic bombs.

Not yet specified for any plane is the Aero 3A rack, an experimental unit containing explosive bolts instead of release hooks. Rack also contains a powder-type displacing gear.

For the Office of Naval Research, Douglas El Segundo is engaged in the development of advanced instrumentation, especially for combat aircraft, and has subcontracts with approximately 25 contractors engaged in fields of engineering psychology, physiology and instrument development, Heinemann said.

This equipment in its final form is intended to present on a flat television-type tube a complete synthesized presentation of steering and attitude information, which may look like a "highway in the sky." Coupled with this would be a plan position indicator (PPI scope) on table in front of pilot.

Improved Titanium Still Has Shortcomings

Titanium used in aircraft and engine manufacture is improving in quality but several shortcomings still remain, according to a Cornell Aeronautical Laboratory report.

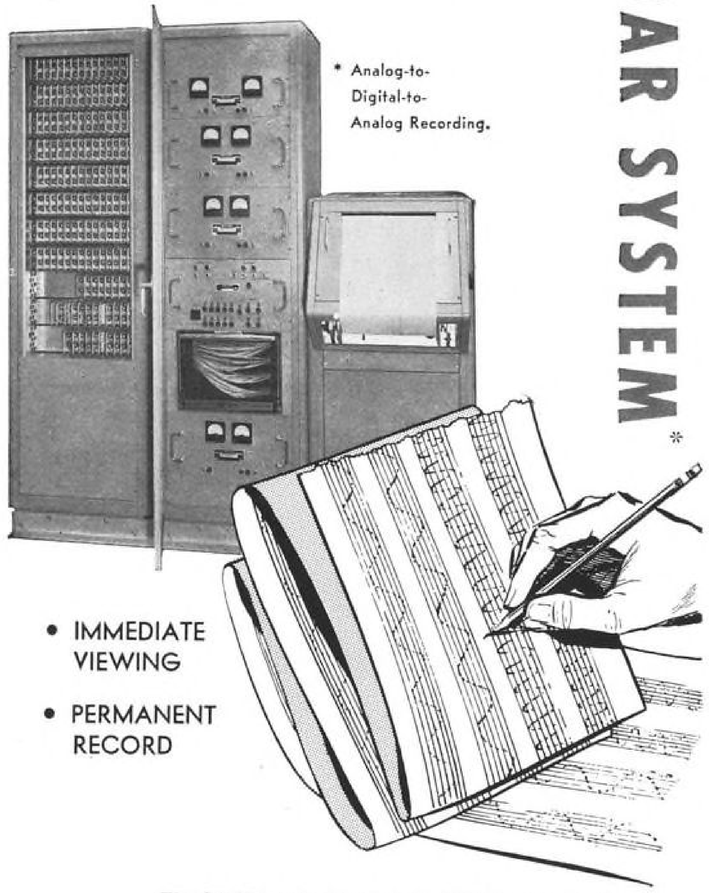
This report presents the results of a survey of manufacturers regarding the mechanical properties, physical condition, and forming properties of the titanium they used in 1956. A similar survey had previously been made for 1953 and was used as a base of comparison for the present report.

Indications are that the quality and uniformity of titanium produced for the aircraft industry has shown improvement in every respect. However, in its current state of development the material often falls short of the manufacturers' requirements in the following areas:

- **Variation** in thickness.
- **Hydrogen** contamination and poor surface finish.
- **Forging** and extruding stability.

The report ended with a recommendation that a standard of surface condition be set by mutual agreement between titanium producers and aircraft manufacturers.

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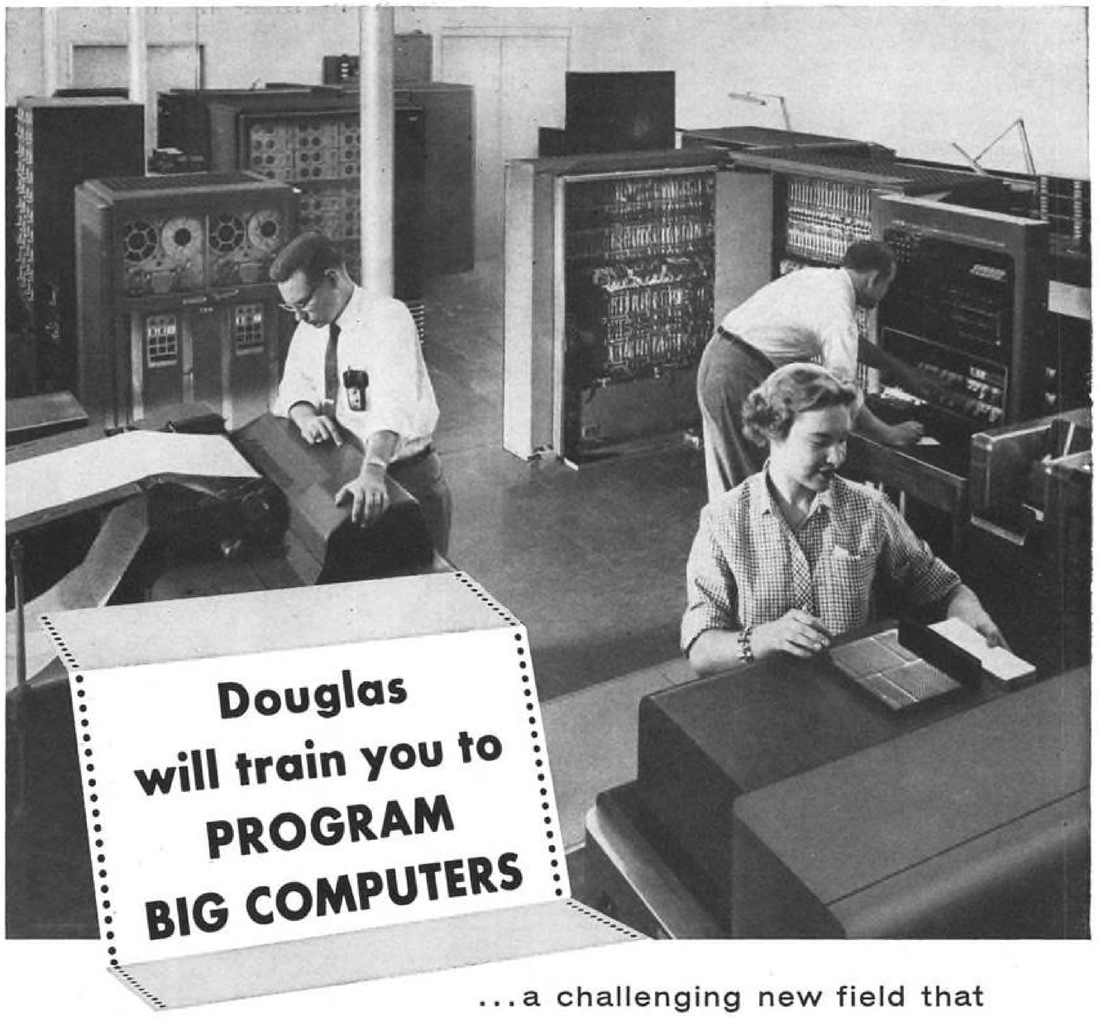
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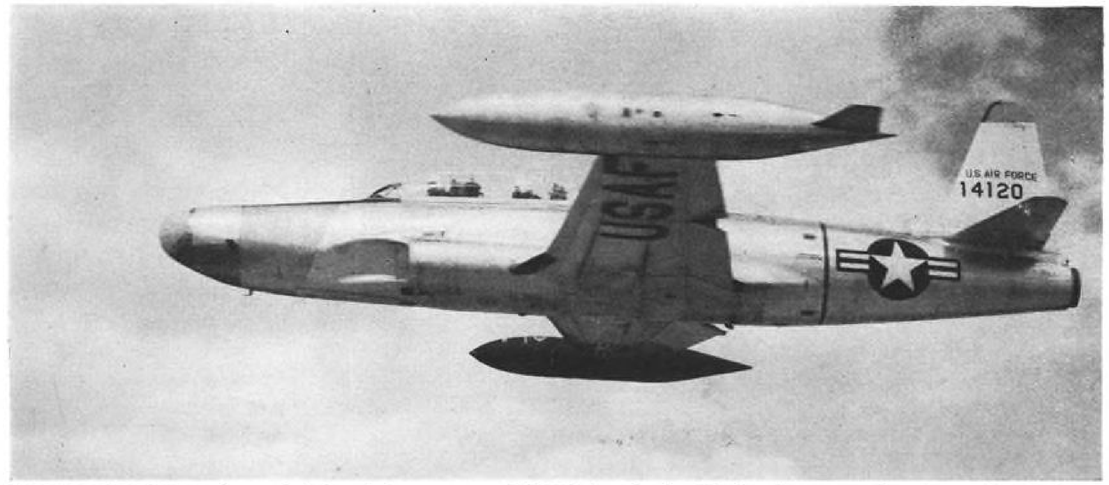
Our computing engineers are involved in every phase of aircraft and missiles work... including many long-range commercial and military projects of vital importance.

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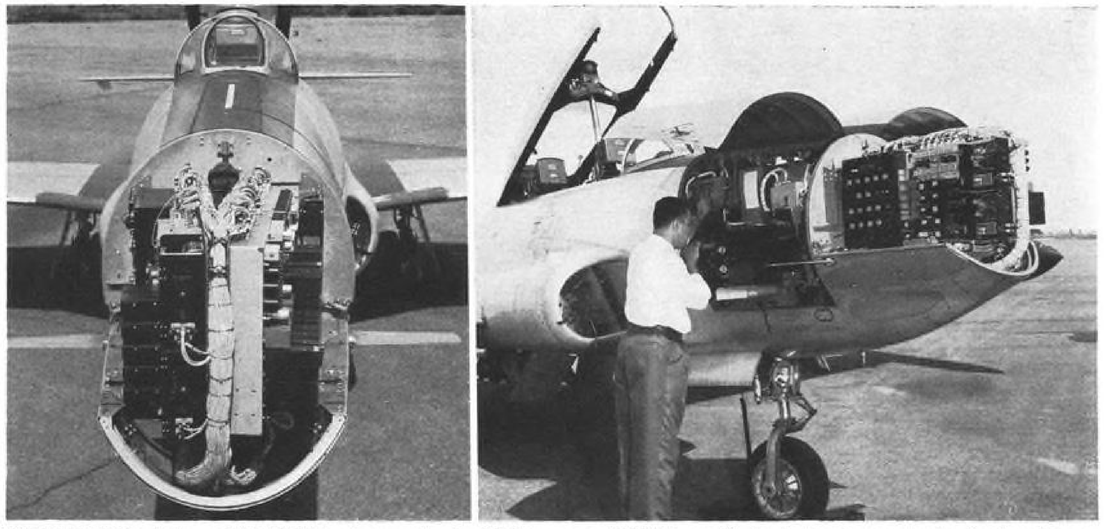
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VARIABLE STABILITY and control airplane is flown as normal T-33 during takeoff and landing by rear-seat pilot. At test altitudes, front-seat pilot flies via airplane's automatic control system. Airplane can readily simulate other aircraft characteristics.



ORIGINAL NOSE of the modified T-33 has been replaced with larger nose of F-94 to provide for electronic components of automatic control system. Control system compares to medium-size analog computer, contains about 250 miniature vacuum tubes.

Cornell's T-33 Simulates Any Jet Plane

By Robert Stanfield

T-33 test airplane that, like its F-94 predecessor, can simulate other jet aircraft in their full-scale flight characteristics and also simulate some new configurations still in the design stage, has been developed by the Cornell Aeronautical Laboratory.

Variable stability and control airplane, equipped with variable system for rudder, ailerons and elevator, is expected to provide answers to stability and control questions well in advance of flight test and under conditions where the test configuration can be readily varied (AW June 3, p. 293).

The earlier Cornell F-94, by comparison, was modified only for variable longitudinal stability and control. Airplane familiarized the test pilot of Convair's B-58 Hustler with that airplane's longitudinal handling qualities long before its first flight.

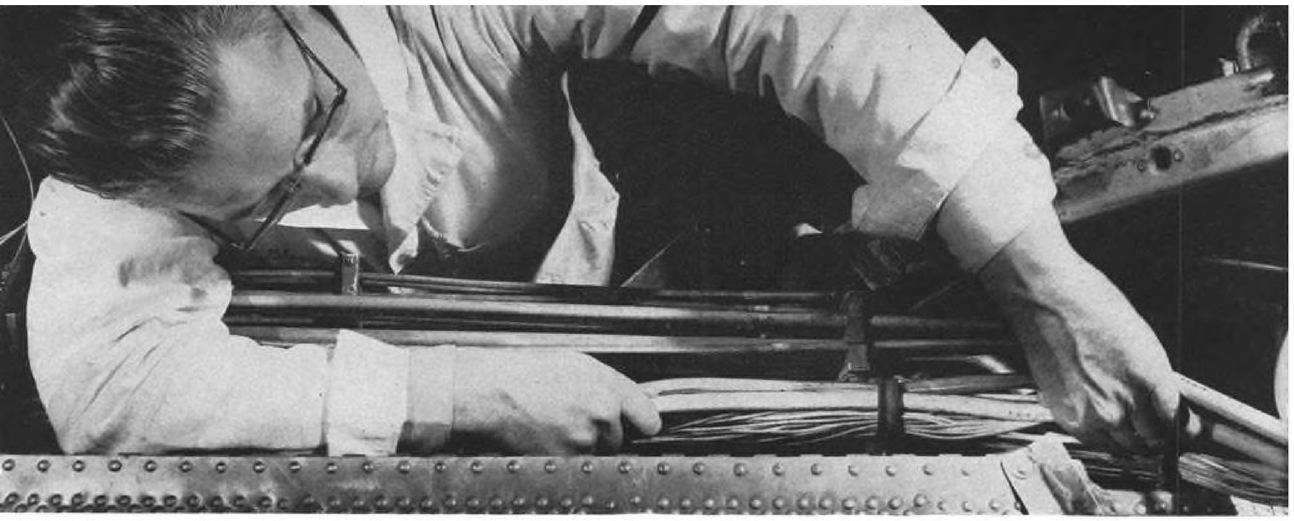
CAL Program

CAL program is sponsored by USAF's Air Research and Development Command. Direct responsibility lies with Aeronautical Research Laboratory of the Wright Air Development Center. Work was initiated in July, 1954. Flight testing commenced early this year.

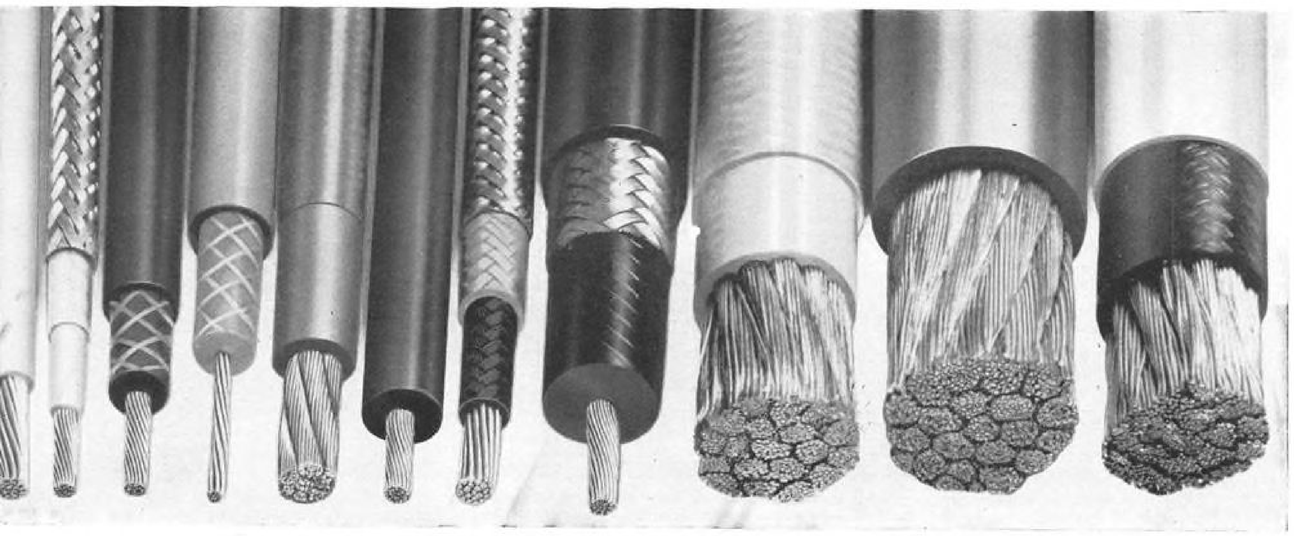
Modified T-33, in which aerodynamic and control system configurations can be tested by changing the settings of 40 miniature gain controls on rear cockpit console, will also aid in solving these military problems:

- **Tracking accuracy,** during short, high-speed target runs. Ease of tracking depends on stability and control characteristics.
- **Cockpit control design,** in which airplane's handling characteristics would be matched to pilot. Better design could make more accurate tracking of target possible.

The flight-testing T-33 makes it possible to vary the important parameters



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Insist on Packard Electric cable—standard of the industry! Aircraft manufacturers use it on the new planes and you can use it, too, when wiring engines, lights, radios and any other part or accessory requiring electricity.

You'll find Packard Electric cable is easy to strip and handle. You can run it through small holes without injuring insulation. You can flex it, heat it, cool it—use it under most every conceivable condition of temperature and altitude. And though small in diameter, class for class its abrasion resistance is unsurpassed.

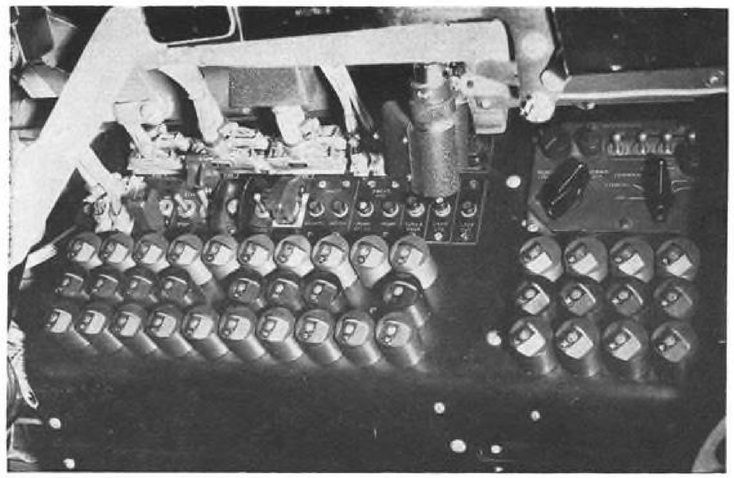
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Warren, Ohio — GM GENERAL MOTORS

"Live Wire" division of General Motors



AUTOMATIC control console in rear cockpit of T-33. During flight, or before takeoff, pilot can set up desired "airplane" through these 40 gain controls on console.

—wing span, tail area and moment of inertia—independently and freely.

Varied Simulations

In its simulation of other airplanes, the T-33 easily can be set up to simulate the undesirable characteristics. These can be varied quickly to spotlight promising approaches to a problem.

Handling characteristics of airplanes still in design stage can be simulated and tried out well in advance of initial flight tests. If need be, design can then be oriented toward suitably revised criteria.

Easily simulated, for example, is the supersonic fighter situation wherein the airplane tends to have low moments of inertia in roll compared to the moments of inertia about pitch and yaw axes.

The T-33 is adaptable to research in cockpit control design. This includes not only physical design, but type of aircraft response to control pressure.

Effective gearing ratio between stick movement and elevator angle can be varied over wide ranges. Automatic turn coordination can be provided. Instead of a rolling velocity, a steady bank angle may be obtained in response to steady lateral stick deflection, etc.

Here's how airplane operates:

• **Airplane is flown** as normal T-33 during takeoff and landing by rear-seat or "safety pilot." Circuits, controls and switches related to its normal functions have been modified to make it more fully a "solo" airplane from the rear.

• **At test altitudes,** front-seat or "evaluation pilot" flies via airplane's automatic control system. However, open bypasses around servopistons allow safety pilot to move controls during all phases of flight.

• **Original nose** of the T-33 has been replaced with larger nose of F-94 to provide for electronic components of automatic control system. These are also installed in cockpits, wheel wells, wings, plenum chamber (ahead of engine) and tail surfaces.

• **Safety pilot sets up** desired "airplane" before automatic control system is engaged. This can be done before takeoff; it can also be changed during a flight through the 40 gain controls on his console.

Control Settings

The setting of each gain control is visible to the pilot through a small window and is presented as two digits. Pilot may select any setting between 00 and 99. Numbers greater than 50 equal "positive" gains. Numbers less indicate "negative" gains.

Elevator, aileron and rudder controls in the front cockpit are mechanically disconnected from their respective control surfaces.

They are connected instead to three separate electro-hydraulic servomechanisms.

His "artificial feel" system has been designed so that either conventional stick or a wheel and column may be installed, as necessary.

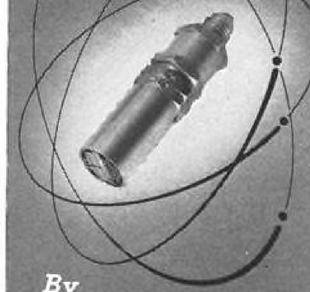
A fourth set of control surfaces, auxiliary surfaces, has been added to the nose of the airplane.

Electrical pickups installed on controls sense both forces applied by pilot and amount he has displaced the controls.

Signals from these transducers are then amplified and either the force or the displacement signal may be selected as the command to the appropriate control surface servo. Servo then moves control surface.

Eleven of the 40 gain controls are

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24 models for various applications from 1 to 6000 psi

The one shown is:

MC 1613 VALVE—RELIEF

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FLUID: Air or Nitrogen
PRESSURE RANGE: 500 to 3800 psi
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FLOW: 4 SCFM
INLET PORT: Per AND 10056-4
OUTLET PORT: Free to atmosphere
INTERNAL LEAKAGE: Zero
EXTERNAL LEAKAGE: Zero
ENVELOPE: .75 hex x 3.01 inch
WEIGHT: .12 lbs.
SETTING: To customer requirements
MILITARY SPECIFICATION: Applicable paragraphs of MIL-P-5518 and MIL-P-8564

Hydraulic and Pneumatic Components for the Aircraft Industry

VALVES OF ALL TYPES: Relief • Solenoid • Manual Control Transfer • Shuttle • Brake • Control • Fluid • Pressure Reducing Restrictor and Special

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related directly to the "artificial feel" system.

Other 20 affect signals which are produced by linear and angular velocities and accelerations and which are used to alter airplane's response and stability characteristics.

Control Inputs

These signals are generated and modified in a variety of instruments, including accelerometers, rate gyros, and altitude gyro and a pressure-monitoring servo system.

There are also three instrument-type servo systems, two of which respectively multiply and divide various signals by dynamic pressure while the third generates a special function of the bank angle.

Here are the total number of inputs available for each control surface:

• **Elevator will respond** to any one, or combination, of: pilot's elevator command, pitching velocity, pitching acceleration, angle of attack, rate of change of angle of attack, non-linear function of bank angle.

• **Auxiliary surface** will respond to any one, or combination, of: rate of change of dynamic pressure, incremental dynamic pressure divided by dynamic pressure.

• **Aileron will respond** to any one, or combination, of: pilot's aileron command, rolling velocity, rolling acceleration, yawing velocity, yawing acceleration, angle of sideslip, rate of change of angle of sideslip, bank angle, pilot's rudder command.

• **Rudder can be made** to respond to: pilot's rudder command, yawing velocity, yawing acceleration, rolling velocity, rolling acceleration, angle of sideslip, rate of change of angle of sideslip, product of angle of attack and rolling velocity, product of angle of attack and pilot's aileron command, pilot's aileron command.

Record System

Airborne recording system monitors performance and calibrates system in flight. "Sampling switch" records on one galvanometer position of every gain control and switch in the system which the pilot may use.

Electrically automatic control system compares to medium-size analog computer. It requires slightly more than 2 kva. of primary power, contains about 250 sub-miniature and miniature vacuum tubes.

Plane power requirements are about 750 ma. at 250 vdc.

Fifteen choppers are used in the automatic control system and 20 in the recording system. Entire system employs 400 cps., suppressed carrier information with phase sensitive demodulators.

Linear-motion position transducer, employed for servopiston feedback on each of the six hydraulic servos, is an inductive-type device developed for this system by Cornell. Every control surface position is sensed by a synchro, every multiplication and every instrument-servo system employs a synchro for position feedback.

Every flight parameter, whether a pressure, an angular velocity or a linear acceleration, is sensed by an instrument employing an inductive pick-off.

Fail-Safe Features

Design necessitates fail-safe features. Circuits will automatically disengage system if control surface servo error signals exceed a predetermined value, or if normal or lateral acceleration of the airplane reaches pre-set limits.

Check valves, connected across servopistons, limit maximum tail loads which automatically controlled surfaces can produce.

Because of lack of nose space, airplane utilizes new type of hermetically sealed, nickel-cadmium battery which is installed in engine compartment.

Estimates are the USAF programs already proposed for study in flight may take seven years to reach completion.

SAC Silver Jubilee Newsreel

BY JACK PATTON



AC, Aeroquip Corp., A.P. Parts Co., Bendix Products Div., B.F. Goodrich, Canadian P & W, A. Delco-Remy, Eclipse-Pioneer, Glidden Co., Gould Nat'l Batteries

HALLOWED GROUND

Here, where SAC gained fame as business flying's "Biggest Service Station", the city of Dallas now has built a great new airline terminal. In a sense, this is "hallowed ground" —we trust the mighty airliners treat it kindly!



Grimes Mfg. Co., Hamilton Standard, Lycoming, Montrose Div. (Bendix), New York Air Brake, Pacific Div. (Bendix), Packard Electric, Pesco

PLUSH!

Across the field, SAC is building an air-conditioned terminal of its own—plushest in the land. From its elegant lobby, to its beautiful lounges, and flight operations room, here is dynamic proof that business aviation Has Arrived. It will open this fall—and **you** are invited.



Pioneer Central Div. (Bendix), Pratt & Whitney Aircraft, Red Bank Div. (Bendix), Scintilla, Skinner Div. (Bendix), Utica Div. (Bendix), and Willard Batteries

1932 A QUARTER CENTURY OF LEADERSHIP 1957

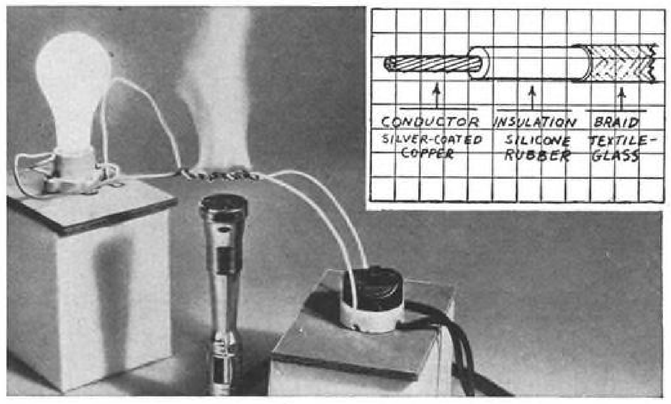
Southwest Airmotive Co.

LOVE FIELD DALLAS

DIVISIONS: KANSAS CITY, KANSAS / DENVER, COLORADO

HOW TO SOLVE AIRCRAFT AND COMPONENTS DESIGN PROBLEMS WITH GE SILICONE IDEAS

AIRCRAFT WIRE



Problem: *Find a high-temperature aircraft wire that protects itself—and the crew.*

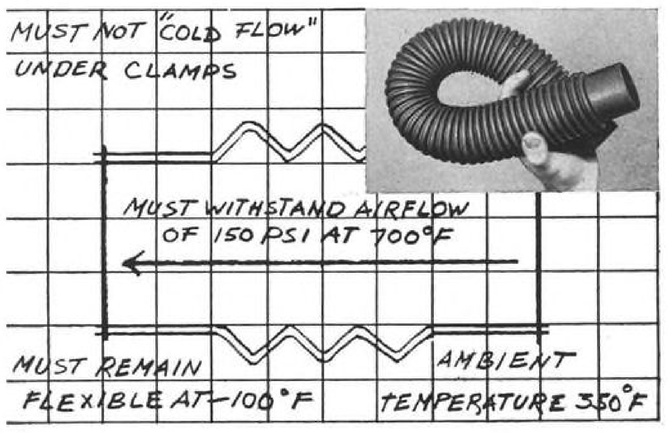
Solution: Wire made with G-E silicone rubber insulation.

Exposed to an 1800°F flame for hours, G-E silicone rubber insulation still insulates, forming an ash of silicon dioxide, an excellent non-conductor. No toxic fumes are released, nor will it shrink and expose the wiring, as the laboratory experiment on the left shows. Silicone rubber has superior dielectric strength at high temperatures and keeps it for years. It stands up well to oil and fuel splashes, has low water absorption. It is highly flexible down to −75°F.

Check into the specifications for silicone rubber aircraft and ignition wire, for it costs little more than standard wire, and much less than other high temperature wire.

Technical literature and names of qualified wire and cable manufacturers are available on request.

HOT AIR DUCT

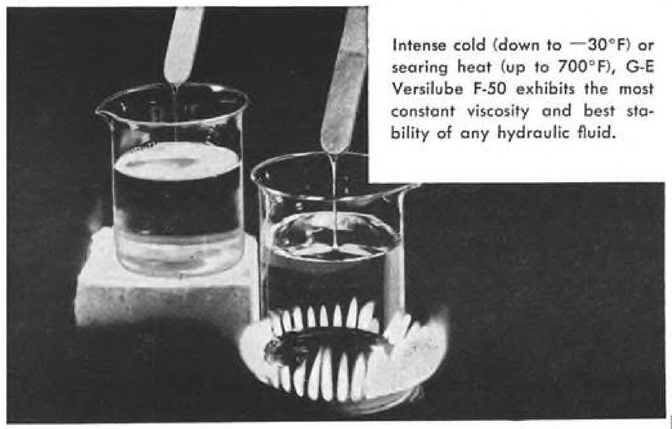


Problem: *Design a flexible duct capable of resisting flames, which will carry air at 700°F.*

Solution: Specify G-E Class 700 silicone rubber.

Problems like this in aircraft de-icing, engine-warming and cabin-heating ducts are being successfully solved with General Electric's improved Class 700 silicone rubber. With a service range from −120° to 600°F ducts made of G-E Class 700 resist prolonged heat at 600°F and can carry air up to 700°F. Tests prove good resistance to common aircraft fuels and lubricants, including MIL-L-7808. Ducts and duct connectors made from G-E Class 700 silicone rubber exhibit low compression set—will not "cold flow" under clamps. And with improved flame resistance, Class 700 is proving to be the ideal material for all flexible hot air duct applications. Special G-E silicone rubbers are available for almost every application. Technical data on request.

HYDRAULIC FLUID



Intense cold (down to −30°F) or searing heat (up to 700°F), G-E Versilube F-50 exhibits the most constant viscosity and best stability of any hydraulic fluid.

Problem: *Find a hydraulic fluid that functions over the −30°F. to 700°F. range needed for future aircraft.*

Solution: *Versilube F-50*, General Electric's new silicone fluid, with the best performance over this range of any hydraulic fluid now available.

Over the −30°F to 700°F range, *only* General Electric's new silicone fluid, Versilube F-50, provides adequate performance in all these areas: thermal stability, lubricity, viscosity-temperature coefficient, oxidative stability, oxidation threshold temperature and hydrolytic stability.

No other serviceable hydraulic fluid matches the thermal stability of G-E Versilube F-50—up to 600°F and for many applications, up to 700°F. Its lubricity is unequalled at temperatures as high as 700°F and comparable to other hydraulic fluids in the moderate ranges. Versilube F-50 also maintains a more nearly constant viscosity than other hydraulic fluids over the −30°F to 700°F.

For more information about Versilube F-50 and other G-E silicone fluids, send the coupon below.

Write for more information . . .

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Please see that I receive all available information, plus names of manufacturers, of: ☐ aircraft wire ☐ hot air ducts ☐ silicone fluids for mechanical applications. ☐ I also want data on:

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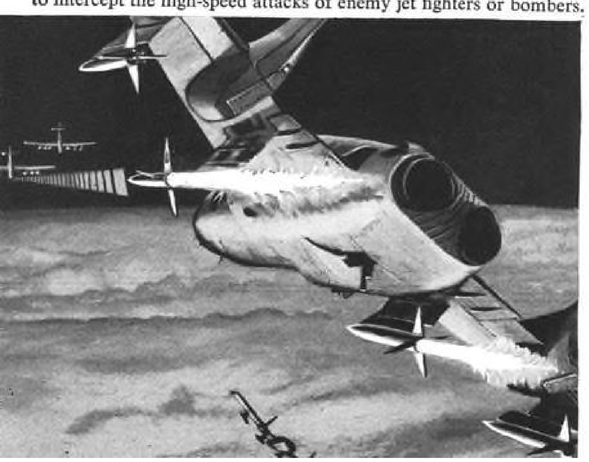
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THE STORY BEHIND THE STORY



LAND POWER takes on new offensive strength by employing surface-to-surface missiles to pinpoint retaliatory blows against aggressors and destroy selected land targets.

AIR POWER is made more formidable by use of air-to-air missiles to intercept the high-speed attacks of enemy jet fighters or bombers.



SEA POWER is strengthened and its range extended by surface-to-air missiles designed to intercept attacking aircraft far from our shores.



MISSILES:

On their precision may rest
the fate of the world

No matter how many missiles a nation builds, no matter how much they cost, the effort is useless if they fail to deliver a warhead squarely on the target. On the other hand, the nation possessing missiles of known precision has one of the greatest powers on earth to prevent wars. No aggressor could afford the swift and deadly retaliation such missiles assure.

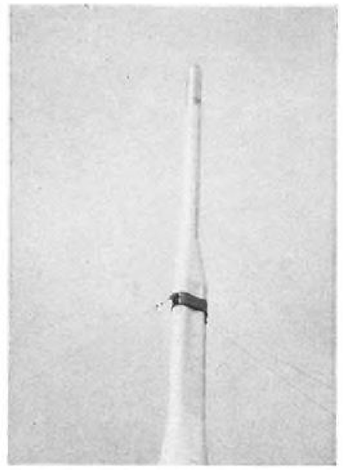
Whether a missile is designed to intercept a bomber at short range — or demolish a target in another hemisphere — its effectiveness depends to a large extent on the performance of the gyroscopic, electronic, hydraulic and mechanical systems which guide it. With new missiles capable of reaching 5,000 mph within *seconds* after blast-off, these ultra-sensitive components must survive violent stresses and hold the missile on its true course to the exact moment of impact.

Through the foresight of America's military strategists our missiles now constitute a strong power in maintaining world peace. Our immunity to attack will continue, however, only so long as their precision remains superior. Sperry's contributions to our missile program range from instrumentation and components through major subsystems like radar and inertial guidance, to complete missile weapon systems and automatic checkout equipment.

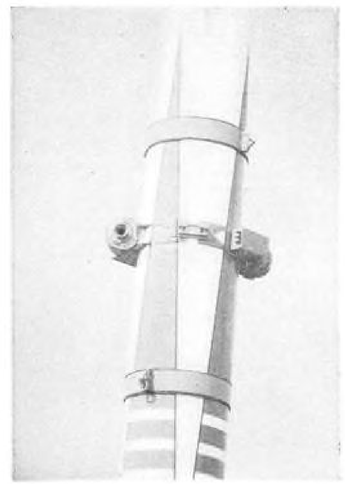
SPERRY GYROSCOPE COMPANY
Great Neck, New York
DIVISION OF SPERRY RAND CORPORATION



SUPER SHEEN is put on blunt nose cone similar to those carried aloft by X-17 vehicle.



BLUNT NOSE CONE at tip of 40-ft. X-17.



SPIN MOTORS provide stability at takeoff.



LAUNCH TABLE aims missile properly.

Various Missile Test Nose Cones Survive Re-Entry in X-17 Program

Numerous ballistic missile test cones have made successful re-entries into the dense atmosphere from altitudes of hundreds of miles using Lockheed X-17 missile as their vehicle.

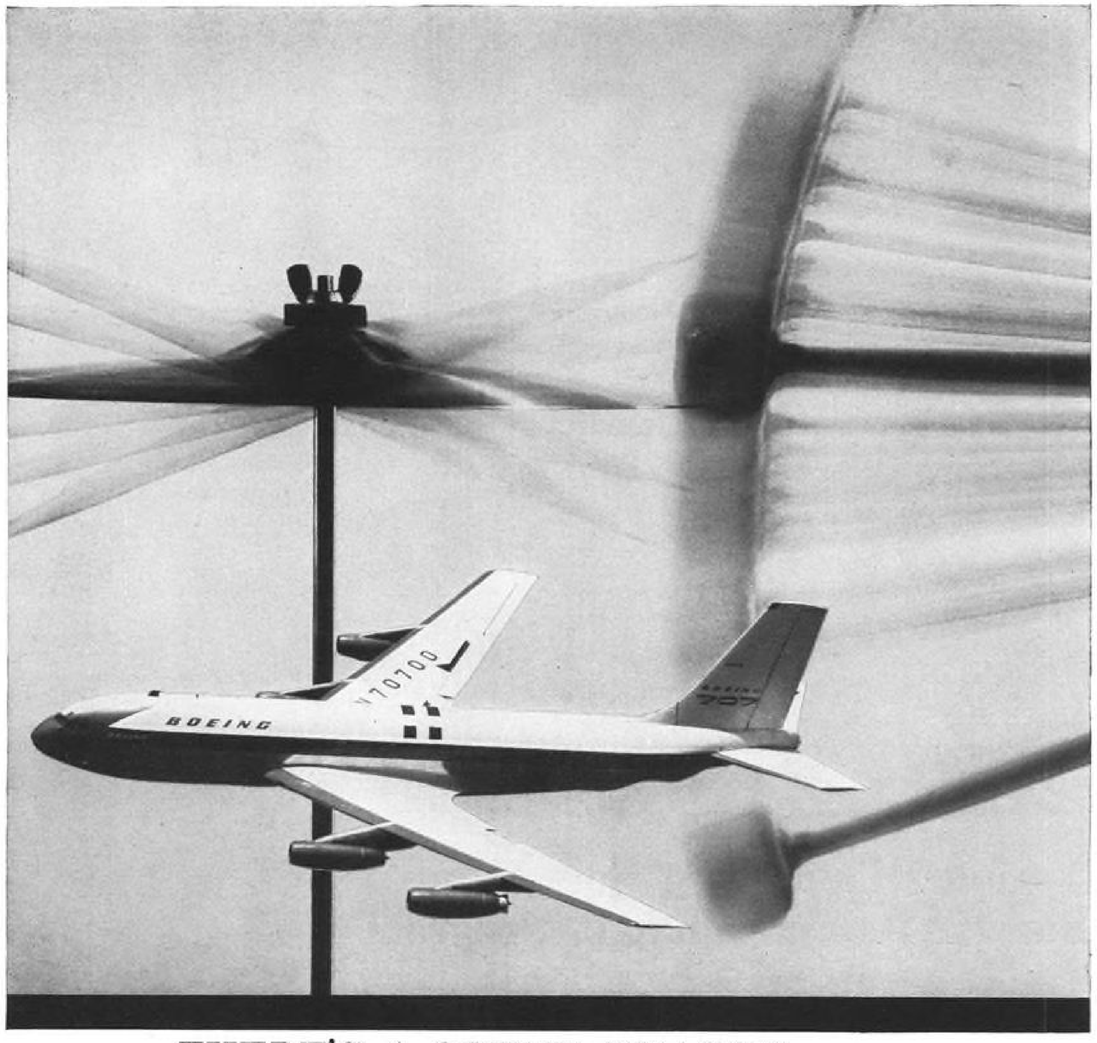
Techniques and materials used in these nose cones are still highly classified, but extremely high degree of finish required is evident in photo of a cone similar to those which have been used in trials.

X-17 Record

Shown publicly at recent Andrews AFB, Washington, D. C. air show for first time in conjunction with Air Force Assn.'s annual convention there, the X-17 has flown successfully in 92% of all launches and has performed 70% perfect missions of all launches, according to Maj. Gen. Bernard A. Schriever, head of ARDC's Western Development Division, which oversees the USAF ballistic missile program.

Three-stage test missile is the largest and most powerful vehicle in existence using all solid propellants, Lockheed states. It is 40 ft. tall, uses Thiokol Chemical Corp. rocket motors. X-17's flight program is as follows:

- **First stage** is a single motor that blasts the six-ton X-17 off its launching pad at an angle and develops thrust equivalent to 500,000 hp. in a few seconds. Small rocket motors shackled on the missile (center photo, left) are fired on takeoff to provide spin stability. The test vehicle assumes a looping trajectory, coasting up to peak altitudes in the ionosphere where it drops tail first until air is sufficiently dense to turn it nose down. First stage is ejected and the X-17 begins its crucial work.
- **Second stage cluster** of three Recruit motors is ignited and in a few seconds develops more than 1.5 million horsepower, accelerating the missile through dense atmosphere. Then the second stage is dropped.
- **Third stage** with nose cone then is fired driving the X-17 downward at maximum velocity, building up extremely high temperatures needed for

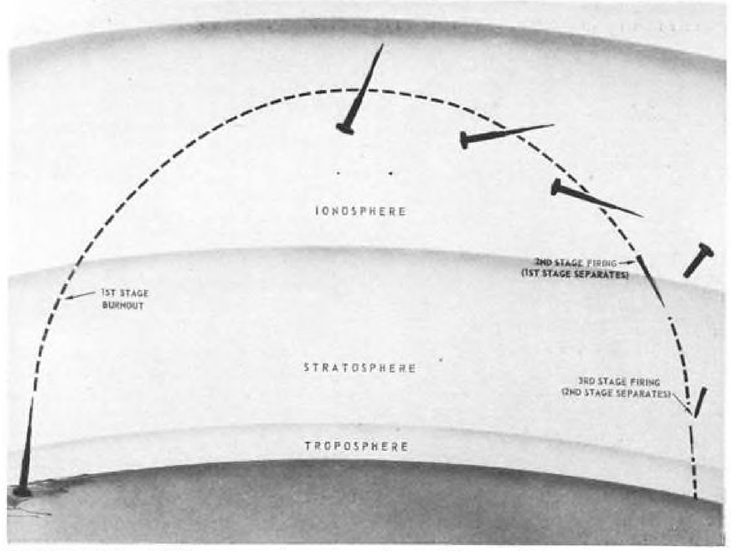


THERE'S A SOUND REASON FOR HEXCEL HONEYCOMB IN THE BOEING 707

THE PROBLEM: The wing's trailing edges, including control surfaces and tabs, are subject to high sound levels created by the exhausts of powerful jet engines. Ordinary structural materials could not resist damage from these acoustics. **THE SOLUTION:** Hexcel Aluminum Honeycomb with its high, inherent rigidity-to-weight ratio is completely resistant to acoustical bombardment. Boeing designers and engineers, working with research and engineering data supplied by Hexcel's laboratories, were able to build these structures–structures which resist acoustical stress, yet are light weight. The 707's tail surfaces have similar Hexcel Honeycomb parts. Hexcel's research facilities and sales-engineering staff are at the aircraft industry's immediate service.

HEXCEL® PRODUCTS INC.
America's leading producer of honeycomb core materials
951-61st Street, Oakland 8, California

PLANTS: OAKLAND, BERKELEY, CALIF.; HAVRE DE GRACE, MARYLAND • SALES OFFICES: INGLEWOOD, CALIF.; FORT WORTH, TEXAS; NEW YORK CITY, N.Y.



TRAJECTORY of X-17 shows various stages along flight at which rocket motors stages are fired and discarded. It has reached over 600-mi. altitudes and traveled more than 700-mi.

evaluation of the ballistic missile test cone.

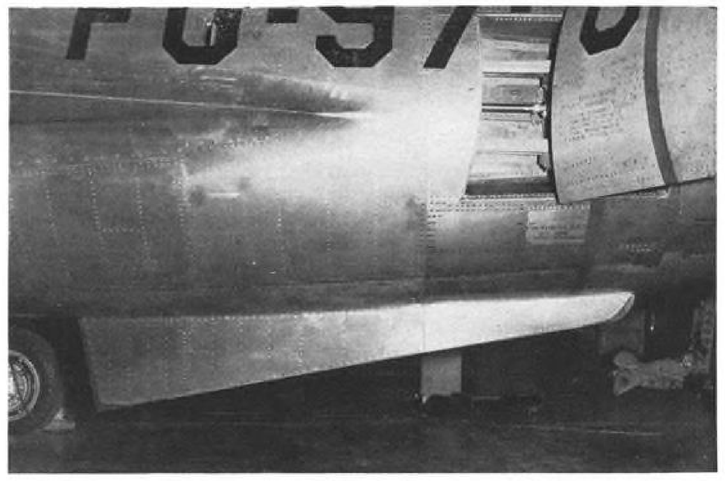
X-17's flight takes a little more than six minutes and data on velocity, acceleration, heat and other conditions are constantly telemetered to ground stations.

Lockheed X-17 test vehicle was designed and built by the company's Missile Systems Division, Van Nuys, Calif. Firings are made at USAF's Missile Test Center, Cape Canaveral, Fla. (AW Feb. 4, p. 26; April 22, p. 31).

Satellite Will Be Ready For Launching

Ft. Worth, Tex.—Earth satellite is ready to be launched any time that its launching vehicle is ready, according to Robert C. Baumann, chief of the satellite structures group of Project Vanguard.

Several satellite prototypes already have been tested, Baumann told a meeting of the Texas section of the Institute



Ventral Fin Stabilizes F-104A

Lockheed F-104A Starfighter at Andrews AFB for USAF's Golden Anniversary air show was fitted with ventral fin to provide additional directional stability at high Mach numbers (AW Feb. 11, p. 23). Chord of fin is 5 ft. and it is 8 in. in span at forward edge, tapering to about 3 in. Fin also could provide added stability at high angles of attack at low speeds when vertical stabilizer is partly blanked out. Actuator and part of open speed brake are visible at top right.



PUMP PRIMERS

by
Arthur A. Nichols

Gerotor multiple element oil and scavenge pumps find increasing application as temperatures and pressures rise in the newer jet engines.

The rather unusual qualities of the Gerotor pump which have kept it intimately associated with aircraft pumping applications from the days of the earliest superchargers for reciprocating engines, can best be summed up as *inherent adaptability* and *high reliability.*



Fig. 1
Multiple Element Lube and Scavenge Pump

• **Engineers find the Gerotor pump most attractive** because there are several convenient variables that can be adjusted to meet the application requirements: Gerotor *diameter* which governs the area of the pumping chamber, Gerotor *thickness*, which, taken with area, determines *unit volume* per revolution and *RPM*. Thus, it is possible to vary the diameter, length and speed of the pump elements to secure wanted capacity. In addition, the porting of this type of pump is completely flexible in location, making for ease of fitting adaptability to the available space and geometry of the engine structure.

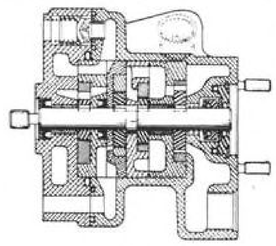
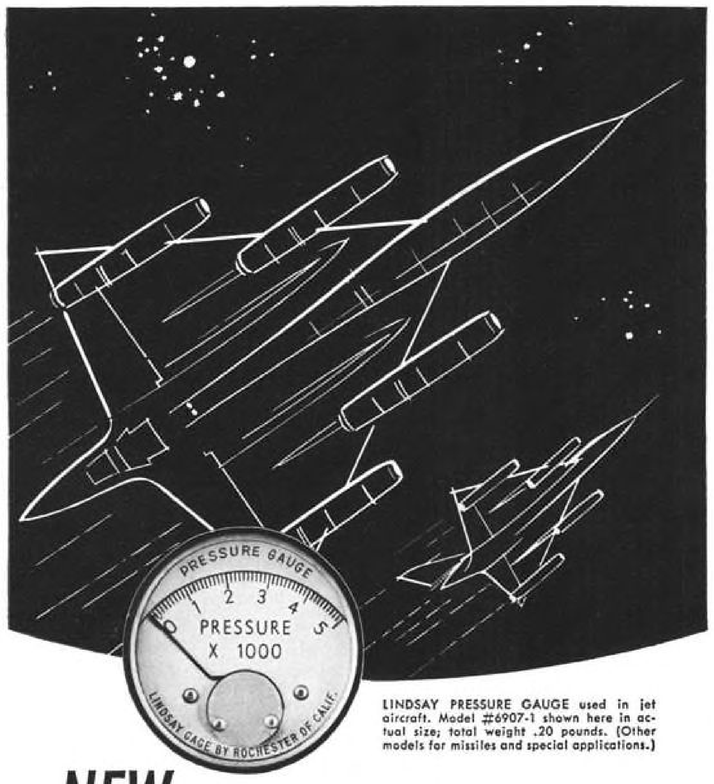


Fig. 2

• **The two parts which make up a Gerotor element are mounted on a single, common shaft** and this structure permits stacking a number of pumping elements along the shaft in a common housing. By providing each set with a separate, fluid tight compartment and inlet and discharge ports, lubricating, scavenging and booster services having the same or different capacity requirements can be combined in a single pump with maximum efficiency. (See Fig. 2).

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LINDSAY PRESSURE GAUGE used in jet aircraft. Model #6907-1 shown here in actual size; total weight .20 pounds. (Other models for missiles and special applications.)

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The RMC-Lindsay Gauge is a bourdon tube type, using a multiple coil, helical bourdon tube with the pointer attached directly to the end of the coil. The life of the Lindsay helical bourdon coil, as compared to the traditional "C" spring bourdon gauge, is more than 10 times greater and its proof pressure limits are increased by a factor of 3 or 4. The helical bourdon tube also eliminates the use of linkages and pivots, improving the gauge's shock resistance by a factor of 5 or 10.

The helical bourdon element is, of course, not a new development. However, the RMC-Lindsay techniques in coiling, heat treatment, calibration and material specifications *are* new—and exclusive with RMC.

Whatever your high pressure gauge problems may be, why not let RMC engineering skill provide the answers. Write to either of the below addresses, outlining your particular requirements.

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LINDSAY PRESSURE GAUGES

of the Aeronautical Sciences. The launching vehicle still is undergoing tests.

Baumann said that initial launching probably will be next spring.

While prototypes have been tested, the final article has not yet been built because the life of some of the shell material is not great, and Project Vanguard engineers don't want to finish the satellite too far in advance of launching.

Three stage launching vehicle will boost the satellite to a speed of 18,000 mph. at its orbit height of 300 miles, where it will orbit for anywhere from two or three weeks to seven to nine years, according to various estimates, Baumann said. Because of magnetic damping, the orbiting satellite will lose approximately one third of its speed every 10 days.

Baumann said the satellite's orbit may range between 200 miles and 1,400 miles from the earth. If the satellite comes within 100 miles of the earth, it will stop orbiting because of the higher density of the air at that altitude.

Baumann said that an error of two degrees during the launch is enough to throw the satellite vehicle off its planned cycle of operation. The launching vehicle will be armed with a self-destruct device.

Pointing out that it takes 1,000 lb. of vehicle to lift each pound of the 21.5 lb. satellite, Baumann said the launching rocket combination is powerful enough to rise 8,000 miles if fired straight up instead of on an orbital course.

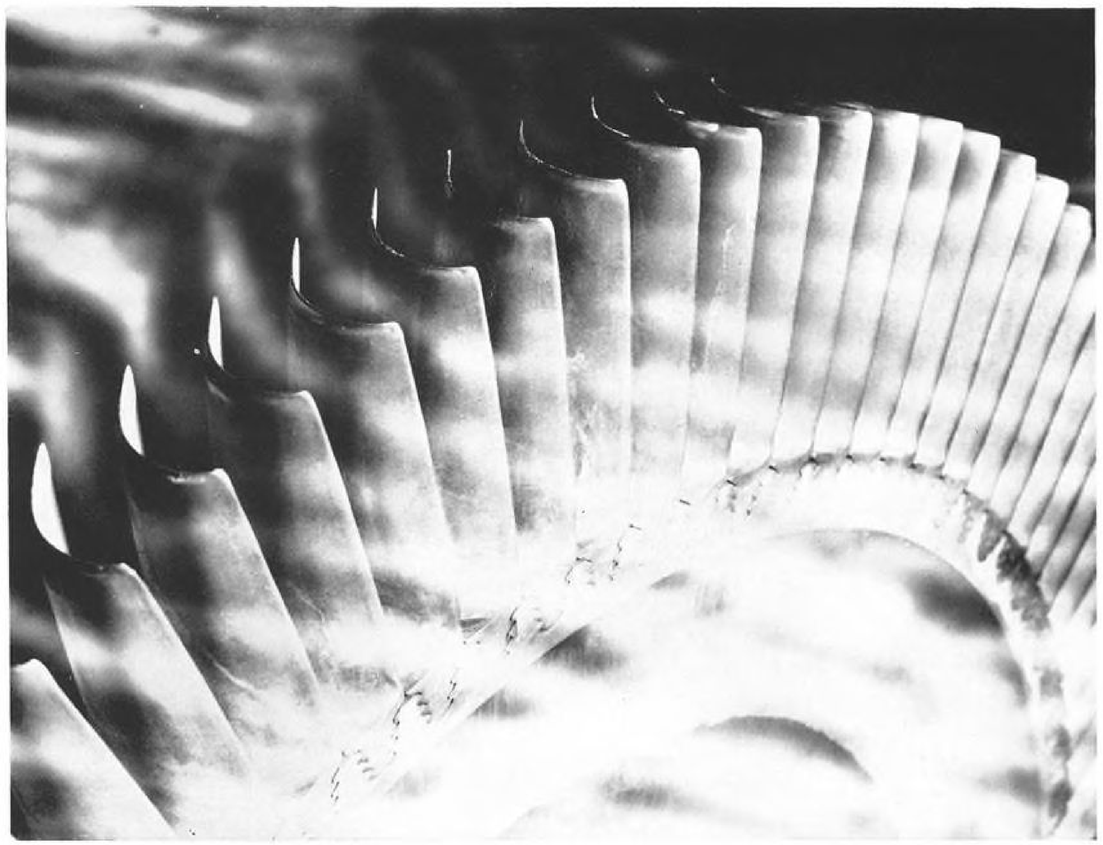
Satellite will be tracked by radio and will have enough power to transmit for from two to three weeks, Baumann said. Since the satellite will be sealed into the vehicle early in the launching procedure, it will be running one to two days before it is launched.

Satellite's .026 in. thick shell is coated with various materials, including gold, which are designed to preserve the thermal isolation of the instruments inside. Baumann said the satellite is designed to maintain an internal temperature range between zero and 60 degrees Centigrade. The shell will be highly polished and will reflect 82% of the light that falls on it.

Included in the satellite's instrumentation is a 48 channel telemetry system which is contained on card 5½ in. in diameter and ¾ in. thick.

Talos Handling System Contract Awarded to GE

Contract for development of a shipboard handling and launching system for Navy's Talos missile was awarded to General Electric's Missile and Ordnance Systems Dept., Pittsfield, Mass. The $5 million contract is GE's first for missile handling systems.



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To fill the requirements for high performance helicopters that do anti-submarine, rescue, hauling, and many other jobs, the Navy contracted with General Electric to design and develop a small, but powerful gas turbine engine—the T58. This gas turbine, today, delivers more power per pound of engine weight than any such engine before. Helicopters will be able to fly faster, farther and with greater payload because of this advanced General Electric engineering achievement.

Developments such as this small gas turbine engine are examples of how Armed Services-industry teamwork today is paying off in greater American security for us all. General Electric Co., Lynn, Mass. 233-11



UNDERGOING FLIGHT TESTS in a Sikorsky S-58, the new General Electric T58 gas turbine engines today are proving their advanced design. Weighing only 325 pounds, each of these engines can deliver more than 1000 horsepower.

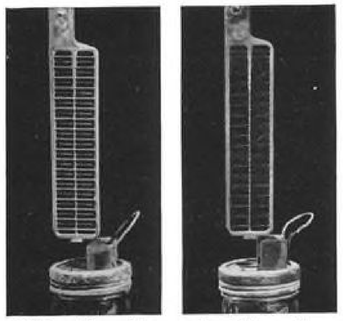
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Non-Silvium alloy grid after same test.

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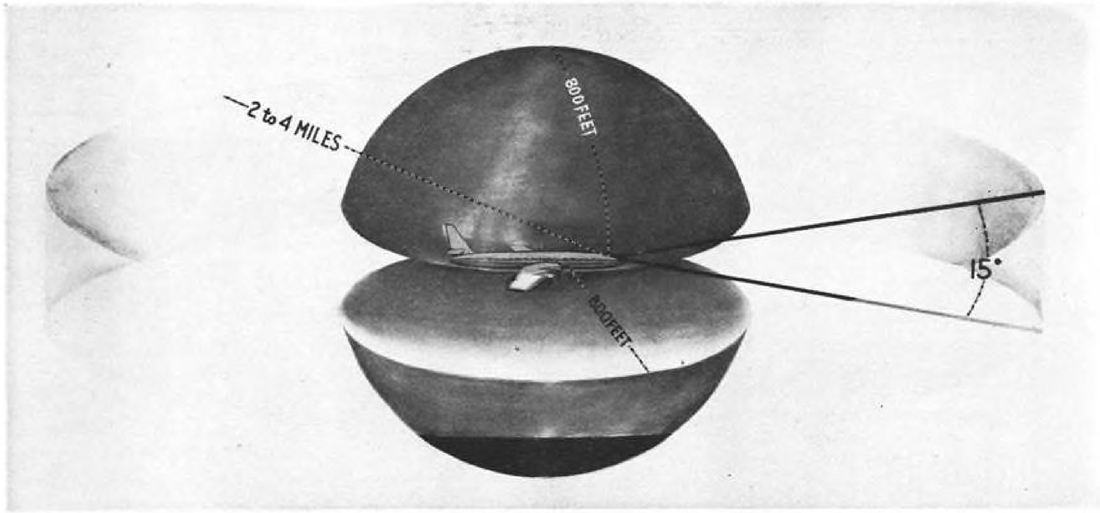
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INFRARED proximity warning indicator is expected to provide minimum detection range of 2 to 4 mi. at own-plane altitude plus 800-ft. hemisphere coverage above and below. System proposed by Aerojet-General will undergo flight evaluation this fall.

Infrared to Get Collision Warning Trial

By Philip J. Klass

New York—Airline hopes for early relief from growing air collision threat will be riding on an Aerojet-General infrared proximity warning indicator (PWI) when it begins its evaluation tests in November aboard a company owned DC-3.

If the tests confirm Aerojet's predictions, airlines probably could start installing self-contained, lightweight, moderate-cost proximity warning indicators in their fleets before end of 1958. Unfavorable test results, on the other hand, would leave only one remaining hope for a self-contained system—modification of existing weather radars to provide PWI coverage in the forward area.

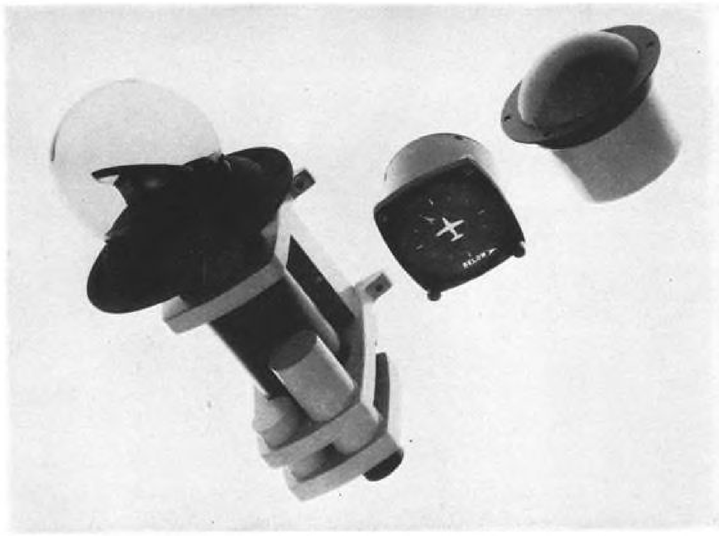
Weather Radar

Radio Corporation of America analysis of the feasibility of converting weather radar for PWI use, reported at recent Air Transport Association meeting in Los Angeles, points out many limitations and operating problems. However, a weather radar PWI may be able to operate under IFR (bad-weather) conditions when infrared PWI detection range is sharply reduced. This raises possibility that airlines might be willing to invest in both, providing size, weight and cost is not excessive.

Aerojet's analysis of many mid-air collisions leads it to believe that the proposed infrared PWI, with an installed weight under 50 lb., could give the pilot a minimum of 20 sec. advance warning under most, but not all, air-collision threat conditions.

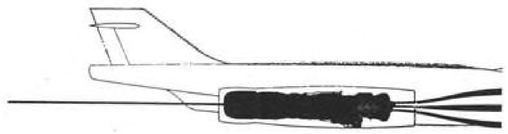
Target detection ranges used in Aerojet's analysis are based on its experience with military IR systems for other applications. This makes the analysis appear well-based, but the air-collision problem involves unknowns which require flight tests. If Aerojet's own tests are encouraging, company plans to build a few prototypes to lend major airlines for trial use early in 1958.

Raytheon, whose West Coast infrared group has shown considerable interest in the air-collision problem, has not yet



MAJOR elements of infrared PWI include 360-deg. azimuth scanner (left), hemisphere coverage detector (right) and 3-in. cockpit indicator to show intruder position (center). Only 4-in. dome of 360-deg. scanner protrudes into windstream. Two hemisphere detectors are required, one mounted above and one below fuselage.

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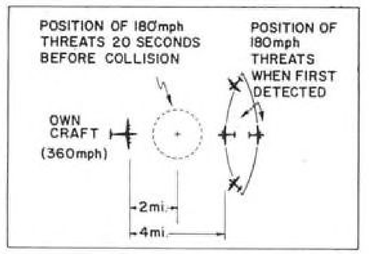
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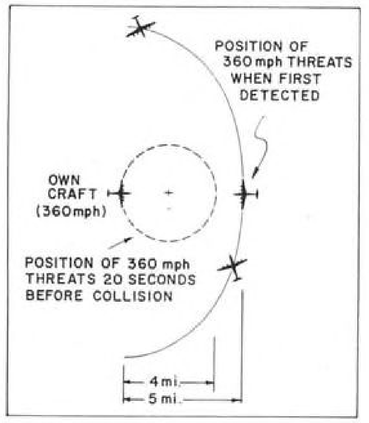
And our business is producing highest quality jet engines, *on schedule*, at lowest possible cost.

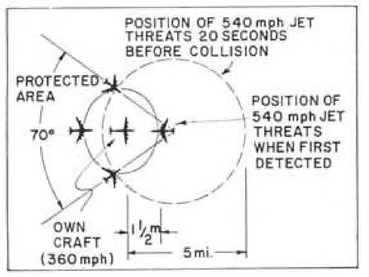


AIRCRAFT ENGINE DIVISION • FORD MOTOR COMPANY

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PREDICTED performance of infrared proximity warning indicator installed on 360 mph. airplane in detecting 180 and 360 mph. piston-engine aircraft and 540 mph. jet is shown in three diagrams.

PWI must provide minimum of 20 sec. warning prior to collision to permit evasive maneuver.

If intruder is a collision threat 20 sec. hence, its position must be somewhere along dotted circle.

Range at which PWI can first detect intruder is shown with solid lines. If dotted circle lies between own-craft and point of initial PWI detection, at least 20 sec. warning will be provided. Proposed infrared system appears able to achieve these requirements against 180 and 360 mph. intruders for all approach angles (top and middle diagrams).

However, against 540 mph. jet, initial detection range lies outside dotted circle only in rear sector. This means PWI can give 20 sec. warning only when jet approaches within rear 70-deg. sector. At other approach angles, PWI warning time will be less than 20 sec.

reached a top-level decision whether to proceed with a PWI development.

The area coverage of the proposed Aerojet system closely follows Air Transport Association requirements and resembles that of the earlier proposed Collins system:

- **360-deg. surveillance** at approximately own altitude is provided by a rotating infrared detector mounted atop the fuselage or vertical stabilizer. This scanner, housed in a infrared transparent dome about four inches in diameter, sweeps out a 15-deg. circle around own-plane and should be able to detect targets at distance of 2 to 4 mi. Exact range will depend upon type of target (jet or piston, number of engines), its aspect angle and atmospheric conditions.
- **Upper-lower hemisphere coverage** out to distance of about 800 ft. will be provided by two nearly flush-mounted passive radar detectors, one mounted in belly, the other atop fuselage. Range is intentionally limited to prevent false alarms from non-threatening aircraft flying with normal 1,000 ft. separation.

Cockpit Indication

When the rotating detector spots an intruder by means of the infrared radiation from its power plants or jet plume, it will cause a flashing light to come on inside a small (3-in.) cockpit indicator which illuminates a small arrow showing target bearing.

More than one intruder can be displayed simultaneously.

If intruder descends or climbs into the 800-ft. hemisphere coverage of the passive detectors, another portion of the cockpit indicator will flash on and off indicating whether target is above or below, to the left or to the right.

To prevent ground-source infrared radiation from producing false alarms, Aerojet proposes to use a technique suggested previously by Raytheon. This is to design the belly mounted detector to sense modulation of background radiation produced by aircraft propellers or jet plume, instead of seeking to detect radiation of the power plant itself.

The weight of the three infrared detectors, plus required amplifiers and indicator, is estimated at 30 lb.—a figure based on similar types of military infrared equipment now in production at Aerojet.

Allowing 20 lb. for interconnecting cables and mounting brackets should give total installed weight of no more than 50 lb., Aerojet believes.

Company is reluctant to quote prices at this time. However, competent observers believe the system should cost between $4,000 and $6,000 per installation, depending upon quantities.

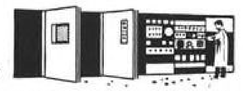
Aerojet acknowledges that the proposed system has certain operational limitations. For example, in its present

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form there is no indication of target range or closing rate, or any hope of obtaining it without considerably more weight and complexity. This means the PWI can not be expected to grow into a fully automatic collision avoidance system—one of the Air Transport Assn.'s early objectives. The proposed PWI is solely an ever-vigilant look-out for the pilot.

Furthermore, the system is primarily a VFR (fair-weather) device, for two reasons:

- **Infrared detection range** is sharply reduced by clouds and precipitation.
- **Pilot cannot evaluate threat** and determine required evasive action without being able to see the target because PWI does not provide sufficient information.

Civil Aeronautics Administration statistics indicate that a high percentage of today's air collisions and recorded near-misses occur under VFR conditions.

This fact, Aerojet believes, makes an infrared PWI a valuable addition despite limitations. If the system performs as well as Aerojet's analysis suggests, ATA and the airlines appear almost certain to concur.

Critical 20 Seconds

Aerojet's analysis of the anticipated effectiveness of its proposed system is based on minimum warning time rather than minimum detection range because the former includes minimum detection range as well as intruder's closing rate and its aspect angle. Analysis assumed that an absolute minimum time of 20 sec. is required after intruder is detected for pilot to visually find the target, evaluate its threat and execute required maneuver.

For example, the study assumed an infrared PWI was installed on a 360 mph. airplane and its performance was then evaluated against possible collision threats from prop-driven 180 mph. twin-engine and 360 mph. four-engine aircraft as well as from 540 mph. jets. Analysis was made under several conditions, including both aircraft at approximately same altitude, different rates of vertical closure and terminal area (reduced-speed) situation.

When both planes are at approximately the same altitude, or have relatively small vertical closure rates, the results of Aerojet's analysis can be summed up as follows: the PWI-protected 360 mph. airplane pilot should receive at least 20 sec. warning before collision with an 180 or 360 mph. intruder, regardless of the intruder's angle of approach (relative heading). Somewhat more than 20 sec. may be provided under certain intruder approach angle conditions.

However, against a 540 mph. intruder, the 20-sec. warning time would be provided only when intruder approaches own-plane from rear cone so that there is less than 35 deg. difference between headings of two aircraft. For example, if own-plane heading were 90 deg. and intruder heading were between 55 and 125 deg., at least 20-sec. warning would be provided. For any course separation angle greater than about 35 deg., it appears that something less than 20 sec. warning is possible.

Cool Areas

Reduced range of PWI against jets results because a jet on a collision course exposes relatively cool front and side areas of its engines and, consequently, radiates less IR energy than from the rear aspect.

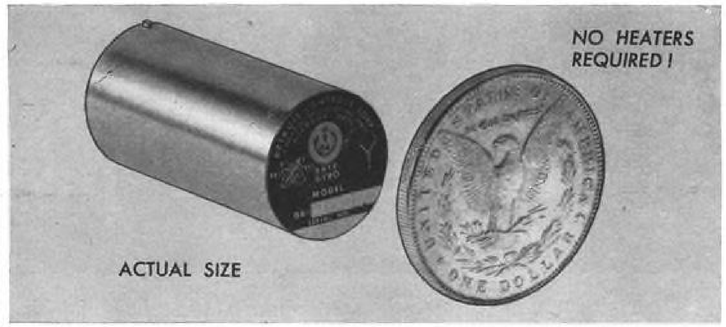
Analyzing the Grand Canyon collision, where aircraft speeds were about the same, vertical closure rate was low and course separation angle was only 20 deg., Aerojet concludes that its PWI could have provided 3½ min. advance warning if either aircraft had been equipped.

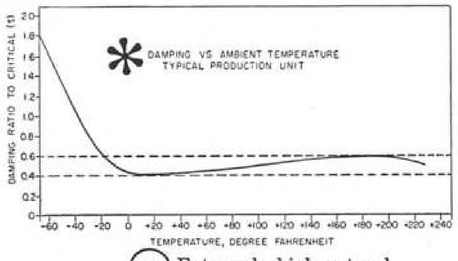
Based on what the company calls a "rough check" of CAA mid-air collision analyses, Aerojet concludes that proposed PWI could have provided minimum of 20 sec. warnings in "well over two-thirds of the collisions."

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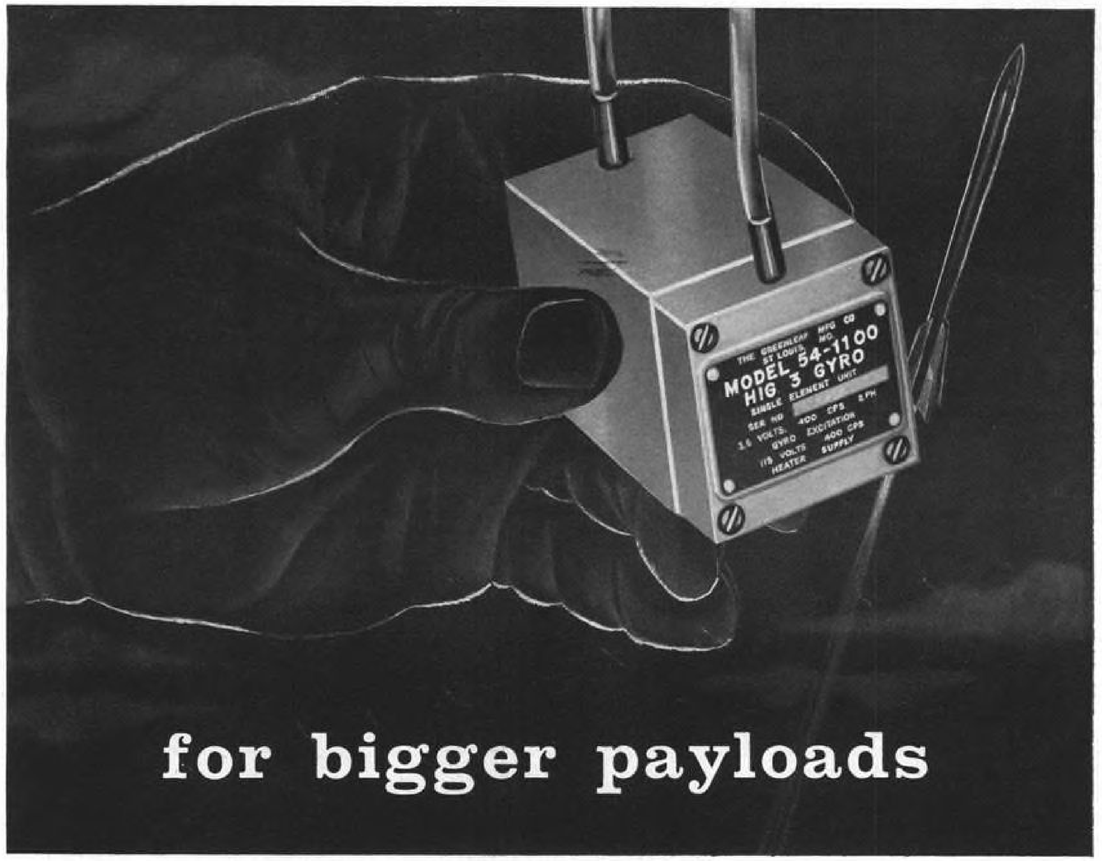
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weather radar for PWI use stems from the fact that it is a self-contained system and that a large segment of the airline fleets are, or will be, equipped in the near future. However, a number of modifications and some additional equipment is necessary to enable radar to spot other aircraft, to alert pilot automatically to eliminate necessity of continuously watching radar scope, and to prevent undue number of false alarms.

RCA spokesman told the ATA meeting that with such modifications and additions, weather radar could be expected to detect a medium-size single-engine prop-driven aircraft at distances of about three miles. Effective range would be greater against larger prop-driven aircraft, might be somewhat less against jets under head-on aspect angles. Because of ground clutter, when aircraft altitude is less than about 15,000 ft. effective range would be reduced to roughly airplane's altitude above ground.

Limited Coverage

Area of protection afforded by a weather radar PWI would be limited to approximately 220 to 250 deg. in azimuth in forward hemisphere and could not provide rear-area coverage unless another antenna were mounted in the tail, adding more weight and complexity.

Vertical coverage also would be more limited than the Aerojet proposed infrared system. Compared to Aerojet's 15-deg. vertical coverage, a C-band radar with 34-in. antenna would have only a $4\frac{1}{2}$ deg. wide beam, or a 7-deg. beamwidth with a 22-in. antenna. This, coupled with lack of upper-lower hemis-



Radar Trainer

Training aid for Delta Air Lines pilots, to acquaint them with operation of Collins weather radar, consists of modified cockpit indicator and motor driven slides which simulate typical cloud formations. Trainer, developed by Delta's J. M. Boxley, cost less than $200.



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DC-DC Converters—28 volts input. Outputs up to +250 VDC. Ripple less than 5 MV rms. Efficiency 75%. Extreme environmental capabilities. Size 3.0" x 3.0" x 4.5".

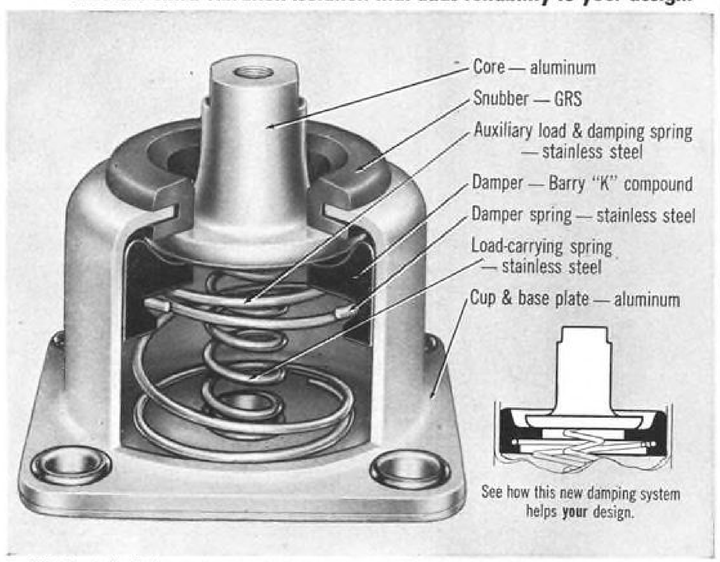
Voltage Regulators — ±0.5% regulation. Output impedance 2 ohms max, dc to 100 KC. Extreme environmental capabilities. Size 2.0" x 2.0" x 2.25".

Also available:
Transistorized low level DC amplifiers and phase sensitive detectors.

UNITED ELECTRODYNAMICS
(Division of United Geophysical Corp.)
Pasadena, California
1200 South Marengo Ave. RY. 1-1134

Barry's New "Lo" Mount meets MIL-C-172B at low cost

— with this extra vibration isolation that adds reliability to your design.



MIL-size 1 "LO" Mount shown 1½ times actual size

We designed for lower cost — *and developed a better mount for MIL-C-172B.* Even at 10° inclination, this new mount performs effectively. And its characteristics far exceed requirements of MIL-C-172B.

The simple and versatile design of the "Lo" mount lets us match characteristics to your specification. Your design now gains added reliability with a mount that more than satisfies MIL-C-172B — and at low cost.

Extra-low transmissibility and low natural frequency

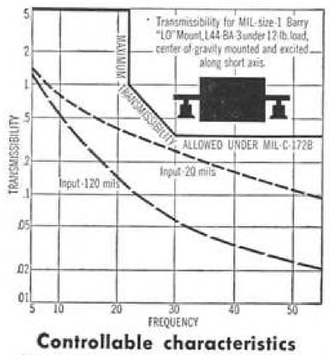
Transmissibility below 2 at resonance in all load ranges is a major advantage of the "Lo" mount. This isolator handles high-amplitude inputs without snubbing, even at resonance and at 10° tilt.

Very low rocking modes

In base-mounted systems, transmissibility of rocking modes under horizontal vibration is so reduced that they are indiscernible. This is due to the inherently low ratio of horizontal-to-vertical stiffness plus *self-centering* horizontal friction damping.

For center-of-gravity designs

Independent horizontal damping makes the "Lo" mount especially suited for installation in the plane of center-of-gravity of the equipment.



Controllable characteristics

These exceptional characteristics, resulting from the unique Barry spring and friction-damping design, can be controlled in manufacture for high performance with a wide variety of equipment. Special versions of the "Lo" mount will control transmissibility at resonance for a given input or handle very high-amplitude inputs at resonance without snubbing.

Physical characteristics

The L44 Mount is available in 7 load ranges from 0.25 to 10 lbs. per mount in long- and short-core models. It meets environmental and vibration requirements of Procedure I, MIL-E-5272A. Temperature range is −85 to +250F. Weight is 1½ oz. each.

Write today for Data Sheet 57-05.

BARRY B MOUNT
BARRY CONTROLS
INCORPORATED
SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES
715 PLEASANT STREET, WATERTOWN 72, MASSACHUSETTS

phere coverage, would provide relatively little protection against intruders from above or below.

Radar may offer one very significant advantage over infrared for PWI use. With addition of circular polarization, radar may be able to provide PWI service under IFR conditions in presence of rain and clouds where infrared is seriously handicapped. (Circular polarization would be cut out when radar is used for storm warning)

RCA has not yet come up with engineering estimate cost and weight of radar modifications and additions. However, one spokesman guesses that $5,000 to $10,000 per airplane would do the job, including a ½ to ¾ ATR size box, weighing perhaps 35 lb.

If these figures are realistic, they suggest that the airlines could buy both types of PWI for less than 100 additional pounds (on radar-equipped aircraft), and at a price which might be as low as $10,000 per airplane. This might not be too steep a price to pay to obtain all possible protection against air collisions.

RCA makes no effort to minimize the limitations of the weather radar PWI. Company is not actively seeking to drum up airline interest, but says it is willing to provide a modified AVQ-10 radar for flight evaluation if airline interest warrants.

Expansions, Changes In Avionics Industry

Two new West Coast firms, both specializing in telemetry, have been formed. **Moore Associates,** Redwood City, Calif., headed by Laurence Moore, will develop and produce telemetry equipment including related accessories. **Telemetering Corporation of America,** Los Angeles, headed by William A. Cook, will encompass entire instrumentation and automation fields with special emphasis on aircraft/missile telemetry.

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

• **Collins Radio** will construct new $2.75 million, 235,000 sq. ft. manufacturing facility in Cedar Rapids, Ia., across from its engineering laboratory. Occupancy is scheduled for early 1959 and will give company a total of more than 1,000,000 sq. ft. of plant in Cedar Rapids.

• **Norden-Ketay Corp.** has licensed the Societe Anonyme Precilec of Paris to manufacture and sell its synchros and servomechanisms in France.

• **Electronic Associates, Inc.,** Long Branch, N. J., has opened its European Computation Center in Brussels, Belgium at Rue de la Science 43. New facility, called first of its kind in Europe, will provide analog computation service on rental basis.

• **Ultradyne Engineering Labs, Inc.,** Albuquerque, N. M., manufacturer of transducers, has merged with **Straus-Frank Co.,** Houston, Texas, a manufacturing-merchandising organization, but will continue operations at present location.

• **Diamond Antenna & Microwave Corp.,** Wakefield, Mass., has taken on additional 5,000 sq. ft. of facility in present building and has constructed new 1,200 foot antenna pattern test range.

• **Cascade Research Corp.,** Los Gatos, Calif., component and microwave tube maker, will merge with **International Glass Corp.,** Culver City, Calif., whose electronics division (Lewis and Kaufman, Ltd.) in Los Gatos now manufactures power tubes, providing stockholders of both companies approve.

• **Pi-Square Engineering Co., Inc.,** has opened new American Center for Analog Computing at 127 Clarendon St., Boston, to provide analog computation service to companies on a rental basis.

• **Westinghouse Electric Corp.** has opened new specialty transformer plant at 3627 Holdrege Ave., Los Angeles. Facility includes design engineering capability.

• **Radiation, Inc., Melbourne, Fla.,** will manufacture and sell teleprinter circuit test equipment in the U.S. following licensing agreement with Automatic Telephone & Electric Co., Ltd. of England.

• **Ohmite Manufacturing Co.,** Skokie, Ill., will build 42,000 sq. ft. addition to its present plant.

• **Decca Radar Ltd.** of England and **Compagnie Francaise Thomson-Houston** of France have signed agreement to pool their efforts in developing radar equipment for NATO air defense system.

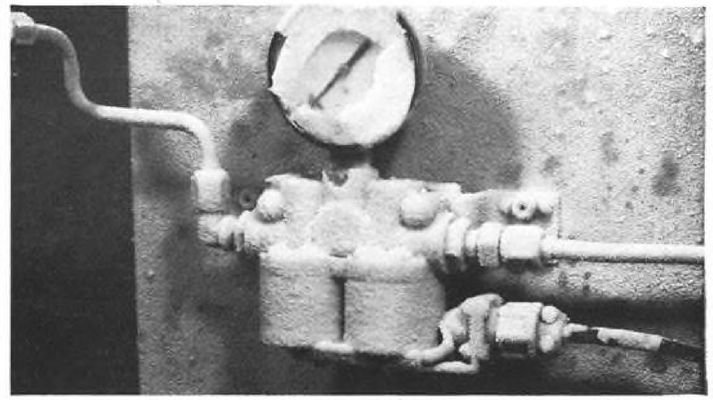
• **Rheem Manufacturing Co.** and **Solartron Electronic Group Ltd.** of England will collaborate in their electronic activities as result of recently signed agreement.

• **Humphrey Inc.,** San Diego, manufacturer of electro-mechanical instruments, has opened new eastern sales and service office in the administration building of the North Philadelphia airport, Grant Ave. and Ashton Road.

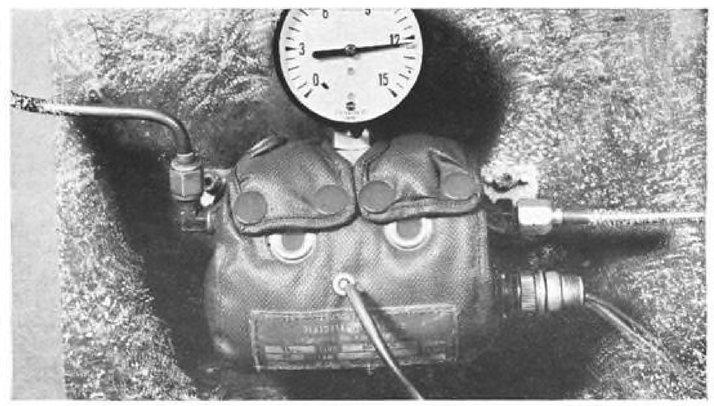
• **ElectroData** division of **Burroughs Corp.** has moved Los Angeles district office to 230 No. Lake Ave., Pasadena, Calif.

• **Gulton Industries, Inc.,** Metuchen, N. J., purchased **CG Electronics Corp.,** Albuquerque, N. M., maker of radio control equipment. New acquisition, which will operate as a wholly owned subsidiary, will retain its corporate name.

• **Bernco Engineering Corp.,** Indianapolis, purchased **Electric Switch Corp.,**



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SPECIAL HEATING unit custom-designed and delivered by G.E. in 5 days enables stock valve to function properly, saves customer time, money.

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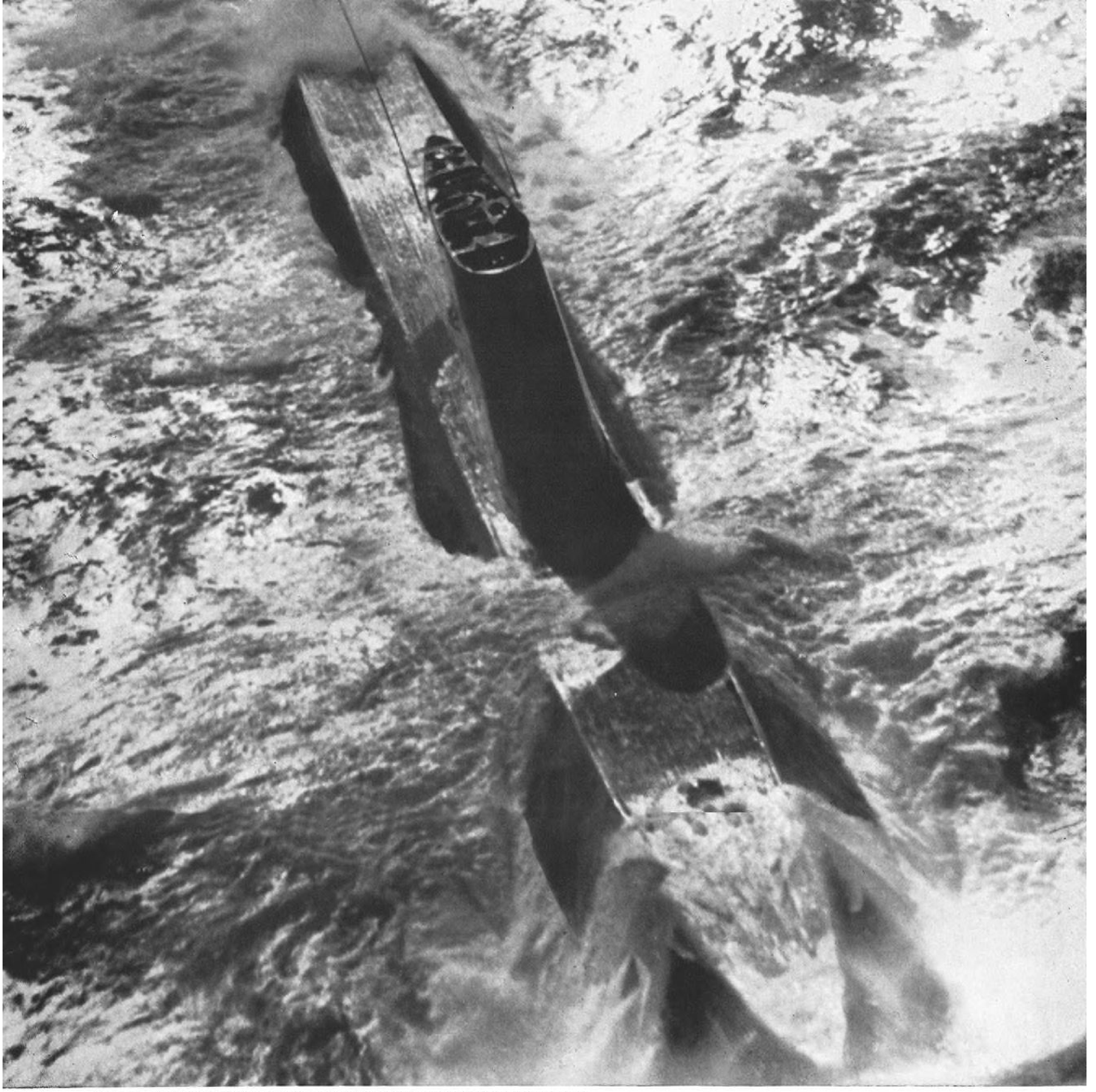
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THE MOST POWERFUL NAVAL GUNS KNOWN HAVE A RANGE OF LESS THAN 25 MILES. THE "POLARIS" MISSILE, FOR WHICH LOCKHEED HAS PRIME RESPONSIBILITY, WILL EXTEND THE FIREPOWER OF THE U. S. NAVY TO TARGETS 1,500 MILES DISTANT -- AND HIT THEM WITH A NUCLEAR WALLOP.

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Columbus, Ind., maker of mercury switches and time cycle controllers.

• **Assembly Products, Inc.**, will double its San Gorcinto division's relay manufacturing facility located near Palm Springs, Calif.

• **Burnell & Co., Inc.**, maker of toroidal coils and networks, moved from Yonkers, N. Y., to 33,000 sq. ft. facility in Pelham Manor, N. Y.

• **Sperry Phoenix Co.**, division of Sperry Rand Corp., opened new 81,000 sq. ft. facility for production of flight control systems in Phoenix, Ariz. Present employment of 130 is expected to reach 500 by mid-1958.

• **U. S. Semiconductor Products, Inc.**, opened multi-million dollar plant in Phoenix, Ariz., at 3650 Osborn Road. Initial production will be low-power silicon diodes.

• **Collins Radio Co.** formed new Systems division to expand its activities in microwave and scatter communication systems. John D. Nyquist has been named executive director of new division, Frank C. Dyer is director systems engineer in Dallas and Richard M. Ringoen holds similar position at Collins' Cedar Rapids facility.

• **Electronic Communications, Inc.** (formerly Air Associates), organized Reliability Assurance section to be headed by G. Wendell Carr.



From "figures of speech" to "conversation" piece *in 53 days with RDA**

One of the few things today's large electronic computer cannot do is **talk.** Yet the product of its fantastic "brain" is useful only when hundreds of operators and researchers are able to **communicate with perfect teamwork, without interruption or interference.**

Recently Hallicrafters was asked by a major firm engaged in guided missile research to devise a superior communications system to solve such a problem. The need was urgent.

The project was assigned to Hallicrafters *RDA Division (Rapid Development Assistance). **From spec sheet to finished product, the CIS-21 Computer Intercom System was designed, built and delivered in exactly 53 days.**

Through more than 1,000 practical combinations of ten amplifiers, the CIS-21 provides instantaneous and perfect communication between 250 remotely stationed individuals or groups. An outstanding feature is a matrix switch that guarantees **constant output** regardless of the number of amplifiers in use.

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FILTER CENTER

► **Avionics at High Speeds**—"Missile Aerophysics Phenomena of Electronic Import," is title of paper by Daniel Bershader of Lockheed's Missile Systems division scheduled for presentation at Wescon (San Francisco, Aug. 20-23) in session devoted to problems of avionics in high-speed flight. Here are some of the other papers with interesting titles slated for presentation at Wescon:

• **"Information Theory in the USSR"** by Paul Green, Lincoln Laboratory.

• **"The Nesistor**—A Semiconductor Negative Resistance Device," by Robert G. Pohl, The Rauland Corp.

• **"Microwave Atomic Amplifiers and Oscillators,"** by George Birnbaum, Hughes Research Laboratories.

Wescon session on military requirements in basic and applied electronic research will include following speakers: James M. Bridges, Office of Assistant Secretary of Defense; L. O. Hollingsworth of Air Force Cambridge Research Center; Harrison J. Merrill of Army Signal Engineering Laboratory, and Arnold Shostak, Office of Naval Research.

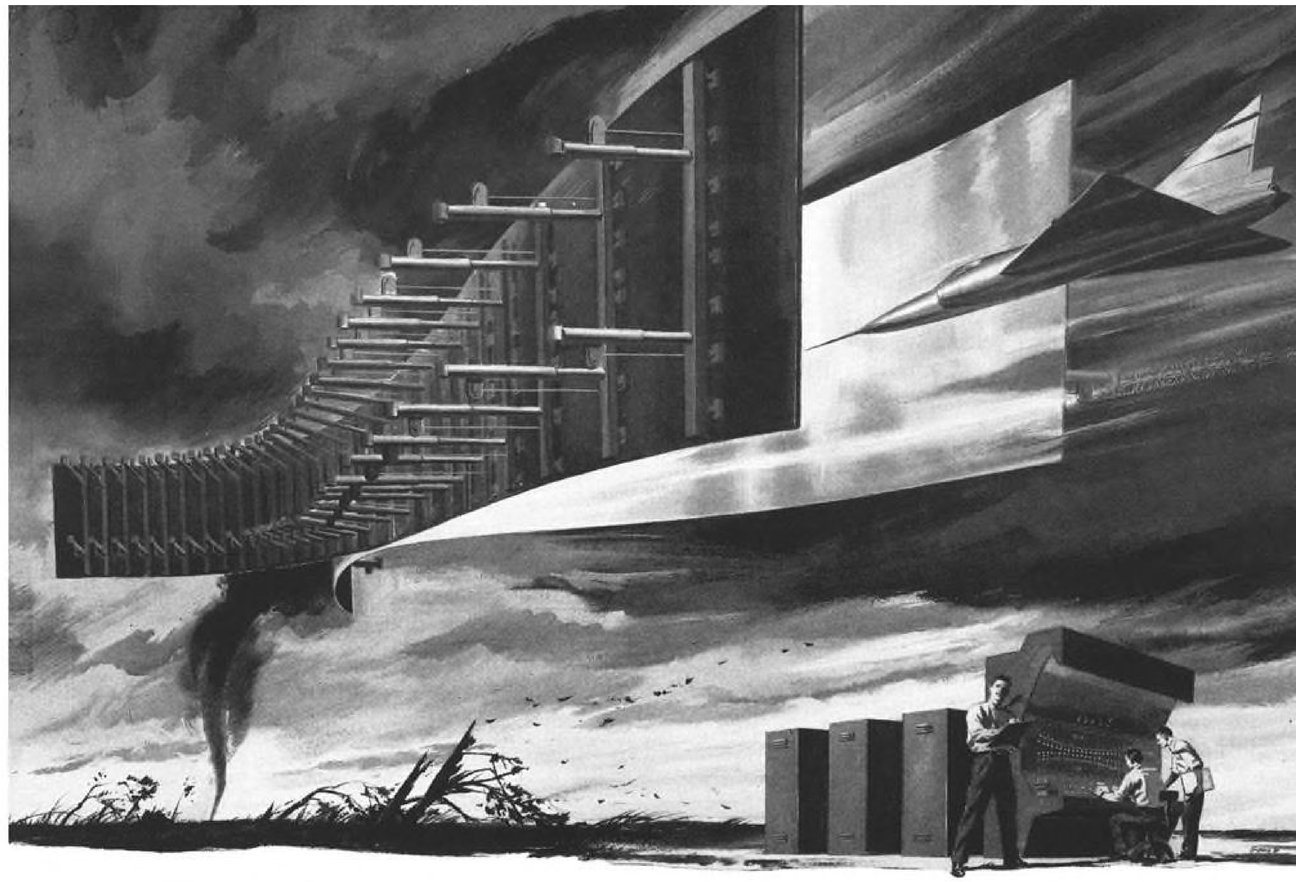
► **Divisions Joined**—Daystrom, Inc., will shortly announce formation of Daystrom Avionics Group, a federation of four divisions intended to strengthen company's bid for prime weapon system and sub-system contracts.

► **SAS to Test CSSB**—Scandinavian Airlines system reportedly will install a Kahn compatible single sideband (CSSB) equipment in Europe to evaluate system performance.

► **Withstands X-17 Impact**—Small sun-position indicator used in Lockheed X-17 ballistic missile reportedly was still in operating condition when dug up from under 12 ft. of sand where landing impact had buried it. The device, which uses subminiature tubes and transistors, withstood impact forces of 1,000 Gs, Lockheed estimates.

► **Transistor Price Cut**—General Electric has slashed price of its high frequency germanium tetrode transistors by 42 to 75%. Price cuts apply to types 3N29, 3N30 and 3N31.

► **Sunlight No Problem**—Bendix Radio's bright tube radar indicator, designed for easy viewing despite high ambient cockpit light, is expected to be ready for airline evaluation later this year. New indicator will be electrically interchangeable with present weather radar scopes, will measure only 1½ inches longer. RCA also is developing bright display for its airline radars.



Putting the screws on a tornado

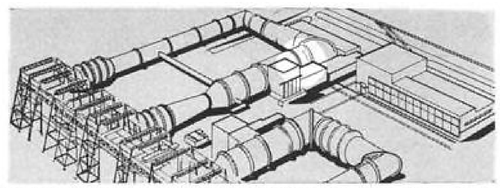
The supersonic wind tunnel under construction at Tullahoma, Tennessee, combines some of the most gigantic construction with some of the most precise electronic controls in the whole history of aircraft testing.

The project simulates conditions of flight in excess of 16 miles altitude, from Mach 1.5 to approximately Mach 4.5. Some of the statistics of design are startling, even in today's world of wonders.

The nozzle walls of the tunnel are solid steel, 100 feet long, 16 feet high. To reach any one of 300 master positions, these plates are moved by 56 huge screw jacks on each side—with a tolerance for error restricted to 8 one-thousandths of an inch in an 8-foot stroke! Each jack "talks back" electronically to Master Control, reporting its position. Provision is made for remote starting and operation by magnetic tape programming, set up in advance.

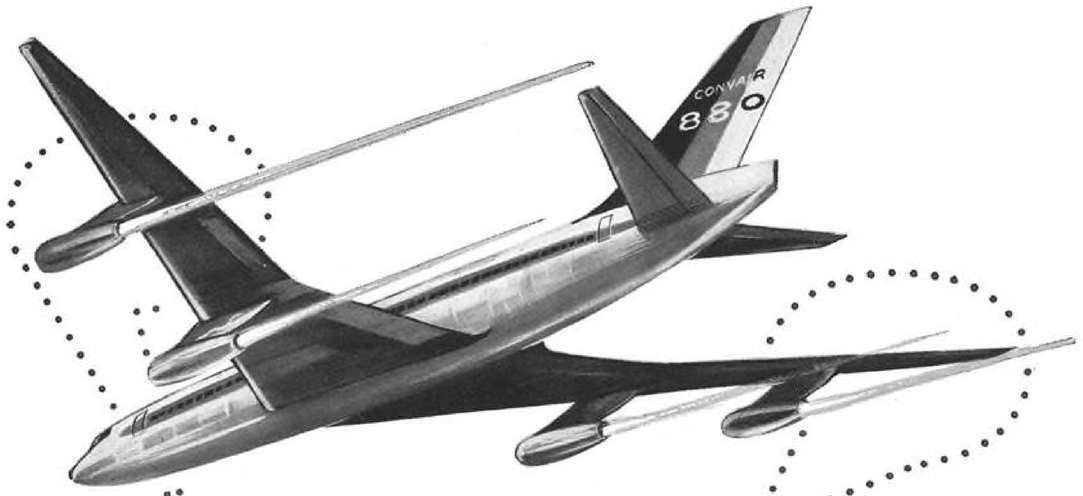
Two associated companies are doing this job—the Electric Boat and Stromberg-Carlson divisions of General Dynamics Corporation. Electric Boat—builders of the atomic-powered submarines, *Nautilus, Seawolf* and *Skate*—has overall responsibility, will supply the jacks and design the servo mechanisms. Stromberg-Carlson is to create and build the digital computer system for the electronic controls.

This project—combining heavy, giant-size, accurate "machinery" with electronic systems of a complex, automated nature—is typical of the service which General Dynamics divisions offer.



Sketch of the project, being built by the U.S. Army Engineers for the U.S. Air Force, Arnold Engineering Development Center. Circled area locates the special walls and nozzle.

S-C STROMBERG-CARLSON
A DIVISION OF GENERAL DYNAMICS CORPORATION
General Offices and Factories at Rochester, N. Y.—West Coast plants at San Diego and Los Angeles, Calif.
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Convair, pioneers of the revolutionary Scotchweld Process*, again chooses "Southern" as Designer-Constructor of the second and largest Scotchweld unit. The new facility will be used for the wing of the *Convair 880 Jet Transport, World's Fastest Airliner.*

There must be a reason!

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"Southern" facilities are available to you regardless of project complexity, size or location.

*Scotchweld: A revolutionary metal-to-metal bonding process, pioneered by the research-minded *Convair Division of General Dynamics* on the F102A all-weather Jet Interceptors. Wing spars and ribs are bonded to the wing skins to provide a bonus light weight structural strength, durability and leak-proof reservoir for jet fuel.

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WHAT'S NEW

Publications Received:

Rockets, Missiles, and Moons—by Charles Coombs—Pub. William Morrow & Company, Inc., 425 Fourth ave., New York 16, New York, $3.75; 256 pp.

A broad survey of the government's program to launch unmanned, earth circling satellites. Accounts based on accurate research of civilian and government experts.

Guided Weapons—by Eric Burgess—Pub. The Macmillan Company, 60 Fifth Ave., New York II, New York. $5.00; 255 pp.

Simplifies the explanations of the pressing problems concerned with missiles. It also classifies each type of missile according to its use; ground-to-air missiles, air-launched missiles, and ground-to-ground missiles.

Research and Development—by American Institute of Management, 125 East 38th Street, New York 16, New York. $12.00; 93 pp.

The meaning and evaluation of research and development in the corporation. It also contains the basic theory and practice of the management audit.

The Sound of Wings—by Joseph B. Roberts and Paul L. Leland—Pub. Henry Holt and Company, 383 Madison Ave., New York 17, New York. $5.00; 303 pp.

An anthology of aviation literature, describing the experience of flight, and tracing its history from man's first dreams of being airborne to his experiments with the rocket.

Rockets, Missiles, and Space Travel—by Willey Ley-Pub. The Viking Press Inc., 625 Madison Ave., New York 22, New York. $6.75 528 pp.

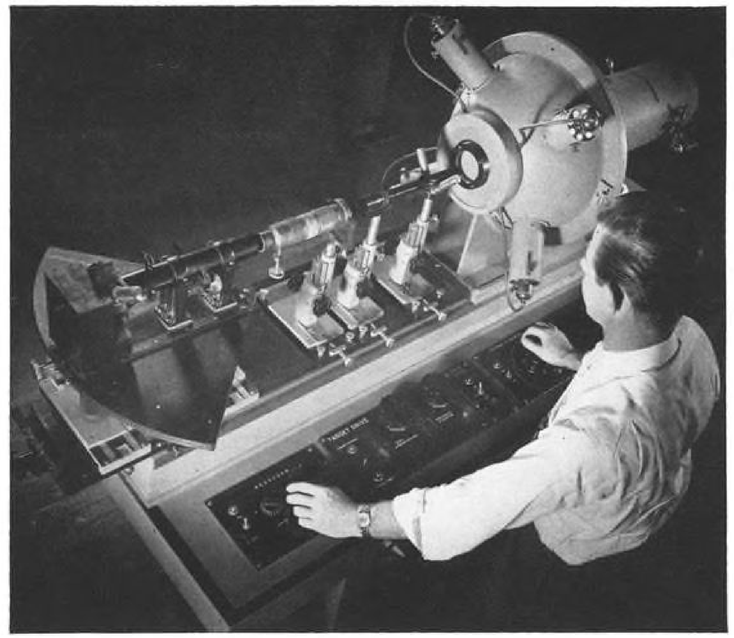
The story of rocket development and space-travel prospects. This is a revised addition from when it was first published in 1944.

Radio Operator's License Q. & A. Manual—by Milton Kaufman—Pub. John F. Rider Publisher Inc., 116 West 14th Street, New York II, New York. $6.60 720 pp.

The 6th Edition contains all the latest question revisions, renumbering and deletions as made by the Federal Communications Commission.

Modern Airmanship—by Neil D. Van Sickle, Colonel, USAF—Pub. D. Van Nostrand Company, Inc., 120 Alexander St., Princeton, New Jersey. $9.75 862 pp.

The first comprehensive, authoritative book on all of the basic aspects



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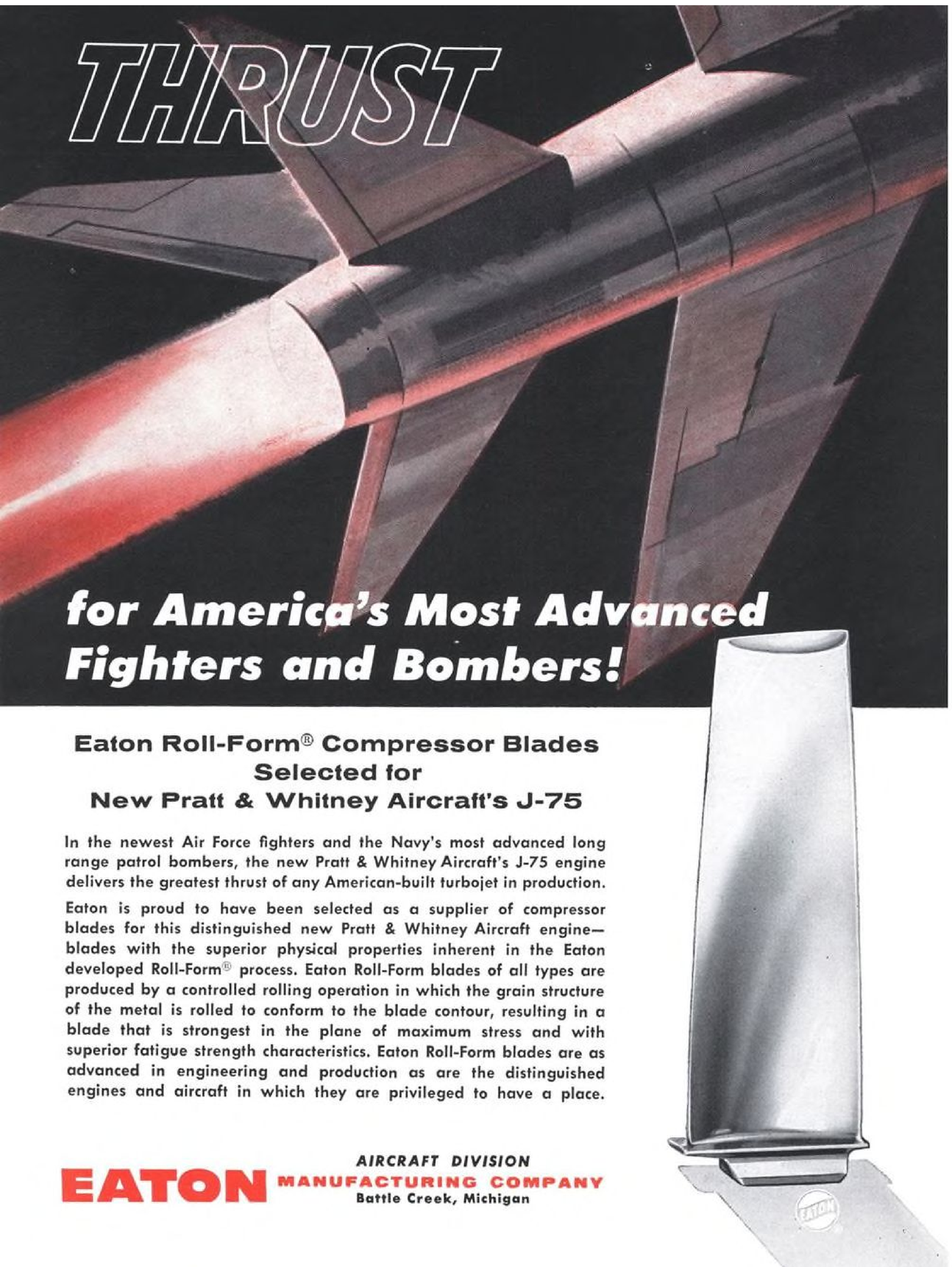


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of modern flying, compiled by authorities in both military and civil aviation.

An A. B. C. of Aeronautics—by L. L. Beckford—Pub. Pitman Publishing Company, 2 West 45th Street, New York 36, New York. $3.95 113 pp.

A dictionary designed to provide the student and enthusiast with a comprehensive guide to all the terms they are likely to meet, from elementary descriptions to highly technical definitions.

Reports Available:

The following reports were sponsored by Office of Technical Services, United States Department of Commerce:

Packaging and Materials Handling, 1941-57—118 technical reports. $.10 (CTR-72).

Microwave Stepped Index Luneberg Lenses.—by G. D. M. Peeler and H. P. Coleman, Naval Research Laboratory, and M. C. Volk and W. R. Cuming, Emerson and Cuming Inc. $.75; 21 pp. (P. B. 121561).

Chemical Surface Treatment of Titanium—by H. A. Pray, P. D. Miller, and R. A. Jefferys, Battelle Memorial Institute for Army Ordnance Corps. $1.25. 43 pp. (P. B. 111805).

Research and Development for the Welding of Titanium and Titanium Alloys. Final report.—by J. J. Chyle and I. Kutuchief, A. O. Smith Corporation for U. S. Army Ordnance. $2.00; 79 pp. (P. B. 111849).

Investigations of Deformation and Fracture of Metals—by R. P. Carreker, Jr., R. W. Guard, and R. E. Lenhart, General Electric Research Laboratory for Wright Air Development Center. $.75; 25 pp. (P. B. 111838).

Survey of Low Alloy Aircraft Steels Heat-Treated to High Strength Levels. Part 1: Hydrogen Embrittlement.—by G. Sachs and W. Beck, Syracuse University for Wright Air Development Center. $2.50; 96 pp. (P. B. 121700).

The Effect of Variations in Control-Display Ratio During Training on Transfer to a "High" Ratio.—by M. R. Rockway, Wright Air Development Center. $.50; 18 pp. (P. B. 121316).

The Effect of Target Velocity and The Area of Error-Tolerance Circles Upon Performance in a Two Dimensional Compensatory Tracking Task.—by J. C. McGuire, Washington University for Wright Air Development Center. $1.00; 38 pp. (P. B. 121380).

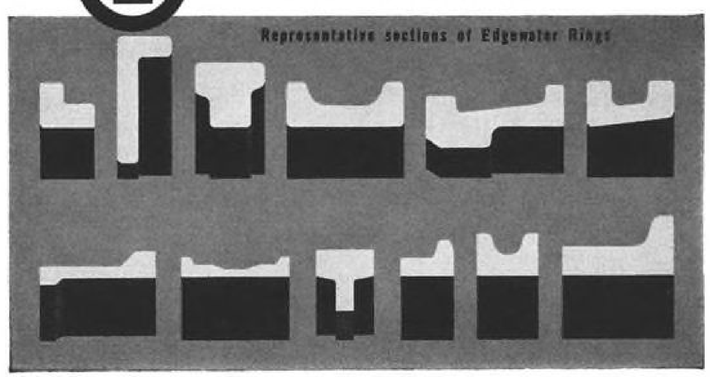
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meet highest quality standards

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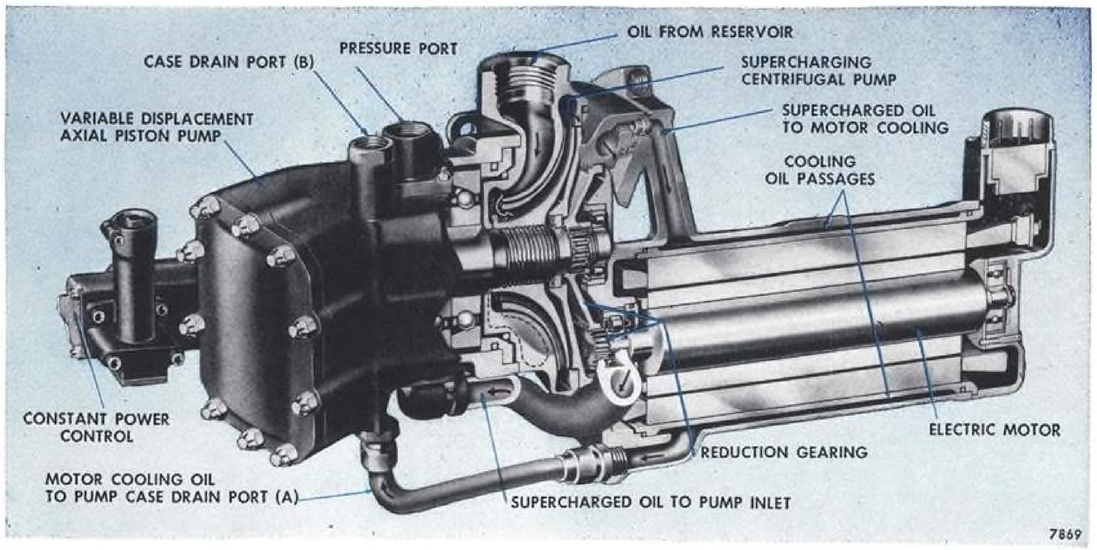
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P. O. Box 478 • Pittsburgh 30, Penna.



(*Advertisement*)

New Vickers OIL COOLED Motorpump

For Continuous Duty Applications



Installed weight approximately 25% less; also offers significant size reduction

The 12 horsepower oil cooled motorpump shown above weighs 31¼ lb and is 20" long overall . . . motor diameter is less than 4". This represents a substantial saving in weight and size over the conventional air cooled motorpump. Also, there is a further saving with the elimination of duct work in the airframe normally required for air cooling the electric motor. The motorpump illustrated *is now in quantity production* for turbine powered transports.

The time-proven Vickers variable displacement piston type pump, which is an integral part of this "package", delivers up to 8 gpm at 2250 psi, reduces to 6 gpm at 2950 psi and zero flow at 3000 psi. These flow and pressure combinations (8 to 6 gpm range) provide constant horsepower for a variety of flight operating requirements. It is designed for *2000-hour* service.

A centrifugal boost pump is located between the pump and the 400 cycle, 200 v electric motor; in addition to supercharging the pump, it circulates oil through the double-walled motor casing. Cooling oil from the motor jacket is discharged into one case drain port (A) . . . then out port (B) to a heat sink. At full pump flow, the impeller provides 2 gpm to the motor casing.

The 12 horsepower unit described above is typical of the Vickers motor and pump combinations now available to the aircraft industry as "packaged power" for continuous duty applications. Remarkable records for reliability in both military and airline service have been established by Vickers designed motorpumps.

Higher Overall Efficiency

Overall motorpump efficiency (hydraulic power output to electric current input) is 75%. This is possible only because Vickers Piston Pumps have an overall efficiency of 92%. The more efficient pump means the use of a smaller, lighter electric motor, minimum heat transfer to the hydraulic circuit, and less current drain.

Heat Rejection Control

The oil cooled motor design offers a definite advantage in that heat dissipated (140 Btu per minute, maximum) can be conveyed readily to a remotely located heat sink. This is one reason why optimum performance for a given weight and size is more readily achieved in a liquid cooled unit.

High Altitude Operation

Motor operation is not affected by low air density since it is not dependent upon air cooling. Inclusion of centrifugal boost pump prevents piston pump cavitation above 30,000 ft, even though reservoir is vented to atmosphere.

Constant Power Control

The constant horsepower control shown on the above unit is optional, depending on the application. The control maintains constant 3000 psi pressure as flow increases until the electric motor is loaded to its maximum horsepower. Additional flow is then available at reduced pressure to maintain the same horsepower load on the motor. This type of control is particularly advantageous for low force, high capacity (flow) and high force, low capacity applications while staying within the limits of recommended electric motor load ratings.

Packaged Unit

The axial piston pump, centrifugal boost pump, reduction gear and electric motor are all integrated into an exceptionally compact and high-performance package. This concept also permits a high degree of design flexibility to meet individual requirements.

Sound Insulated

Because air ducts are not needed to dissipate motor heat, the oil cooled motorpump can be sealed in a compartment and effectively sound insulated.

Additional Advantages

Low frictional starting torque characteristics of the 12 horsepower unit permit acceleration to maximum speed in less than 200 milliseconds. The electric motor meets the military specifications for explosion-proof operation.

For further information contact the nearest office listed below.

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Ceramic Coating Aids Aluminum Resistance

Ceramic coating which may make structural aluminum resistant to 1,000F has been successfully applied to laboratory sized samples, according to Gulton Industries, Inc., Metuchen, N. J.

Presently being applied to 24-S and 75-S, the new coating may reverse the present trend away from aluminum in high performance aircraft, the inventor, Dr. Paul Huppert, predicts. Coating would enable designers to continue the use of 1:3 weight advantage of aluminum over stainless steels despite the 300-700F temperatures of supersonic flight. This trend reversal will be especially likely, Dr. Huppert said, if Gulton is able to use the coating on the recent super-strong aluminum alloys developed by Alcoa and North American Aviation.

Previous attempts to porcelain structural aluminum alloys ran into difficulty because they produced blistering, brittleness and excessive warping, Dr. Huppert said. The new coating avoids these failings and provides a tough layer which promises to be able to withstand bending, shearing, drilling and punching in production. The coating may be applied before final heat treatment so that its lining can be combined with heat treatment in a single operation.

One of the tests performed by Gulton to determine the coating's ability to protect aluminum was to subject a 0.04 in. aluminum sheet to a 2,200F flame for two hours. In this test the .0015 in. coating layer prevented the flame's heat from reaching the aluminum for two hours. Under the same circumstances, an uncoated sheet was burned through in 30 sec. The temperature at the surface of the coating was 1,700-1,800F.

Obviously coatings of this sort provide only a transient barrier to external heat. They would not prevent the aluminum from losing strength and melting out if it were kept immersed in high temperature surroundings for any length of time. But most supersonic aircraft and missile flights last less than two hours and it would appear that such a coating would be satisfactory.

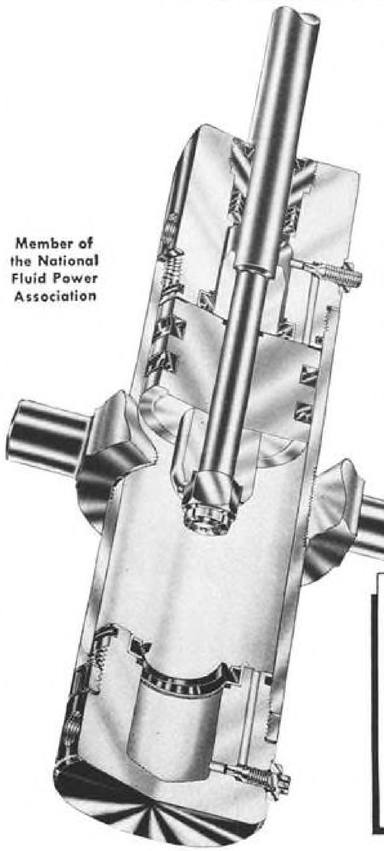
Gulton said that in fuel-cooled surfaces the coating could be used as a protection against skin friction heating on the outside and against the corrosive effects of high energy jet engine and rocket fuels on the inside.

The present Gulton coating is composed of lithium chromate, lithium borosilicate and lithium fluoride compounds. It is fired at much less than the 975F of previous coatings, Dr. Huppert said.

Beside the investigation of use of

all the EXTRAS are standard with

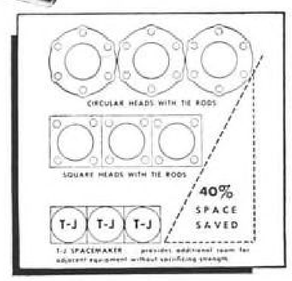
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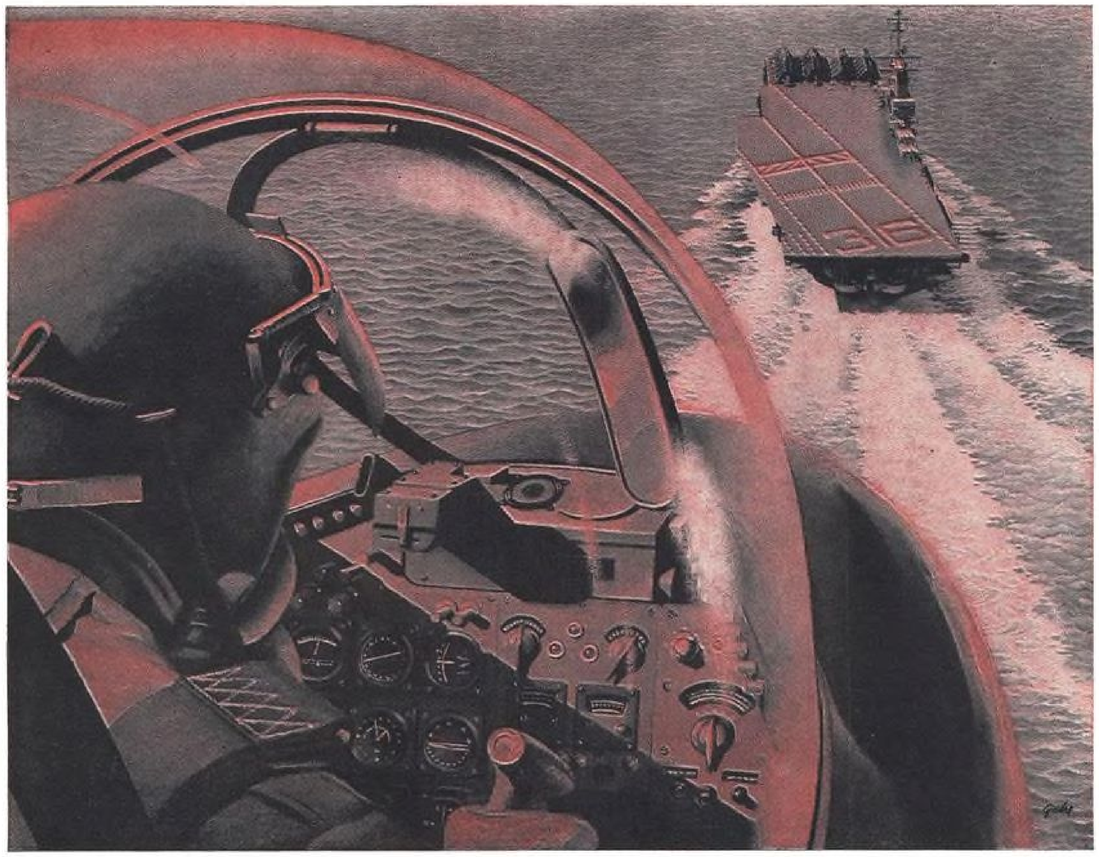


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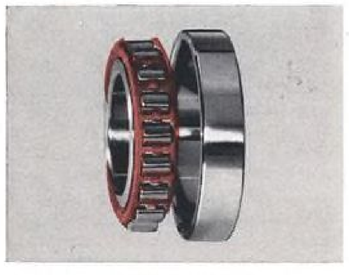
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BOWER ROLLER BEARINGS

the coating on the super-strong aluminum alloys, future Gulton efforts will include coatings for magnesium, titanium and beryllium. Also, because the coating may prove to to be corrosion resistant as well, Gulton will attempt to develop a special coating for hulls of salt-water based supersonic flying boats.

Surplus Milling Units Made Into Duplicators

Los Angeles—Conversion of World War II surplus single-purpose Cincinnati Fin Milling machines to general purpose Tracer Control Duplicators by Utility Metal Products, Inc. of Pasadena has produced a potential saving of $30 million according to the chief of the Air Procurement District here.

The multiple spindle milling machines were manufactured especially to cut cooling fins on cylinder barrels of radial engines and are no longer needed for that purpose. There are 123 of them stored in USAF warehouses. Five of the machines have been leased to Utility Metal Products for conversion purposes and two already have been converted.

Duplicators are urgently needed for Air Force production of structural parts in such aircraft as the F-100, F-102, F-106, B-58, B-52, and KC-135 as well as in engine and missile programs. They must be capable of machining to close tolerances such hard metals as titanium, chrome molybdenum, Hastelloy, Distaloy Inconel and Met-X. The converted machines meet these requirements.

New duplicating machines cost about $60,000 apiece and with the highest priority, can only be had after a production lead time of as much as 24 months.

USAF cash advantages from the conversions will amount to:

- **Storage** cost savings.
- **Rental savings** to contractors of $3,000 per year per machine.
- **Parts production** savings of about $4-million per month.

Cost of conversion is about $15,000 each.

All rights and drawings of the converted machines revert to the Air Force for the use of other defense contractors as the machines were leased to Utility Metal Products and the company has no proprietary interest in the conversion.

Fairchild Will Develop Surveillance Drone

A $12 million research and development contract has been awarded Fairchild Aircraft Division for work on a high speed surveillance drone for the Army Signal Corps.

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Flexflyte is an exceptionally lightweight ducting that is highly resistant to abrasion, vibration and flame and impervious to temperatures from minus 120°F. to plus 650°F. It will handle internal working pressures up to 70 psi and external working pressures up to 15 psig depending on type. Designed for use with ventilating, defrosting and de-icing systems, Flexflyte will take tight turns at any point up to 180° without buckling. No elbows or special fittings are required for installation.

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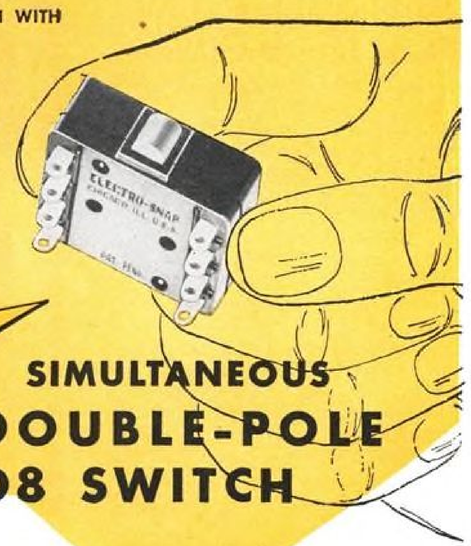
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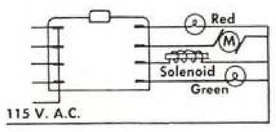


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SIMULTANEOUS DOUBLE-POLE D8 SWITCH

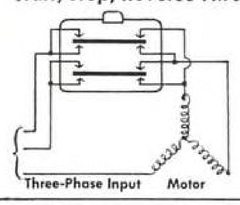
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Control Four Circuits with ONE Snap



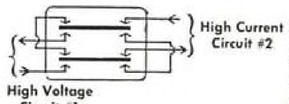
Used in motor control device at left, switch, when actuated, (1) turns off red pilot light; (2) completes circuit to motor winding, starting motor; (3) opens circuit to solenoid latch; locking door to motor gear box; and (4) turns on green pilot light.

Start, Stop, Reverse Three-Phase Motors



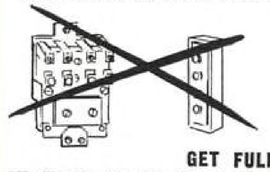
Because this new double-pole switch can simultaneously break or reverse current flow through *two* windings of a three-phase motor, you can use it as an inexpensive limit switch on three-phase lathes and drills. Use it to control automatic sequences, to limit motion of machine members driven by three-phase motors and as a start-and-stop switch.

Wire Movable Poles in Series to Switch High Current or High Voltage



As proof of simultaneous action, you can connect the two movable poles in series to increase contact area for high current applications and to increase number of contact breaks for high voltage switching.

Eliminate Expensive Relays and Additional Switches in Many Applications



This double-pole switch offers designers a wide variety of circuit hook-ups that were formerly possible only with complicated relays or a number of separate switches. Controlling three-phase motors is but one example.

Equip with Actuator



Push-button actuator may be added for panel mounting or for long overtravel. Switch is rated at 15 amps 125/250 v. AC or 10 amps inductive, 30 v. DC. Case dimensions are only 1½" x ⅞" x ½". Weighs only 20 grams.

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PRODUCTION BRIEFING

Jet engine flameouts can be instantly relighted by this small platinum-alloy rod which acts as a combined glow-plug and catalyst. Made by Charles Engelhard, Inc., East Newark, N. J., the 1½

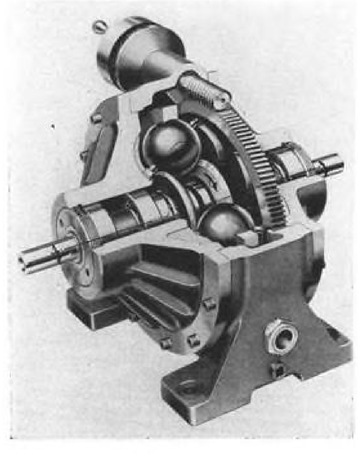


in. long device is being used in the Proteus 705 turboprop engines in the Bristol Britannia 102 airliner. Engelhard said that seven U.S. jet engine manufacturers are considering its product.

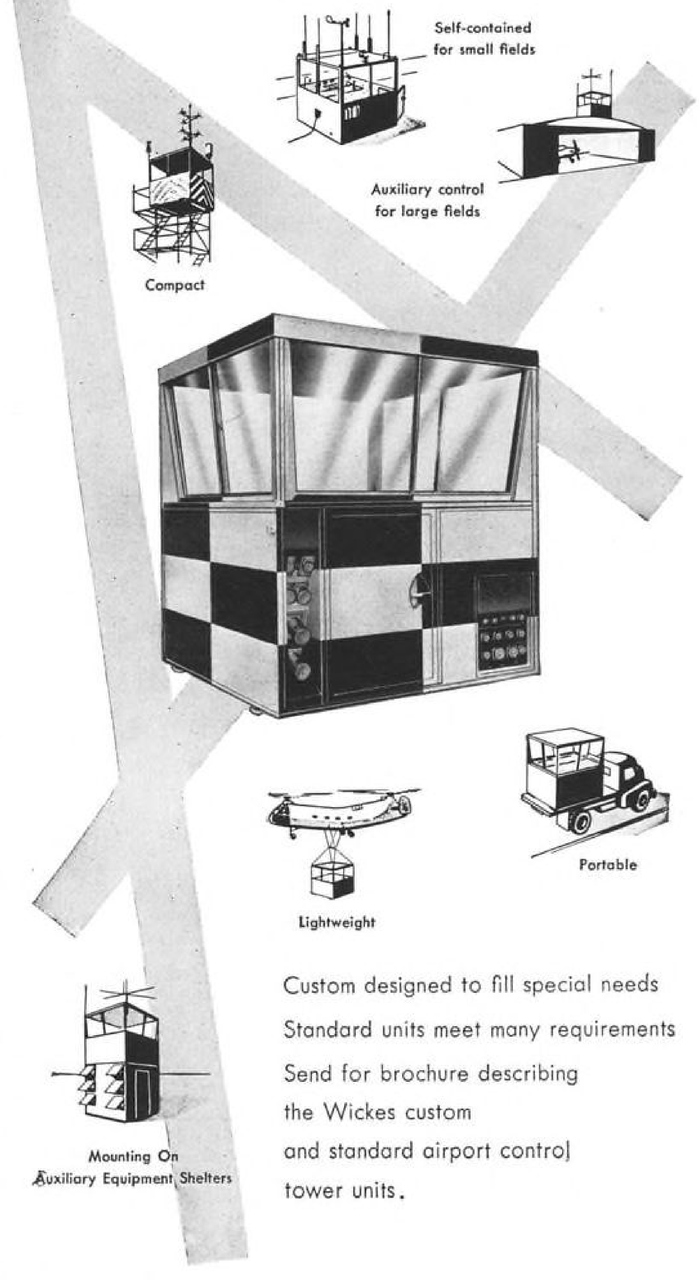
Laminair, Inc., Gardena, Calif., is a newly formed company which plans to specialize in structural and radio-frequency Fibreglas laminates for aircraft and missiles.

Robertshaw-Fulton Controls Co. will move its executive offices from Greensburg, Pa., to Richmond, Va., in early fall. Move will bring the company into closer contact with government defense agencies and provide a more central location to the company's main plants in Milford, Conn., Philadelphia, and Knoxville, Tenn.

Mechanical variable speed transmission by Cleveland Worm & Gear Co., Cleveland, Ohio, uses tilting-axis balls to vary rpm. smoothly between the input and output shafts. Based upon a Swiss invention, originally developed



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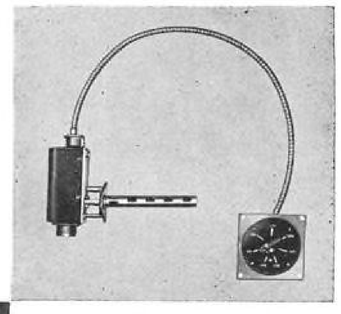


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A leading aircraft manufacturer has used S.S. WHITE flexible shafts for many years to transmit control between this graduated dial and aircraft thermostat. He finds that under any kind of temperature conditions, there is no measurable variation in torque to turn the shaft, or in torsional deflection required to initiate cam movement over the temperature range!

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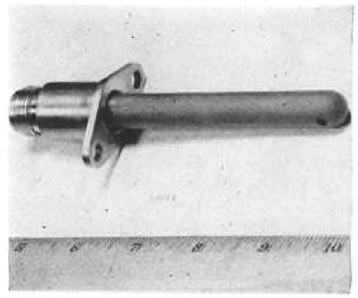


USEFUL DATA on how to select and apply flexible shafts. Write for Bulletin 5601.

S. S. White Industrial Division, Dept. V, 10 East 40th St., New York 16, N.Y. Western Office: 1839 West Pico Blvd., Los Angeles 6, Calif.

for variable pitch aircraft propellers, Cleveland's industrial drive is especially interesting in view of the current efforts to produce mechanical constant speed alternator drives (AW Aug. 8, p. 87). The Cleveland "Speed Variator" provides ratios up to 9:1 and comes in nine sizes up to 16 hp.

Thermocouple for jet engine afterburners, developed by the Thermo Electric Co., Saddle Brook, N. J., uses a cermet protecting cover. The design objective for this probe is five hours at 3,000F. So far it has been tested at 2,750F for 1½ hr. in a Curtiss-Wright J67 afterburner. Combination support tube and radiation shield cover is made from titanium oxide. Platinum rhodium thermocouple wire combinations are used for 3,000-3,100F temperatures and iridium, iridium-rhodium wires are



used for 3,500-4,000F temperatures. Since no auxiliary cooling is used, the extraneous conduction errors from this source are eliminated. However the ambient temperatures at the connection end must be kept below 800F. While the first relatively short-lived units will be used for engine tests, it is possible that later longer-lived units could provide improved engine controls through temperature feed-back from the hottest parts of turbojet engines.

Pacific Optical Corp., Inglewood, Calif., numbers among its present projects the first successful aerial photographic reconnaissance at crepuscular twilight light levels and the fabrication of complete Schlieren optics for the study of shock patterns in wind tunnels. Pacific's new 16,000 sq. ft. plant is equipped to produce optical parts up to 36 in. diameter whose end usage can vary from infrared to missile guidance.

Robert L. Bralla and J. Rodgers Magee have formed a new company bearing their names to specialize in training aids, technical models, flight simulators and to provide design services for the aircraft industry. Both men were formerly with Burton Rodgers Technical Training Aids Co., Cincinnati, Ohio.



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OBLIQUE PHOTO taken by Fairchild CAX-12 from over 40,000 ft. in the midwest shows curvature of earth, high altitude darkness.

How F8U-1P Photographed U.S. at M 1.1

By George L. Christian

New York—Six aerial cameras—three CAX-12s, two K-17s and a P-2 teamed with automatic avionic camera control system NCCS-4 (Navy Camera Control System No. 4)—made the coast-to-coast photographic mapping survey during the record-breaking flight of a Chance Vought F8U-1P.

The photographic Crusader version was flown from California to New York in 3 hr. 23 min. 8.25 sec. by Maj. John Glenn, Jr., USMC (AW July 22, p. 30).

Five cameras, the three CAX-12s and two K-17s, were made by Fairchild Camera and Instrument Corp. The CAX-12s (AW May 21, 1956 p. 105) are the latest, miniaturized Image Motion Compensation (IMC) cameras to be developed by Fairchild.

NCCS-4 (AW Nov. 21, 1955, p. 34) is the most advanced camera control system installed in an operational aircraft, according to Chicago Aerial Industries, which designed and manufactured the equipment.

P-2 camera is an orientation type designed for forward firing pictures used primarily for strike damage assessment. Camera was developed for the Air Force five years ago and has since been produced in many models for USAF and Navy by J. A. Maurer, Inc.

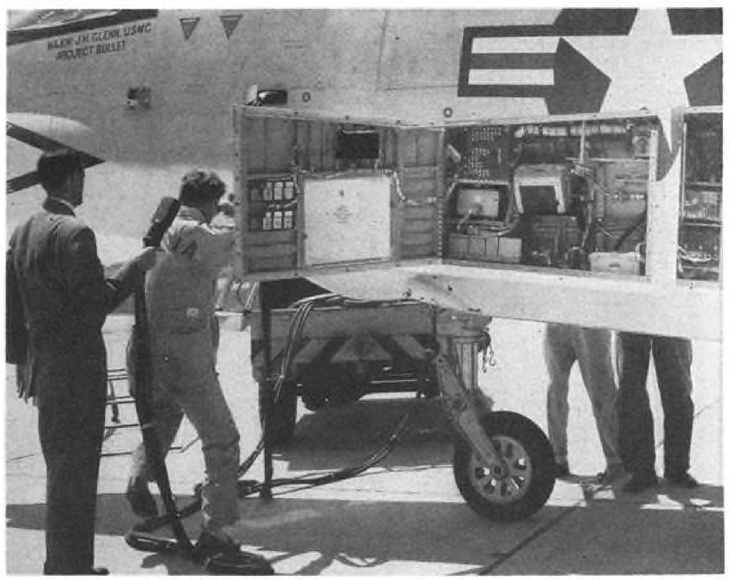


PHOTO COMPARTMENT of record-breaking F8U-1P shows complex wiring, port oblique CAX-12 Camera (center), vertical CAX-12 (lower right). Note glass window in open panel.

Photographic Details

Details of the photographic aspect of the F8U-1P's record coast-to-coast flight given to AVIATION WEEK by Commander M. Alexitas, director of Aeronautical Photographic Experimental Laboratory, Naval Air Development Center, Johnsville, Pa., and assistant director, Lt. Cmdr. J. Condren. The laboratory was responsible for operation of the F8U-1P's photographic equipment during the trip.

The plane's transcontinental dash was its first operational photographic flight; it had previously made only short test flights to check out its 600 lb. of photographic equipment prior to the record run.

Tasks assigned to the camera were:

• **CAX-12:** Continuous record from takeoff to touchdown. Taking of the still pictures was timed automatically



VERTICAL reconnaissance photo taken from 30,000 ft. at maximum speed shows Trenton, N. J. (upper center), Morrisville, Pa., across Delaware River (left). Newly erected Fairless steel works lies in elbow of river at lower left.

to give a 20% overlap of one shot on another. At cruising altitudes of 35,000 to 50,000 ft. average time interval between exposures was 75 sec. Shutter speed was usually 1/200th of a sec. The three cameras were mounted in a trimetrogon arrangement—three across. The port and starboard oblique cameras carried the film plane at 60 deg. from the horizontal. Middle camera was mounted vertically. The 100 ft. roll of 70 mm. film supplied each camera was ample for the 3½ hour flight since about 400 2¼ in. square shots can be taken on this length of film.

• **K-17:** Two K-17s were mounted side-by-side in the rear camera compartment. The cameras gave complete take-off-to-landing vertical coverage. First camera operated from California to Garden City, Kan. There Maj. Glenn started second camera and shut off the first. Second camera photographed strip from Garden City to New York. Pictures were taken with 60% overlap. Magazines held 400 ft. of 9 in. film.

• **P-2:** The single P-2 unit was mounted pointing forward and down at an angle 15 deg. from the horizontal. The camera was operated at will by the pilot through a trigger switch on the control column. Capacity of the camera's magazine was 50 ft. of 70 mm. film. Magazines with 15 ft. and 100 ft. capacities are available.

Prevent Blurring

CAX-12 and K-17 cameras were equipped with IMC magazines. These are moved automatically during film exposure in the appropriate direction and at the correct speed to prevent blurring the exposure because of the plane's high speed. Plane's ground speed is precisely measured by a Chicago Aerial Industries' twin-lens scanner, which, through electronic controls, synchronizes movement of the magazine to ground speed to prevent blurring. Variations of light and dark on the ground are detected by the scanner to set IMC system in operation.

CAX-12 cameras are less than one-fourth the size of standard aerial cameras, according to Fairchild, yet have a faster cycling speed. Cameras can map territory at plane speeds varying from very slow to supersonic and from low to very high altitudes. Four different lens cones are provided, 1½, 3, 6, and 12 in. Speed run CAX-12s used 1½ in. focal length lenses.

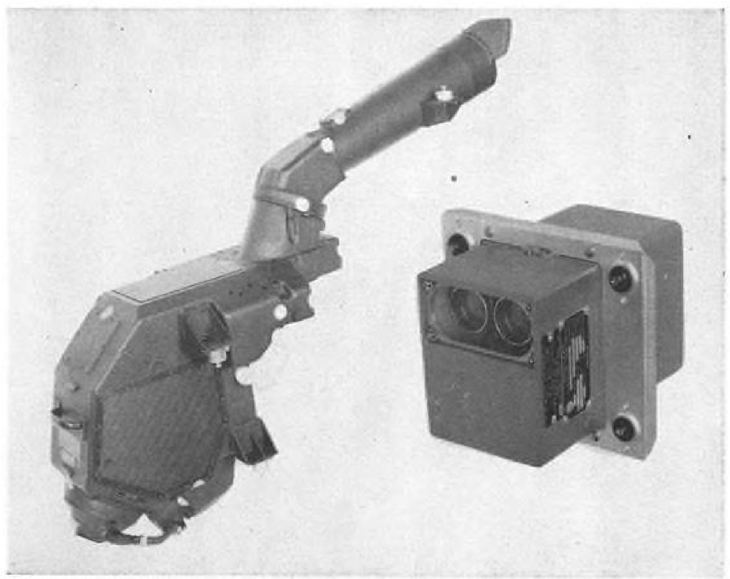
Camera is now in production.

Control Refinements

Chicago Aerial Industries says that the NCCS-4 "is the first complete camera control system designed to meet 500 cps. vibration requirements. At the same time, weight was decreased and rigidity, vital to optical accuracy, was maintained. Earlier systems were designed to withstand 55 cps."

New installation concepts reduced cockpit display area requirements approximately 50% and simplified system operation.

Viewfinder, designated VF-33, serves to locate targets optically and doubles as a precision navigational aid. It gives the pilot drift angle and provides a means for determining true air speed. A moving grid lets the pilot perform an independent check on the IMC sys-



CHICAGO AERIAL INDUSTRIES' VF-33 viewfinder (left) is shock-mounted. Company's twin-lens scanner (right) controls Image Motion Compensation. Units are not to scale.



4 IMMEDIATE OPENINGS FOR ENGINEERS

Nuclear Propulsion Specialist. To make studies producing state of the art evaluations and recommendations ultimately resulting in design of aircraft nuclear propulsion systems. Requires advanced degree and 2 years related experience.

Propulsion Performance Engineer. Must be capable of analytical airplane installed performance determination with varying inlet and exit conditions. Requires minimum of 5 years experience in jet engine cycle analysis. Advanced degree preferred.

Compressible Flow Engineer. To design supersonic inlet and exit systems. Requires advanced M.E. or A.E. degree, with minimum of 2 years experience in analytical design of inlet diffusers and nozzles.

Development Engineer. For weapon and tactical analysis. To plan optimum weapon systems prior to preliminary design, and to evaluate the military worth of new aircraft and missiles in preliminary design.

To arrange for a personal interview, or for a prompt report on these or *other current openings*, return coupon to:

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A Vought Vignette
NO. 7 IN A SERIES



The propulsion engineer who was allergic to switches

During the Vought Crusader's N.A.A. record-breaking flight across the continent, fuel management was a vital factor. But it wasn't the constant worry it might have been. Fred Alvis had seen to that, beginning four years ago.

When the Crusader project was formed, Fred was just a few years out of Alabama Poly. His was still a new face. Mighty new, Fred would have agreed when he was tapped to develop the functional design of the Crusader fuel system.

Navy specs told Fred his system should be reliable and very lightweight. Pilots, too, gave him a special request. In the ready room near the flight line they described the constant in-flight attention required by complex fuel systems. "Can you fix it so we can forget fuel for a minute?" they asked the young designer. "Can you cut down on those switches?"

Fred went all-out for simplicity, plunging into a three-month whirl of schematics. He was encouraged by close design group assistance in studies and layouts. Soon he was making procurement selections and writing functional reports. Then, with the fuel system mockup, Fred unveiled what he'd done.

It was a showpiece of simplicity. Absent was the usual complex CG control system. Fred had bypassed the problem entirely by canny choosing of fuel cell locations and fuel line sizings. Absent, too, was an emergency system — together with the need for it! There was a unique air transfer system for moving fuel from the Crusader wing tank to the main sump, plus some freshly conceived lesser features.

As mockup and flight tests proved, Fred's ideas more than met weight and reliability requirements. And, as pilots were shown, all simplification features led directly to the cockpit. There Fred had won his war against switches.

Only one had survived.

At Vought, the invitation to find a fresh approach is extended to every engineer. Here, in groups that coordinate for mutual progress, and in test facilities that can evaluate the most advanced proposals, ideas receive the attention they deserve.

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40th ANNIVERSARY
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"We're developing the Atlas ICBM ...giant step toward Outer Space!"



DR. HANS R. FRIEDRICH
Assistant Chief Engineer – Development of CONVAIR-*ASTRONAUTICS*, received his Ph.D. at the University of Leipzig, and was the co-developer, with Dr. Wernher von Braun, of the famous V-2 rocket. He is responsible for directing the research and technical development of the Atlas ICBM.

"The Atlas Intercontinental Ballistic Missile, now being designed and developed by CONVAIR-*ASTRONAUTICS*, will be, for a time during its flight, a true space vehicle. At hypersonic speeds, it will travel hundreds of miles beyond the earth's atmosphere.

"That's why our top theoretical scientists here at CONVAIR-*ASTRONAUTICS* are exploring every implication of flight into space. Even now these men are thinking in terms of multi-stage rocketry, re-entry, solar propulsion and cosmic dust bombardment. Other teams of our engineers and technicians are engaged in the practical application of this new science, Astronautics.

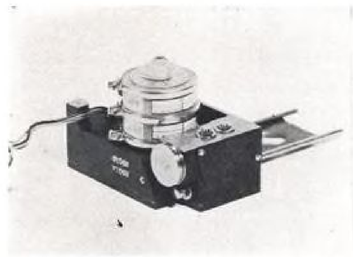
"Our first job here at CONVAIR-*ASTRONAUTICS*, of course, is to make the Atlas ICBM operative, for we are aware that this is a top priority weapon. You – as an engineer – can appreciate the stimulating atmosphere generated by a project so vital to America's defense.

"As a graduate engineer or scientist with an aptitude for creative thinking, your future is with CONVAIR-*ASTRONAUTICS*. Here you will associate with the leaders in this advanced field – work in our new $40,000,000 facility. You will see and feel the kind of achievement that means personal progress. And you will enjoy living at its best in beautiful, smog-free San Diego.

"For your future's sake, write today to: Mr. G. N. McMillan, Engineering Personnel, Dept. 78-A."

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3302 Pacific Highway, San Diego, California

CONVAIR IS A DIVISION OF GENERAL DYNAMICS CORPORATION



FAIRCHILD automatic exposure control built into CAX-12 camera adjusts lens opening to light intensity. If lens is full open, device slows shutter speed for correct exposure.

tem to determine the proper interval rate for photographic overlap.

VF-33 combines two separate optical systems for narrow and wide angle views of the terrain. In the F8U-1P, the narrow angle system is forward-looking because the plane is so fast that the pilot does not have time to select targets through a vertical narrow angle system.

Another innovation, according to the Chicago company, is a single, wide-angle exit pupil replacing two smaller ones previously used.

It doubles light transmission, making it easier for the pilot to select targets under dawn, dusk or other minimal light conditions, thus increasing the system's photo reconnaissance capabilities.

Greater Freedom

Use of a single, large exit pupil also gives the pilot greater freedom. It allows him to move his head over twice the area previously permissible without distorting or losing viewfinder presentation.

This simplifies the pilot's job of flying without his losing track of his photographic objectives.

CAI increased the night capabilities of the NCCS-4 system with night sequential mode of operation. Cameras in stations three and four operate alternately.

While one camera makes an exposure, the other re-cycles. Thus the exposure rate is double that of earlier night systems and clear pictures can be obtained at twice the speed or from half the altitude.

Chance Vought's F8U-1P is an example of how a camera control system can be integrated into its vehicle. CAI and Chance Vought engineers converted the F8U-1 for reconnaissance without adding a special nose. The only changes were dictated by the need for optically flat windows in the belly. The bulge on top of the fuselage was added by application of the area rule to maintain speed performance.

STRATOFLEX "SUPER-T" Teflon*



CONVAIR B-58

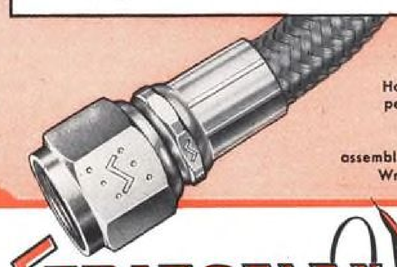
developed for extreme temperature ranges in supersonic jets...

Stratoflex "Super-T" hose assemblies are designed for extremely high and low temperatures. Stratoflex "Super-T" tube is extruded from specially compounded Teflon* and reinforced with high strength, corrosion resistant stainless steel wire braid. "Super-T" is unaffected by fuels, petroleum or synthetic base lubricants, acids, solvents, alcohol, and coolants. It is non-inflammable and the shelf and operating life are practically unlimited to provide long and trouble free service.

*TEFLON is a registered DuPont trademark.



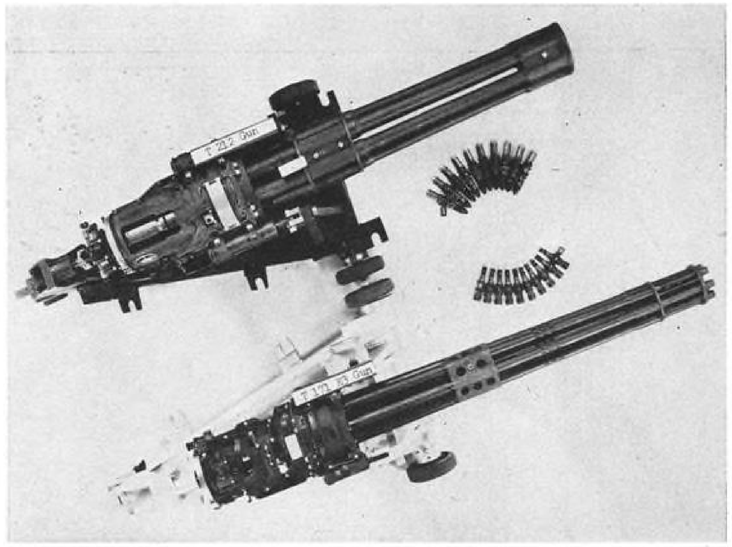
Straight 45° and 90° fittings in stock



Stratoflex "Super-T" hose is available in standard sizes from —4 to —20. Hose is factory assembled, fittings permanently attached — corrosion resistant, high temperature or lightweight types. Special assemblies, made to your specifications. Write for information (S-3 Bulletin).

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VULCAN CANNON'S newest version, the T212 (top) is compared with the earlier 20 mm. version (bottom). The 30 mm. T212 weighs about the same, is shorter. Production contract was just awarded for the earlier version.

Harder Hitting 30 mm. Vulcan Weighs About Same as 20 mm.

New 30 mm. version of the Vulcan rotating barrel gun which has three times the striking power, is eight inches shorter and weighs about the same as the 20 mm. predecessor version has been developed by General Electric for the USAF under a U. S. Army contract.

Designated T212, it may be used on Convair's supersonic B-58 Hustler.

The T212 weapon (AW Aug. 6, 1956, p. 314) has six barrels like its forerunner, the T171E3, but each barrel weighs 22 lb. compared to 18 lb. for the 20 mm. gun. T212 is 64 in. long—8 in. shorter than T171 Vulcan. Both guns use the Gatling revolving barrel principle to give a very high rate of fire.

The new weapon is a standard, trigger-operated gun driven by either a hydraulic or electric motor which rotates the barrels and applies voltage to the firing circuit. When power is interrupted, motor is braked to a stop.

Power required to drive the gun is 24 gpm. at 2,600 psi. across the motor if a hydraulic motor is used, or 40 kva. if it is powered electrically.

Average recoil force is about 6,600 lb. for steady-state firing. Peak recoil force is 12,500 lb. maximum, may possibly be lowered to 10,000 lb. This low peak value can be achieved by permitting the gun to recoil 0.75 in. on its recoil adapters.

Gun has fired both steel and brass ammunition satisfactorily, according to GE.

The 20 mm. T171 Vulcan is now being used on USAF's supersonic Lockheed F-104A Starfire.

Flying Tiger DC-6A Salvaged Successfully

Flying Tiger DC-6A, which recently made a belly landing in the marshes of Jamaica Bay after experiencing a power loss on all four engines, shortly after taking off from New York International Airport has been successfully salvaged.

A hundred foot long barge was towed to a few yards of the aircraft through a specially-dredged channel, then sunk beside the plane.

A sand ramp was built between plane and barge. Aircraft, which had been jacked up, had its landing gear lowered and was towed onto the barge by a floating derrick. Water was pumped out of the barge, refloating it and plane was floated away.

None of the nine passengers and crew aboard was injured.

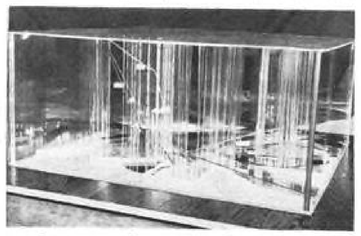
Flying Tiger awarded a contract for repair of the airplane to Lockheed Aircraft Service-International at the New York airport. This includes changing the four engines, replacement of belly skin and main landing gear, nose gear and nacelle repair, replacement of flaps and thorough cleaning of the airplane.

Plastic Display Depicts Norfolk Control Area

Clear and colored plastic strips and rods are used in a Navy-developed, three-dimensional display to form a model of the Norfolk, Va. Air Traffic Control Area. Purpose of the device is to familiarize Navy flight crews with the complexity of current instrument approach and departure procedures.

Used as a static display or in classroom instruction, the 3-D display measuring 48 in. long, 45 in. wide and 18 in. high, is designed to indoctrinate pilots on existing radio aids, airways, GCA patterns, ILS paths and military and commercial airfields under the cognizance of Norfolk control area.

A photographic enlargement of a standard Norfolk area aeronautical chart is mounted beneath the display. Airways are presented in colored plastic and conform with the appropriate color designations used on the chart: green, amber, red and blue. They are installed at the 700 ft. level. Radio range cones of silence, beacons and fan



markers are shown in clear plastic of appropriate shapes. The Cofield Omni-Range station and Victor airways are represented by ¼-in. diameter clear plastic rods. Special flight patterns are included to illustrate the Navy Norfolk standard holding pattern, GCA approach, and jet penetration pattern.

The display represents altitudes up from zero to 10,000 ft., is lighted and includes numerous model aircraft to represent air traffic. The display was designed and manufactured by the Norfolk regional office of the U.S. Naval Training Device Center, Sands Point, N. Y.

Silicone Rectifiers Used In B-58 Electric System

Electrical generating and control systems for USAF's supersonic B-58 Hustler are being built by Westinghouse Electric Corp.'s Aircraft Equipment Dept., Lima, O. System, made up of three completely enclosed 40 kva. generators, uses Westinghouse-developed silicone rectifiers that rotate with an a.c. exciter to provide d.c. excitation. Purpose is to eliminate conventional carbon brushes which break down rapidly at high altitudes.



H-23D Flies With New Drive System

Hill H-23D, using a new drive system, has completed a 1,000 hr. accelerated ground endurance test at Hiller's Palo Alto, Calif., plant. Deliveries of the H-23D, first designed to meet an Army requirement for 1,000 hr. interval between overhauls, will begin this fall. A three-place helicopter powered by a Lycoming VO-435 engine developing 250 hp., H-23D will be used for training, utility missions.

USAF Contracts

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

SACRAMENTO AIR MATERIEL AREA, McClellan AFB, Calif.

Lockheed Aircraft Service, Inc., Box 33, Ontario, Calif., IRAN and modification of RC-121 C/D aircraft: 55 (PR 536828) $789,287.

Servomechanism Inc., Western Div., 12500 Avia, Hawthorne, Calif., modification kits for conversion to be used of F-86D 1179 (PR 25448), $179,684.

Joy Mfg. Co., Michigan City, Ind., compressor assembly, intercooler—aftercooler assembly, pilot valve assembly 48, 31, 40 (PR 2444), $113,476.

United States Rubber Co., Mishawaka, Ind., kit cell assy., 1,200-gal. capacity for installation in bomb bay B-45, 100 (RP 23268), $219,500.

Bergen Research Engineering Corp., 30 Henry St., Teterboro, N. J., procurement of helicopter transmission test rigs and performance and analysis of a 12,000-hr. transmission test. Contract DA 44-177-TC-422, $266,369.

ROME AIR FORCE DEPOT, U. S. Air Force Griffis AFB, N. Y.

Collins Radio Co., 855 35th St., Cedar Rapids, Iowa, modification kit blower T-217/GR transmitter, 981 ea., (RFP 30-635-57-4781Q) $123,512.

Carnish Wire Co., Inc., 50 Church St., New York, N. Y., cable assembly, 2 conductors, 2 AWG, IFB-30-635-57-275B 2,569 ea., $106,485.

Bendix Aviation Corp., Bendix Radio Div., Baltimore 4, Md., radome ancillary equipment, RFQ 30-635-57-4380Q, 26 ea., $682,223.

Roanwell Corp., 662 Pacific St., Brooklyn, N. Y., headset, application AIC-10 (IFB 30-635-57-141B), 1360 ea., $74,202.

Roanwell Corp., 662 Pacific St., Brooklyn, N. Y., headset, applicable to AIC-10 (IFB 30-635-57-317B), 25,000 ea., $713,425.

Polarad Electronics Corp., 43-20 34th St., Long Island City, N. Y., microwave field intensity meter & receiver, Polorad Model FIM, (RPF 30-635-57-5098Q), 3 ea., $61,650.

Electric Auto-Lite Co., 1201 Champlain St., Box 931, Toledo, Ohio, electrical wire, MIL-W-8777A (IFB 30-635-57-323B), 5,462,500 ft., $301,521.

General Electric Co., Electronics Park, Syracuse, N. Y., mock up equipment system consisting of antenna systems, UHF-SSB receiver, UHF-SSB exciter, power amplifier and system monitor (RFP 30-635-57-504-0Q, $4,594,905.

CAMBRIDGE RESEARCH CENTER, ARDC, USAF, Bedford, Mass.

Massachusetts Institute of Technology, Cambridge, Mass., research directed towards the study of the maintenance and fluctuations of the large scale atmospheric circulations, AF19(604)-2242, $48,972.

Psychological Research Associates, Inc., 507 Eighteenth St., South, Arlington, Va., study to determine the nature of information required for decision making and the issuance of orders at the various echelon levels, AF19(604)-2282, $88,935.

Georgetown Univ., Wash., D. C., study of measuring long arcs by the solar eclipse method—AF19(604)-229—$56,987.

Baird-Atomic, Ind., 33 University Road, Cambridge, Mass., research directed toward the development of a two-beam infrared interferometer—AF19(604)-2264—$29,926.



Martin Orlando Plant Nears Completion

Martin Co.'s plant at Orlando, Fla., first privately owned and financed major aviation facility in the U. S. under Army cognizance, is nearing completion on a 7,000 acre site. Plant, scheduled for completion late this year, will turn out Lacrosse artillery missile, Bullpup air-to-surface missile, and Missile Master, control system for missile AA batteries. Plant contains 500,000 sq. ft. of space.

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Model ETC-30-10-P.A.M.-1

30 Channels — 10 Samples / Sec.

- Directly replaces mechanical commutators in 0-3 Volt and 0-5 Volt airborne telemeter applications.
- Available in all standard sampling rates required for P.A.M. and P.D.M. commutated systems.
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- Errors due to drift, cross-talk and non-linearity less than 0.50 percent under MIL E-5272A environment.
- Noise-free operation assured for thousands of hours without maintenance.
- Twenty-Seven (27) information channels, plus Master pulse.
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- Size: 3" diameter x 5" long.
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CESSNA T-37As at Bainbridge Air Base, Ga., are first T-37As assigned to a primary training contract school. Nine T-37As are with Project Palm, which was transferred from Connolly AFB to handle Phase VIII evaluation of the T-37 at Bainbridge.

Contract School Evaluates Cessna T-37

By Erwin J. Bulban

Bainbridge, Ga.—Final phase of evaluating twin-jet side-by-side Cessna T-37A in the field is underway at Southern Airways School, of USAF's seven civilian-operated contract pilot primary training facilities, prior to replacing the 100-odd piston-powered North American T-28As at each school.

Southern Airways is the first school to receive the T-37A under a contract negotiated with Air Materiel Command, whereby Project Palm, suitability and employment evaluation of the twin-jet, was transferred from Flying Training Air Force Headquarters, Connolly AFB, Waco, Tex. Bainbridge air base is handling Phase VIII of the T-37A program; unit employment and suitability.

Experimental Class

An experimental class, 58-N comprises 20 students who had completed 30 hr. of training in the piston-powered Beech T-34A, are now taking their final primary training phase in the T-37A. This consists of 251 hr. of academics and 150 hr. of flying. This class, comprised of above-average, average and below average students, will graduate in March.

Southern Airways' responsibilities go far behind training and graduating this first crop of primary students to undertake a jet course. In Phase VIII the school, is literally "writing the book" to be used by all of the contract schools for T-37A training.

Among the answers sought are these:

• **Optimum number** of student flying hours on the T-37A. The 150-hr. being given class 58-N is an arbitrary figure for evaluation; indications are it will be adjusted downward. Normal flight time on the T-28A, which the T-37A is scheduled to replace, is 100 hr.

• **Logistics support** needed by a school to keep their T-37A flying, from ground equipment to nuts and bolts. Project Palm gets T-37A airframe support from Tinker AFB and engine requirements are furnished by depot at San Antonio.

An initial indication of how the T-37A requires additional facilities is the extra fuel storage Bainbridge AFB is planning. It is currently using a 36,000-gal. surplus facility to support the program; scheduled is a 450,000 above ground tank for JP-4, for which contracts have already been let, according to the school's general manager, Hugh Davis.

• **Maintenance procedures** and overhaul schedules on the scores of aircraft, engine and equipment items. Periodic check on the T-37A takes about 37 hr. and this will probably go down as the learning curve of ground personnel goes up; the same checks on the piston T-28As takes about 40 hr. Cost figures will take experience to establish, but indications are that both maintenance and operational figures will be under those for the T-28A.

Procedures and schedules get particularly complicated when it is remembered that both airframe and engine are new and are still undergoing modification as a result of past and current evaluation. T-37A operation is especially watchdogged because planes are being flown by inexperienced students. Instructors say that flying the airplane is no problem and that they feel they could turn students loose in a few hours; the only drawback being that they want to ensure that students are thoroughly familiar with the cockpit and emergency procedures.

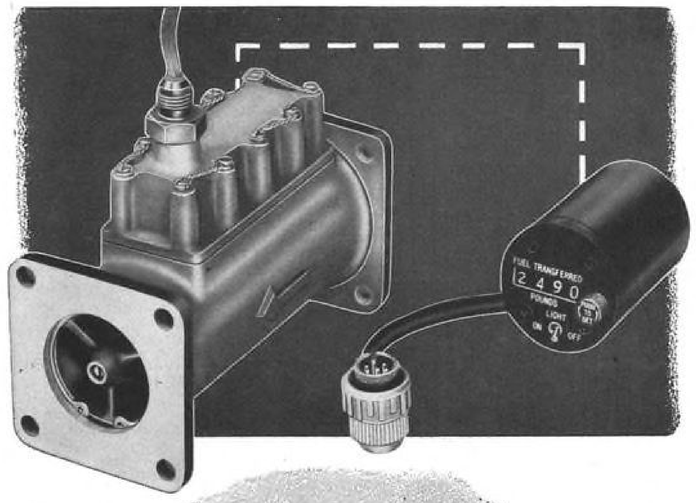
Early Solo

Southern soloed its first Class 58-N student, 2nd Lt. James A. Riggs, Jr., Richland, Wash., after only 7 hr. 10 min. dual time.

The school has a $120,000 Link EM-2 simulator duplicating the T-37A. Now occupying some 24 ft. x 24 ft., electronic cabinets are being redesigned to take 11 ft. x 17 ft. area.

The school has nine T-37As for student training, another three are used to upgrade instructors who get some 50 hr. before flying students, soloing on a proficiency basis. They say that they think they could solo after the second or third check ride.

Current utilization of the nine T-37As used by the students is about 60%. Turnaround time on the airplanes is faster than the T-28As, even at these early stages and ground personnel like



Revere FLOWMETER used in BUDDY-SYSTEM REFUELING

...No "Black Boxes" Needed

Buddy-system inflight refueling means greatly increased range and striking ability for carrier-based aircraft. The Revere Flowmeter System, used in this new method of mid-air refueling and now being produced for two Navy prime contractors, *totalizes flow accurately and dependably without the use of "black boxes" or vacuum tubes.*

The output signal of the transmitter, shown above, is fed directly into the electrical counter, eliminating the need for external electronic amplification.

Various impulse-flow ratios, flow rates to suit your totalizing applications. Rate of flow indication also available.

REVERE CORPORATION OF AMERICA
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the airplane's servicing features. One lineman told AVIATION WEEK he has yet to hear an instructor criticize the airplane.

Not that all the problems are solved. For example, the 920-lb. thrust Continental-built J69-T-9 turbojets are still 50 hr. engines, although as of recently one engine had about 140 hr. on it. Among the still critical items: outer basket rarely goes beyond the 50-hr. periodic check, as does the exhaust diffusor—cracking is the problem. Considerable research is underway on various materials to combat this condition.

Brakes are another subject for unsatisfactory reports: both seizing and fading. Problem lies in both the General Tire & Rubber Co.-built brakes themselves and the system. Southern Airways personnel say that they think that the material used in the brakes does not dissipate heat rapidly enough, although the brakes themselves were designed to USAF specifications.

Among the modifications in the works at Cessna is a project to delete the exhaust deflector system, used on approaches to maintain high engine rpm. and reduce thrust, and replace them with larger, more effective wing flaps. This will reduce maintenance. Company is also planning to revise the nose gear, providing a narrower tread tire to make taxiing easier. Current large wheel requires excessive effort in some ground maneuvering angles, personnel feel.

There is also concern about the short range of the radio gear (AW Apr. 1, p. 49); opinions vary as to whether this is due to antenna installation or the sets requiring individual adjustment to get peak performance.

PRIVATE LINES

Cessna third quarter sales totaled $18,668,000, a gain of 8% over the previous quarter; net profits showed a higher gain, being $1,146,633 after taxes compared to $852,298 in the second quarter. Sales volume for the nine months ending June 30 was $50,905,000 with net earnings being $2,840,000. President Dwane Wallace estimates final quarter sales at $18.5 million, bringing the company's total sales for Fiscal 1957 about five percent higher than last year.

Contract of some $1.2 million to overhaul Lockheed F-80 jet fighters for delivery to foreign allies has been received by Aircraft Engineering & Maintenance Co., Oakland, Calif.

Chance Vought is one of the latest of the large prime military plane contractors to become interested in busi-

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hook it up...

turn it on...

In little more than the time it takes you to read this ad, the Herman Nelson MC-1 portable heater is connected to the Convair F-102A's own ventilating system, turned on and already sending volumes of heated or ventilating air where needed for a quick and proper preflight . . . another example of the leadership of Herman Nelson Products.

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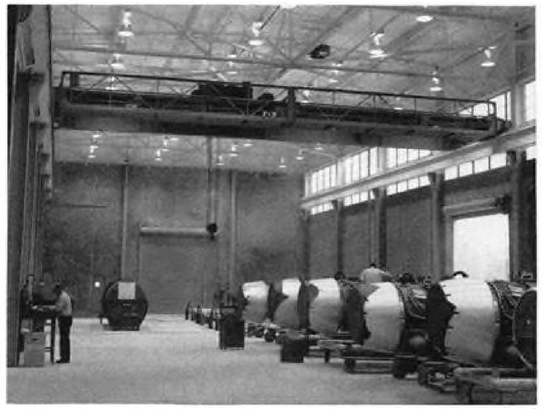
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This new Rohr Assembly Plant was recently completed at Auburn, Washington. It will facilitate final assembly and delivery of Rohr Jet Power Packages and other components for the Boeing KC-135 Stratotanker (shown above) and the Boeing 707 Stratoliner. This new, modern location is

ROHR'S LATEST MOVE TO SERVICE CUSTOMERS "ON THE SPOT"

It's another reason why, more and more, America's leading airplane builders look to Rohr for major aircraft components.



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ness aircraft field. Company has been conducting market survey and collecting pilot opinions for possible design studies.

U. S. export of aircraft weighing 6,000 lb. or less during May totaled 120 units valued at $1,629,918, an increase of 43% over May 1956 in units and 43% in dollar value. During first five months of 1957, aircraft shipments abroad totaled 560 planes valued at $8,525,842 compared to 391 planes shipped in the same period last year with a value of $4,464,237.

First six months unaudited figures for Pacific Airmotive Corp., Burbank, Calif., indicate a net profit of $443,548 after taxes compared with $361,285 in the same period last year. Consolidated sales for PAC and subsidiaries in 1957's first half totaled $16,716,361 compared with $9,550,483 in the first six months of 1956. Pac is expanding to increase diversification of efforts along civil aviation lines, anticipating increased competition for reduced Defense Dept. Fiscal Year 1958 funds allocated for contract maintenance.

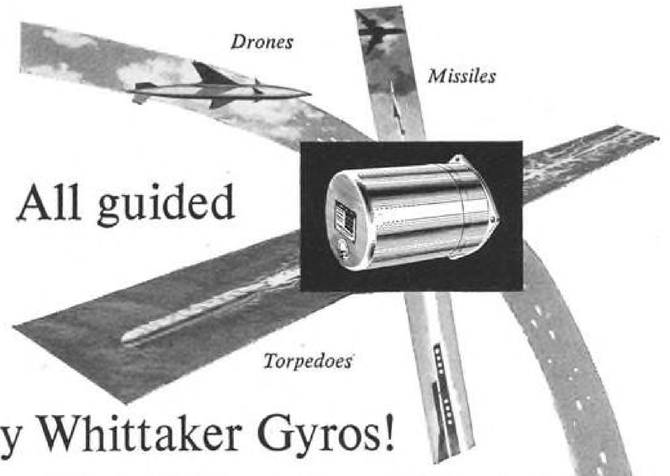
Prototype Morane-Saulnier MS-760 Paris twin-jet four-seat executive plane is being shipped to South America to be displayed at the Lima, Peru, fair and to undergo flight demonstrations.

Timmins Aviation, Ltd., Montreal businessplane service operator, is now Beech distributor for Eastern Canada; Dallas Airmotive, Ltd., named Timmins its exclusive Canadian distributor.

First export order for Westland Widgeon four-place utility helicopters covers two units for use by recently formed Brazilian Naval Aeronautics Dept.

Orders for nine Edgar Percival E.P. 9 utility aircraft have been placed by foreign operators: three will go to Bahamas Helicopters in Tripoli to support oil drilling operations, another will be used by a French firm for passenger/cargo operation in Africa, two will go to Australia for aerial fertilizing work, a German firm is getting one for spray/dust operations, one is going to Canada for bush operation and one will be used in Sweden for aerial fertilizing.

New foam material suitable for cushioning, sound and heat insulation is said to have half the weight of natural latex foam and high tensile strength permitting sewing and stitching through the material. Another feature: its compatability with many materials and resistance to sun and air. Polyfoam is in production by General Tire & Rubber Co. at Marion, Ind.



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Army Contracts

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

REDSTONE ARSENAL, Huntsville, Ala.

J. A. Postell, 936 W. Peachtree St., N. W. Atlanta, Ga., cylinder, ord part No. 8136289 (line item 12-1-857) F.O.B.: Lacarne, Ohio, 18 ea., F.O.B.: Avondale, Colo., 10 ea., (purchase request RSP 177-57) $50,060.

Clark Cable Corp., 3184 W. 32nd St., Cleveland, Ohio, cable, assembly, F.O.B.: Lacarne, Ohio, 472 ea., F.O.B.: Avondale, Colo., 18 ea., F.O.B.: Avondale, Colo., 30 ea., plate, back up splash apr, F.O.B.: Lacarne, Ohio 50 ea, insulator, F.O.B.: Lacarne, Ohio, 420 ea., F.O.B.: Avondale, Colo., 240 ea., (Purchase Request: RSP 47-57) $52,659.

Linde Air Products, 2900 Cahaba Rd., Birmingham, Ala., liquid oxygen (purchase request: ME-10268) 16,000,000 cu ft. $44,-000.

Penellit, Inc., Instrument Services Div., 7401 N. Hamlin Ave., Skokie, Ill., additional work and to extend time performance (purchase request: ME-449) $34,880.

CORPS OF ENGINEERS, OMAHA DISTRICT, 1709 Jackson St., Omaha 2, Neb.

Langer & Associates, Inc., 225 Jewett Bldg., Des Moines, Ia., construction of flight simulator training building, Des Moines Municipal Airport, Des Moines, Ia., contract No. DA-25-066-eng-4401 (IFB ENG-25-066-57-89) $94,780.

The Weitz Co., Inc., 406 Fleming Bldg., Des Moines, Ia., construction of Nike facilities (stage II) west site, Ellsworth AFB, Rapid City, S. D., contract No. DA-25-066-eng-4405 (IFB ENG-25-066-57-66) $788,295.

Kingery Construction Co., 1941 Y St., Lincoln, Neb., construction of flight simulator training bldg. Lincoln AFB, Lincoln, Neb., contract No. DA-25-066-eng-4397 (IFB ENG-25-066-57-75) $69,174.

Swanson & Youngdale Painting & Decorating Co., Inc., 737 France Ave., North, Minneapolis, Minn., Rehabilitation of buildings, Natrona County Airport, Casper Wyo., contract No. DA-25-066-eng-4406 (IFB ENG-25-066-57-72) $334,343.

NEW YORK ORDNANCE DISTRICT, 180 Variek St., New York 14, N. Y.

Reaction Motors, Inc., Denville, N. J., development and construction of a rocket engine type combustion system (DA30-069-ORD-1084), $178,032.

Electronics Associates, Inc., Long Branch, N. J., various computer groups, DA-30-069-ORD-2025, $255,000.

Ford Instrument Co., 31-10 Thomson Ave., Long Island City 1, N. Y., facilities to be furnished contractor for use in connection with Contracts DA-30-069-ORD-1564, 1678 and 1735, $523,260.

U. S. ARMY SIGNAL SUPPLY AGENCY, 225 S. 18th St., Philadelphia 3, Pa.

Airborne Instruments Lab., Inc., Mineola, N. Y., services, facilities and materials for 12 months to conduct a research program on tropospheric propagation. Contract No. 73276 (PR&C 57-ELE/R-2310) $130,000.

Western Electric Co., Inc., N. Y., additional services, facilities and materials for 8 months for systems engineering relating to communications facilities for the common system of air traffic control, modification Contract No. 64567 (PR&C 57-ELC/R-4700) $145,829.

Collins Radio Co., Dallas, Tex., services and materials required for the installation in L-20 Aircraft of electronic and navigational equipment, 30 ea., Contract No. 75089 (PR&SC 36-039-57, 10337-43) $144,095.

CORPS OF ENGINEERS, Mobile District, 2301 Grant St., Mobile, Ala.

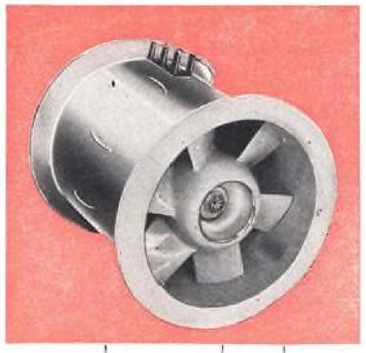
Blount Bros. Construction Co., Montgomery, Ala., construction of Bomarc test facilities at Elgin AFB, Fla. DA-01-076-ENG-3771, $3,447,944.

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Certificates of Necessity

Washington—Office of Defense Mobilization has awarded General Motors Corp., Oak Creek, Wis., a certificate of necessity for accelerated tax amortization totaling $10,193,000 to cover the manufacture of guided missiles. Of the amount, 65% of the rapid rate was allowed. Other certificates awarded:

National Water Lift Co. Division, Cleveland Pneumatic Tool Co., Kalamazoo, Mich., military aircraft parts, $400,000 certified with 40% allowed.

Hughes Aircraft Co., Culver City, Calif., research and development, $859,387 certified with 65% allowed.

Bendix Aviation Corp., North Hollywood, Calif., $154,500 certified with 40% allowed.

United Aircraft Corp., Windsor Locks, Conn., military aircraft components, $2,-985,348 certified with 65% allowed.

The Aid Corp., Clayton Ga., military aircraft components, $31,000 certified with 60% allowed.

Weston Hydraulics Ltd., North Hollywood, Calif., military aircraft parts, $43,-334 certified with 70% allowed.

Northrop Aircraft Inc., military aircraft, $88,632 certified with 60% allowed.

Robertshaw-Fulton Controls Co., Anaheim, Calif., military aircraft parts, $42,368 certified with 65% allowed.

Denver Division, The Martin Co., Jefferson County, Colo., guided missiles, $40,000 certified with 60% allowed.

Radiation Inc., Orlando, Fla., scientific instruments for military use, $90,000 certified with 45% allowed.

The Cornelius Co., Minneapolis, military aircraft parts, $36,213 certified with 70% allowed.

Northrop Aircraft Inc., Anaheim, Calif., military aircraft, $72,385 certified with 65% allowed.

CAB Accident Investigation Report:

Similar Failures Indicate Ditching Cause

A Pan American World Airways Boeing 377, N 90943, was ditched in the Pacific Ocean because of powerplant difficulties near Ocean Station November[1] located between Honolulu, Territory of Hawaii, and San Francisco, Calif., on Oct. 16, 1956, at 0615.[2] All 31 occupants were evacuated safely; the aircraft sank in deep water and could not be recovered.

HISTORY OF THE FLIGHT

Trip 6 of Oct. 13 was a regularly scheduled "around-the-world" flight eastbound from Philadelphia, Pa., to San Francisco, Calif., with en route stops in Europe, Asia, and various Pacific Islands. All prior segments had been routine and the flight departed Honolulu on the last leg of the trip on Oct. 15.

It was cleared to San Francisco Airport via Green Airway 9, then track to position 30° N 140° W at 13,000 ft., then 21,000 ft. to San Francisco. There were 24 passengers aboard, including three infants, and a crew consisting of Richard N. Ogg, captain; George L. Haaker, first officer; Frank Garcia, Jr., flight engineer; Richard L. Brown, navigator; Patricia Reynolds, purser; Mary Ellen Daniel and Katherine S. Araki, stewardesses.

The 8-hr. 54-min. flight was planned IFR and the aircraft carried sufficient fuel for 12 hr., 18 min. The gross takeoff weight of the aircraft was 138,903 lb. (maximum allowable 144,000) and the center of gravity was located within limits.

N 90943 departed Honolulu at 2026. The climb to initial altitude was normal and the flight proceeded in a routine manner. At 0102, the approximate midpoint of the flight, a request for VFR climb to its secondary altitude of 21,000 ft. was approved by ATC.

Engine Overspeeds

After reaching 21,000 ft. and simultaneously with the reduction of power the No. 1 engine oversped. Airspeed was immediately reduced by the use of flaps and reduction of power.

Attempts were also made to feather the No. 1 propeller. It was impossible to control the engine or to feather the propeller and the captain decided to freeze the engine by cutting off the oil supply. Shortly after this was done there was a momentary decrease in the rpm., followed by a heavy thud. The propeller continued to windmill. At this time airspeed had slowed to 150 kt. and the aircraft was losing altitude at a rate of approximately 1,000 fpm.

The captain contacted the U. S. Coast Guard weather station November at 0122, alerted it to a possible ditching, and asked assistance. He also alerted the passengers to the emergency and told them to prepare for a possible water landing.[3]

The flight course was altered to home on station November and climb power was applied to engines Nos. 2, 3, and 4 to check the rate of descent. At this time it was noticed that No. 4 engine was only developing partial power at full throttle.

At 0125 the flight notified November that ditching was imminent and received a ditching heading from the cutter. During the descent the crew found it could maintain altitude at an airspeed of 135 kt. with rated power on engines Nos. 2 and 3 and the partial power on No. 4. About 0137 the flight overheaded the cutter.

Prior to overheading the cutter the maximum range with the fuel remaining had been computed and it was determined to be insufficient either to complete the flight to San Francisco or return to Honolulu.

Mortar flares had been fired by the cutter and electric water lights laid to illuminate a ditching track for the aircraft. However, it was decided to postpone the ditching until daylight, if possible, meanwhile remaining close to the cutter.

About 0245 the No. 4 engine backfired and power dropped off. Its propeller was feathered normally. The flight was still able to maintain altitude and continued to orbit November to burn the fuel aboard down to a minimum while awaiting daylight.

At 0540 Captain Ogg notified the Pontchartrain he was preparing to ditch the aircraft. A foam path was laid along the ditching heading of 315 deg. by the cutter and the aircraft was ditched at 0615. Passengers and crew safely evacuated the aircraft, boarded liferafts, and were completely clear of the aircraft at 0632. The aircraft sank at 0635 at position 30°01.5′ N 140°09′ W.

INVESTIGATION

Investigation showed that the crew of this flight was properly qualified and certificated, and that dispatching of the flight was in accordance with government regulations and company procedures. All of the members of the crew had completed ditching training conducted by the company or Coast Guard.

The weather encountered en route was substantially as forecast and was not a factor in this accident. The weather and sea conditions at the time of ditching were: wind calm; skies partly cloudy; major swells from 80 deg., height 3 to 4 ft., speed 24 kt., distance between swells 500 ft.; minor swells from 130 deg. height 2 to 3 ft., speed 13 kt., distance between swells 75 ft.; barometer 30.28; seawater temperature 74 F.

Complete overhaul and maintenance records of N 90943 were kept at San Francisco, headquarters of the Pacific-Alaska Division. A study of these records disclosed that the aircraft had been maintained in an airworthy condition according to CAA-approved maintenance procedures, and was properly certificated and equipped. No discrepancies were noted in any of the records of N 90943.

Approximately 25 minutes before reaching etp. (equitime point), calculated to be 0131, a climb to the secondary altitude was initiated. At 0119 the aircraft was leveled off at 21,000 ft. and speed allowed to increase to about 188 kt.

Control Vibration

When the first officer, who was flying the aircraft, called for cruise power he noted a vibration in the controls and an increase in the propeller noise; until this time the flight had been routine. Upon noticing the tachometer for No. 1 engine reading about 2,900 rpm., he immediately depressed the feathering button for that propeller, and then lowered 30 deg. of flaps. The flight engineer actuated the No. 1 fire switch gangbar, closed the No. 1 throttle, and cut the mixture control. He then reduced power on the other three engines to help reduce airspeed. At this time the No. 1 engine rpm. had exceeded the highest calibration on the tachometer.

The captain, who had been performing duties at the navigator's table, had by this time regained his seat and, after several unsuccessful attempts to feather, called to the engineer to cut off the oil supply to the engine to freeze it.

About 2-3 min. after this was done the crew noted a momentary decrease in the rpm., then a heavy thud, followed by an immediate increase again in the propeller speed. They thought this indicated that the engine had frozen; that the propeller had uncoupled through a failure in the propeller drive mechanism and was windmilling in the airstream.

Several subsequent attempts were made during the remainder of the flight to feather the No. 1 propeller. It was then noted that the tachometer indicated zero and that the circuit breaker in the No. 1 feathering system would not remain closed. The No. 1 oil quantity gauge indicated empty while prior to feathering attempts the quantity had been normal. No external oil leaks were noted.

During the short interval of this emergency (2-3 min.), the captain had called ocean station November, alerted it for a possible ditching, altered course slightly so as to home on the station, and alerted

---

[1] November is a U. S. Ocean Station vessel located approximately midway between the Hawaiian Islands and the west coast of the United States. The U. S. Coast Guard Cutter Pontchartrain was on station at the time of the ditching.

[2] All times referred to herein are Hawaii standard and are based on the 24-hour clock.

[3] Passengers were given a life jacket demonstration by the cabin attendants at Honolulu prior to departure. In addition, each passenger had been provided with a folder describing ditching procedures entitled "Just in Case."

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the passengers to the emergency, instructing them to prepare for a water landing.

When the emergency call was received the aircraft's position was determined by radar aboard November to be approximately 38 mi. from the ship on a bearing of 256 deg. This information, along with a recommended ditching heading, was transmitted to the flight.

About 0124, approximately five minutes after the propeller emergency and when the situation had stabilized somewhat, climb power was placed on engines Nos. 2, 3, and 4 to check the rate of descent. The No. 4 engine failed to respond with normal power. When full throttle was applied the engine instrument readings were as follows: 2,350 rpm.; 80 BMEP; 23 in. manifold pressure; oil and fuel pressures normal; fuel flow was 600 lb./hr.; oil temperature, carburetor air temperature, and cylinder head temperature were lower than normal; turbo supercharger operation appeared normal.

There was a slight rise in manifold pressure and in cabin airflow when the No. 4 turbo calibrating control was rotated to the full on position. When the crew reduced rpm. to 1,750, closed the oil cooler and intercooler, and closed cowl flaps to one-half inch, the BMEP increased to 90 with 26 in. of manifold pressure at the same fuel flow.

Engine Behavior

All patterns on the engine ignition analyzer were normal, oil temperature, carburetor air temperature, and cylinder head temperature increased slightly, and the engine continued to operate.

By this time the aircraft had descended to about 5,000 ft. It was found that this altitude could be maintained at an airspeed of approximately 135 kt. with flaps up, rated power on engines Nos. 2 and 3, and the partial power available from No. 4. However, the aircraft was allowed to descend slowly to about 3,000 ft. before overheading the cutter.

Prior to overheading November, the flight had called Honolulu and reported the situation. It was also in constant contact with November and had received the latest weather, wind, and sea conditions for the probable ditching. The cabin attendants had issued instructions to all passengers to remove eyeglasses, shoes, and sharp objects from their pockets, and to put on life jackets.

Adult-sized life jackets were improvised for the children. Locations of liferafts were pointed out and several passengers assigned to assist in launching them. All loose gear was stowed in the lower lounge. Passengers were relocated in the safest seats, forward of the tail section (which the captain believed would break off upon landing), and were instructed to bend over with arms clasped around their legs. The children aboard were placed on the floor and held tightly between their parents' feet. By the time the aircraft overheaded November the ditching preparations were complete.

It was found that the rpm. of the windmilling propeller could be kept under control if the airspeed was kept below 140 kt. This airspeed is about 20 kt. less than that required for efficient two-engined flight.

The range of the aircraft was seriously impaired by the additional drag of the wind-

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milling propeller and necessarily low airspeed. With the remaining fuel aboard, maximum range under these conditions was computed to be 750 mi. The distance to either San Francisco or Honolulu was over 1,000 mi.

A shuttle pattern had been set up over November on the ditching track of 240 deg. during the later part of the descent. The cutter had laid out a string of electric water lights along the track and was standing by for the rescue. After careful evaluation of the situation, the captain elected to delay the ditching, when daylight and other conditions would be more favorable. Meanwhile, the flight continued to shuttle over the cutter. The passengers were advised of the decision and more complete detailed preparations for the ditching were made.

About 0245 No. 4 engine backfired and its power dropped off. An engine analyzer check at this time showed many low resistance shorts and no combustion pattern on the B row of cylinders.

The propeller was feathered normally. Engines No. 2 and 3 at this time were maintaining the aircraft at 2,000 ft. at an airspeed of 140 kt., with 2,550 rpm., 190 BMEP, and 2,000 lb./hr. fuel flow.

As the fuel weight burned off the aircraft was allowed to climb to about 5,000 ft., where several practice approaches were made to determine the controllability of the aircraft at low speeds. The flight continued to circle over the cutter to burn out the fuel weight so that at touchdown the aircraft would be as buoyant and light as possible.

As daylight arrived Coast Guard personnel removed the water lights and requested that they be notified 10 min. prior to the time the flight intended to ditch. This would enable the rescue team to be in absolute readiness and allow sufficient time to lay a foam path to mark the revised ditching path and heading, 315 deg.

At 0540 Captain Ogg notified the cutter of the intended ditching time. He also notified the passengers, who had been allowed to smoke and move about during the several intervening hours, to take their ditching positions as instructed. The captain descended to 900 ft. to establish a landing pattern and later gave a final warning to the passengers, one minute before landing.

Water Landing

Touchdown was made at 0615 with full flaps at a speed of 90 kt. with the landing gear retracted. First contact with the water was slight, followed almost immediately by a tremendous impact. The aircraft was partially driven under water but bobbed quickly to the surface and stopped with very little forward travel.

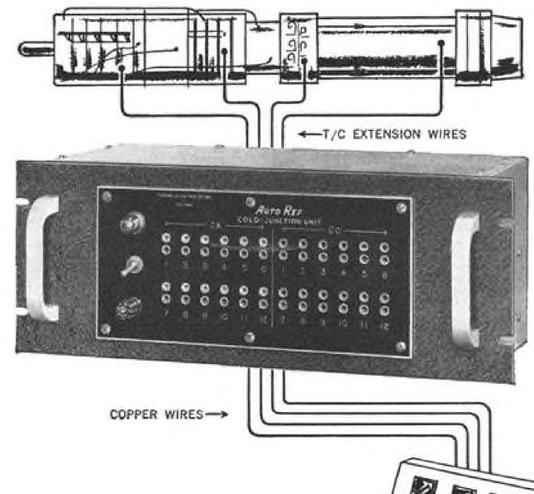
As anticipated, the fuselage broke off aft of the main cabin door. Several unoccupied seats remained in this section. A number of seats forward of the fracture were torn loose and several passengers were hurled to the floor. Two children who were being held were thrown from their mothers' arms. There were no fatalities or major injuries and no occupants were incapacitated by the crash; however, five people received minor injuries.

After the aircraft stopped, members of the crew and the passengers assigned to assist removed the emergency exit doors. Two

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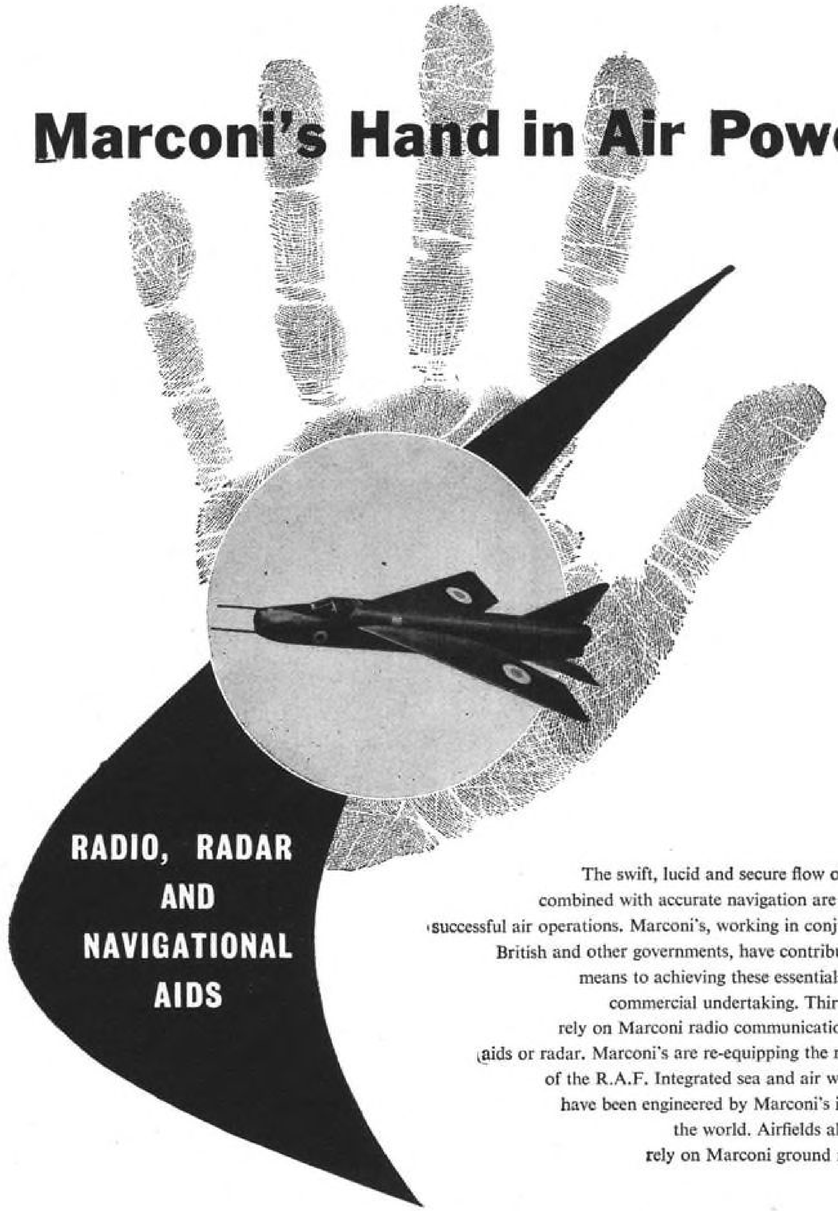
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LA25

20-man liferafts were launched through the emergency exits over the wing and one raft was launched through the main cabin door. All occupants then evacuated the aircraft successfully through these exits.

The liferaft that had been launched from the main cabin door was trapped against the wing and fuselage by the broken tail section, which had swung to the left. Some of the occupants transferred over the wing to another raft, enabling the first raft to be freed.

The raft launched between Nos. 1 and 2 engines did not inflate properly and filled with water while it was being pulled clear by a Coast Guard rescue launch. All of the occupants of this raft were immediately transferred to the rescue boat without further mishap. The remaining passengers and crew, who evacuated the aircraft on the starboard side, were then transferred from the raft to the cutter Pontchartrain. The aircraft sank at 0635.

ANALYSIS

Since there was no opportunity to examine the aircraft engines and propellers, this analysis must be based on the most logical conclusions drawn by experience and knowledge from the evidence available.

The Board is of the opinion that two separate and unrelated mechanical malfunctions occurred during this flight and the relationship of each failure to the accident should be treated separately.

N 90943 was powered by four Pratt and Whitney R4360-B6 engines and equipped with Hamilton Standard, model 24260, propellers. The initial difficulty encountered resulted in the overspeed of No. 1 engine and inability to feather its propeller.

Engine rpm. is normally maintained by engine oil at boosted pressure which is directed by the propeller governor to either side of a piston in the propeller dome. Movement of this piston changes propeller blade angle to maintain the desired rpm. Feathering is normally accomplished by auxiliary pump oil taken from the engine oil supply tank and directed by the governor through passages used for rpm. control to the outboard side of the piston. Consequently, a portion of the governor and the increased pitch side of the dome piston are common to both feathering and constant speed operation.

It is considered most likely that the inability to feather was caused by the same malfunction which resulted in the original overspeed. If the auxiliary pump had failed there would have to have been a second near-simultaneous failure in the propeller system. This possibility is considered to be remote. Furthermore, depletion of the oil supply from the No. 1 tank, subsequent to the overspeed, with no external signs of leakage, is most logically attributed to operation of the auxiliary pump during attempts to feather following the stoppage of the engine by freezing.

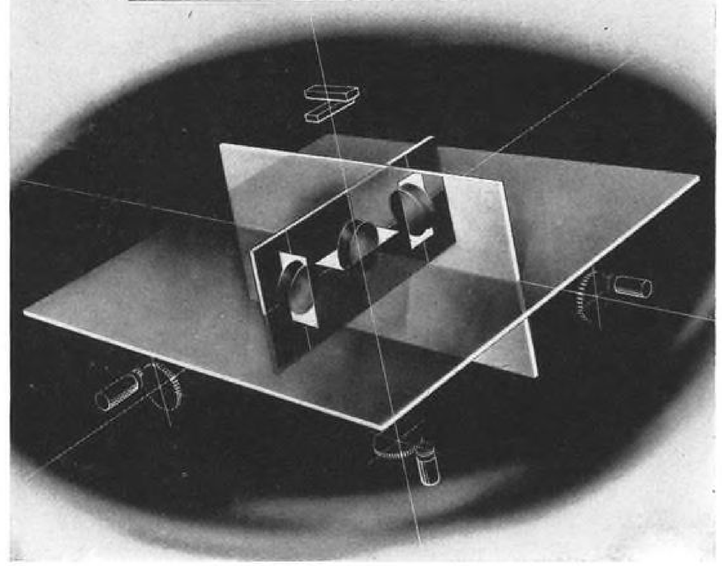
The most likely causes of the overspeed and inability to feather were that oil was being misdirected at the governor pilot valve or that there was insufficient oil pressure at the dome piston.

Improper direction of the oil would involve governor malfunctions, caused either by a fault within the unit itself or by contaminated oil being supplied to the governor.

Contaminated oil would indicate some

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failure within the engine which would most likely be of a progressive nature. No such failure was evident to the crew prior to the overspeed.

Insufficient oil pressure at the dome piston is most generally due to excessive leakage. Leakage usually involves seals, passages, transfer tubes, or bearings in the propeller, propeller control, or the engine.

The Board believes that a single failure occurred which affected the portion of the system common to the constant speed and feathering portion of the propeller control system. Oil was being delivered to the system by the feathering pump and then dumped into the engine. A more specific reason for the overspeed cannot be determined.

Other Failures

Subsequent to this accident PAWA Pacific-Alaska Division experienced two uncontrollable engine overspeeds and inability to feather propellers due to failure of the propeller oil transfer bearing. A redesigned propeller oil transfer bearing has been provided by the manufacturer and its use was made mandatory by CAA Airworthiness Directive issued Mar. 25, 1957.

From the information available concerning the No. 4 engine, it would appear that the initial power loss resulted from a reduction of the airflow through the carburetor.

Fuel to the engine is metered by the carburetor in proportion to the air-mass flow through the throttle body. Engine instrument readings reported by the crew indicate oil and fuel pressures were normal but that temperature indications and fuel flow were low. Turbo supercharger responses indicated that that system was at least partially operating.

These conditions could result from an obstruction caused by a deformation or partial breakup and displacement of the carburetor inlet air duct system, or a failure of the engine-driven impeller drive assembly.

Although the first possibility cannot be completely discounted, the latter appears to be more probable.

It is significant to the analysis that PAWA records indicate three engine-driven impeller drive failures on like engines prior to this accident. The BMEP and manifold pressure readings, taken subsequent to one of these failures, were almost identical to those on No. 4 engine in this accident. Also, in the prior engine failure the crew reported light backfiring approximately one minute after the impeller drive failure and the propeller was feathered immediately.

In the subject accident the engine continued to run at reduced power for some time before backfiring commenced. Then, indications of many low-resistance shorts and the lack of combustion pattern on the B row of cylinders were observed on the engine analyzer. This evidence is not inconsistent with an impeller drive failure.

With the failure of the impeller drive assembly, impeller rotation would stop thus reducing the airflow which in turn would reduce the fuel flow. Turbo supercharger air and normal engine breathing would provide a limited combustible air-fuel mixture to the cylinders; however, distribution of the mixture to the cylinders would be impaired. It is believed, therefore, that all of the indications reported by the crew of Flight 6 could result from the engine-driven impeller drive assembly failure.

Following these failures, the basic design of the Pratt and Whitney R4360-B6 impeller drive was re-evaluated by the manufacturer and the CAA. No design deficiency was found to exist and it was concluded that this type of failure is not chronic with this model engine. As a result of this study, the Board concluded that the design of the impeller drive is adequate and that no corrective measures are necessary.

With the propeller windmilling, the range of the aircraft was unquestionably reduced to less than that required either to return to Honolulu or continue to San Francisco. Required fuel for the subject flight was computed on the basis of two-engine operation; therefore, only if the crew had been able to feather the No. 1 propeller and maintain the most efficient two-engine airspeed (165 kt.) could it have reached land.

Drag Calculation

Data received from Hamilton Standard and Boeing, and derived from calculation and tests of the subject type propeller, indicate that the drag resulting from this propeller with the blades on the low pitch stops, 21.3 deg. at 145 kt, 2,000 feet msl., would be:

- **Uncoupled windmilling**—520 lb.
- **Coupled windmilling**—1,880 lb.
- **Frozen**—2,320 lb.

The additional power necessary to compensate for the additional drag in each of the above conditions is:

- **520 lb.**—295 bhp (Brake Horsepower).
- **1,880 lb.**—1,060 bhp.
- **2,320 lb.**—1,380 bhp.

Since drag resulting from these conditions varies as the square of the velocity, it is evident that exceedingly higher drag forces would be encountered at speeds greater than 145 kt.

This drag information is extremely important because prior to the investigation of this accident it was not widely known. In fact, it is believed, many thought that the drag with the propeller windmilling and coupled was greater than that with the engine and propeller frozen, whereas the drag condition is greatest with the engine and propeller rotation stopped. It is noted, however, that the above data applies only to the subject aircraft and propellers.

The Board believes that this report would be incomplete without a word of praise concerning the handling of this emergency by all the personnel involved. The Board highly commends the crew members for their ability in recognizing the malfunctions and taking correct emergency actions consistent with all known procedures. Their calm and efficient control of the situation averted what could have been a major air disaster.

In addition, the prompt response by the Coast Guard to the emergency and the immeasurable assistance rendered to the flight are deserving of particular praise.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The company, the aircraft, and the crew were properly certificated and the flight was properly dispatched.
2. The aircraft was properly loaded with

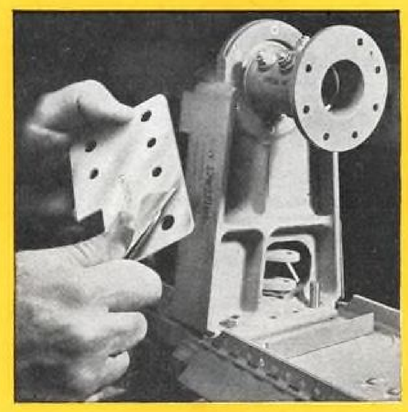
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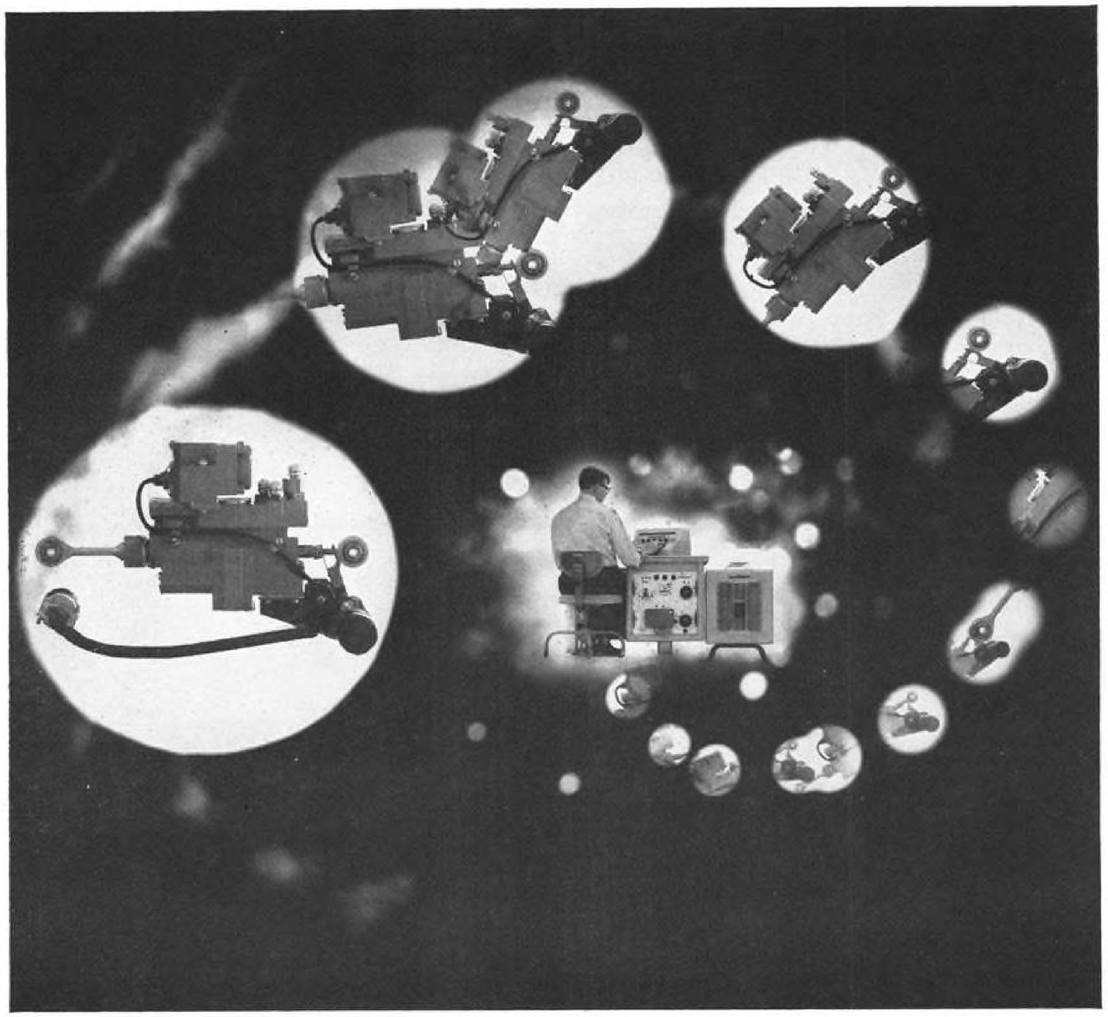
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respect to gross weight and center of gravity limits.

3. The flight was normal until the control of the No. 1 propeller was lost and the engine oversped.

4. It was impossible to control the engine speed or to feather the propeller.

5. The engine was frozen; however, the propeller became decoupled from the engine and continued to windmill.

6. There was a partial power loss on engine No. 4; it subsequently failed completely and the propeller was feathered.

7. Airspeed was restricted to 145 kt. to prevent the windmilling propeller from overspeeding.

8. Range of the aircraft was so reduced that it was impossible to reach land.

9. The passengers were thoroughly instructed in correct emergency procedures and the aircraft was ditched under control with no fatalities.

10. Evacuation of the aircraft was well planned and orderly.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was an initial mechanical failure which precluded feathering the No. 1 propeller and a subsequent mechanical failure which resulted in a complete loss of power from the No. 4 engine, the effects of which necessitated a ditching.

By the Civil Aeronautics Board:

/s/ JAMES R. DURFEE
/s/ CHAN GURNEY
/s/ HARMAR D. DENNY
/s/ G. JOSEPH MINETTI
/s/ LOUIS J. HECTOR

SUPPLEMENTAL DATA

The Civil Aeronautics Board was notified of the accident at 0655 H.S.T., Oct. 16, 1956. An investigation was immediately initiated in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. Depositions, ordered by the Board, were taken in San Francisco, Calif., Oct. 19, 20, and 26; San Mateo, Calif., Oct. 22, 1956; Oakland, Calif., Oct. 23, 1956; and Silver Spring, Md., Nov. 19, 1956.

Air Carrier

Pan American World Airways, Inc., is a New York corporation with its main offices in New York, N. Y. Headquarters for the Pacific-Alaska Division are at San Francisco International Airport. The corporation operates as an air carrier under a certificate of public convenience and necessity issued by the Civil Aeronautics Board and an air carrier operating certificate issued by the Civil Aeronautics Administration. These certificates authorize the carrier to engage in air transportation between various points in the United States and foreign countries, including the route involved in this instance.

Flight Personnel

Capt. Richard N. Ogg, age 43, was employed by Pan American World Airways on Feb. 20, 1941. He held a valid airman certificate with airline transport rating and rating for the subject aircraft. Captain Ogg had a total of 13,089:41 flying hours, of which 738:27 were in Boeing 377s. He had passed a CAA medical examination on Sept. 21, 1956. He had completed an emergency equipment training course—dry ditching—on June 4, 1956.

First Officer George L. Haaker, age 40, was employed by PAWA on Mar. 1, 1946. He held a valid airman certificate with airline transport rating and rating for the subject aircraft. Haaker had a total of 7,576:00 flying hours, of which 3,674:06 were in Boeing 377s. His last physical examination was passed on Sept. 4, 1956. He completed an emergency ditching training course on Aug. 2, 1956.

Navigator Richard L. Brown, age 31, was employed by PAWA on Dec. 9, 1955. He held a valid airman certificate with commercial rating, and a temporary CAA navigation certificate issued Aug. 24, 1956. Mr. Brown had a total of 1,283:16 flying hours, of which 446:00 were in Boeing 377s. His last physical examination was passed on Feb. 28, 1956. He had completed the initial emergency equipment training course—dry drill—on Jan. 13, 1956.

Flight Engineer Frank Garcia, Jr., age 30, was employed by PAWA on Aug. 16, 1954. He held a valid flight engineer certificate, mechanic certificate with A&E rating, and radio operator certificate. He qualified on Boeing 377s on Mar. 28, 1956, and had accumulated 1,728 flying hours in B-377s. He received his last CAA physical examination on June 29, 1956.

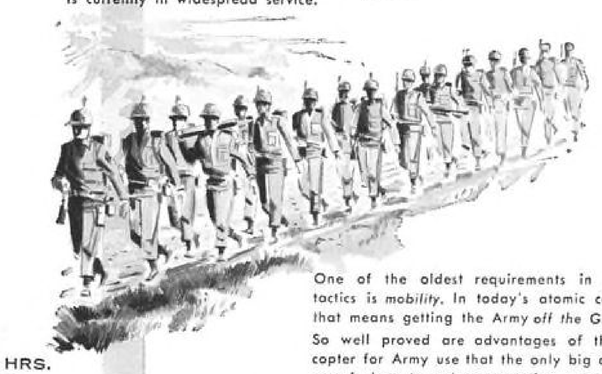
Purser Patricia Reynolds, age 30, was employed by PAWA on Sept. 23, 1946. She had completed her latest B-377 emer-

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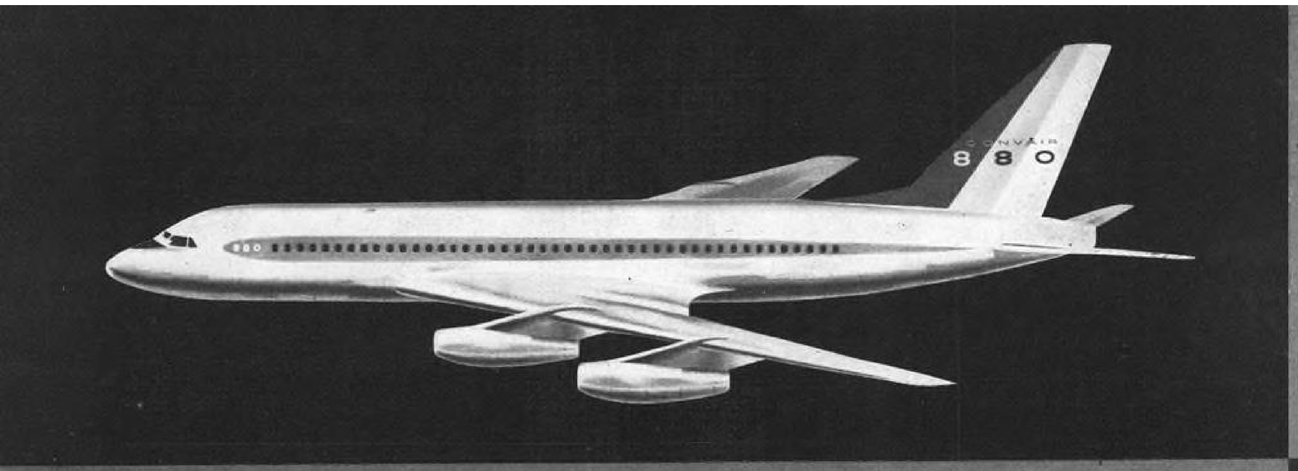
1000 HRS. — The Army H-23D is the first helicopter designed to incorporate the Army's concept of a 1000 hour overhaul cycle on major components.

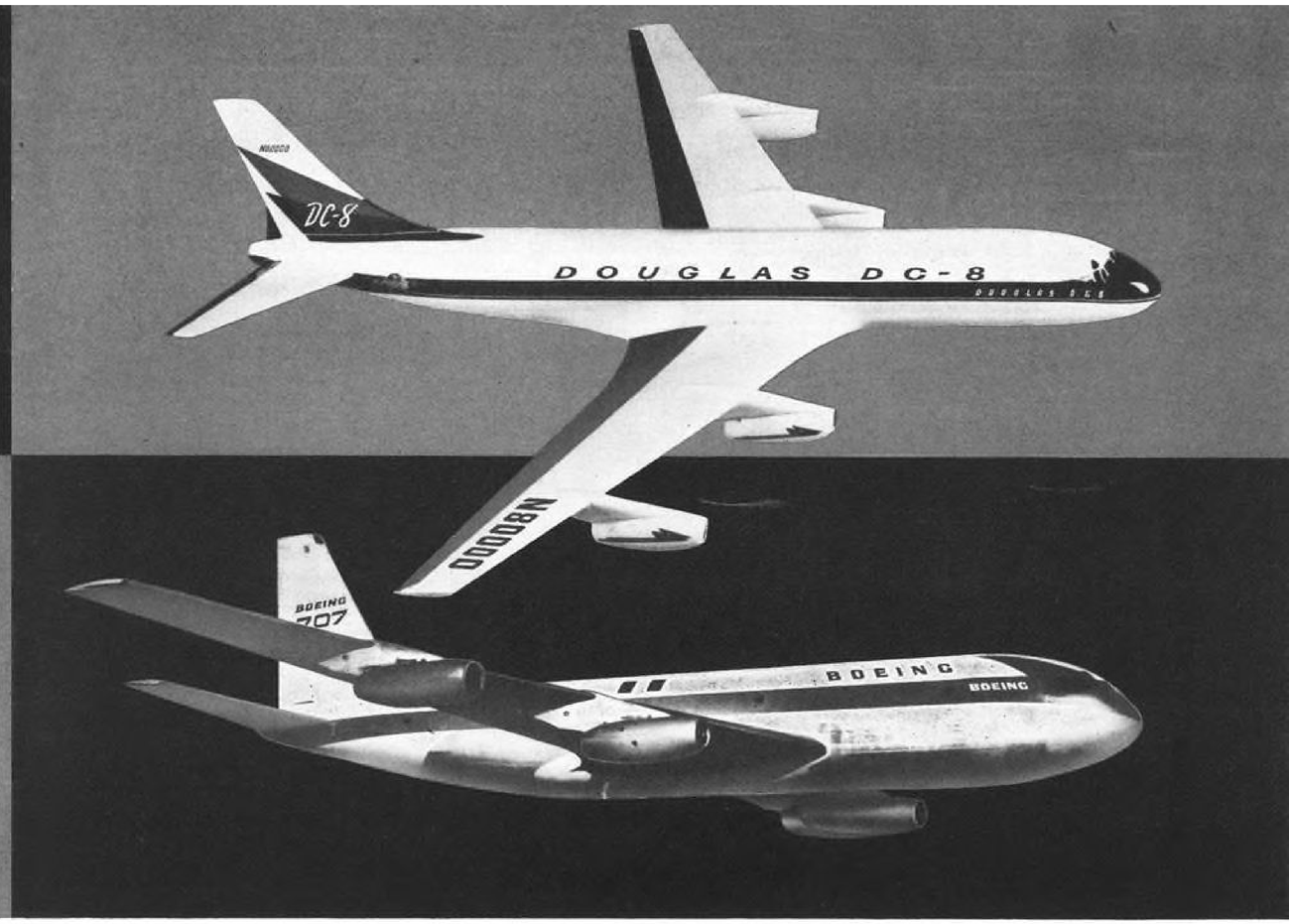
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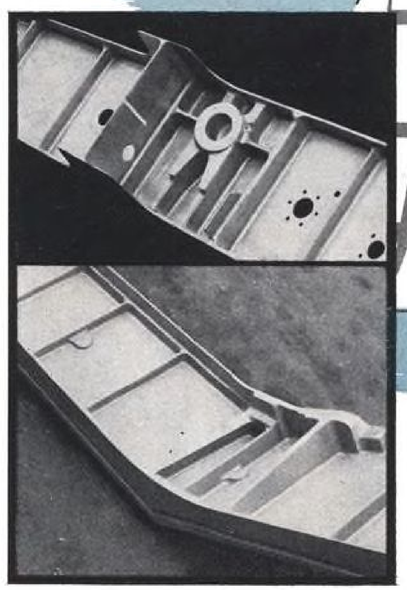
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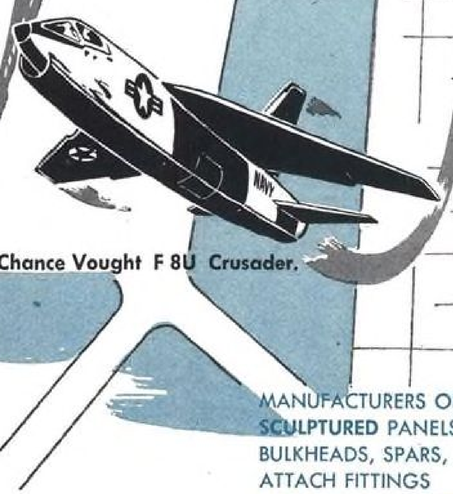
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Washington—Navy announced last week that its aviators achieved a new low accident rate record in the year ending June 30. The rate: 3.06 accidents per 10,000 hr. flown. The goal for next year has been set at 2.9 accidents per 10,000 hr.

Major accidents were reduced by 150 during the year and Navy estimated that 61 fatalities were prevented. Improvement was attributed to improved training and safety equipment, offsetting the advent of more complex and higher performance aircraft.

gency equipment recheck on Feb. 10, 1956, and had completed the USCG wet drill in San Francisco on July 12, 1956.

Stewardess Mary Ellen Daniel, age 24, was employed by PAWA on June 23, 1954.

She had completed the B-377 emergency equipment recheck on Mar. 12, 1956, the USCG wet drill on Sept. 18, 1956.

Stewardess Katherine S. Araki, age 23, was employed by PAWA on Mar. 28, 1955. She had completed the B-377 emergency equipment recheck on May 7, 1956.

The Aircraft

N 90943, a Boeing 377, serial number 15959, was owned and operated by Pan American World Airways and was currently certificated by the Civil Aeronautics Administration. The aircraft had accumulated 19,820:51 flying hours. It was equipped with four Pratt and Whitney R4360-B6 engines, and four Hamilton Standard model 24260 propellers with model 24260-43/2J17 blades. The aircraft, engines, and propellers had been maintained in full compliance with prescribed methods and within all time limitations.

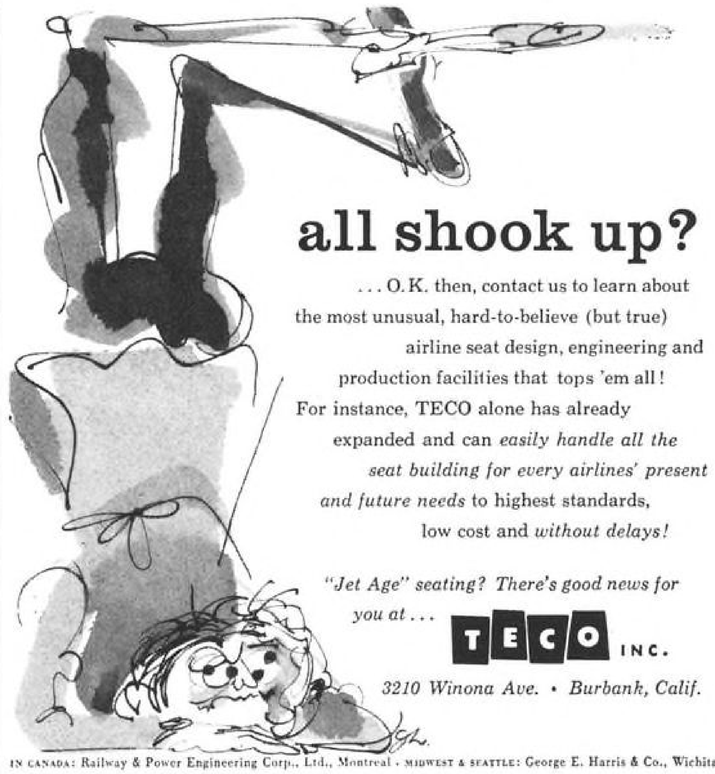
Taxicab Fee System Ends At New York's Airports

New York—Port of New York Authority will drop its charge to taxi drivers picking up customers at LaGuardia and New York International Airports. The fees—25 cents per trip, $5 per 26 trips, or $10 per month—will end this week.

The agency said its open line system of handling cabs at the two airports, as opposed to the closed line or exclusive franchise system, will no longer be feasible at Idlewild because of the decentralized nature of the new terminal development there. Any taxi operator will be able to serve the airport under the new setup, but will not be charged fees.

The fee system simultaneously will be dropped at LaGuardia, PNYA said, to avoid confusion. It had been planned to end the system when that airport's rehabilitation program is completed several years hence.

Newark Airport operates under the closed line system.



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WHO'S WHERE

(Continued from page 23)

Changes

Dr. Harold Asher appointed a member of the technical staff, Technical Military Planning Operation, General Electric Co., Santa Barbara, Calif.

Ben. W. Badenoch, general manager, recently-created Aero Hydraulics Division, Vickers, Inc., Detroit, Mich.

Seth H. Stoner, general manager, New Departure Division, General Motors Corp., Bristol, Conn. Also: **Frederick J. Garbarino,** director-sales and engineering. **Richard H. Valentine** succeeds Mr. Stoner as chief engineer.

Robert J. Eden, district manager-New York Office, Cleveland Pneumatic Tool Co., Cleveland, Ohio.

William H. Shapiro, manager-engineering services, Rocket Division, Bell Aircraft Corp., Buffalo, N. Y.

Arthur J. Warner, director of research, Mycalex Corporation of America, Clifton, N. J.

Sydney L. Britton, chief administrative engineer, Orenda Engines Limited, Malton, Ontario, Canada. **A. Edwin Caswell** succeeds Mr. Britton as chief projects engineer.

Stephen J. Jatras, assistant to the director-research and development branch, Missile Systems Division, Lockheed Aircraft Corp., Palo Alto, Calif.

Donald P. Germeraad, chief pilot-880 flight test program, Convair, division of General Dynamics Corp., San Diego, Calif. Mr. Germeraad is chief engineering test pilot.

Sterling C. Spielman, director of engineering, Government and Industrial Division, Philco Corp., Philadelphia, Pa.

Jorge A. Gonzalez P., assistant manager-commercial sales, Transport Division, Boeing Airplane Co., Seattle, Wash.

Joseph A. Cannon, manager-military sales, and **Albert W. Courtial, Jr.,** chief of flight test, Aircraft Division, Bell Aircraft Corp., Buffalo, N. Y.

Dr. Arthur C. Ruge, director-research development, Electronics and Instrumentation Division, Baldwin-Lima-Hamilton Corp., Waltham, Mass., Also: **Robert P. Lathrop,** manager-research and development.

W. L. Rogers, manager, and **G. G. Whipple,** assistant manager, Azusa Operations, Aerojet-General Corp., Azusa, Calif. Also: **E. E. Nelson,** resident manager-administration, Aerojet's Sacramento Plants; **R. D. Geckler** succeeds Mr. Nelson as manager, Solid Rocket Plant (Sacramento); **W. C. House,** manager, Liquid Engine Division (Sacramento).

Anthony G. Bari, manager-Miami (Fla.) Division, Van Dusen Aircraft Supplies, Teterboro, N. J.

G. J. Rauschenbach, director of sales, Denver Division, The Martin Co., Denver, Colo.

W. Jerome Peterson, chief design engineer, Chandler-Evans Division, Pratt & Whitney Company, Inc., West Hartford, Conn.

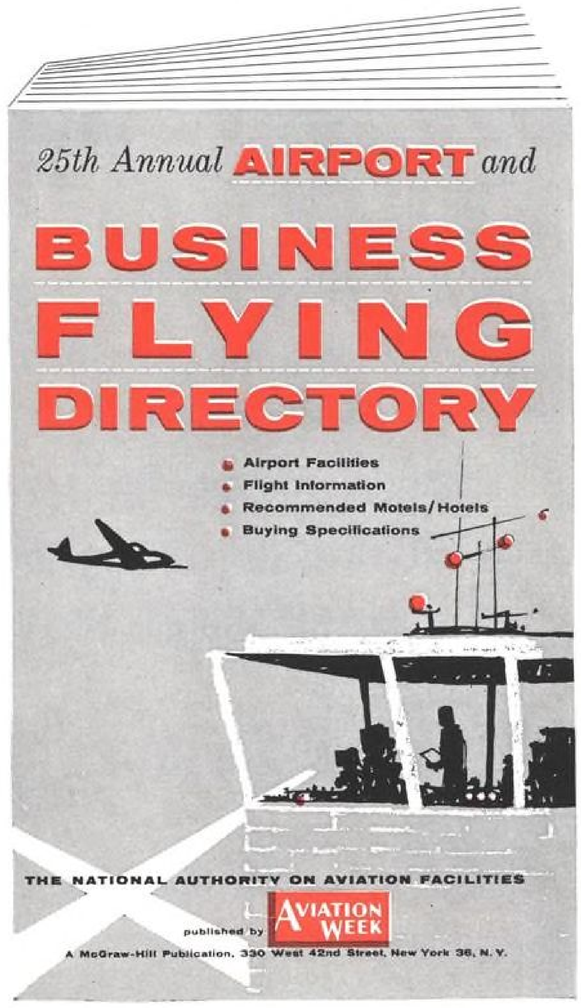
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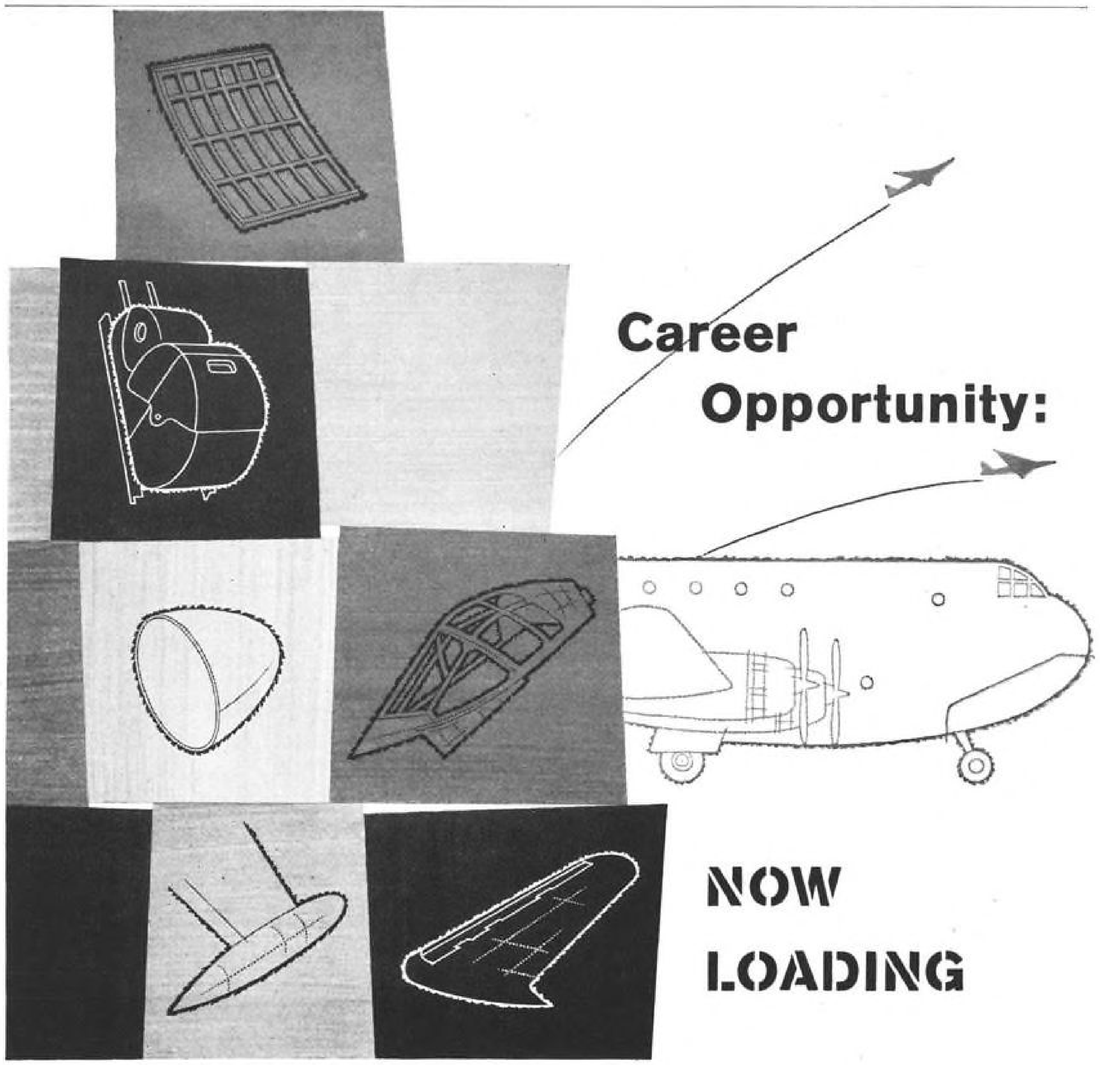
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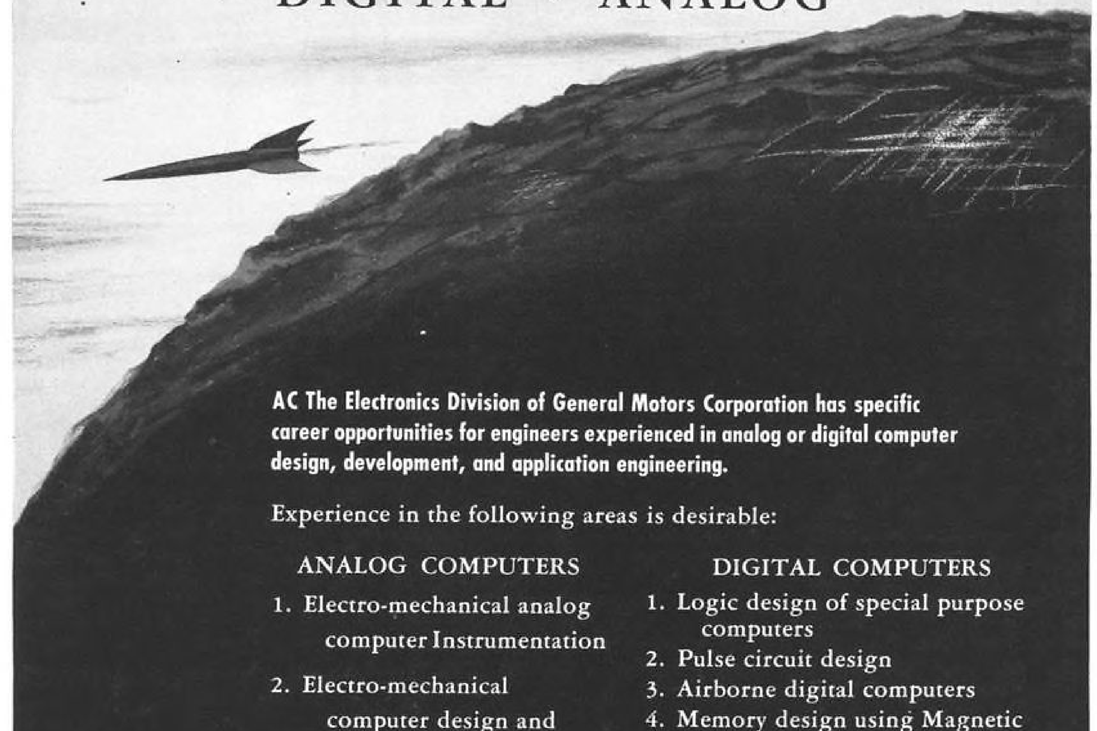
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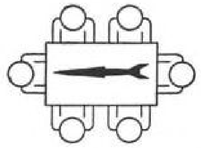
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ADVERTISERS IN THIS ISSUE

AVIATION WEEK, AUGUST 12, 1957

AERONUTRONIC SYSTEMS, INC. 124
Agency—Dan B. Miner Co., Inc.
AERO TEST LABORATORIES, INC. 79
Agency—Industrial Marketing Assoc.
AIRBORNE ACCESSORIES CORP. 46
Agency—Gray & Rogers, Adv.
AIRWORK CORPORATION 115
Agency—Gene Wyble Advertising
ALUMINUM TAPER MILLING CO., INC. 130
AMERICAN AIR FILTER CO., INC. DEFENSE PRODUCTS DIV. 113
Agency—Zimmer-McClaskey Adv.
AMPEX CORPORATION INSTRUMENTATION DIVISION 7
Agency—Boland Associates
ARNOUX CORPORATION 110
Agency—Kay-Christopher Adv.
AUTONETICS DIV. NORTH AMERICAN AVIATION, INC. 126
Agency—Batten, Barton, Durstine & Osborn, Inc.
AVCO MANUFACTURING CORP. (CORPORATE) ... 24
Agency—Benton & Bowles, Inc.
AVIATION WEEK 133
BARBER-COLMAN COMPANY 11
Agency—Howard H. Monk & Associates, Inc.
BARRY CONTROLS, INC. 84
Agency—Engineered Advertising
BAUSCH & LOMB OPTICAL COMPANY 51
Agency—Ed Wolff & Associates
BENDIX PRODUCTS DIV., BENDIX AVIATION CORP. ..... Third Cover
Agency—MacManus, John & Adams, Inc.
BOWER ROLLER BEARING DIV., FEDERAL-MOGUL BOWER BEARINGS, INC. 96
Agency—MacManus, John & Adams, Inc.
BRUSH BERYLLIUM CO. THE 123
Agency—T. J. Stead Adv.
CALIDYNE COMPANY, THE 57
Agency—Melsner & Company, Inc.
CALIFORNIA TECHNICAL INDUSTRIES 57
CHANDLER-EVANS 6
Agency—G. F. Sweet & Company, Inc.
CHANCE VOUGHT AIRCRAFT, INC. 104, 105
Agency—Tracy-Locke Adv. Co., Inc.
CLEVELAND PNEUMATIC TOOL COMPANY ... 128, 129
Agency—Meldrum & Fewsmith, Inc.
CONNECTICUT HARD RUBBER COMPANY 115
Agency—Troland, Inc. Adv.
CONVAIR A DIVISION OF GENERAL DYNAMICS CORPORATION 106
Agency—Hixson & Jorgensen, Inc.
CONVAIR A DIVISION OF GENERAL DYNAMICS CORPORATION 35
Agency—Buchanan & Company, Inc.
CONTROL ENGINEERING UNIT—DETROIT CONTROL CORPORATION 31
Agency—S. Gunnar Myrbeck & Company
DALMO VICTOR COMPANY DIV. OF TEXTRON, INC. 119
Agency—Long Advertising, Inc.
DEAN & BENSON RESEARCH, INC. 116
Agency—John Phillips Adv. Co.
DOUGLAS AIRCRAFT COMPANY, INC. 62
Agency—J. Walter Thompson Company
DOW CORNING CORPORATION 14
Agency—Church & Guisewite, Inc.
EATON MANUFACTURING CO. AIRCRAFT DIV. ... 92
Agency—Clark & Bubertz, Inc.
EDGEWATER STEEL COMPANY 93
Agency—Downing Industrial Advertising, Inc.
ELECTRIC STORAGE BATTERY COMPANY 76
Agency—Gray & Rogers Adv.
ELECTRO SNAP SWITCH & MFG. COMPANY 98
Agency—Stoetzel & Associates, Inc.
FAIRCHILD ENGINE & AIRPLANE CORPORATION 48, 49
Agency—Gaynor, Colman, Prentis & Varley, Inc.
FLEXIBLE TUBING CORPORATION 97
Agency—Wilson, Haight, Welch & Grover, Inc.
FORD MOTOR COMPANY AIRCRAFT ENGINE DIV. 78
Agency—Kenyon & Eckhardt, Inc.
GABB SPECIAL PRODUCTS, INC. 143
Agency—Charles Palm & Company, Inc.
GENERAL ELECTRIC COMPANY 74, 75, 65
Agency—G. M. Basford Company
GENERAL ELECTRIC COMPANY, SILICONE PRODUCTS DEPT. 67
Agency—Brooke, Smith, French & Dorrance, Inc.
GENERAL ELECTRIC COMPANY (LMEED) 12
Agency—DeGarmo, Inc.
GENERAL ELECTRIC COMPANY METALLURGICAL PRODUCTS DEPT. 73
Brooke, Smith, French & Dorrance, Inc.
GENERAL MILLS INC. 132
Agency—Knox Reeves Advertising, Inc.
GENERAL PRECISION LABORATORY, INC. 18
Agency—Geer, DuBois & Company, Inc.
GOODRICH COMPANY, THE B. F. AVIATION PRODUCTS DIV. 20
Agency—Batten, Barton, Durstine & Osborn, Inc.
GREENLEAF MFG. COMPANY—DIV. MANDREL INDUSTRIES, INC. 82
Agency—Batz-Hodgson-Neuwoehner Adv. Agency
HALLAMORE ELECTRONICS COMPANY — DIV. THE SIEGLER CORPORATION 56
Agency—Getz & Sandborg, Inc.
HALLICRAFTERS COMPANY 88
Agency—Henry B. Kreer & Company
HARNISCHFEGER CORPORATION, WELDING DIVISION 144
Agency—Hoffman & York, Inc.
HARTWELL AVIATION SUPPLY COMPANY 55
Agency—The McCarty Company
HEXCEL PRODUCTS INC. 70
Agency—Peter Hurst Advertising Inc.
HILLER HELICOPTERS 127
Agency—Philip S. Boone & Associates
HOWARD AERO INCORPORATED MANUFACTURING DIV. 120
Agency—Jack Kemp & Associates
HYDRO-AIRE INC. 3
Agency—Gaynor, Colman, Prentis & Varley, Inc.
LAMINATED SHIM COMPANY, INC. 125
Agency—Wilson, Haight, Welch & Grover, Inc.
LAND-AIR, INC. 101
Agency—The Admaster Associates
LEROY D. OWEN COMPANY 145
Agency—West-Marquis, Inc.
LOCKHEED AIRCRAFT CORPORATION 86, 87
Agency—Foote, Cone & Belding
LYNDON AIRCRAFT, INC. 59
Agency—Raymond-Nicholas Adv.
MARCONI WIRELESS TELEGRAPH COMPANY, LTD. 122
Agency—Lovell & Rupert Curtis Ltd.
MARQUARDT AIRCRAFT CO. 47
Agency—Grant Advertising Agency
MC MANUFACTURING COMPANY 65
Agency—St. Claire Advertising Agency
MONADNOCK MILLS DIV.—UNITED—CARR FASTENER CORPORATION 10
Agency—H. P. Humphrey—Alley & Richards, Inc.
MOOG VALVE COMPANY, INC. 13
Agency—Warman, Robins & Gorham, Inc.
MOTOROLA, INC.— MILITARY ELECTRONICS DIVISION 15
Agency—Kolb & Abrahams Adv.
NICHOLS COMPANY, W. H. 71
Agency—Shattuck, Clifford & McMillan, Inc.
NUCLEAR PRODUCTS-ERCO DIV., ACF INDUSTRIES, INC. 16
Conti Advertising Agency, Inc.
PACKARD ELECTRIC DIVISION—GENERAL MOTORS CORPORATION 64
Agency—Campbell-Ewald Company
PHILCO CORPORATION—G & I DIVISION 58
Agency—Maxwell Associates, Inc.
RADIATION, INC. 61
Agency—Charles F. Fry Advertising Associates, Inc.
RADIO CORPORATION OF AMERICA 42
Agency—Al Paul Lefton Company, Inc.
READING BATTERY DIV. ELECTRIC AUTO-LITE CO. 17
Agency—Grant Advertising, Inc.
REM CRU TITANIUM, INC. 22
Agency—G. M. Basford Company
RESISTOFLEX CORPORATION 118
Agency—Marsteller, Rickard, Gebhardt & Reed, Inc.
REVERE CORPORATION OF AMERICA 112
Agency—W. L. Towne Adv.
REYNOLDS METALS COMPANY ..... Fourth Cover
Agency—Clinton E. Frank, Inc.
ROCHESTER MANUFACTURING COMPANY, INC. 72
Agency—Hutchins Advertising Co., Inc.
ROHR AIRCRAFT CORPORATION 114
Agency—Barnes Chase Company
SARGENT ENGINEERING CORPORATION 4
Agency—Darwin H. Clark Company
SEARCHLIGHT SECTION 134-143
SERVICE STEEL DIVISION—VAN PELT CORPORATION 132
Agency—Claude E. Whipple Adv.
SHORT BROTHERS & HARLAND LTD. 131
SOUTHERN ENGINEERING & CONSTRUCTION CO., INC. 90
Agency—Sarver-Witzerman Adv.
SOUTHWEST AIRMOTIVE CO. 66
Agency—Don L. Baxter, Inc.
SPERRY GYROSCOPE—DIV. OF SPERRY RAND CORPORATION 68
Agency—Reach, Yates & Mattoon, Inc.
STRATOFLEX, INC. 107
Agency—Magnussen Adv. Agency
STROMBERG-CARLSON, DIV. OF GENERAL DYNAMICS CORPORATION 89
Agency—The Rumprill Company, Inc.
TELE-DYNAMICS INCORPORATED 8
Agency—Al Paul Lefton Company, Inc.
TECO, INCORPORATED 131
Agency—Jayeraft Company
THERMO ELECTRIC COMPANY, INC. 121
Agency—Fred Lange Associates, Inc.
THOMPSON PRODUCTS, INC.—JET DIVISION 9
Agency—Meldrum & Fewsmith, Inc.
TIMKEN ROLLER BEARING COMPANY 60
Agency—Batten, Barton, Durstine & Osborn, Inc.
TITANIUM METALS CORPORATION OF AMERICA 54
Agency—W. L. Towne Adv.
TOMKINS—JOHNSON COMPANY 95
Agency—Beeson-Reichert, Inc.
TORRINGTON COMPANY, THE 36
Agency—Hazard Adv. Company, Inc.
TRANS-SONICS, INC. 5
Agency—Technical Marketing Associates, Inc.
UNITED ELECTRODYNAMICS DIV. OF UNITED GEOPHYSICAL CORP. 83
Agency—Dozier Eastman & Co.
VICKERS, INC. DIVISION OF SPEERY RAND CORPORATION 94
Agency—Witte & Burden Adv.
WHITE COMPANY S. S. INDUSTRIAL DIV. 100
Agency—Hazard Adv. Company, Inc.
WHITTAKER GYRO—DIV. TELECOMPUTING CORPORATION 115
Agency—Mogge Privett, Inc.
WICKES ENGINEERING & CONSTRUCTION COMPANY 99
Agency—Roland G. E. Ullman Organization
WIGGINS OIL TOOL COMPANY, INC., E. B. ..... Second Cover
Agency—Gaynor, Colman, Prentis, & Varley, Inc.
ZENITH PLASTICS COMPANY 80
Agency—Batten, Barton, Durstine & Osborn, Inc.

CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 134-141
PROPERTY
EQUIPMENT
(Used or Surplus New)
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LETTERS

Lower Tracker Price

We would like to express the appreciation of H. A. Wagner Co. for your excellent article on the RADOTT Tracking Theodolite which we have designed and developed (AW July 1, p. 71-76). However, we would like to correct the final paragraph of the article with respect to the price at which the RADOTT will be offered to the tracking market.

We presently estimate that the cost for limited production quantities with complete digitizing equipment will be approximately $50,000 rather than $100,000 as the last line of your article indicated. It is believed that for any applications the requirements will be less exacting, so that some of the present computing mechanisms of the RADOTT can be omitted.

RAY F. PRICE
Manager, Customer Relations
H. A. Wagner Co.
Van Nuys, Calif.

Past Performance

Quoting from the AVIATION WEEK editorial ("Where Do We Stand?") of July 1: "For several years . . . top USAF leaders have been warning the industry that they were becoming increasingly selective in their buying and were placing heavy emphasis on a firm's past performance in economic production and technically sound development." And from the "USAF Gives Industry Guides to Survival" article (p. 26): "Firms which have not moved into missile and electronic fields will be hardest hit."

I feel that these quotes, even though "out of context," accurately reflect the general tenor of your presentations, and thus, I am sure, the true feelings of USAF leaders. It is therefore difficult in the extreme to explain USAF actions which resulted in the recent mass layoffs at North American Aviation. Without sounding like a salesman (which I am not). I would like to call the Air Force's attention to the fact that, since the B-25, T-6, and P-51, North American has been a leader in the manufacture of military aircraft. The F-86 series is a classic example of "technically sound development," and the F-100, having pioneered the problems of supersonic fighter aircraft, has replaced the F-86 as the Air Force's number one fighter. During the development of the F-100, a number of problems were encountered and mistakes were made, but in the light of more recent "supersonic" problems of other companies, even with the benefit of North American's experience, the company still deserves the reputation it has enjoyed for years among fighter pilots and other operating people as the best fighter manufacturer in the business.

The company's management accurately foresaw the paths to expansion and diversification about ten years ago, and with considerable capital investment established what are now divisions specializing in atomic energy (whose reactor is now producing the first commercial electric power in this country), rocket propulsion, missiles and electronics, in addition to the airframe divisions. During the growing period of these new divisions, the airframe business managed partially to "carry" them, and still produced the best fighter of the decade—the F-86.

Compare this record of production and aggressive management since North American's founding with the rather sorry history of some other aircraft companies which have yet to build a decent airplane and have been carried by the government for years. Incongruously, they continue to be carried while one of the real leaders is forced to disband parts of its proven team. It would seem that if the Air Force has been warning industry "for several years" it could have also been arranging to take better advantage of the "past performance" to which it now gives lip service.

I speak from a strictly personal viewpoint as a North American employe, but I also speak as an ex-Air Force pilot who flew practically all jet fighters up through the F-100, and as a taxpayer who is interested in more Air Force per dollar.

H. Z. HOPKINS, JR.
Palos Verdes Estates, Calif.

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Calm Approach

Perhaps you will bear with my reaction to the letter from "Disgusted Engineer" (AW July 8, p. 154).

I have been following with considerable interest the comments regarding the engineer situation in general. It would seem that much of what one finds objectionable when reading some of these letters stems from the common human failings of oversimplifying or overcomplicating in analyzing a situation.

We also have observed engineers during the workday and can see how Disgusted Engineer might have arrived at his conclusions.

However, it is known that engineers who appear to be thinking more than often are thinking, or, just as important, relaxing. Also, that what appear to be bull sessions are more than often something other than wastes of company time. I have found that misunderstandings and misinformation are often eliminated, and new items apropos the state-of-the-art are revealed. And, even though these discussions do at times degenerate, I've noticed a definite tendency for a group to break up when the industry-type content lags.

No coffee breaks and (until recently) excessive overtime are two legitimate gripes not easily resolvable. Management's argument that authorized coffee breaks would result in excessive loss of manhours is just as valid as the engineers' argument that the break is a necessary psychological release from the work situation. As for overtime, studies have pointed up that it defeats its purpose after about six weeks, excepting, of course, war-motivated effort.

Seems people just get burned out, then stagnate.

Short of a major break-through, it seems certain that the problem of eliminating nonproducing engineers will not soon be simply solved. However, motivating factors can be identified and effectively dealt with, such as professional salaries for competent men, and realistic individual goals. Along this line one of the major reasons for dissatisfaction is frustration. The following are typical sources of frustration:

- **Over-cautious** supervisors not willing to delegate responsibilities.
- **Jealous**, often undertalented lead personnel or supervisors who expend considerable effort to ensure that subordinates do not attract excessive amounts of favorable attention from superiors.
- **Work assignments** whose successful conclusions are frustrated by such statements as, "Oh yes, uh, that has already been decided."

It boils down pretty much to this. Leaders who command respect because of their own performance and understanding of people will come by the fruit of their labors as a natural consequence.

AVIATION WEEK deserves a real pat on the back for its continuing generally high quality. Keep up the good work!

CLYDE P. MATTESON
Seattle, Wash.

Area Rule 'First'

I would like to call your attention to an advertisement on p. 16 of the July 8 issue of your publication.

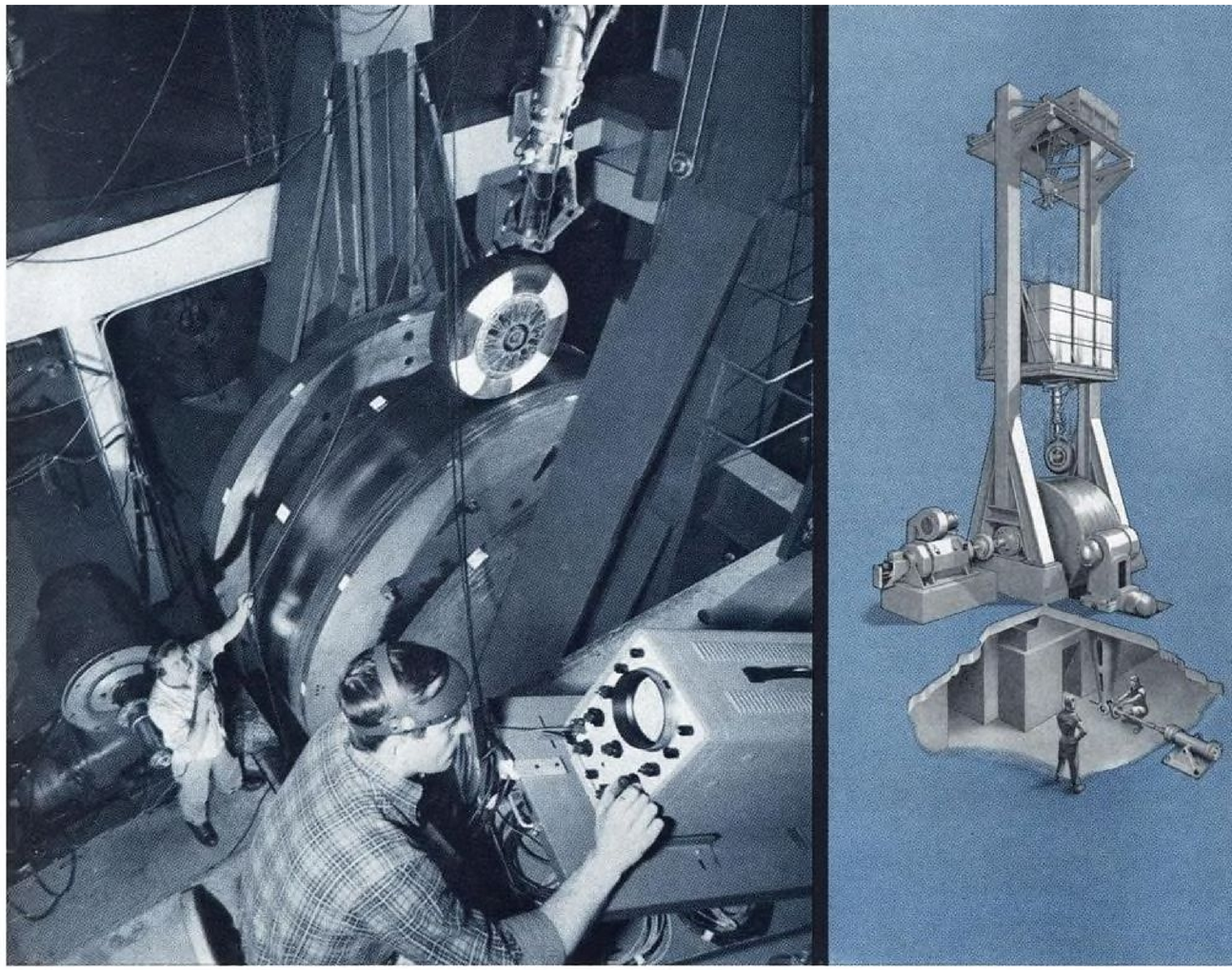
This advertisement describes the F-102A and refers to that airplane together with "the first application of Area Rule." "First application" is italicized in this advertisement.

I believe a correction is in order here as the first application of Area Rule on any aircraft was on the Grumman F11F-1 Tiger, the first aircraft to fly with this design concept incorporated. The aircraft flew on July 31, 1954, and the flight was, incidentally, described by Dave Anderton in AVIATION WEEK.

I certainly don't want to get into a controversy over "firsts" but I do want to see credit go where it is due—and that is to Grumman engineers whose Tiger first flight demonstrated the application of the Area Rule principle.

J. B. RETTALIATA
Grumman Aircraft Engineering Corp.
Bethpage, N. Y.

(The Grumman F11F-1 Tiger was the first aircraft to fly with NACA Area Rule applications, the flight made on July 31, 1954. First Convair F-102A incorporating Area Rule made its initial flight several months after the Tiger took to the air. Grumman and Convair engineers became interested in the NACA Area Rule data about the same time—during the fall of 1952.—Ed.)



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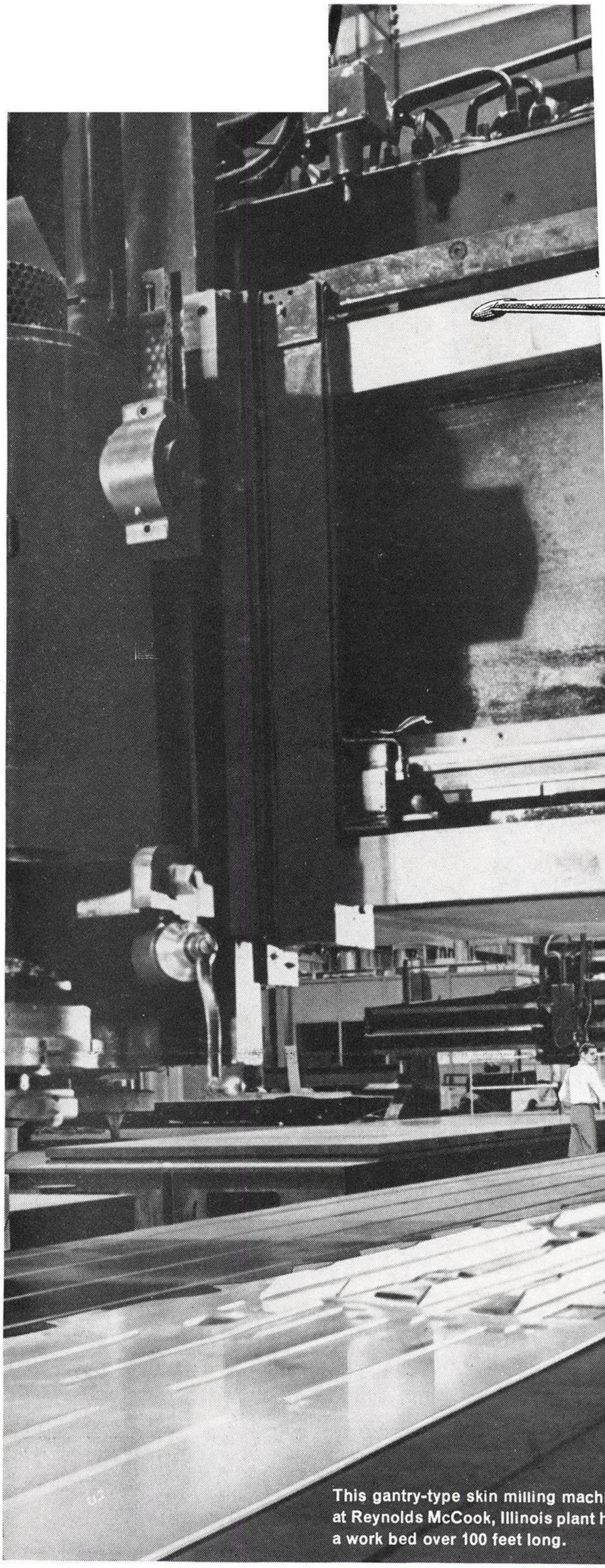
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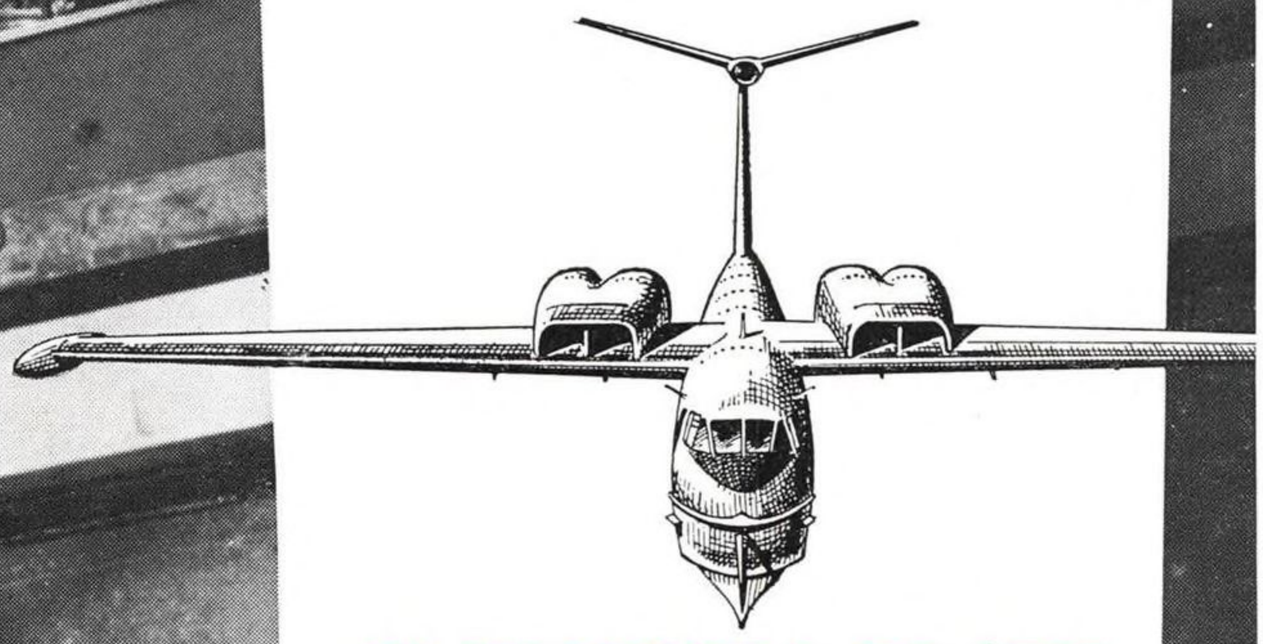
So, when it comes to gear for landing, think and plan in terms of a complete landing gear system. Then, we suggest you think of Bendix and Bendix Products Division at South Bend, Indiana. *REG. U.S. PAT. OFF.

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