AVIATION WEEK

A McGRAW-HILL PUBLICATION

September 9, 1957 50 cents

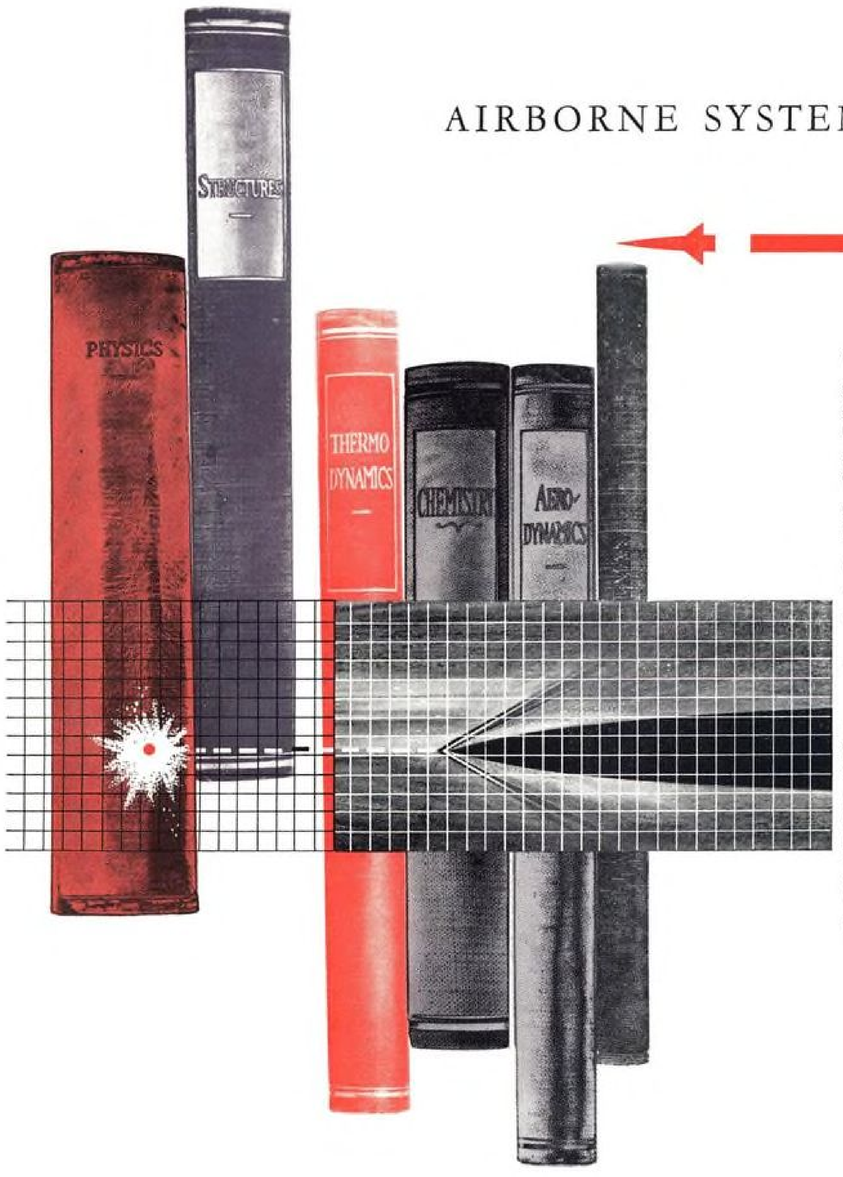
Army Launches Helicopter Cost Cutting Program

Convair F-106



Special Report From Farnborough

ARMY · · · AIR FORCE · · · NAVY



AIRBORNE SYSTEM CAPABILITY

The Research and Development group at Rheem Aircraft is currently engaged in the conception, evaluation and design of advanced airborne systems.

The wide scope and diversified capabilities of this group are evident in the list of current activities:

- DRONE SYSTEMS
- SMALL MISSILE SYSTEMS
- EXPLOSIVE and ORDNANCE DEVELOPMENT
- PROPULSION SYSTEM ANALYSIS

Advanced studies of future missile, aircraft and ordnance requirements are currently under way.

If you would like to join this group of technically capable personnel and participate in broad and diversified projects, submit a resume: Personnel Manager, Aircraft Division, Rheem Manufacturing Company.

All inquiries held strictly confidential.

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Rheem

27-57

How to cope with an avalanche of urgent data

Tape keeps ballistic missile tests in manageable form



Four of the twenty-four Ampex FR-100 Tape Transports at the General Electric Missile and Ordnance Systems Department facility in Philadelphia.

Nobody intends to get buried, drowned, suffocated or trampled as the floodgates open on one of the biggest of all data-acquisition programs. For its ballistic missile development contracts, General Electric's Missile and Ordnance Systems Department has installed a data-processing and computation center to match the challenge.

A PREFERENCE FOR TAPE

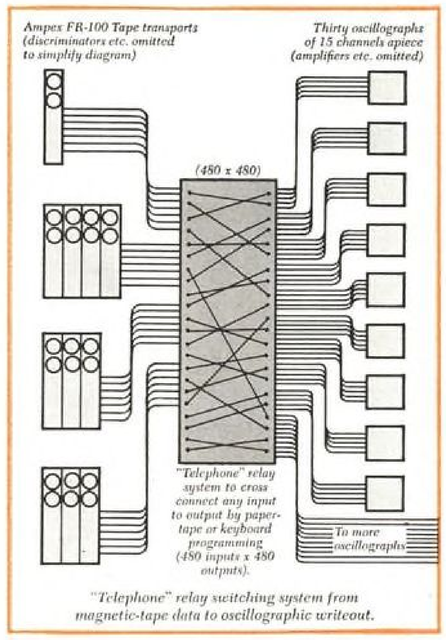
Of the test information received, about 90 percent will be on tape. Two facts about magnetic tape recording help keep the sheer mass of information under control: (1) hundreds of simultaneous parameters are recorded on one tape with a common time base; (2) tape gives live electrical voltages, hence reducing, correlating, computing and handling steps can be done automatically. General Electric's goal is to provide all interested engineering groups with both analog and computed data within three days of receipt of raw tapes.

Tapes from flight test, ground test and component development will be received from sources all over the U.S. These tapes will include quarter, half and one-inch widths. Hence most "tape stations" in the data-reduction system will have three Ampex FR-100 tape transports for the three widths. They will share electronics.

NOVEL USE OF A TELEPHONE TECHNIQUE

The right data must get to each of a large number of research and design groups. No traffic snarls allowed – so General Electric's engineers have made ingenious use of taped data's electrical form. They use a "telephone central station." After the necessary conversion steps, hundreds of channels of data from magnetic tape are fed into an automatic relay switching system. This connects them into 450 channels of oscillographic writeout (30 oscillographs with 15 channels apiece). When desired one input can go through a multiple relay putting the same data trace on two or more of the oscillograph records. Programming is done by a carefully checked paper tape. The end result is visual traces in a desired side-by-side relation. And each oscillograph record contains the data of interest to particular engineering groups.

Magnetic tape comes to life again in computation. The visual records are marked wherever special computer effort is required. Another group



"Telephone" relay switching system from magnetic-tape data to oscillographic writeout.

of Ampex FR-100 Tape Reproducers plays the tapes through a high-speed analog-to-digital conversion system which finds and converts selected sections to digital form at a rate of 45,000 conversions per second.

If mass of data is your problem, we would be pleased to discuss some practical answers. Or would you like to have this informative ad series mailed direct? For either request, write Dept.UU-7.

INSTRUMENTATION DIVISION
AMPEX CORPORATION
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934 CHARTER STREET · REDWOOD CITY, CALIFORNIA

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MAGNETIC TAPE APPLICATIONS BY AMPEX

ONE OF A SERIES 7



Series FR-100



Series 800 Mobile and Airborne



Model FR-200 Digital



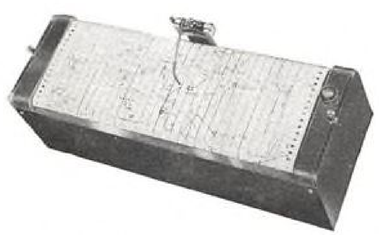
Series FL-100 Loop Recorders



Series FR-1100



...with the Bendix-Decca Area Coverage Navigation System



The actual position of the aircraft is continuously traced on the Flight Plotter—a moving road map of extreme accuracy.

In California in 1941, when two midwesterners invented a new navigation system, they didn't dream how much "growth potential" it had. Today that system is not only the most thoroughly proven navigation system in the world, but recent developments combine to give it outstanding air traffic control capability.

The Bendix-Decca system permits maximum utilization of air space at all flight altitudes — along airways or in terminal areas. It continuously shows instantaneous position location to the pilot, *with precision never before approached*, thus permitting minimum track separation, so essential to effective air traffic control.

Fixed wing aircraft and helicopters can maintain holding patterns with absolute accuracy and can feed into an approach system from any point with complete certainty.

Bendix
PACIFIC DIVISION
Bendix Aviation Corporation
NORTH HOLLYWOOD, CALIF.

AVIATION CALENDAR

Sept. 7—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. 9-11—15th Annual Meeting, Electron Microscope Society of America, Massachusetts Institute of Technology, Cambridge, Mass.

Sept. 9-13—Twelfth Annual Instrument-Automation Conference, and Exhibit, Cleveland Auditorium, Cleveland, Ohio.

Sept. 10-11—First Regional Business Aircraft Safety Seminar, Jack Tar Hotel, Galveston, Tex.

Sept. 13—Summer Space Flight Meeting, American Astronautical Society, Roosevelt Memorial Hall, American Museum of Natural History, Central Park West & 79th St., New York.

Sept. 13—Third Pacific Area National Meeting, American Society for Testing Materials, Sheraton-Palace Hotel, San Francisco, Calif.

Sept. 14-15—Meeting of Antique Airplane Assn., Ottumwa, Ia.

Sept. 15—1957 Garden Party and Flying Display, Royal Aeronautical Society, Wisley Aerodrome, Weybridge, England.

Sept. 19-20—Business Aircraft Operations Symposium & Eighth Annual P&WA-Air-work Engine Operation and Maintenance Forum, Millville Airport, N. J.

Sept. 21—Third Annual Helicopter Air Display, Bridgeport Municipal Airport, American Helicopter Society, New England Region, Bridgeport Municipal Airport, Conn. Rain date is Sept. 22.

Sept. 23-25—Fall Meeting American Society of Mechanical Engineers, Statler Hotel, Hartford, Conn.

Sept. 25—Pratt & Whitney Aircraft Engine Maintenance and Operation Forum, sponsored by Southwest Airmotive Co., Melrose Hotel, Dallas, Tex.

Sept. 26-27—Fifth Michigan Aeronautics Conference, jointly sponsored by University of Michigan Transportation Institute, Western Michigan University, and The

(Continued on page 6)

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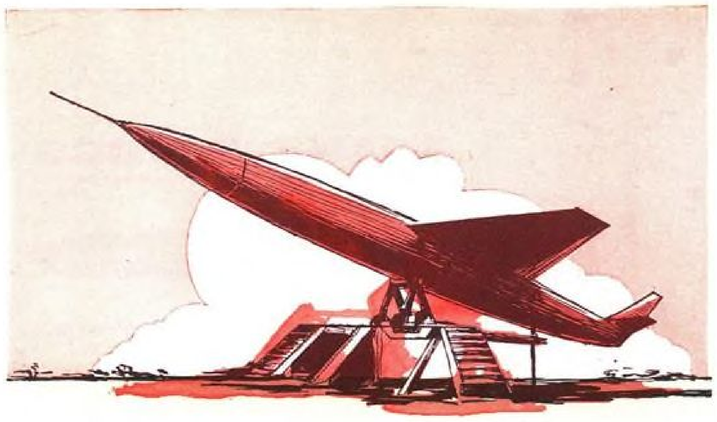
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AVIATION CALENDAR

(*Continued from page 5*)

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. 5—First Annual Awards Banquet, Society of Experimental Test Pilots, Beverly-Hilton Hotel, Los Angeles.

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. 8—Tenth Annual Airport Development and Operations Conference, Onondaga Hotel, Syracuse, N. Y.

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. 16-18—Conference on Computers in Control, American Institute of Electrical Engineers, Chalfonte-Haddon Hall Hotel, Atlantic City, N. J.

Oct. 16-18—1957 IRE Canadian Convention, Automotive Building, Exhibition Park, Toronto, Ont., Canada.

Oct. 17-18—13th Annual Convention, The Magnesium Association, Biltmore Hotel, New York.

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. 21-25—45th National Safety Congress, Conrad Hilton Hotel, Chicago.

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.

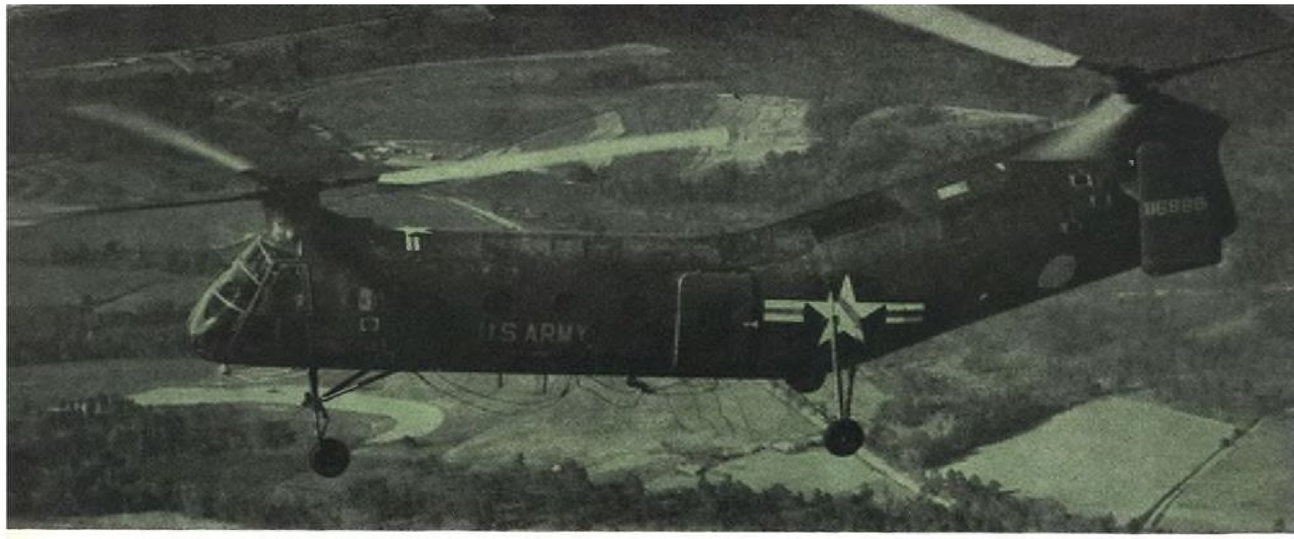
Oct. 28-30—Annual East Coast Conference on Aeronautical and Navigational Electronics, Fifth Regiment Armory, Baltimore, Md.

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.



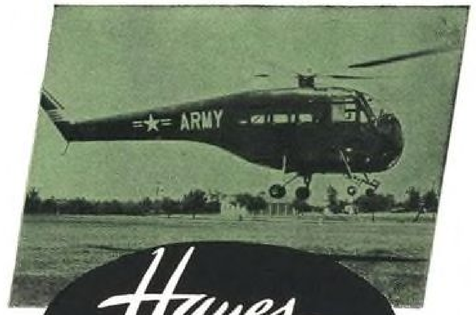
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Hayes Aircraft has completed the company's first year of inspection, overhaul and maintenance of United States Army's 500 helicopters and fixed-wing aircraft at the Army's huge aviation school at Fort Rucker, Alabama, — and the contract has been renewed.

"Service over and above the line of duty" is synonymous with established policies of Hayes Aircraft. In our line of duty at Fort Rucker we simply put into operation our efficient cost control system, our quality control methods and streamlined management policies, as developed and practiced during our years of experience in engineering, modifying and maintaining thousands of aircraft for another Hayes customer — the U. S. Air Force.

Hayes has not received any formal citation in recognition of service rendered during our first year's dealings with the United States Army. But we like to believe that the integrity of Hayes Aircraft Corporation has been recognized in a more material way — renewal of our contract for daily inspection and maintenance of all aircraft at the Army's mammoth training center at Fort Rucker.



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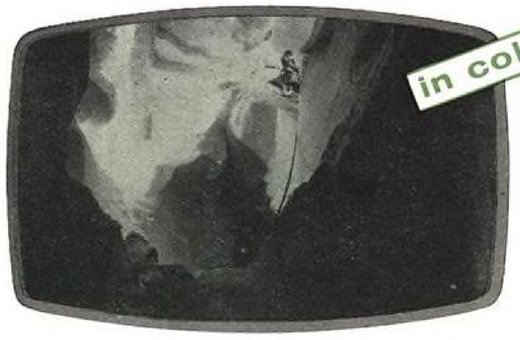
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"The Innocent Years". Recaptured from exciting old films and newsreels, you'll see happy days relived. Experience the excitement of "Teddy" Roosevelt, Thomas Edison and Mark Twain in action. Hear songs like: "In the Good Old Summertime", "He'd Have to Get Out and Get Under". Enjoy the fun of family picnics, the joys of people in the last untroubled time in our history.

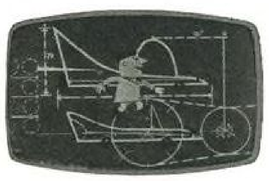
And commercials that help you sell . . .



See How man stumbled on the concept of the wheel.



See Why America's railroads have always led the world.



See Why Americans jump for the latest thing in cars.

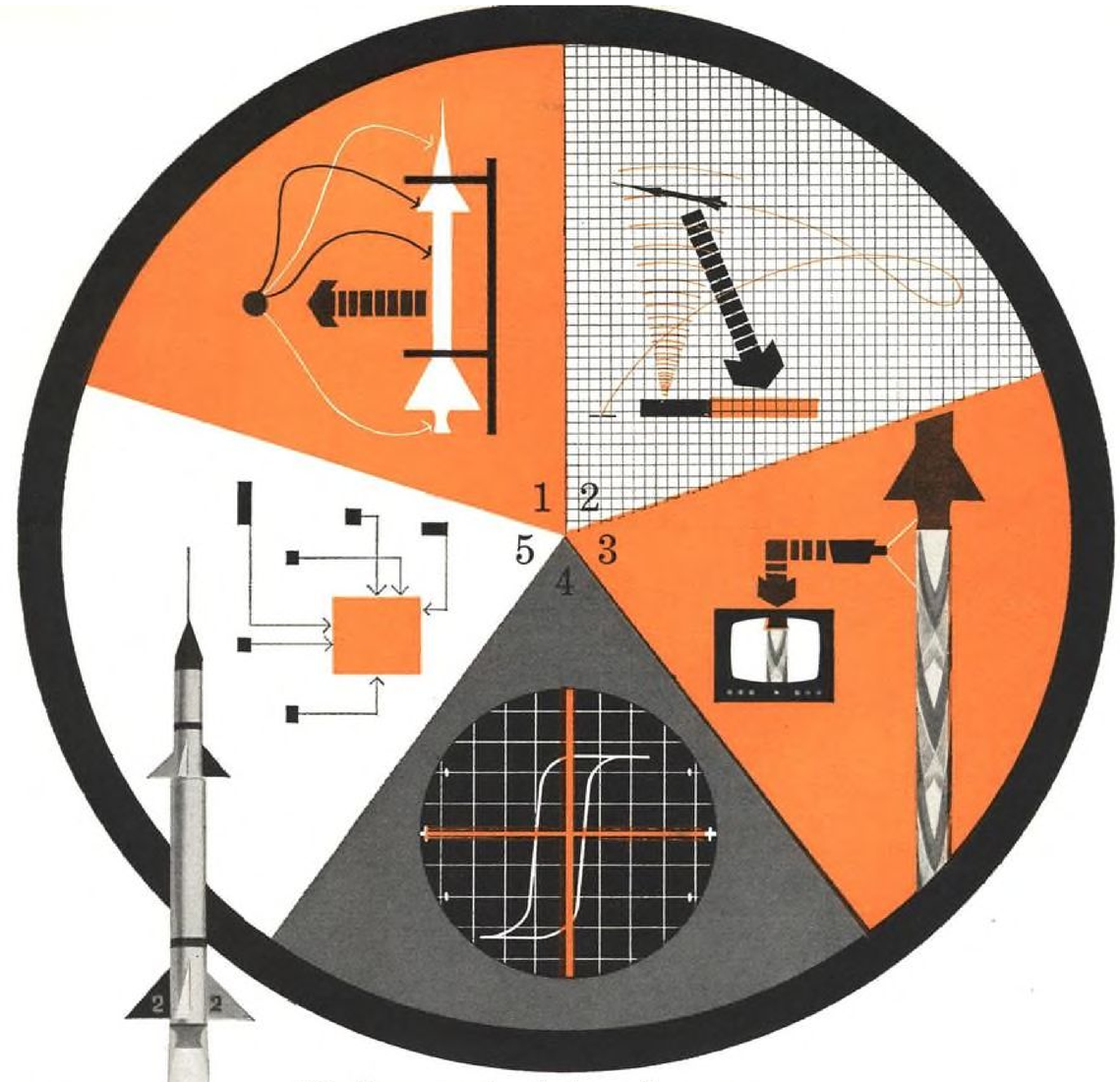


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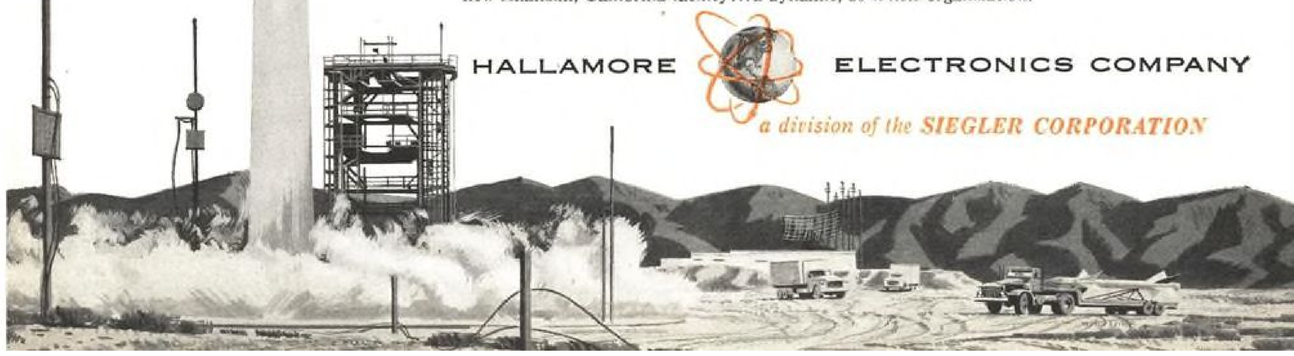
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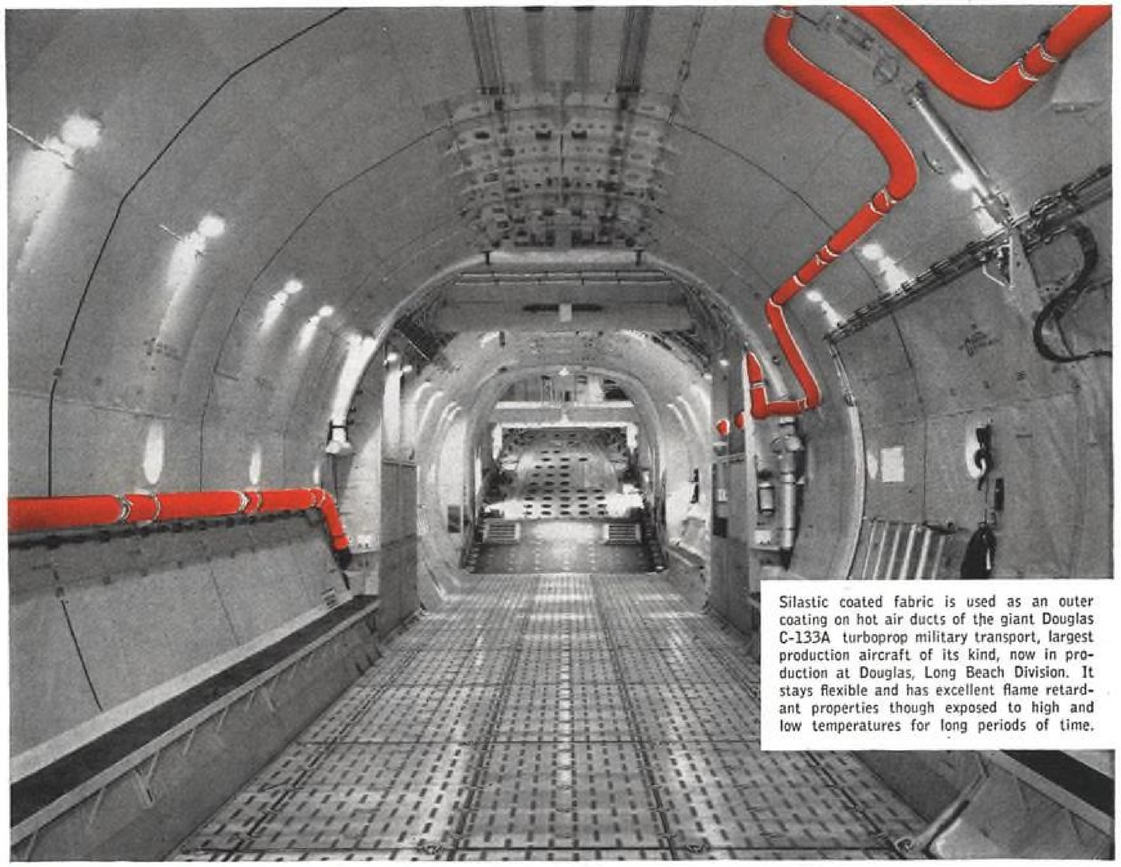
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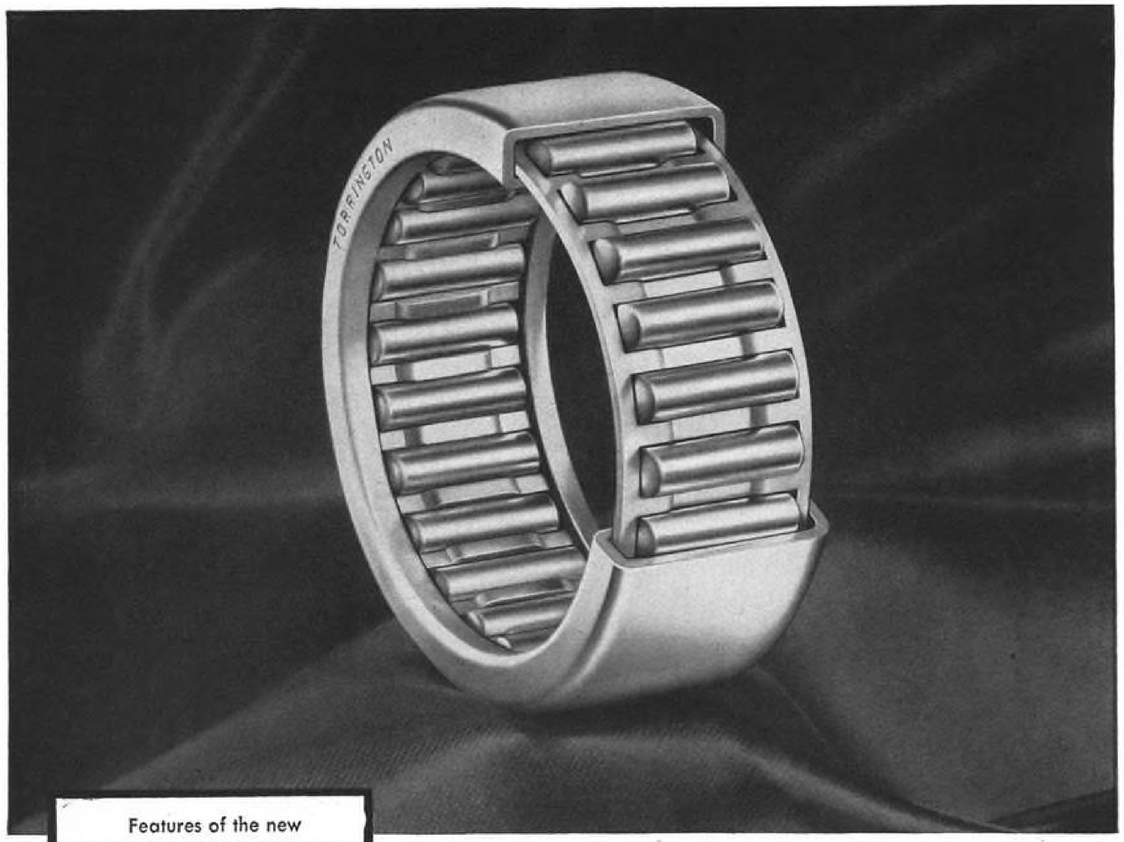
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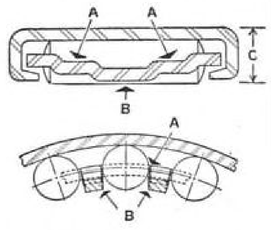
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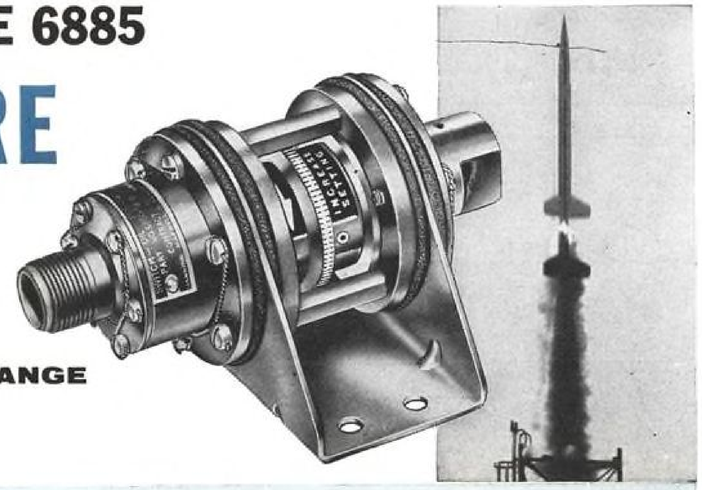
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ACCURACY OF SETTING (Under all test conditions)	±1 psi	±0.3 psi at 2.5 psi setting	±0.5 psi at 5 psi setting	±4% at 50 psi setting	±3% at 100 psi setting	±4% at 500 psi setting	±4% at 800 psi setting	±60 psi at 3000 psi setting	According to selected ranges
PROOF PRESSURE (Without setpoint drift)	500 psi	100 psi	750 or 4,500 psi (as required)	750 or 4,500 psi (as required)	750 or 4,500 psi (as required)	750 or 4,500 psi (as required)	4,500 psi	4,500 psi	250 psi
BURST PRESSURE	750 psi	450 psi	1,000 or 7,500 psi (as required)					7,500 psi	450 psi
TEMPERATURE RANGE	−75° F. to +250° F.								
VIBRATION	Up to 2,000 cps at 40 g. Exceeds MIL-E-5272A Procedure I								
OVERALL DIMENSIONS	Switch Proper — 2" Diameter; Length 4⅜". Mounting Bracket to Suit Application								3½" wide 4⅜" long
WEIGHT	9 Ounces							10.5 Ounces	16 Ounces
ELECTRICAL RATING	30 Volts, 2.5 Amperes Inductive Load at 50,000 Feet								

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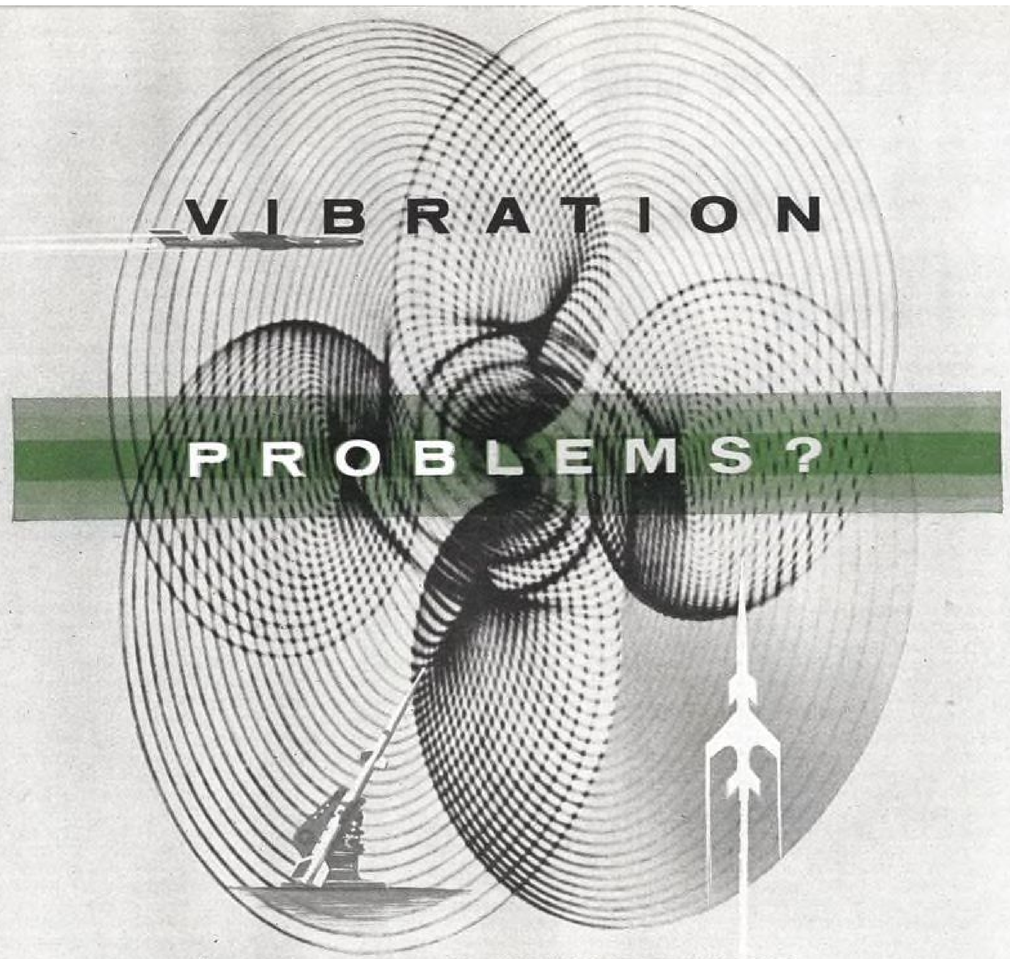
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COVER: Convair F-106 supersonic all-weather interceptor shown here during flight tests at Edwards AFB is an advanced version of the original F-102A design now in service with Air Defense Command. F-106 is powered by a Pratt & Whitney J75 turbojet with afterburner producing about 23,000 lb. thrust, has a clipped vertical fin and new enlarged air intake ducts. It will carry the Douglas MB-1 air-to-air missile with atomic warhead and operates in the Mach 2 speed range at altitudes in the 60,000 ft. area. It is scheduled for production at Convair's San Diego plant. Additional pictures on pages 32-33.

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EDITORIAL

Missile Misinformation

Seldom has the American public been inundated by such a flood of misinformation from official government sources and the daily press than during the two weeks since the Soviet Union announced the successful test firing of an intercontinental ballistic missile (AW May 20, p. 31 and Sept. 2, p. 27).

This flood of missile misinformation on a subject of vital importance to every American citizen and the future of our country is the inevitable result of the public information policies of the Pentagon dictated by the White House during the past three years.

Citizen in Dark

These policies are based on the philosophy that the American citizen whose vote elects the government and whose hard earned tax dollars finance its activities has no "need to know" how wisely or well his money is being spent to provide him with an adequate defense against potential foreign enemies. The White House has clamped an iron curtain of secrecy on Pentagon release of almost everything concerning the vital ballistic missile program that now involves the Air Force, Navy and Army. This is a program that is absorbing billions of the taxpayers' dollars and to date has produced nothing much—Army claims notwithstanding—in the way of useful military hardware.

Certainly the American people have a need and right to know within the limits of genuine technical security what is being done with this money and what we can expect to get for it. Both USAF and the Army have made strong representation to the Secretary of Defense and the White House that the current tight secrecy policy on the ballistic missile program is neither effective nor wise. But they have been rebuffed by the "poppa knows best" attitude emanating from the executive branch of the government.

Officially Misleading

Official government statements on the Russian ICBM firings have been deliberately misleading and withhold a good deal of information the American people are entitled to have on the subject. These official statements by President Eisenhower, Secretary of State Dulles and Deputy Defense Secretary Quarles have been manipulated solely for political effect with a technique that we expect from the Kremlin but not from the White House. In fact Mr. Quarles since his USAF budget experience has become quite expert in publicly slaloming around facts without actually disturbing them.

The White House and Pentagon know when the Russians began their ICBM test firing program, they know approximately how many rounds have been fired to date and the general performance of these rounds in altitude and range. They also know how long the Soviets have been firing intermediate range missiles, where these test firings have been made and the general progress of this program. These are certainly not facts that need concealing from the Russians so why conceal them from the American people? Even the methods by which this information is scientifically collected is known to the Soviets and there is little they can do except bluster to stop this process.

If we are running neck and neck with the Soviets in the next major round of weapons development the American people are entitled to the unvarnished facts on what this country must do to stay significantly ahead of any competitors in this field. No amount of official soothing syrup will remedy this situation.

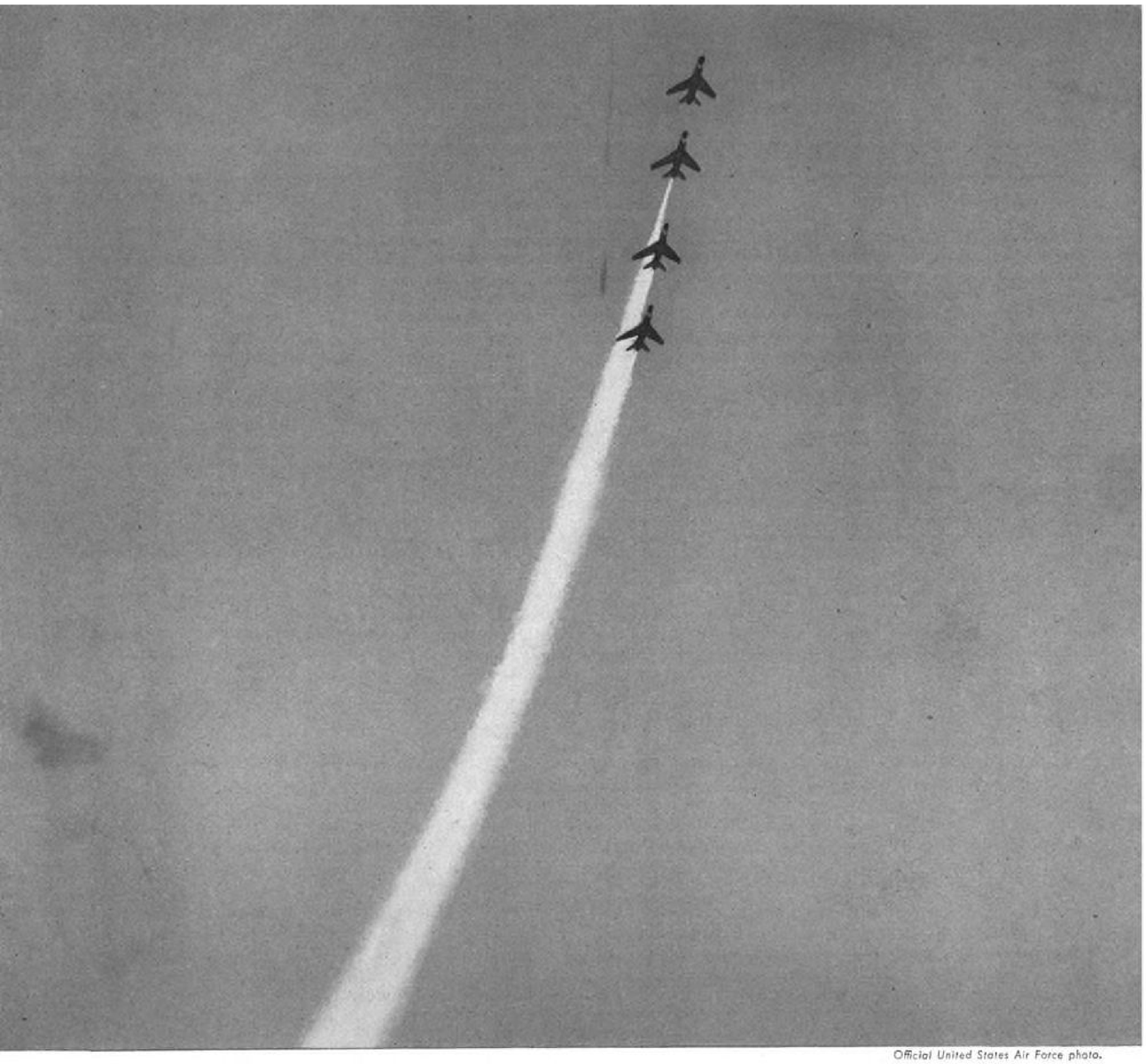
Florida Farce

Another ridiculous aspect of the official information policy on missiles is the farce being enacted on Florida beaches near Cape Canaveral with increasing frequency. Large ballistic missiles and research vehicles are being launched in plain view of hundreds of civilian observers who now plan their picnics to coincide with the missile firings. Cameras of all sorts film these launchings and record the successful flights out of sight or the ignominious burnings on the pad or detonations in early flight by the range safety officer.

Yet official policy has its head buried deep in the Florida sand like an ostrich and takes the attitude that these firings are top secret and nobody knows anything about them. In the case of the abortive Atlas test firing last June this reached a climax of absurdity. Movie films taken from public beaches only a few miles from the launching pad were shown two days later in 600 European movie houses. From these films, available all over the world, technical experts could reconstruct all significant detail of the missile structure, the type of fuel being burned, the exact component that failed and many other details. So who are we kidding about what's secret in our ballistic missile program?

Official missile information policy needs a thorough, realistic revision aimed at giving the American people all the facts on both our programs and those of the enemy that are consistent with maintaining genuine technical security. Any other policy is heading toward failure and eventual disaster.

—Robert Hotz



Official United States Air Force photo.

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Vernon L. Haag, vice president-missile test equipment, Farnsworth Electronics Co., division of International Telephone and Telegraph Corp., Fort Wayne, Ind.

Geoffrey Parsons, Jr., vice president for Europe (Paris), Northrop International, Northrop Aircraft, Inc., Hawthorne, Calif.

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Gerald J. McCaul, vice president-contracts and service division, and **Myron G. Domistz,** vice president-research and development division, Simmonds Aerocessories, Inc., Tarrytown, N. Y.

Richard A. Wilson, a vice president and head of newly formed Avionics Group, Daystrom, Inc., San Francisco, Calif.

Theodore Voorhees, general manager, International Division, Bendix Aviation Corp., Detroit, Mich.

Col. Robert L. Johnston (USAF, ret.), assistant to the president, Advance Industries, Inc., Cambridge, Mass.

Honors and Elections

The Aircraft Manufacturers Council of the Aircraft Industries Association has announced the following elections: Eastern Region—**George M. Bunker,** board chairman and president of The Martin Co., chairman, and **James S. McDonnell,** president of McDonnell Aircraft Corp., vice chairman; Western Region—**C. J. McCarthy,** board chairman of Chance Vought Aircraft, Inc., chairman, and **William M. Allen,** president of Boeing Airplane Co., vice chairman.

The Public Relations Advisory Committee of the Aircraft Industries Association also announced the following elections: Eastern Region—**Carlyle H. Jones,** director of advertising and public information for Sperry Gyroscope Co., chairman, and **William G. Key,** assistant to the president of Fairchild Engine and Airplane Corp., vice chairman; Western Region—**A. V. Cline,** director of public relations for Northrop Aircraft, Inc., chairman, and **Leland R. Taylor,** assistant to the president of North American Aviation, Inc., vice chairman.

Changes

Lt. Cmdr. D. R. Geehring has joined the staff of General Electric's Flight Propulsion Laboratory, Aircraft Gas Turbine Division, Cincinnati, Ohio. Cmdr. Geehring formerly headed the Bureau of Aeronautic's high energy fuel Project ZIP, one of the largest projects even undertaken by BuAer.

Thomas Wolfe, a veteran of the aviation industry, has formed Thomas Wolfe & Associates, Los Angeles, Calif. (professional and industrial specialists) to serve the aviation industry.

INDUSTRY OBSERVER

(The following column was written by Aviation Week *editors attending the 18th SBAC Flying Display at Farnborough and the Joint Technical Conference of the Royal Aeronautical Society and the Institute of Aeronautical Sciences in London.)*

► **English Electra P.1 production fighters will be armed with a pair of de Havilland Firestreak missiles installed on short horizontal pylons on fuselage sides below and slightly aft of cockpit. Possible blast and flash problems are expected. Armament of two 30-mm. Aden cannon has been installed and tests of the cannon have been made on one of the prototype P.1A aircraft.**

► Unofficial height record established last week by a Canberra test bed powered by standard Rolls-Royce Avons plus a pair of Napier Scorpion rocket engines in the belly was actually set on the fourth of four runs all well above the current official mark. First of the runs was a rehearsal, second a confirmation of the ability to make the altitude. Third run was officially observed, but camera recording equipment malfunctioned. Fourth run has been submitted for homologation. This attempt is expected to be officially confirmed at altitude several hundred feet in excess of the 70,000 ft. level announced.

► **First squadron of Vickers Supermarine Scimitar naval strike fighters is forming and is expected to be fully equipped by next month. Plane was developed to Royal Navy requirement for tactical delivery of atomic weapons over long ranges operating from carrier decks with target run-in at low altitude.**

► Aerodynamic fixes for improved transonic performance cropped out on almost every airplane exhibited at Farnborough. Vortex generators have been fitted to tails and wings of Gloster Javelin, Avro Vulcan, Vickers Valiant and some of the English Electric Canberra engine test beds. Blunt trailing edge ailerons appeared on the Javelin and the English Electric P.1 series of fighters. Notable exception was the aerodynamically simple and as yet relatively untested Saunders Roe 53 mixed powerplant (jet and rocket engine) interceptor.

► **Deliveries of Firestreak missile, now standardized as armament for the P.1, Javelin and de Havilland Sea Vixen, are not yet keeping pace with the requirements for test rounds. At least one of the three planes being matched to the missile is waiting in its development trials for delivery of enough rounds to start an adequate test program. Most of the two dozen individual rounds shown at Farnborough in the static display or fitted to the flying aircraft were obviously dummies or mockups of the de Havilland air-to-air missile.**

► Watch for announcement of a major airline order for conversion of Lockheed Constellation to Napier Eland turboprop powerplants. Napier has current contract for REAL airlines of Brazil for conversions of its Convairs to turboprops.

► **Technical observers rate the Bristol Bloodhound ramjet-powered anti-aircraft missile as somewhat comparable to the Western Electric Nike in range and performance, but give a slight edge to Bloodhound performance because of its more-recent development cycle. Bloodhound is not yet sited in the United Kingdom for defense of target areas; Nike sites have been operational in the United States for several years now and cover many American cities.**

► Royal Air Force announcement of order for English Electric Thunderbird anti-aircraft missiles gives the apparent nod to that weapon over the Bristol Bloodhound for future defense work. English Electric is now in the position of making the major contribution to British air power, with its aging but still potent Canberras with atomic bomb loads as the guts of Bomber Command's tactical strength and the P.1B supersonic interceptor as the future mainstay of Fighter Command along with the Thunderbird missile for the air defense of England.



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Washington Roundup

Information Gag

Watch for increasing efforts to spotlight the Operations Coordinating Board as the real gag on adequate public information at the Pentagon. Defense Secretary Charles E. Wilson and Murray Snyder, his assistant for public affairs, are forced to draft the directives and try to enforce them, but the real aversion to telling Americans where they stand in the ballistic missile race (see page 40) comes from OCB, a watch-dog for the White House. The board was created by President Eisenhower to see that his orders are carried out, and this includes reflecting his strong aversion to letting the public in on military business. USAF, effectively gagged in the current battle over capabilities and the state of the missile art, recognizes that OCB is running the show. Major hope appears to be that strict observation of the rules will result in crackdown on other services that violate them.

There is little possibility that public opinion can force a change in OCB's edicts. Board is sacrosanct, highly powerful, seldom publicized and accountable only to the President.

Moss Hearings

Defense Department public information policies, particularly its blackout on information on missile firings as opposed to the public's need to know, will be scrutinized at open hearings before the House Government Information Subcommittee. Hearings are tentatively scheduled to begin Nov. 18. The key witness will be Assistant Secretary Snyder. Rep. John Moss (D., Calif.), chairman of the group, has sharply criticized Synder for his memo prohibiting the disclosure of any details on firings except confirmation of the fact that a firing occurred and "a brief statement" as to any casualties in the event of an accident.

Transpacific Reopened

The CAB is being asked for the second time in less than three years to reopen the Transpacific Air Route Case to consider Pan American World Airway's bid to serve Portland and Seattle on the Great Circle route to the Orient. The request by President Eisenhower was made one month and one day after the President had approved the CAB recommendations denying Pan American's application, but which permitted the airline to fly direct from California to Tokyo on the route. The President said it had come to his attention that there may have been substantial increases in traffic and that Northwest Airlines might divert flights from the West Coast through Minneapolis and Alaska. In view of this, he said, "I desire the Board to prepare and submit to me for my approval an order reopening Docket No. 5031 to the limited extent of deferring final decision on Pan America's request to serve Seattle and Portland on the Great Circle route."

New Name For Holloman

Name of Air Research and Development Command's Holloman Air Development Center at Holloman AFB, N. M., has been changed to Air Force Missile Development Center—because, one Air Force spokesman said, "we develop missiles, not air."

Mission of the center as well as management of missile weapon systems through ARDC's Ballistic Missile Division at Los Angeles and headquarters offices located at Wright Air Development Center, remains unchanged.

Small Business Review

Senate Small Business Committe wants the Air Force to make a survey of all its weapon system contractors "to determine what not-previously-produced components the contractors have begun to manufacture in their own plants since being assigned management responsibility for a weapon system."

USAF also was called on to require all contractors to submit their subcontracting requirements to the 18 USAF district offices "thereby eliminating the necessity for smaller manufacturers, individually, to contact each weapon system contractor."

The committee commented in its report: "Recent years have brought no visible lessening of the ingrained proclivity of military contracting offices to lean toward the larger manufacturers in preference to doing business with qualified smaller companies."

ATA Rebuttal

Air Transport Assn. charged last week that a report by the House Antitrust Subcommittee suggesting possible antitrust violation in ATA's activities is "chocked full of vague hints and innuendo, signifying very little.

The report scolds but provides little substance, and no support from the record of the hearings.

Soviet Satellite Visit

Soviet Russia has indicated it will attend an international conference here on rocket and earth satellite programs from Sept. 30 to Oct. 5. Host is National Academy of Sciences.

Chairman is Dr. Lloyd V. Berkner, President of Associated Universities, and reporter on rockets and satellites for the special committee on the International Geophysical Year.

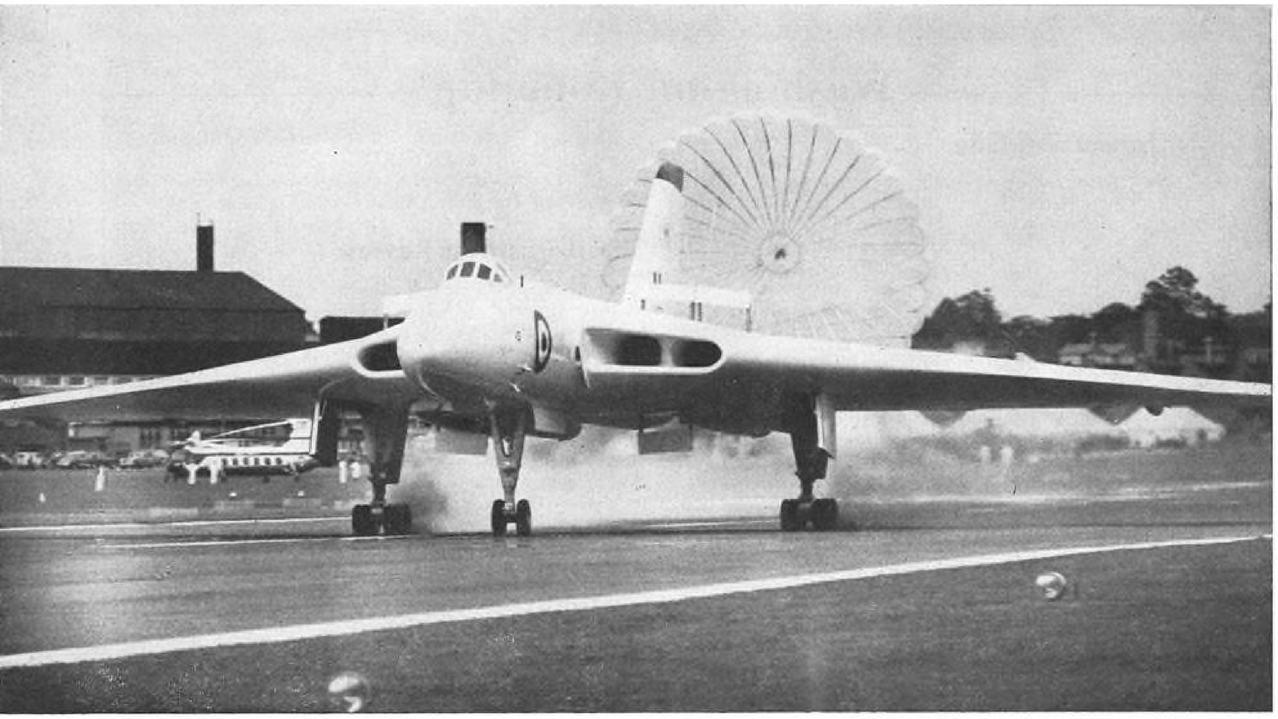
The meeting is the first international IGY conference to be held in this country. Others have been held in a dozen countries abroad.

Agenda includes discussions on interchange of data from rocket and satellite experiments among the participating countries and should produce clearer indications of Russia's satellite plans.

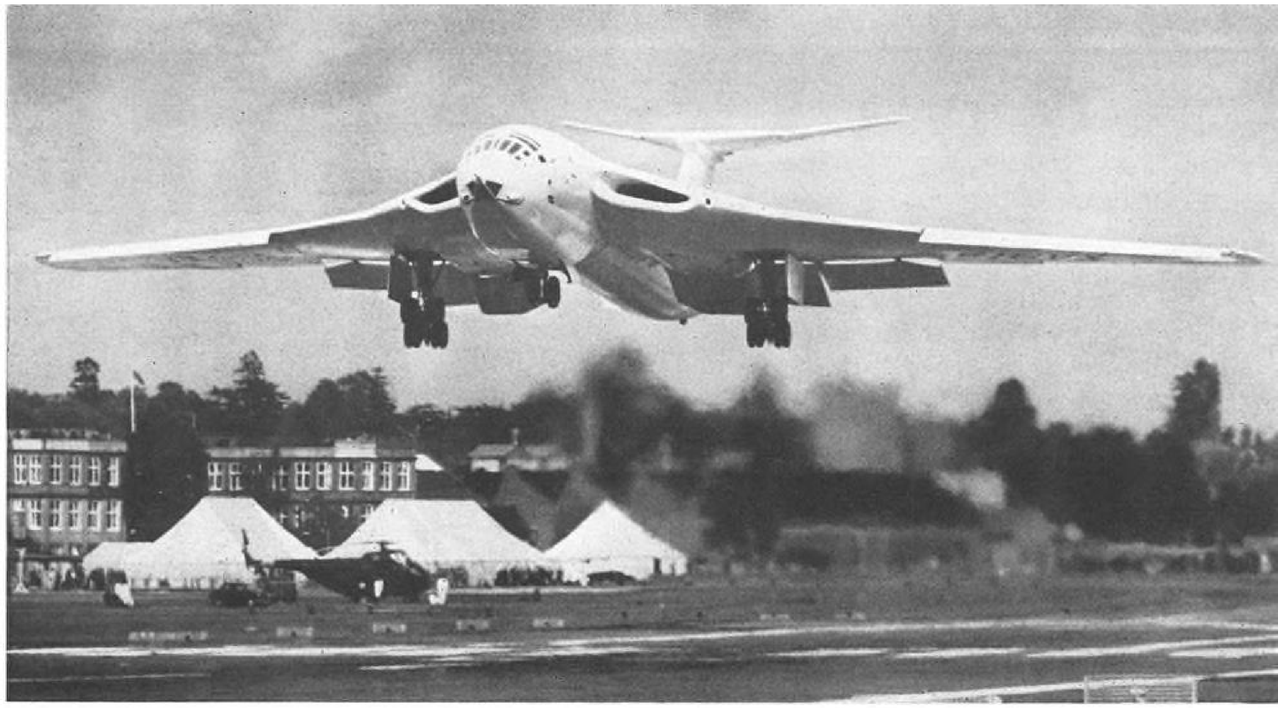
Traffic Control

House Interstate and Foreign Commerce Committee is pressing for new air traffic control procedures and strict enforcement of regulations to protect expanding civil air transport operations. In a report on air transportation and airspace use problems, the committee pointed to the collision of a jet fighter and a civil passenger transport last Jan. 31 during test-flight operations in the Los Angeles area as an example of the need for tighter airspace control. The committee added that, from information it had received, the collision involved a violation of the spirit, if not the letter, of the Civil Air Regulations then in effect pertaining to test-flight operations.

—Washington Staff



AVRO VULCAN pops drag chute for landing. Plane shown is a development of the basic Mk.1 version, designated B.Mk.2, and has Bristol Olympus engines plus altered leading edge incorporating conical camber.



HANDLEY PAGE VICTOR, one of two heavy bombers just beginning to get into service with the Royal Air Force Bomber Command, comes in for a landing.

SBAC Display Suggests British Missile Policy Is Premature

Impressive aircraft performance in flight demonstrations contrasts with unimpressive missiles.

By David A. Anderton

Farnborough — Impressive performance of the English Electric P.1 contrasted sharply with the unimpressive appearance of a batch of British missiles at this 1957 Society of British Aircraft Constructors display.

Highspeed passes restricted to subsonic speeds by a Ministry of Supply order forbidding sonic booms at the air display, coupled with tight high G turns well within the boundaries of the western half of the field emphasized the aerodynamic capability of the P.1, listed to be the last of the RAF's manned fighters.

Missile Evaluation

Its prospective replacements, the English Electric Thunderbird and the Bristol Bloodhound missiles on display in the SBAC park, externally showed no startling advances over their American in-service counterparts.

This contrast mirrored the growing belief here that the Defense White Paper of last spring, which ruled out further generations of manned fighters and bombers, was ahead of its time by about one more generation. "Now that we've learned how to build a modern fighter," said one engineer, "we're not allowed to do it again."

Most technical observers, even those who are strong proponents of the missile systems, do not feel that the day of the missile has yet dawned in Britain.

Backing up this belief is a continuing series of manned fighter developments and interim missile systems to be added to existing aircraft. Foremost among these was the little white Saunders-Roe 53 interceptor using a mixed powerplant of an Armstrong Siddeley Viper turbojet and a de Havilland Spectre throttlable rocket.

Sr. 53 Performs

Inflight demonstration of the plane by John Booth showed its extremely short takeoff run, near-vertical rate of climb and hinted at its level flight supersonic speed capability. Even though official support has been withdrawn from the P.177 development of this plane, the company is continuing development in the hope of foreign future orders.

Major contribution to the air display was made by military services in flypasts of current operational aircraft and acrobatic teams which tried to bring the flavor of the recent Paris Air Show to the record crowds. Fighter Command flew over formations of 27 Gloster Javelins and 27 Hawker Hunters, No. 111 Squadron sent its acrobatic team now increased to nine Hunters, and Bomber Command flew over two Avro Vulcans and two Vickers Valiants.

Royal Navy made flypasts of a dozen of its Fairey Gannet anti-submarine aircraft and an acrobatic team of five Hawker Sea Hawks plus one solist. Central Flying School sent a team of four piston-engined Percival Provost trainers to do acrobatics in a style reminiscent of prewar RAF displays at Hendon.

More Static Display

Under the canvas roof of the static display, exhibition space has been increased by almost half this year to take in the increasing number of firms now playing roles in the modernization of Britain's air power.

The static park showed those hardy perennials of the display—the Avro Shackleton, DH Vampire Trainer, the Blackburn Beverley—veterans of six years or more of flypasts at Farnborough. As at previous SBAC displays, large portions of the flying were devoted to the variety of engine flying test beds with a predominance of Canberras this year and to civil aircraft including the DH Comet 3 and Bristol Britannia.

Weapon System Accent

Noticeable at Farnborough this year was the accent on the weapon system. For the first time at these displays, almost every military aircraft and missile was listed as either a weapon system or part of one. But there is still considerable difference between the organization of Britain's weapon system projects and those of the United States where advantages of the systems approach have been hammered home in a large number and a wide variety of weapon projects.

Closest approach to a complete weapon system was the English Electric Thunderbird antiaircraft missile. Designed to take maximum advantage of existing army equipment, the Thunderbird has been simplified in a systems program which is the largest underway in England. The missile has an ogival head and cylindrical body tapering slightly to a boattail shape over the exhaust nozzle of the solid propellant sustainer. The wings are fixed, low aspect ratio surfaces. The tail is cruciform and in the same plane as the wings. Tail surfaces are all movable and provide all control; their aspect ratio is higher than that of the wings. Tail and wings are located quite closely together, and this characteristic is almost standardized in the British missiles.

Built to a similar requirement—target area defense—the Bristol Bloodhound has a different kind of geometry, propulsion and guidance system. Bloodhound is also ogival headed and has a cylindrical body, but its powerplant is a pair of Bristol Thor ramjet engines producing about 8,000 lb. thrust each and designed for speeds probably in the Mach 2-3 range.

Both Bloodhound and Thunderbird are boosted by a cluster of four wraparound solid propellant rockets in a configuration which makes for missile compactness but aerodynamic untidiness. First glance at both missiles reveals fins, wings, bodies and boosters everywhere. Continued use of the cluster boosters on these and other British missiles reflects the current lack of large solid propellant charges for boosting.

Semiactive Homing

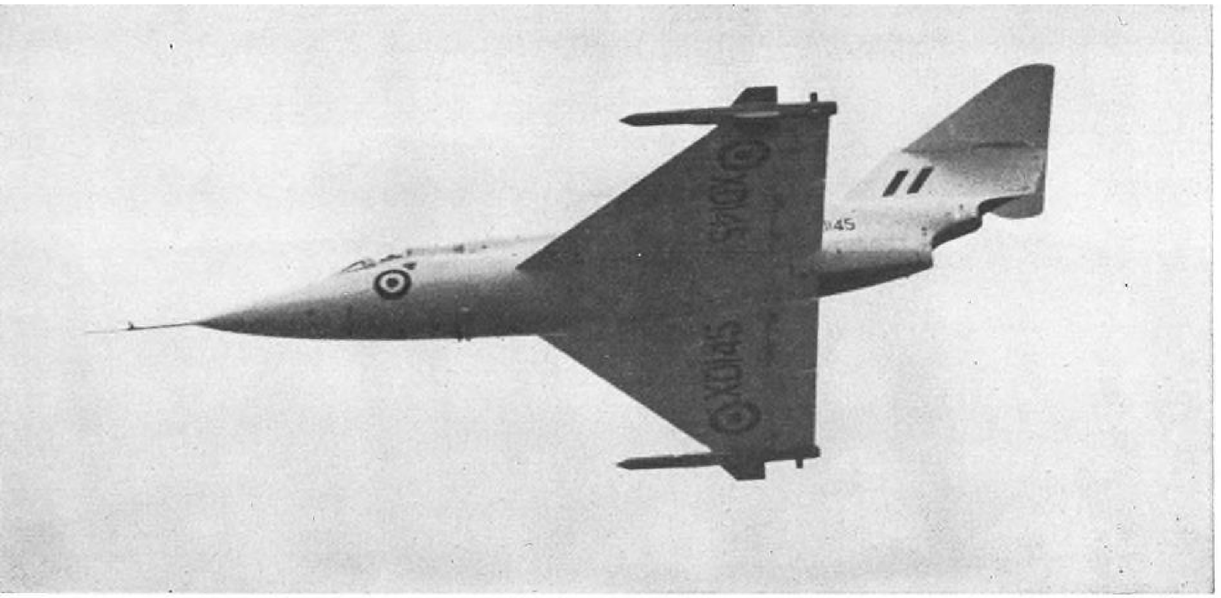
Bloodhound and Thunderbird both have semiactive homing systems in which the target is illuminated by ground radar and the target reflection is picked up by ground radar and passed along to the missile's homing equipment. Advantage of such a system over beam riding guidance common to several American missiles, is that accuracy increases nearing the target.

Bloodhound and Thunderbird differ in their adaptability to current radars. The Bristol missile was designed to take advantage of existing radar networks and requires a fixed base for operations. Thunderbird has its own radars as battery equipment and can be deployed in the field.

Third of the British antiaircraft missiles is the Armstrong Whitworth Sea Slug, a shipbased fleet defense weapon. The actual missile was not shown at Farnborough, but two types of development vehicles were shown. Basic layout of the Sea Slug is a cone cylinder body, wings of very low aspect ratio and tails of high aspect ratio and a cluster of four wraparound boosters, each consisting of three solid propellant rockets.

Firestreak Concept

Most sophisticated of the missiles shown was the de Havilland Firestreak, an air-to-air weapon equipped with infrared guidance. Externally Firestreak seems to follow the same design concept as the Philco Sidewinder—a solid propellant rocket used as the basic body shell and powerplant, with fixed lifting surfaces, and control and guidance packages added at nose and tail respectively. Firestreak will be fitted on both RAF and Royal Navy aircraft. Current in-



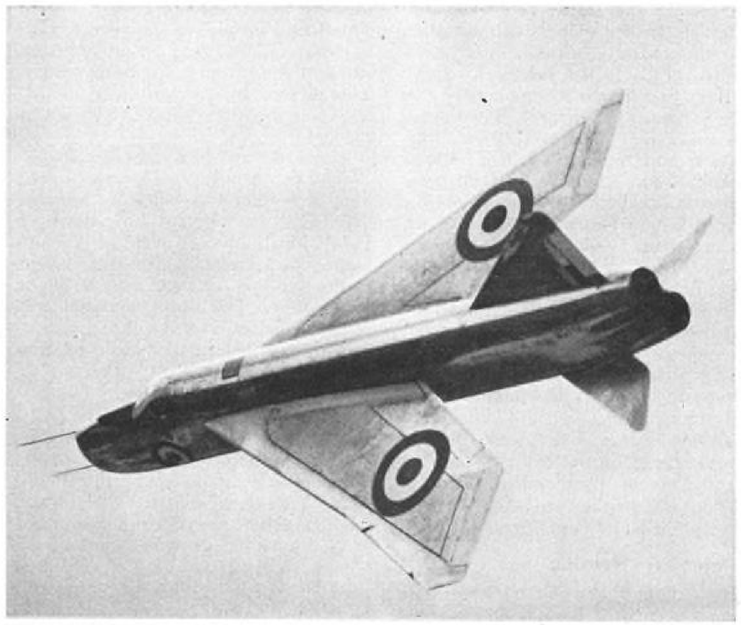
SAUNDERS-ROE is working on development version of SR. 53, without official support. SR. 53 is shown with Firestreak missiles at wingtips. Basic mixed powerplant of Viper and Spectre probably will be replaced by a de Havilland Gyron Jr.-Spectre combination.

stallations include those on the English Electric P.1, de Havilland Sea Vixen and the Gloster Javelin. De Havilland says the weapon is also suitable for the Sabre, Sea Venom, Hawker Hunter and Saunders-Roe 53.

Fairey Fireflash, ordered as an interim type air-to-air type and now serving as a training missile, was also demonstrated at the show under the wings of a Hawker Hunter. Hunter and the Vickers Supermarine Swift has been equipped with Fireflash missiles for development trials of missile systems.

Vickers displayed a full-size diorama showing the use of its Type 891 antitank missile developed as a private venture. Missile is wire controlled, and is transported and fired from a single container. Sighting system for optical observation of the flight path is a pair of artillery spotting binoculars on a simple mount. Asimuth and elevation control signals originate in drums mounted on the binoculars and thumb-controlled by the gunner. Total weight of the solid propellant missile, its transporter-launcher and the binoculars is about 40 lbs.

Short Brothers showed a general purpose test vehicle developed for the Ministry of Supply as an aid to various missile programs. Most of the current program for the vehicle revolved around guidance work particularly on the problems of homing devices. Powerplant is a liquid propellant sustainer burning kerosene in the high test peroxide.

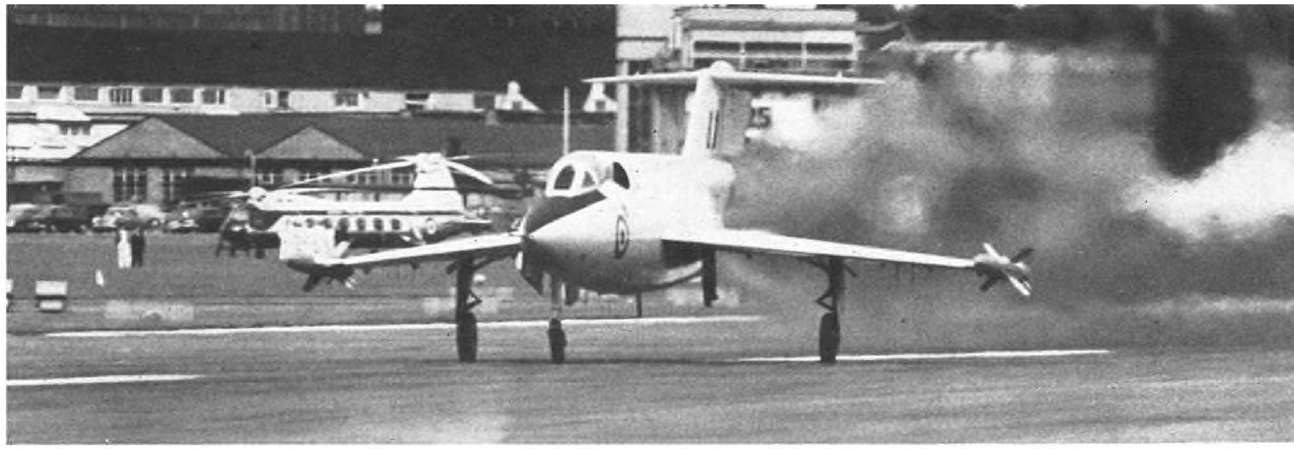


ENGLISH ELECTRIC P.1A has cranked leading edge of wing incorporating conical camber for evaluation trials. In this photo, demonstration pilot R. P. Beamont was making turns low over the field at Farnborough pulling 6 Gs.

Most spectacular of the flying demonstrations was the one put on by English Electric Chief Test Pilot R. P. Beamont, flying both the P.1A and P.1B on different days of the show. After high-speed level runs at Mach 0.98 low over the runway, Beamont—who was not wearing a G suit—racked the P.1 around the field in a 6G turn through two complete circuits and a tight figure eight. Planes flown at the show were from the four prototype P.1A and P.1B aircraft now in flight status. These will be followed by twenty preproduction aircraft now on the line. Production orders have been placed for a large number of P.1s.

Miles Student

One of the few new airplanes at the show, the Miles Student trainer was beautifully shown off in a flight demonstration that was being talked about after the show was over. Starting with a long inverted gentle climb down the main runway, the pilot put the little single jet trainer through its paces with highspeed runs, tight turns and tighter



SAUNDERS-ROE SR. 53 mixed-powerplant interceptor, only basically new military aircraft in the show, starts takeoff run (above) on power of Armstrong-Siddeley Viper turbojet and de Havilland Spectre rocket. Shock diamonds show (below) in takeoff exhaust of Spectre rocket.



BRAKES OUT, Supermarine Scimitar (below), rolls to stop. Plane usessuper-circulation system in which air from engines is ducted over the wing flaps to increase the available lift coefficient for landing and takeoff.



New Missile For S.R. 53

Farnborough—Saunders-Roe 53, currently armed with a pair of DH Firestreak infrared homing missiles mounted at the wingtips, is also proposed as a carrier for the Canadian Blue Jay missile. A future version of the aircraft will be powered by a DH Gyron Jr. turbojet and the DH Spectre throttleable rocket. Observers at Farnborough expect the rapid appearance of either a dorsal fin or increased vertical tail area.

loops. Developed by a firm that has long been noted for fast, light racers and sport aircraft, the Miles Student can be sold as a trainer, ready to fly, for less than $40,000.

Other highlights of the flying display at Farnborough.

• **Tremendous takeoff** acceleration of the Folland Gnat powered by a Bristol Orpheus jet. An RAF squadron leader flying the plane pulled the Gnat off the runway into a near vertical climb and was out of sight in seconds after leaving the runway.

• **Marked noise reduction** of the Rolls-Royce Avon engines in the Comet III due to the toothed silencers installed in the four tailpipes. On final approach, the compressor noise seemed to be a little louder than usual, but this impression was probably because the tailpipe noise has previously masked compressor noise. Once the airplane passes, the noise vanishes as suddenly as if the engines had been cut.

• **Extremely high rate** of climb of the Saunders-Roe 53 after lightoff of its Spectre rocket at takeoff.

• **Landing run reduction** of the Hawker Hunter fitted with Rolls-Royce thrust reverser on its Avon engine. Estimates of the reduction varies, but most observers agreed that 50% was a reasonable figure.

Only new transport in the show was the Aviation Traders Accountant, designed as a Douglas DC-3 replacement and offered in two versions. The executive plane has eight seats and a range approaching 2,500 mi. High density feederliner version would seat 28. Gross weight of the plane is 28,500 lb. powerplants are pair of Rolls-Royce Dart turboprops.

Newcomer to the helicopter ranks was the Westland Wessex, basically a development of the Sikorsky S-58 with a Napier Gazelle free turbine engine as the replacement powerplant. Westland has this type under development for the Royal Navy.

New Engines

New engines to be added to the large range available to British designers included a pair of Armstrong Siddeley gas turbines for rotary or fixed wing aircraft. The P.182 is a 1,075 eshp. unit with a maximum diameter of 30 in. Specific fuel consumption is 0.687 lb. per eshp. This engine is designed for horizontal installation in fixed wing aircraft. The P.181 for rotary wing aircraft is rated at 950 shp. Has a specific fuel consumption of 0.75 and a specific weight of 0.50. Diameter is also 30 in.

This has been a Farnborough in the traditional manner with superb flying demonstrations by Britain's top test and military pilots, plus the usual handful of new airplanes and the majority of familiar types. It might have been a Farnborough in transition, emphasizing the gradual switch from manned aircraft to unmanned missiles. But it was definitely not a Farnborough reflecting the requirements of the Defense White Paper eliminating future manned aircraft by sophistication in missiles.

Most of the reaction here has been around the theme of the missile shadow cast across the traditional shapes of manned aircraft.

But today everywhere in the United Kingdom outside the static display at Farnborough that shadow has little substance.

Aviation Week IRBM Story Causes British Protest Against Security

London — Disclosure by AVIATION WEEK (Aug. 26, p. 23) that de Havilland Propeller Co. is at work on a British intermediate range ballistic missile last week resulted in strong protests against British security regulations by the British press and the British Broadcasting Corp.

A banner headline on page one of the London News Chronicle said. "Rocket Secret Is Out," noting that the test towers for the missile were so "hush-hush in Britain that America tells the story," the newspaper asserted it had known of the story but security officers would not let it be printed.

Test Rig

"Now the secret is out—because an American magazine disregarded the ban," wrote Correspondent John Chappell. The paper then gave details of the 60 ft. towers that are part of the test rig—which are in plain view from the main highway from London to Scotland near the de Havilland plant at Hatfield (see photo P. 120).

"All this can be stated—because (the) American (magazine) AVIATION WEEK which is not subject to our censorship regulations, have given it," the report went on. "Yet the Ministry of Supply still refuses to allow pictures to be published. In fact, wooden screens were yesterday being put up to mask the towers—with which every passing motorist is already fully familiar."

The News Chronicle noted that one of the towers is within 60 ft. of a main bus stop and children in the neighborhood call it "the helter skelter."

McWhirter's Secret

"The test rig is supposed to be highly hush-hush," the News Chronicle said, "but it has been an open secret at McWhirter's Cafe immediately opposite the 'helter skelter' ever since construction started.

The BBC said its television cameramen have been forbidden even to take photographs of the wooden screen. The news story broke in Britain after a BBC announcer queried de Havilland about the AVIATION WEEK item. The Ministry then permitted the company to confirm the report.

"So at last it becomes permissible to print what everyone in Hatfield knows," said the News Chronicle.

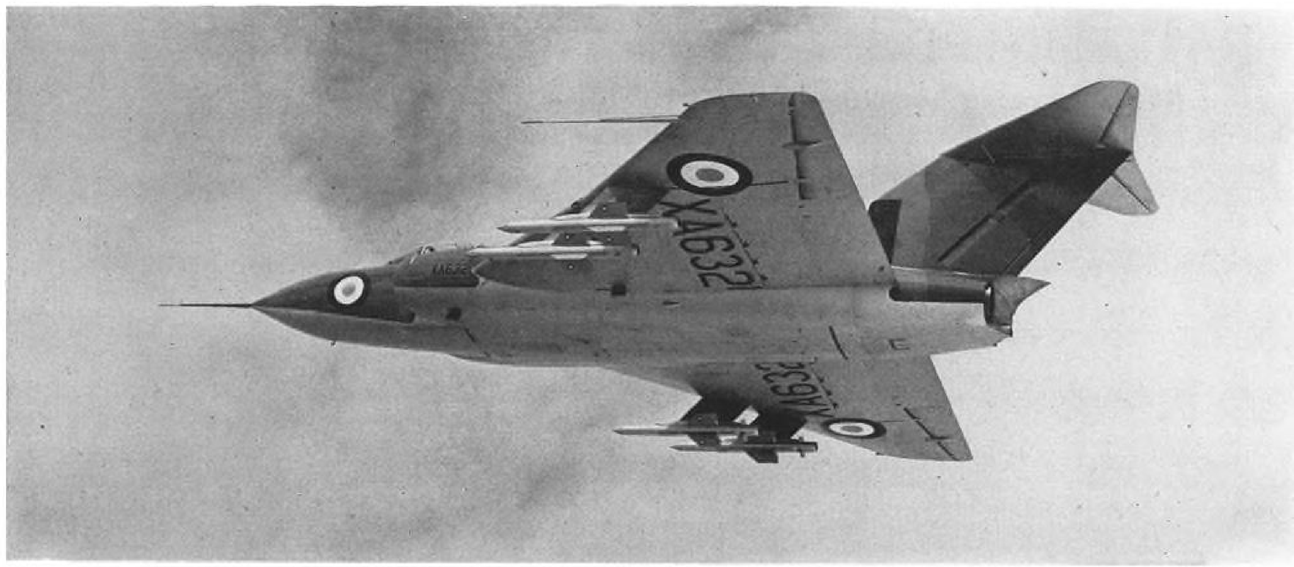
De Havilland Propellers apparently is the prime contractor on the IRBM program and is building the airframe with Rolls-Royce doing the rocket engine work under a technical assistance agreement with North American Aviation, Inc., and Sperry developing the guidance system. Only static testing of the missile will be done at Hatfield.

New Soviet Fighter

Moscow—Red Air Force has a new supersonic fighter-bomber with the NATO code name "Backfin." The new fighter-bomber, which is in the Mach 1.5 speed range, has been spotted in the air above Moscow indicating it is being flight tested from the major Red Air Force development testing center at Ramenskoye, near Moscow.

Backfin has a 55 deg. wing sweepback with a wing fence located midway along each wing. Wingspan is about 75 ft. and overall length of the plane is about 85 ft. Wing root inlets are used for the twin turbojet installation in the fuselage. Twin exhausts similar to those on the MiG-19 (Farmer) are also used. Tail is swept with a slab horizontal surface located high on the vertical fin.

When seen over Moscow the single Backfin had a sharply pointed nose with what appeared to be a flight test instrumentation boom protruding from the nose, an indication that it is still in prototype flight test stage.

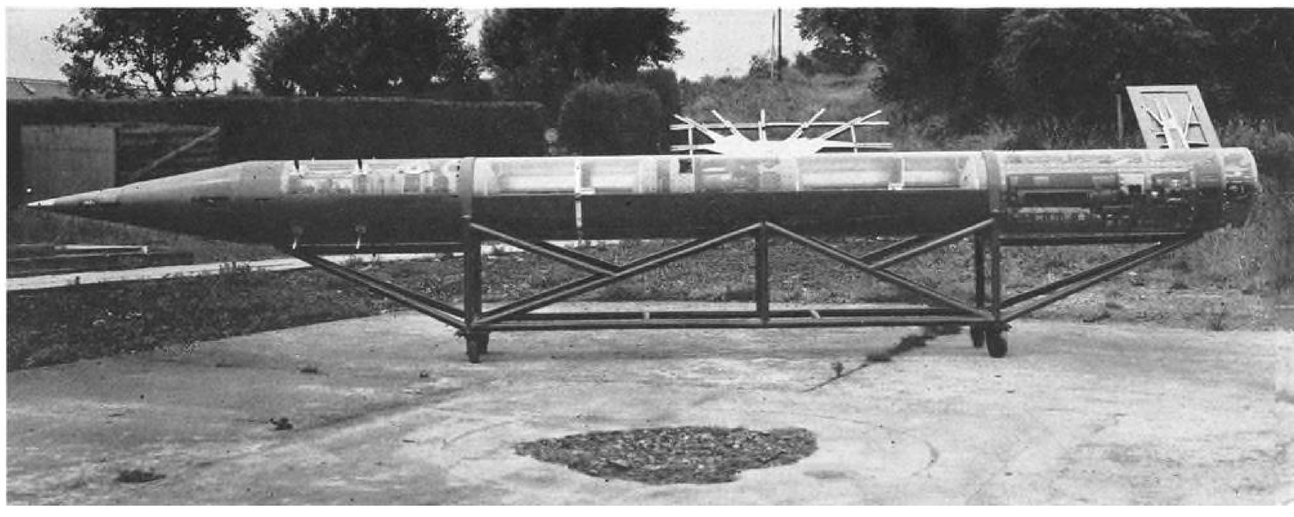


FOUR FIRESTREAK air-to-air missiles developed by de Havilland are mounted on underwing pylons of Gloster Javelin.





WRAPAROUND BOOSTERS are common to several British missiles. Bristol Bloodhound (left) is on its mobile transporter. Armstrong Whitworth test vehicle (right) for Sea Slug shipboard missile uses four three-unit boosters. Sea Slug cutaway is shown (below).



Tight-Rein Defense Finance Bill May Pass Congress Next Year

By Katherine Johnsen

Washington—First session of the 85th Congress left the most important legislation affecting military aircraft contractors on the brink of enactment ready for action when Congress reconvenes in January.

This legislation, passed unanimously by the Senate with the sponsorship of 49 senators and cleared by the House Rules Committee for action on the House floor, would:

- **Put government financing** on an annual expenditure basis. The military services—as well as other government departments and agencies—would have to estimate their actual cash outlays approximately a year and a half in advance. They would then have to live within this expenditure estimate—whether it meant stretchouts or curtailments in progress payments.
- **Provide "contract authorization"** for aircraft and other procurement involving commitments of more than one year. The authorization would amount to a promise. It would not be backed by cash approved by Congress. Contracts let or indicated under the "authorization" would rely, year to year, on the disposition of Congress for their financing.

Opposition by Defense

Defense Department's vigorous opposition to the legislation was expressed by Assistant Secretary W. J. McNeil on these two points:

- **Expenditures:** "Impossible to calculate scientifically in advance."
- **Contract authorization:** "I don't want the job of trying to finance things started under vague contract authority easily obtained. . . ."

House Appropriations Committee, led by Rep. Clarence Cannon (D., Mo.), chairman; Rep. John Taber (R., N. Y.), and Rep. George Mahon (D., Tex.), chairman of the Armed Services Subcommittee, blocked House passage of the measure in the wind-up before adjournment. However, in January it will require only one step—House passage—to become law. The President has announced that he approves it, following the position of the Bureau of the Budget which views the legislation as a measure to hold down the defense budget (AW Aug. 12, p. 30).

Budget Debate

While this basic measure slid along its course, its terms only vaguely comprehended by some of its Senate sponsors, debate on the Fiscal 1958 defense budget and the adequacy of the U. S. defense position dominated that scene.

The prolonged debate on the Fiscal 1958 defense budget added to confusion, without any clear-cut alignment politically.. In brief, the steps were these:

- **House Appropriations Committee,** dominated by its Democratic majority, trimmed the President's request for $36 billion by $2.5 billion—to $33.5 billion.
- **Republican leadership** attempted to restore $313 million of the cut, including $50 million for naval aircraft procurement and $175 million for USAF aircraft procurement. They were defeated 151 to 242.
- **President, on reconsideration,** announced that restoration of only $1 billion of the $2.5 billion House cut was essential.
- **Senate,** under the leadership of Sen. Stuart Symington (D., Mo.), restored $971 million—the major portion of the President's restoration request.
- **Meanwhile,** the administration's plan to clamp a lid on the defense program by restricting expenditures became clear. The Senate, which had supported a high appropriation figure, decided it would be of little use to vote funds which the administration would not obligate or expend. The result: the Senate largely acceded to the House and a defense budget of $33.7 billion was finally voted.

The Senate was firm on only one item: funds for research and development.

Research Funds

The House originally had made an arbitrary 10% reduction in the research and development requests of all three services on the theory that this would encourage economy without touching on basic programs. But House members finally concurred with the Senate and the full amounts asked for research and development were appropriated to each of the services.

Moneywise, Congress clipped the Fiscal 1958 requests of all aviation agencies but not as sharply as other government agencies. Cuts included:

- **Civil Aeronautics Administration** asked for $410 million, was voted $335 million, but this is still markedly above CAA's Fiscal 1957 budget of $245 million.
- **Civil Aeronautics Board** asked $5.7 million for its administrative operations, was voted $5.4 million. CAB's Fiscal 1957 allocation was $4.6 million.
- **National Advisory Committee for Aeronautics** asked for $118 million, was given $106 million. This is $30 million more than NACA's $76 million Fiscal 1957 budget.
- **Military Research and Development.** The three services were voted their full requests—Air Force, $661 million; Navy, $505 million; Army, $400 million.
- **Military aircraft procurement.** Requests of both USAF and Navy were moderately reduced, but Navy has more new funds for contract letting this year than for Fiscal 1957. USAF's request for $6.2 billion was trimmed to $5.8 billion—$1 billion less than USAF had for Fiscal 1957. Navy asked for $1.9 billion, was voted $1.8 billion —approximately $100 million more than the Fiscal 1957 allocation.

Civil Aviation

Several unspectacular, but progressive, civil aviation measures also were placed through both Houses:

- **Local service airlines.** Two measures to assist these carriers in financing their reequipment programs were sent to the White House. One authorizes Civil Aeronautics Board to make government guarantees up to 90% on loans for new equipment. The other encourages private financing by giving financial institutions rights over aircraft they have financed in possible cases of bankruptcy.
- **Permanent carriers.** Over the opposition of the Commerce Department, Congress passed, and the President signed, legislation directing CAB to award permanent certificates to U.S.-Alaska airlines—Alaska Airlines, Pacific Northern Airlines, Northwest Airlines. A measure for permanent certificates to the all-freight carriers—Slick Airways, The Flying Tiger Line, Riddle Airlines, AAXICO—passed the Senate but is pending House action.
- **Airways modernization.** Congress went along with the administration's proposal for a three-member Airways Modernization Board with Lt. Gen. Elwood Quesada as chairman. Other members are Secretary of Defense and Secretary of Commerce. The board will direct development of an airways navigation system. There was some reluctance —because the measure didn't go far enough. Congress requested the Administration to submit its plan for a thorough reshuffle of the government organization for civil aviation by January.
- **Military airline business.** Heavy pressure was put on Defense Department to shift the operations of Military Air Transport Service to a contract basis with commercial carriers. The Appropriations Committees directed a report on moves in this direction by January. Meanwhile, Senate Commerce Committee organized a special committee to make an investigation. Its membership is composed of the top ranking members of the committee.

Fairchild To Begin VTOL Model Tests

Hagerstown, Md.—Aerodynamic tests will begin next month on scale models of Fairchild Aircraft Division's re-designed M-224-II Fledgling, four-propeller Army VTOL research vehicle using one General Electric T58 turbine engine.

Construction of the vehicle, which uses the vectored slipstream principle, will begin about Jan. 1. Completion is expected in July.

Fairchild expects considerably improved performance from the new design. Original proposal was based on existing National Advisory Committee for Aeronautics data on research with a sliding-flap model that used one engine in the fuselage and four gear shafts to run propellers mounted along wings.

Fairchild found in checking the NACA data that it did not hold for other configurations. Introduction of shaft nacelles reduced thrust to lift ratio radically. Re-run of tests by NACA corroborated Fairchild's tests.

Company did research on vectored slipstream principle as far back as seven years ago, but until recently engines were considered inadequate for the aircraft's requirements. Contract with Army's Transportation Research and Engineering Command is for $1 million. Initial "II" in M-224-II designation indicates this is ninth version of the design.

First Production F-106s Are Flown





Clipped vertical fin and enlarged air intakes farther aft on fuselage are major differences between Convair's F-106 supersonic interceptor and its predecessor, the F-102. F-106A, here undergoing flight tests at Edwards AFB, Calif., is in production and first production airplanes now are being flown from Convair's San Diego, Calif., plant. F-106B, two-place tandem version also is under development and forward fuselage sections are being fabricated at Convair-Ft. Worth. Powerplant of F-106A is a Pratt and Whitney J75 turbojet producing 23,000 lb. thrust with afterburner. It will carry Douglas MB-1 nuclear air-to-air missile.

Mach 5 Avionic Cooling Method Tested

By James A. Fusca

Baltimore, Md.—Cooling technique which permits avionic equipment to operate in the 425C (800F) environment of Mach 5 flight has been disclosed here by The Martin Co.

System uses water placed in a jacket around the equipment to pick up both externally and internally generated heat and carry it off as steam which is dumped overboard.

Although not yet tested under high altitude or flight conditions, the system has been evaluated from temperatures to 150C to 400C (equivalent to Mach 2-4.5) and under shock and vibration.

Design Problem

In discussing their system, Martin thermodynamicists pointed out that there were two approaches to the problem of heat in the design of avionic equipment for aircraft and missiles. First method is by use of special high temperature components; the alternative method is by cooling of the equipment.

Although the most attractive approach is the use of high temperature components, only a few are available today that can withstand temperatures above 125C. Therefore, equipment being designed in the immediate future will require some method of cooling to maintain nominal component temperatures.

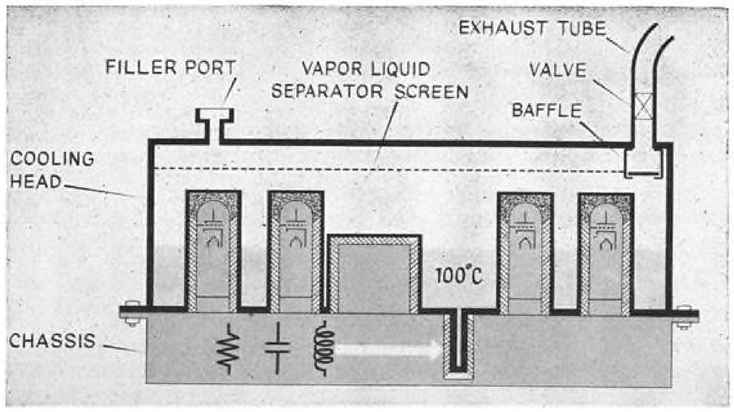
Although ram air and refrigerated air cooling systems are adequate for vehicles traveling at relatively slow speeds, at speeds above Mach 2 it is necessary to go to the additional bulk and complexity of a cold plate or evaporative cooling system.

According to its designers, The Martin evaporative cooling system offers simplicity and reduced volume, weight and cost when compared with other systems for operation above Mach 2. They estimate the increase in volume of the basic equipment to be slight, in weight about 10% (exclusive of water), and in manufacturing cost about 5% with their method.

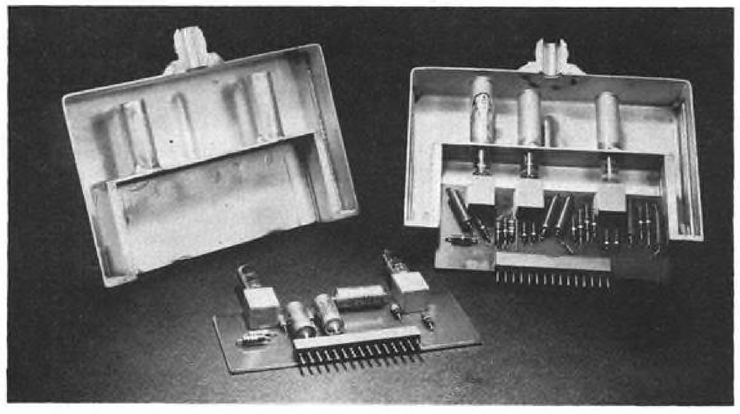
Principles of Operation

By surrounding a conventional electronic chassis with a water jacket, The Martin technique utilizes water's high latent heat of vaporization (970 Btu./lb.) to maintain the components at about the temperature of boiling water. Heat generated internally by the equipment or externally by aerodynamic friction reaches the water by conduction and is carried off as steam.

Tubes and transformers fit into recesses in the water jacket and finger-type material is used to provide a direct conduction path to the interior wall of the jacket. Jacket is provided with a filler port and a vent through which the steam escapes. A check valve in the vent prevents loss of water during inverted flight or negative gravity and controls boiling pressure. A baffle prevents loss of water during violent boiling.



SCHEMATIC DRAWING (top) shows principles of Martin evaporative cooling system. Aluminum wool and finger-type material provide direct conduction path from heat-generating components to water jacket. Photograph at bottom shows water jacket and conventional printed circuit boards used in test program.



System has been undergoing tests at Martin for slightly more than a year. These tests have included operation of an experimental unit in an oven over a range from 150C to approximately 420C with hot spot instrumentation to indicate component temperatures. Significant result was that component temperatures remained under 125C with fluctuations no greater than 10C.

Water boiling as a cooling technique is not new. It has been investigated at Ohio University, Cornell Aeronautical Laboratory, Naval Air Development Center, and elsewhere. Martin believes its system is an improvement in this field in terms of the efficiency of heat transfer and of packaging.

In the Works

Among the problems of water boiling systems that Martin plans to investigate further are: operation under the reduced pressure of high altitudes, results of standing at below-freezing temperatures, prevention of leakage.

Robert Berner, Martin thermal engineer in charge of the development program, pointed out that while the technique can be applied to existing avionic systems maximum advantage would be obtained by integrated design of equipment and cooling system in standard modules. Effectiveness of this cooling technique, he said, would permit functional layout of chassis without necessity for separation of heat generating components.



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The officers and men of the U.S.A.F. Aircraft Control and Warning searching the heavens 'round the clock with radar, are the guiding hands behind America's air defense. Through their diligence, our Interceptors are *forewarned* and electronically directed to any unidentified aircraft.

The pilots of the U.S.A.F. Air Defense Command are *forearmed* with advanced weapons systems like Convair's supersonic F-102A all-weather delta Interceptor. From the ground up, this formidable air defense team is keeping an eye on your freedom!

CONVAIR

A DIVISION OF GENERAL DYNAMICS CORPORATION



Sum total: 27 years. With many firsts along the way. The first military plane with retractable landing gear. The first carrier-based aircraft with folding wings. First swept-wing jets on operational service with carrier squadrons. First in the air with area-rule (coke bottle) fuselage for fighters. The first aircraft capable of performing the complete search-attack mission against subs. First in amphibians with the production of more such craft than the rest of the world combined. First with two-place transonic jet fighter-trainers.

Sum total: more than 24,000 planes. Ready in quantity when needed. At minimum cost to our government. And backed by unexcelled operational and maintenance field support throughout the world. Small wonder Grumman products have been in uninterrupted service every day of every year since 1930.

GRUMMAN EXPERIENCE

GRUMMAN AIRCRAFT ENGINEERING CORPORATION
Bethpage • Long Island • New York
Air Superiority Fighters • Anti-submarine Aircraft • Jet Trainers
Air Transports • Nuclear Research • Aerobilt Truck Bodies
Hydrofoil Research • Grumman Boats



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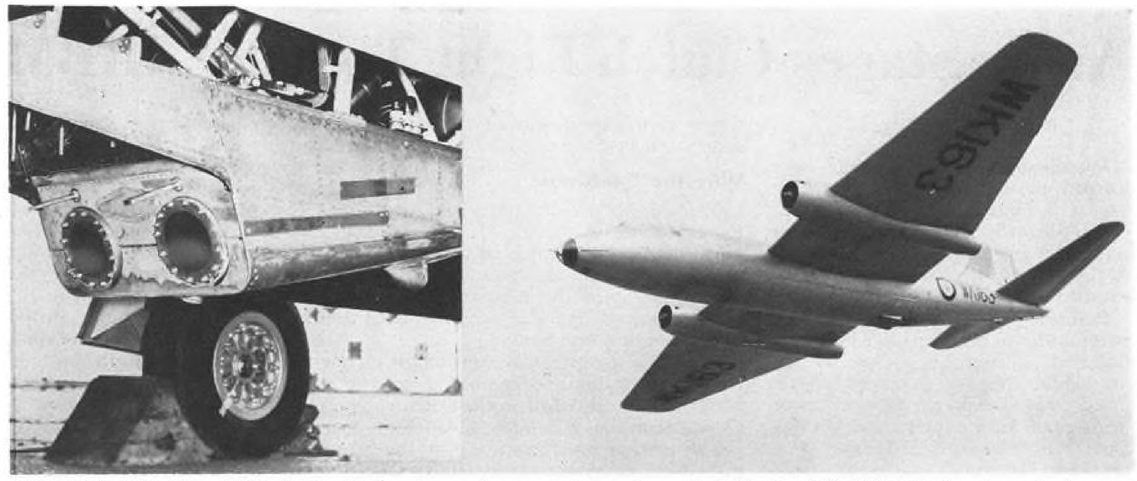
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CECO SYSTEMS / CONTROLS



CANBERRA TEST BED with Napier Double Scorpion engine mounted in belly reached altitude of 70,000 ft. Engine, shown in closeup of mounting, uses decomposition products of hydrogen peroxide to initiate and sustain combustion.

Scorpion Pushes Canberra to 70,000 Ft.

London—A twin-barreled Scorpion rocket motor belly-mounted in a standard Canberra B.2 bomber helped notch the "officially observed" altitude record up to 70,000 ft. last week. The 44-minute flight was carried out over the English Channel to assist measurement by a radio altimeter.

Grumman F11F-1F Navy fighter powered by a General Electric J79 turbojet has flown to an altitude of 77,000 ft. and Lockheed F-104A also powered by the J79 has flown at altitudes in excess of 70,000 ft. Grumman applied last December for an official Federation Aeronautique Internationale attempt to break both the world speed and altitude record with the F11F-1F but was denied this opportunity by a Defense Department ruling.

Engine Design

Although Scorpion is Napier's first non-expendable aircraft rocket engine, its design follows closely that used throughout the missile motor series on which the company has been engaged for the last nine years. Scorpion details are still classified.

It is an on/off unit using high-test peroxide as oxidant, a silver catalyst, kerosene as fuel and is self-lighting on the thermal ignition principle. Either barrel can be used separately.

Most engineering interest centers on the steam turbo-driven kerosene and peroxide pumps which are mounted on the opposite sides of the turbine disk and the use—for the first time in an aircraft motor—of quickly replaceable liners containing all the short life components.

Turbine, situated forward between the barrels, is supplied from a steam generator mounted alongside on the left hand barrel. Superheated steam pressure and temperature conditions arising from the peroxide/silver reaction in the generator in the region of 500/600 psi. and 500/600C. The turbine exhausts to atmosphere, and its speed is in excess of 30,000 rpm.

Peroxide, which first circulates the double walled barrels, is pumped into the reaction chamber containing the catalyst and the steam and oxygen generated pass through annular passages in the diaphragm separating the reaction chamber from the combustion zone through a single nozzle. In the early missile motors fuel was pumped direct to the combustion zone through a single nozzle, an arrangement which may have since been modified.

Combustion conditions are thought to be of the order of 400/450 psi. with temperature in the region of 2,200C.

A most outstanding construction feature is the use of a liner which, complete with nozzle, catalyst pack and burner head can be replaced by ordinary service personnel in less than 20 minutes. This facility enables relatively cheap and expendable materials to be used. Present liner is believed to be of stainless steel but the company is already carrying out trials with ordinary mild steel liners. The missile motors must have ceramic liners.

Peroxide flow through the stem generator is maintained by the main peroxide pump on the turbine, but during the starting sequence an electric motor-driven pump mounted below the steam generator provides a supply of peroxide to the generator until the turbine reaches self-sustaining speed. It then cuts out. Turbine overspeed control mechanism, which operates the cutout valves, is mounted in the cylinder on the right hand barrel.

Critical Speed

Speed of the Canberra at 70,000 ft. is not likely to have been much more than Mach .7 and latitude between its critical Mach number and the stall was no more than 15 mph. Vortex generators were prominent on wing and tail.

Apparently complete unit was lifted by two men at Napier field, Luton. Putting its weight at 200 lb., with a specific weight no better than 20:1 quoted for other aircraft rocket motors, indicates a thrust of the Scorpion somewhere between 4,000 and 5,000 lb.

U. S. manufacturing license for all Napiter rocket motors has been taken out by Aerojet-General.

Gen. Power Flies In Convair B-58

Fort Worth, Tex.—Gen. Thomas S. Power, new commander of the Strategic Air Command, made an hour and a half familiarization flight last week in the third crew station of Convair's B-58 supersonic bomber.

Gen. Power, who termed the ride "smooth" and "an interesting experience," said he made the flight to help in his evaluation of later reports on the B-58 test program. Convair test pilot B. A. Erickson piloted the flight from the Convair plant here, with J. D. McEachern, Convair flight engineer, in the second crew station.

Army Stages Clutch Fight To Keep IRBM

By Claude Witze

Washington—U. S. concern over Russian missile capabilities last week was a cauldron of misinformation, propaganda and bitter rivalries. The amount of official and public confusion in the absence of facts rarely has been equalled outside of a political campaign.

Possibly the greatest contributing factor is the impending clash over control and management philosophy for the hybrid intermediate range ballistic missile that is expected to result from marriage of Army's Jupiter and USAF's Thor. On the eve of a decision by a top-level Defense Department committee, there was evidence that the Army is making a last-ditch struggle to preserve Redstone Arsenal's control of the IRBM. USAF, now scheduled to assume operational control of the missile, procurement policies favor contractor management under the weapon system concept.

Why the Confusion

These other factors contributed to the confusion:

- **Misinformed reporting** in the daily press, usually resulting from failure to differentiate properly between various missile projects and the expected results of missile test firings.
- **Lack of a positive and constructive** public information policy in the administration, particularly in the Defense Department, on a matter of intense public interest and concern over the magnitude of a threat and America's capability to meet it.
- **Surreptitious disclosure** of information to the press, some of it from the Pentagon. Almost all of this data appears to support the Army's argument for the Jupiter program and missile development by government arsenals.

At the top level, administration reaction to this situation last week continued to favor comment rather than any disclosure of facts. President Eisenhower himself discounted the importance of a Russian announcement that an ICBM has been developed in that country. The White House attitude is that the Soviets have a poor reputation for telling the truth on such matters and that test vehicles fly a long time before production items. In fact, however, the Russians have been usually reliable in their disclosure of new technical developments.

Soviet Questions

Top questions remaining to be answered about the Russian achievement are two:

- **How many ICBM firings** in Russia are known to our intelligence officials? There are reports that the number varies all the way from four to about 15.
- **What do we know about Russian** launching sites, their number and location?

Most sensational result of the present attitude that the public has no "need to know" was the headlining of a Miami newspaper report that the Convair Atlas ICBM made a flight of 2,400 mi. two months ago. It appeared that the report confused a test of an Army Jupiter research vehicle with the Atlas program.

One test firing of the Atlas was unsuccessful, a second is expected next month. Meanwhile, USAF is strictly observing Defense Department orders that it is to give out no information on the progress of its program. The Air Force is chafing under the restriction and has presented evidence to point out the short-sightedness of the policy, but so far the barrier has not been lowered.

Brucker On Jupiter

Meanwhile, Army Secretary Wilber M. Brucker has set the example for his own service by declaring the Jupiter program "a spectacular success" and "slightly ahead of schedule." The statement was made one day after reports of a successful firing of a Jupiter vehicle.

The same day, word was dropped that Army feels Jupiter is ready for production and that operational units could be rolling off the line in 30 days. This was followed by an argument that Jupiter is better than an ICBM so long as the U. S. has bases in Europe, that its launching sites are easily concealed and that the missile is more accurate.

Since spring, there has been an increasing amount of discussion in the press of the concept that the inter-service rivalry stems mainly from a determination by USAF to continue as a separate branch of the armed forces. This school holds that missiles are "artillery" and that their use is an Army function.

Extremists argue that USAF not the Army, is "fighting for its existence" and that there is no reason to support an Air Force.

Variations of the doctrine have appeared on radio programs, in popular magazines and in speeches before Congress.

IRBM Decision

Defense Department's three-man IRBM committee named to study the possibility of merging the Jupiter and Thor projects is scheduled to report about the time Charles E. Wilson leaves the Pentagon later this month. He will be succeeded by Neil H. McElroy, who will face the decision almost immediately after taking office.

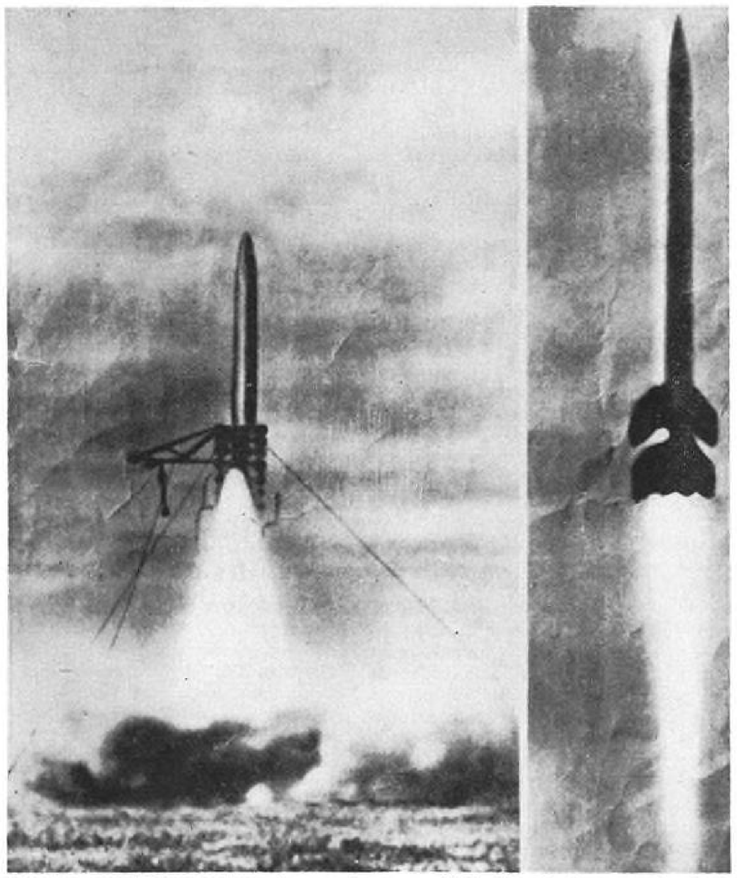
The committee is composed of William H. Holaday, the Secretary's assistant for guided missiles; Maj. Gen. John B. Medaris, chief of the Army's Ballistic Missile Agency, and Maj. Gen. Bernard A. Schriever, chief of USAF's Ballistic Missiles Division.

Arsenal Concepts

There was speculation last week that Gen. Medaris and supporters of the Army's arsenal-controlled development concept are planning a knock-down battle against USAF control and industry management of the IRBM program. Presumably, Wilson settled this dispute last fall when he ordered USAF to assume control and provide for funding of the IRBM project during this fiscal year.

Army hopes for a reversal of this decision appear to rest on the possibility of convincing McElroy that Redstone Arsenal and the Army agency are best-equipped to carry out the program.

Army's supreme achievement, of course, would be to convince McElroy that the ground forces, not USAF, should operate the missiles.



RUSSIAN RESEARCH ROCKET photographs were published in Russian magazine Soviet Union coincident with ICBM announcement. Magazine said rocket ascended to 124 mi.

Tillinghast Retiring

T. E. Tillinghast, sales manager of Pratt & Whitney Aircraft Div. of United Aircraft Corp. since 1934, will retire next May. Until then he will continue as sales manager of the engine division and president of United Aircraft Service Corp.

B. J. McNamara, executive assistant to the general manager, was appointed manager of sales and service for Pratt & Whitney effective last week.

Navy Researchers Utilize Moon As Communications Relay Station

By Evert Clark

Washington—Radar waves bounced off the moon in six years of experiments indicate the moon is smooth enough to serve as a passive relay station for many types of communications, including voice, Naval Research Laboratory scientists reported last week.

Navy called this "the most significant discovery made by radar."

Frequencies used have ranged from 30 to 3,000 megacycles—roughly, the high, ultra-high and very-high frequency bands—and have included 30 m.c., 200 m.c., 300 m.c., 2,000 m.c., and 3,000 m.c.

'Highlight'

Significant indications of the work are that the moon's surface is much smoother than telescopic and early radar observations had indicated, and that the distance between earth and moon differs from that calculated on the basis of optical observances.

James H. Trexler, chief scientist on the project, told a meeting of the International Scientific Radio Unions in Boulder, Colo., that the six-year study "has revealed a lunar phenomenon which produces a 'highlight.' Near 200 megacycles, more than 50% of the echo power is confined to the first 45 microseconds after the leading edge of a short incident pulse contacts the moon. This fortunate situation permits the use of wide-band communication signals in a circuit using the moon as a passive relay.

"Many types of modulation have been successfully passed over the lunar circuit including amplitude modulation by voice."

Six large radar systems have been used in the Navy's work. At least eight groups of investigators have probed the moon's surface with radar over the past 15 years. But Naval Research Laboratory decided in 1950 that marginal conditions such as inadequate transmitter powers would continue to limit the value of most of these experiments.

NRL began to assemble large radars specifically designed for moon work, and in the summer of 1951 the first began operation. First instrumentation was at 200 m.c. in 1951. This was followed by 300 m.c. work in 1955 and by 30 m.c., 2,000 m.c. and 3,000 m.c. experiments in 1957, Trexler said. Benjamin S. Yaplee of NRL described the 3,000 m.c. work.

Parabolic Hole

A parabolic reflector with an aperture of a little more than an acre, made by scooping out 10,000 yards of earth from an elliptical area 220 by 260 ft. and paving it with blacktop, was "the most important item of the NRL meter wave installations," Trexler said.

"A galvanized iron grid having openings three by three inches was attached to the paving, providing a reflecting surface good for wave lengths of one meter or more," Trexler said. "The surface at all points lies within three inches of a true parabola, providing an antenna power gain of 10,000 at 200 m.c."

Focal point was 90 ft. above the dish. Feed structures, including a 700 lb. magnesium horn 17 ft. across, were steered in celestial coordinates by a set of cables that moved a supporting boom.

Transmitters consisted of a 1.2 megawatt, 10 microsecond SK-1M radar transmitter and several low powered CW transmitters.

Yaplee and his associates in NRL's radio astronomy branch modified the laboratory's 600-inch radio telescope to transmit a super high frequency 3,000 m.c. signal. Last Feb. 24 signals lasting 2 microseconds, sent 300 times a second, were returned 2½ seconds later as weak but detectable signals. Yaplee's group is concentrating on distance and relative size measurements and Trexler's on communications.

Reflection Point

Trexler said the area of the moon "that supplies the main bang of the echo is only some 300 to 400 miles in diameter if we assume that the echo is formed at the nearest point on the moon and not by some peculiar formation somewhere else on the surface."

Accuracy of attempts to locate the reflection point by measuring range with crystal controlled counters, checked against radio time signals from station WWV, "seemed to be controlled by varying velocity of propagation in the space between earth and moon," Trexler said.

"This variation could be caused by material emitted by the sun, since a slight correlation between magnetic storms and the apparent distance to the moon was detected.

"The changes in apparent distance were normally less than a small part of one percent, but this represents a large amount of material in space or several hundred miles discrepancy in our knowledge of the reflection point. This field of investigation . . . may provide much interesting data in the future."

U.S. Fare Policy Hit at IATA Meeting

References to "unilateral" action on 5% fare increase apply to CAB action; economic plight aired.

By L. L. Doty

Madrid—International Air Transport Assn. Thirteenth Annual Meeting opened here today with sharp criticism directed against the United States for recent action in blocking a resolution that called for 5% fare increase on Atlantic routes.

Although the U. S. was not specifically named in the attack, retiring IATA President Lord Douglas of Kirtleside made obvious reference to the Civil Aeronautics Board refusal to approve the fare increase when he termed action "taken unilaterally by one government" as "unfortunate."

Echoes Views

Lord Douglas echoed the views of Sir William Hildred, director general of IATA, who in his annual report on the state of international air transport system warned that the air transport industry is faced with financial deterioration as a result of rising costs, capital commitments and frozen fares.

In their opening addresses both Sir William and Lord Douglas coupled air traffic control development with the fare issue as major problems facing the air transport industry in the jet age. Sir William declared that immediate need is not so much in new facilities as in a "new approach" to the problem of air traffic control and air navigation. Lord Douglas warned that navigation facilities are lagging seriously behind general development of the industry and charged that collectively governments of the world have failed to provide services and facilities essential to growth of civil aviation.

In emphasizing capital requirements for jet age equipment, Sir William pointed out that aircraft on order currently exceed in value aircraft now operated by scheduled airlines and will cost approximately the equivalent of present annual airline operating revenue. He added that cost of placing jet transports into operation may in the long run be equal to original purchase price excluding operating costs of aircraft. He had reference to such transitional costs as new hangars, revised maintenance facilities, training and new ground handling facilities. Sir William described the present economic plight of the air transport industry as a "great financial squeeze" (AW May 13, p. 39).

He said operating profit margins of world airlines have dropped from 2.6% in 1955 to 1.5% in 1956. Operating expenses, he said, climbed in the same period and warned that inflationary costs can no longer be offset effectively by increases in operating efficiency.

Sir William stated that industry has tried to pass on increased costs to users of air transport "in accordance with sound business principles" but added "we have not been allowed to do so and have had a lot of figures thrown at us to show why we do not deserve it." He emphasized that industry was not seeking a large fare increase and did not plan to abandon its policy of developing new low fares to tap new travel markets. He did state, however, that industry hopes to lift the entire rate structure "just a fraction higher."

Decries Custom

The IATA director general decried the custom of applying public utilities principles of finance to the airline industry. He pointed out that in public utilities a rate of return on capital investment permits higher operating profit in relation to revenues. He added, "in the air transport industry, the same principle holds down the operating profit to a very precarious margin between revenues and expenses."

He emphasized "the volatile nature of the profit margin in air transport finance" and charged that government regulation fails to recognize the need for a fare structure which would provide an average rate of return adequate to meet new capital. He further accused government regulation of superimposing its own accounting system on financial returns of airlines to inflate profits but shrink the capital base. He charged government regulation with recalculating certain expenses with abstract ideas that have nothing to do with airline practice.

Sir William said "This has been applied, for example, to depreciation and since this item provides a very important source of funds for replacing equipment, the juggling of accounts has struck a heavy blow at the financial soundness of the industry." He said airlines are in "a financial mess" despite mounting revenues because both governments and IATA members have set the reduction of rates as chief objectives in traffic development. He reported the airlines carried 78 million passengers last year and forecast that the 100 million mark will be passed in 1959.

Number of passengers and passenger miles increased 15% last year, he said.

Orders May Be Near For DC-7D

New York—Douglas Aircraft Co. may be on the verge of landing orders for its DC-7D turboprop cargo version of the DC-7. Flying Tiger Line wants to buy 20 if financing can be arranged, and at least two major trunklines are seriously interested in the Douglas proposal.

Negotiations with American Airlines and United Air Lines for DC-7D orders have been in progress for some time here and on the west coast and definite action is possible in the near future. United also is believed interested in the DC-7T, passenger version of the turboprop plane.

Gross Weight

Specifications of the proposed DC-7D are not firm, but it will gross in the neighborhood of 170,000 lb. takeoff maximum and carry a payload approaching 35 tons. Both in payload and speed which is over 400 mph. top, the plane will have a competitive edge over the Lockheed C-130B cargo aircraft, recently entered into the commercial market (AW Sept. 2, p. 30).

The C-130B will lift 22 tons of payload and cruise at about 350 mph. On the other hand, the Lockheed plane will cost about $1 million less than the DC-7D, which probably will sell for about $3 million. The C-130B also includes built-in loading features possible in a cargo plane designed as such from the ground up.

Money is the big if for Flying Tigers, whose board of directors has approved purchase of the DC-7D if suitable financing can be arranged. If Flying Tigers buys the plane, delivery would be scheduled for fall of 1960 with the first available Rolls-Royce Tyne engines. In 1961, the DC-7D could be fitted with later model Tynes.

Delivery date is important to the cargo carrier, among other reasons, because of the financial importance of a good re-sale market for planes the DC-7D would replace.

The earlier new equipment is delivered, the better prices could be expected for used piston planes when they are ready for retirement.

Lockheed Offer

Resale is a factor in Flying Tigers' consideration of another turboprop proposal that Lockheed has made. This is a version of the Super Constellation with Allison 501 engines, which would be offered for 1959 delivery.

Price is about $2.3 million, or approximately $700,000 less than the DC-7D.

Flying Tigers might buy the Super Constellation turboprop, wait for the later Tyne, and then sell the Lockheed planes and apply the money to Douglas DC-7Ds.

In this way, Tigers could retire its piston equipment sooner, presumably at better prices, and then, with delivery of the Douglas turboprops, offer used turboprop equipment instead of piston planes.

Another possibility for Flying Tigers is modification of its present Super Constellations to turboprop configurations.

Flying Tigers is not interested in the C-130B, which the airline feels has too little payload for its needs.

Flying Tigers may buy only as many DC-7Ds as it can handle if it can't finance 20 of the planes. A financing problem is the $2 million deposit Douglas is asking on an order for 20 DC-7Ds.

The DC-7D's wing will have the same span as the DC-7C—127 ft., 6 in. Fuselage will be lengthened to approximately 124 ft., 6 in., about 12 ft. longer than the DC-7C.

The fuselage also will be widened to about 135 in.

If Flying Tigers buys the airplane, some units will be fitted with windows for use on passenger charter flights. Otherwise they will be strictly cargo aircraft.

Proposed Configuration

In the proposed Flying Tigers configuration, the DC-7D achieves a 380 mph. block speed with a range of 1,200 mi.

The DC-7T in standard configuration will carry about 86 passengers. Gross maximum takeoff weight will be around 143,000 lb. By way of comparisons, the Lockheed Electra grosses about 113,000 lb.

Dimensions of the DC-7T will be similar to those of the DC-7D. Range will be almost 3,500 mi.

Speed would be about 430 mph. top, 25 mph faster than the DC-7C piston-powered airplane.

Soviet Engine Competition

Moscow—Some production line versions of Russia's four-turboprop Ukrania and Moscow transports will be equipped with engines designed by N. D. Kuznetsov and others with powerplants designed by A. G. Ivchenko. First experimental models of both the Ukrania and Moscow had Kuznetsov engines (AW July 22, p. 27).

Results of the competition should be interesting—Kuznetsov is credited with designing and building Russia's first turboprop engines, while Ivchenko's design bureau is comparatively young, with much of its previous work being on helicopter engines.

Soviets also say engines used to power the new twin-jet Tu-104A transport are "modernized versions" of those used in the earlier Tu-104. Improvements include "more thrust, less fuel consumption and a considerably increased interval between overhauls." Modification work on the Tu-104A engines is credited to the design bureau headed by P. F. Zubets. Original design of the 19,500 lb. thrust Tu-104 engine was credited to Lulko (AW July 22, p. 27; Aug. 19, p. 30). The engine also powers the Bison four-jet bomber and the Tu-110 four-jet transport.

American Gets Final Approval For Chicago-Mexico City Route

By Ford Eastman

Washington—President Eisenhower last week accepted Civil Aeronautics Board's recommendation that American Airlines be designated the U. S. carrier on the Chicago-Mexico City route. At the same time, Braniff's application to operate over the route was denied, but its certificate authorizing such service will remain in force.

Both American and Braniff have held authority to fly from the Midwest to Mexico City.

However, under the U. S.-Mexico air transport agreement only one carrier can be designated.

American has been operating the same route under temporary agreement with Mexico.

U. S. Routes

The naming of American to operate Chicago-Mexico City service concludes the designation of U. S. carriers to serve the seven routes authorized under terms of the bilateral.

They are:

- **Eastern Air Lines** to fly between New York, Washington and Mexico City nonstop.
- **American Airlines** between Chicago, Dallas/Fort Worth, San Antonio and Mexico City via intermediate points and nonstop.
- **Western Air Lines** between Los Angeles and Mexico City via intermediate points in the U. S. and nonstop.
- **Eastern Air Lines** between New Orleans and Mexico City nonstop.
- **Pan American World Airways** between New Orleans-Merida, Mexico to Guatemala and beyond.
- **Pan American** between Miami and Merida and to Guatemala and beyond.
- **Pan American** between Houston, Brownsville-Tampico, Mexico City and beyond to Guatemala and beyond.

Air carriers designated by Mexico to serve the same routes with U. S. carriers are:

- **Aeronaves de Mexico**—Mexico City-Washington, New York.
- **Compania Mexicana de Aviacion**—Mexico City-Los Angeles via intermediate points in Mexico.
- **Aeronaves de Mexico**—Mexico City-New Orleans via intermediate points in Mexico.
- **Guest Aerovias Mexico**—Mexico City-Miami and beyond via intermediate points in Mexico.
- **Compania Mexicana de Aviacion**—Mexico City-San Antonia via intermediate points in Mexico.
- **Houston - Mexico City**—Guatemala route is pending.

Why American

The CAB in selecting American said that more passengers would enjoy the benefits of effective single carrier service to Mexico City than through the selection of Braniff. Also, the Board said, American has for the last 15 years been providing U. S.-Mexico service and has developed an established position in Mexico of value to both the carrier and the public.

CAB said selection of Braniff also would provide public benefits that American cannot provide, but, since only one carrier can be designated, the Board selected the one it felt could provide the greater service.

"The bilateral expires by its terms on June 30, 1959," the CAB said, "and

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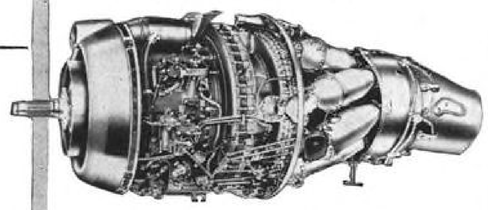
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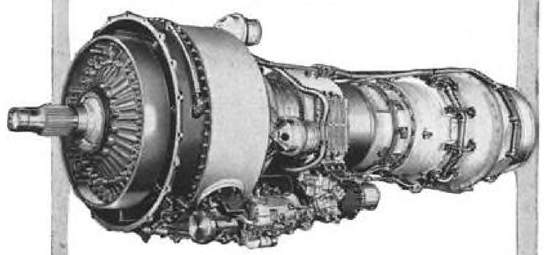
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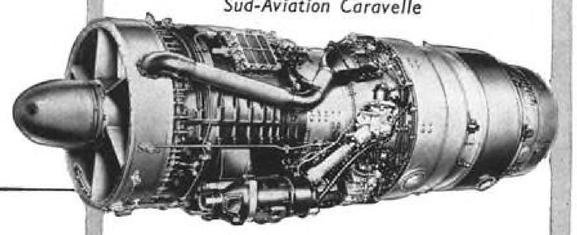
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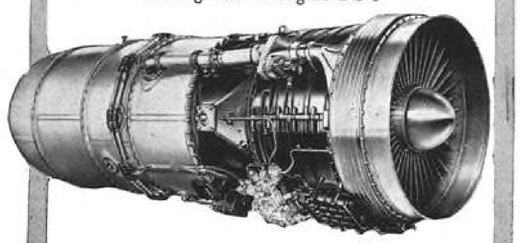
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we cannot close our eyes to the possibility that thereafter it may be possible for both of the present applicants to serve the route in question so as to provide benefits to N. Y. points on the systems of each not duplicated by the other. Our decision, along with the selection of American, not to suspend Braniff's present unused certificate authority for United States-Mexico operations, is an indication of the importance we attach to the prospects for service by both carriers in the not too distant future."

Braniff's Plea

Braniff contended during the hearings that it should be designated as the carrier on the route in order to provide one-plane service to Mexico City from the central portion of the United States between the Rockies and the Mississippi.

American Airlines inaugurated service to Mexico City from Dallas/Fort Worth and San Antonio in 1942 under a temporary wartime certificate issued at the direction of President Roosevelt and with the approval of the Mexican government. Through its domestic authorization, American provided one-plane service from Chicago to Dallas and San Antonio and on to Mexico City, although it could not fly Chicago-Mexico City nonstop.

In the Latin American Case in 1946, American's temporary authority to Mexico was made permanent. In the same case Braniff was awarded a certificate to operate between Mexico City and San Antonio and Laredo, Texas, but was never able to implement service because of the inability of the United States and Mexico to negotiate an air transport agreement until this year.

BEA Orders Comet 4Bs

London—British European Airways has ordered six de Havilland Comet 4B jet airliners for operation in 1960, as predicted in Aviation Week.

Deliveries of the Comets, powered by four Rolls-Royce Avon 29 engines, are to begin late in 1959 and be completed by spring, 1960. The 545 mph. Comet 4B will serve as an interim jetliner with which BEA can meet competition from the Caravelle on European routes.

The airline is expected to make an announcement shortly on its choice of a more advanced jet aircraft. This will be chosen from three-and-four-engined designs submitted by Bristol Aeroplane Co. and de Havilland.

If the decision favors de Havilland, it is expected that there will be a "buy-back" arrangement under which the Comet 4Bs can be returned to the manufacturer.

Tu-104 Arrival Tied To U.S.-Soviet Service

McGuire AFB, N. J.—Landing of the Soviet Tu-104 jet here last week was tied to the possibility of future Russian airline service to the United States by one of the transport's passengers, Aeroflot Chief of Flight Operations Alexei I. Semenkov. AVIATION WEEK predicted a year ago Aeroflot would attempt international expansion.

"Let this flight be the positive forecast of the beginning of regular flights of our civil aircraft between the Soviet Union and the United States of America" Semenkov said as he stepped off the Tu-104.

The plane flew here from Moscow in an elapsed time of 21 hr., 54 min. after stops in London, Reykjavik, and Goose Bay. Air time was 13 hr., 29 min.

The apparent Aeroflot bid for U. S. rights bears out a statement last year by Maj. Gen. Beletsky, the airline's operations chief, told AVIATION WEEK that Aeroflot definitely plans to fly to North America (AW July 9, 1956, p. 27).

With the recent appearance of new Russian transport aircraft types and the probability of further advancement in this area, Aeroflot could emerge as a tough competitor in the international airline business, as suggested by AVIATION WEEK a year ago (AW July 30, 1956, p. 23). No reciprocal air traffic agreement has been established with the United States, although Pan American World Airways has held discussions in Moscow over landing rights.

The Tu-104, carrying members of Russia's United Nations delegation, was forced to land here instead of at New York International Airport because of the Port of New York Authority. That agency, despite State Department pressure and Russian protests, stuck by its policy of banning jets at Idlewild without permission based on passing Port Authority noise tests. The Boeing 707 and Comet III previously have been refused such permission, while the twin-jet Caravelle, after satisfying the agency's noise experts, was given the go-ahead.

The Port Authority was standing by at McGuire, experts, instruments and all, when the Tu-104 landed. But apparently the Russians weren't interested. Port Authority aviation director John R. Wiley buttonholed a Russian assistant air attache to discuss noise tests as a prerequisite to Idlewild entry. But the Russian said "no test."

"No land," Wiley replied.

The Port Authority was still waiting with its decibel counters Thursday morning, but the Russians did not seem to care.

"Jetstar" Flies

Edwards AFB, Calif.—Lockheed Aircraft Corp.'s Model 329 utility jet transport made its first flight here last Wednesday, 241 days from its three-view design stage.

The 10-passenger "Jetstar" was flown for 39 min. by pilot Ray Gudey, who reported its performance "smooth as silk."

Flight, scheduled for 9 a.m. Sept. 4 by C. L. Johnson, Lockheed vice president in charge of special projects, early in the program, actually got off at 8:58 a.m.

McGuire is more than 60 miles from Manhattan.

A second Tu-104 is expected to make the trip to America this month with additional delegation members, including Soviet Foreign Minister Andrei A. Gromyko.

The plane was met at Goose Bay, Labrador, by a three-man U. S. Air Force crew that guided the plane on its final leg of the journey to McGuire. The jet was captained by B. P. Bugayev, a veteran Soviet airline pilot.

The twin-engine Tu-104 reportedly has a 2,000 mile range and a cruise altitude of 33,000 ft.

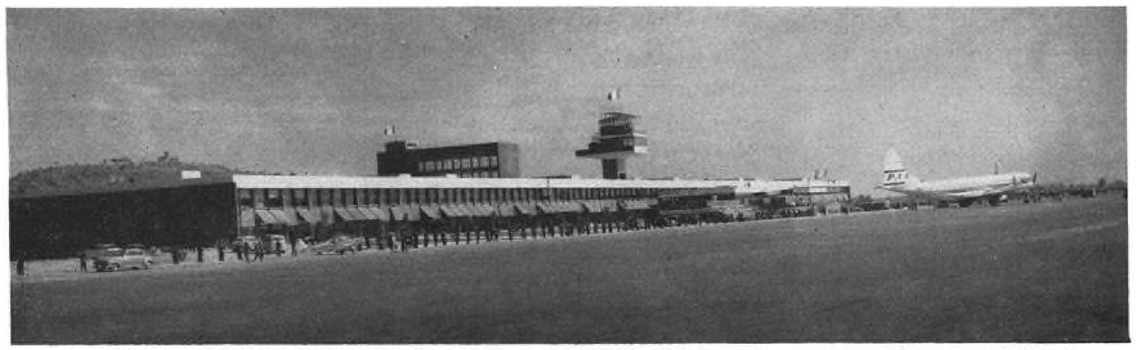
CAB Rules Against Complaint By Slick

Washington—Slick Airways' complaint that American Airlines engaged in unfair competition was dismissed last week by the Civil Aeronautics Board.

Slick charged that American violated the Civil Aeronautics Act by circulating two letters among the shipping public dated Nov. 10, 1953, and Dec. 26, 1956. The complaint said the letters implied that lower rates for air freight transportation would be brought about by abandoning the services of Slick and other all-cargo carriers and leaving the field free for American and other passenger carriers.

In dismissing the complaint, CAB said the case does not involve regular and frequently recurrent activity allegedly in violation of the Civil Aeronautics Act but two isolated occurrences three years apart. The Board added that the matters alleged do not involve a sufficiently specific and substantial public interest to warrant further action at this time.

Member G. Joseph Minetti dissented with the majority. He said the record reveals a charge that these isolated occurrences have produced a continuing injurious effect and could cause irreparable harm to the industry, to the public interest and to Slick itself. He said that, without a hearing, there is no way of knowing if Slick is correct in its allegations.



MODERN TERMINAL facilities at Mexico City Central Airport will be augmented by runway, taxiway, lighting and fueling improvements. Earlier modernization cost $5 million and additional work will cost $1 million.

Mexico City Plans Airport Improvement



INTERIOR of terminal includes reservations desks for the nine foreign airlines now operating to Mexico City. Terminal handles 3,000 passengers a day.



DECORATION in the terminal includes this clock which shows the time in various cities around the world. Flags represent nations whose airlines serve Mexico City.

Mexico City—In line with its expanded international character, Mexico City's Central Airport is to undergo a $1 million improvement program, concerned mostly with increased safety.

Work is to begin this month on new and better main runway and taxi-runway lighting systems, a centralizing of fuel facilities and additional covered passageways for passengers.

In addition, installation is being considered of surveillance radar to complement the present radio system in air traffic control.

Main lighting improvement will be for the 10,000 x 200 ft. instrument runway. This strip, now illuminated with medium-intensity flush type lights, will be bordered with high-intensity lights installed to CAA L-820 specifications. It also will be resurfaced with asphaltic concrete. There are three other runways which will continue with the medium-intensity lights.

Fuel stations now are scattered all round the landing field. The new program calls for a centralized hydrant system with underground pipes feeding hydrants at the parking aprons. The hydrants will provide both avgas and kerosene (for Aeronaves de Mexico's two Bristol Britannias).

All taxiways will be widened from the present 52 ft. to 75 ft. Two new covered passageways for passengers are to be built, one each on the international and on the domestic halves. This will double the number of parking bays for aircraft.

The program is to be completed by December, 1958, which will coincide with the end of the six-year term of President Adolfo Ruiz Cortines.

Engineering plans have been made for an 3,600 ft. extension of the instrument runway to prepare for the advent of jets in Mexico. Expense of this project would be increased by the necessary diversion of a brook and the appropriation will have to be voted by the next administration.

There are now nine foreign carriers flying in and out of Mexico City. Western Air Lines and Eastern Air Lines began last month under terms of the new U. S.-Mexico bilateral agreement which will greatly increase international traffic at this airport. Also, there are nearly 30 domestic carriers which use Mexico City's Central Airport. In all, there are about 280 operations a day, handling a daily average of about 3,000 passengers.

The airport itself is generally considered to be one of the world's most beautiful. It was opened nearly four years ago as a $5 million project. At that time, it was believed that the facilities would be adequate for 20 years.

In addition to its architectural beauty, the airport has some Latin touches. To exchange pleasantries before getting down to business, all foreign carriers when reporting in to the control tower are greeted with "Bienvenido a Mexico" before being given landing instructions. Passengers deplaning from foreign carriers are given a cup of Mexico's native strong coffee and women are given gardenias. Just recently, peacocks were turned loose on the tropically-landscaped gardens of the passenger terminal.

Gen. Alberto Salinas Carranza, director of civil aviation, still is considering another Latin touch: a honeymooners' room for newly-married couples to escape from friends and relatives while awaiting their plane departure.

SHORTLINES

► **Detroit-Willow Run** airport management will be advised on public relations customer service and policy matters by a 12-man committee set by Airlines Terminal Corp. The terminal corporation has announced formation of the advisory group, whose members represent industry and business in the Detroit area. Announcement cited need for "the airport's management to have the benefit of the criticism, advice and wisdom of men who are familiar not only with modern business needs, but with aviation as a vital economic factor."

► **Northwest Orient Airlines** has put DC-7s into transcontinental service between New York and Seattle with a stop at Chicago. Flying time for the first-class, daily flights in each direction is scheduled as 8 hr., 17 min. eastbound, 9 hr., 23 min. west bound.

► **L. B. Smith Aircraft Corp.** has received a contract to convert three new DC-6A cargo aircraft to 102-passenger

AIRLINE OBSERVER

► **Air France will counter Aeronaves de Mexico's plan to use Bristol Britannia turboprop transports on its Mexico City-New York nonstop flights by the inauguration of Lockheed Super Starliners. It hopes to have them in service on a daily basis by the end of November, height of Mexico City's tourist season. Aeronaves is expected to begin its daily nonstop service to New York in early November. Meanwhile, Eastern Air Lines plans to begin daily service between New York, Washington and Mexico City late this month with DC-7Bs.**

► C. O. Turner, Qantas Airline chief executive, has begun discussions in London with British officials on plans for an Australia-to-Britain route via the U. S. Qantas received approval to extend its route to San Francisco across the U. S. to New York and on to London and beyond under a recently negotiated air transport agreement with the U. S.

► **Northwest Airlines has sold its four 1049G Super Constellations to Linea Aeropostal Venezolana (LAV) the national airline of Venezuela. The four aircraft, which have been used on its U. S.-Orient routes, have been replaced by DC-7Cs.**

► Trans Australia Airlines (TAA) will resist political pressure to buy British-made turbine transports and will soon place orders for either the Sud Caravelle or Lockheed Electra. TAA currently favors the Caravelle turbojet but has doubt regarding its possible performance on the long Adelaide to Western Australia route under unfavorable weather conditions with full payload. TAA has asked Sud Aviation to make certain modifications to increase range. If the manufacturer is unable to do this, TAA will probably order the Electra.

► **Civil Aeronautics Administration air carrier inspectors have completed a week-long course in large-plane accident investigation. Although accident investigation comes under Civil Aeronautics Board jurisdiction, CAA participates in the investigations since findings often show the need for immediate CAA action in such areas as aircraft airworthiness and airman competency.**

► Proposals by Slick Airways, Flying Tigers, American, United and Western Air Lines to increase general commodity rates will be investigated by the Civil Aeronautics Board. Rates filed by the carriers have been suspended pending outcome of the investigation. Rates filed by Slick would have become effective Sept. 1, while the proposed rates of the other carriers would have become effective Sept. 18.

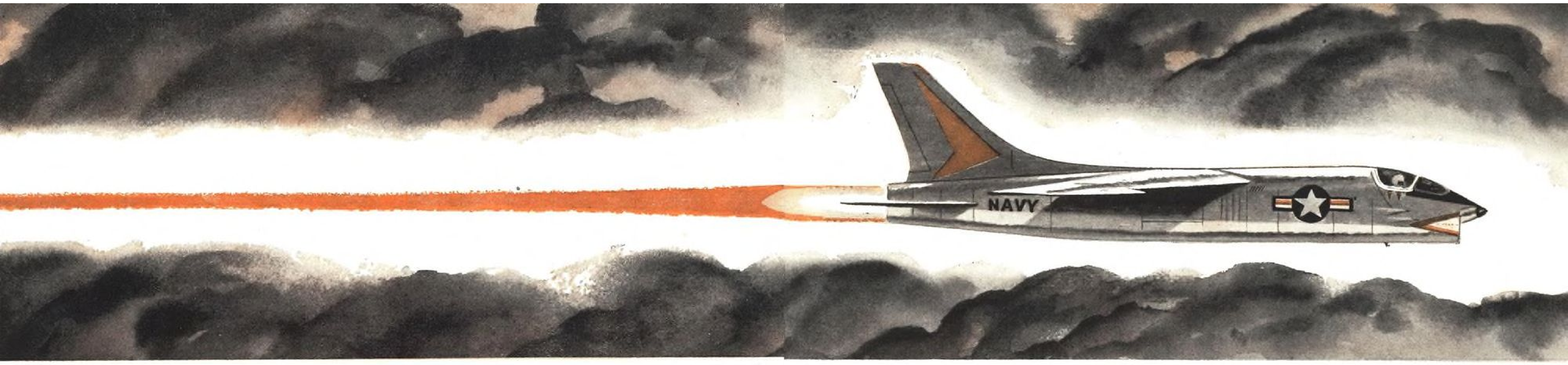
► **Civil Aeronautics Administration is installing $100,000 worth of electronic and recording equipment in a C-47 to be used by the Spanish government to check airway aids. The project is being financed by the International Cooperation Administration as a part of U. S. aid to Spain.**

► Hunting Clan Air Transport and Airwork, independent British airline operators, plan to introduce four Vickers Viscounts on their jointly operated Safari coach flights to East and Central Africa. Each company will buy two Viscounts to replace piston-engine Vikings. The airlines have applied to the British government and African authorities for permission to operate the Viscounts beginning in October on the Central African Safari service and shortly thereafter on the East African service.

► **Eastern Air Lines recorded a 61% load factor during the first month of its nonstop service from Mexico City to New Orleans. In 31 days, Eastern flew 1,289 passengers out of Mexico City. Of this amount, 565 continued on to New York. DC-7Bs, with a first-class capacity of 68 passengers, are being used on the route.**

► Air France has taken delivery of its fifth Lockheed 1649A Starliner. The plane was flown from Los Angeles to Paris nonstop in a record time of 16 hours and 21 minutes, a distance of 5,700 miles. The airline has five more planes on order for luxury service across the North Atlantic.

AVIATION WEEK, September 9, 1957



BULLET

The shot that traveled 2,445 miles

Chance Vought's Crusader was cocked and fired cross-continent July 16 in a test called "Operation Bullet."

Aimed along the 2,445.9-mile F.A.I. route from Los Angeles to New York City, the fighter made it in good bullet time . . . 3 hours, 22 minutes and 50 seconds. In fact, a .45-caliber slug would have needed 47.5 *more* minutes to make the trip at muzzle velocity.

Averaging 723.5 mph from start to finish, the Crusader pilot, Marine Major John Glenn, Jr. —

- bettered by 22 minutes the previous course record
- set a new mark for supersonic, high-altitude flight
- made long-distance, high-altitude travel beyond the sound barrier a reality.

It was a dazzling show of speed and stamina.

Pilot Glenn moved faster coast to coast than man or projectile ever had. Every 4.6 minutes he advanced another degree of longitude across the face of the earth. Over most of the course, he held speeds of about 1,000 mph at altitudes in the vicinity of 50,000 feet.

It was a flight that plumbed the *elements* of time.

Had the course been flown from east to west, Crusader speed would have virtually neutralized the earth's rotation and the resultant advance of time. Thus, by the clock, Pilot Glenn might have completed the coast-to-coast flight *at almost the same time he began it.*

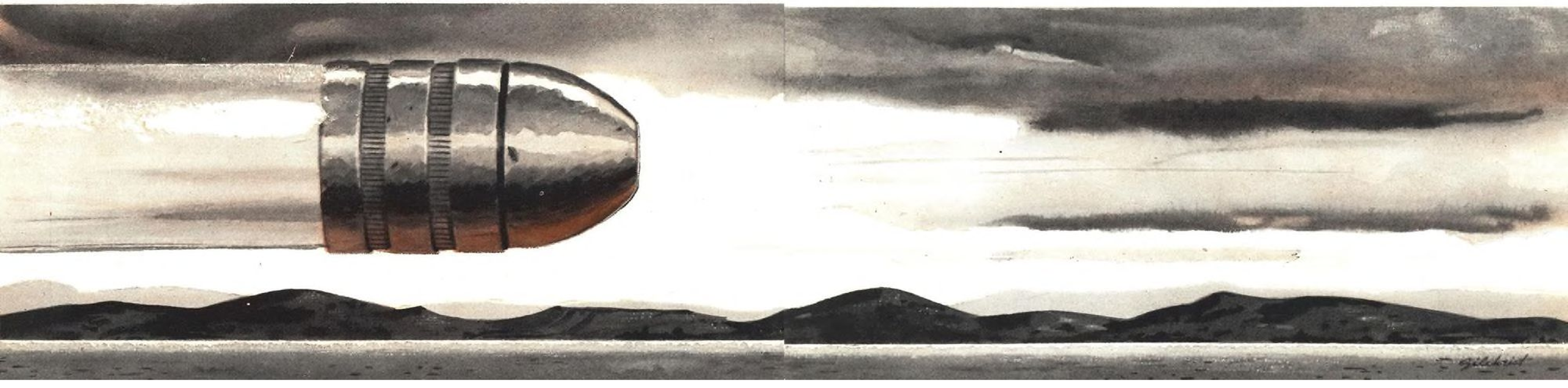
It was an impressive display of *power on hand.*

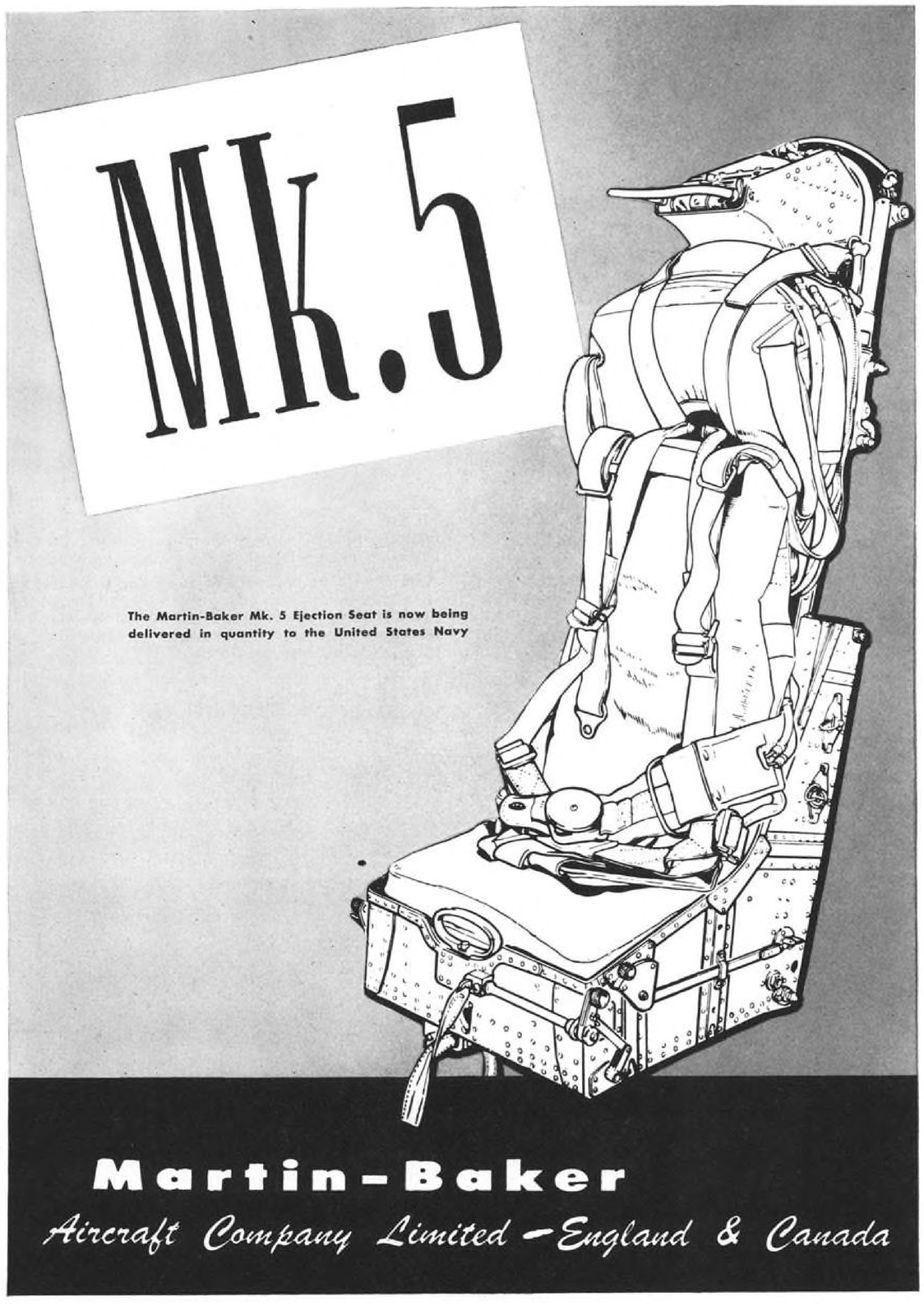
No experimental sample of things yet to come, the Crusader is an integrated Fleet weapon right now.

Another Vought product of years-ahead thinking that is providing us Air Power today. Dramatic proof that Vought projects challenge creative engineers with the opportunity to carry ideas right on through to operational service.

For details on select openings on Vought's engineering team, write today to C. A. Besio, Supervisor, Engineering Personnel, Dept. A-17.

CHANCE VOUGHT AIRCRAFT
INCORPORATED · DALLAS, TEXAS





configuration for Trans Caribbean Airways, Inc. Planes will be used in New York-San Juan service. Configuration is described as "de luxe" tourist.

► **United Air Lines** will reserve seats for its passengers to National Football League games this fall at all the airline's ticket offices through an arrangement with United and eleven of the twelve league members. Previously, tickets to National League games could be purchased only in cities where the games were being played. Detroit Lions are not participating in the program.

► **Slick Airways** sold its 13 C-46s to American Air Export and Import Co., with a lease-back provision covering ten of the planes for one year and six for a second year. Deal will become effective with Civil Aeronautics Board approval. Slick is phasing out the old planes pending delivery of five new DC-6As. Carrier bought its original equipment, nine C-46s, from War Assets Administration in 1945.

► **Nonstop service** between New York and Seattle-Tacoma will be inaugurated Sept. 15 by United Air Lines. United will use 58-passenger DC-7s on the run, expects to fly the eastbound segment in 7 hr., 40 min., take 8 hr., 45 min. westbound. New UAL service will be first class.

► **Trans-Canada Air Lines** plans direct weekly service between Toronto and Prestwick, Scotland beginning Oct. 4. Super Constellations will be used on the route. TCA also is planning a new Viscount service from Montreal via Ottawa and Windsor to Winnipeg and other western Canadian points.

► **Emery Air Freight Corp.** expanded its international division with agents in seven additional European cities for a total of 22. The foreign service began in June, 1956. Domestic operation has been expanded too, now includes more than 100 agents in the U.S., Canada and Alaska.

► **Alaska Airlines** has big expansion plans made feasible by recently awarded permanent certification. Plans include introduction of pressurized equipment this fall between Fairbanks and Seattle, development of new hangar and maintenance facilities, purchase of Electra or Britannia turboprop equipment.

► **Seaboard and Western Airlines** flew 5,500 lb. of newly released Paris fall fashions, valued at $\frac{1}{2}$ million, from Orly Field to New York in a Super Constellation. Seaboard says the clothes, packed in 200 special boxes, were closely guarded to maintain style security.

COCKPIT VIEWPOINT



By Capt. R. C. Robson

The Price of Progress

Careful study of aeronautical problems and constant improvement in the tools of our trade have made for continued progress in aviation. In slightly more than a decade we have graduated from the venerable DC-3 to the superb DC-7 and super-duper Constellation. More passengers fly in greater comfort than ever before.

But the big item, after safety, is time. Speed is the thing that counts. We continually straighten airways to fly shorter distances; we use radar separation to shorten intervals; we use twin-stacks to feed our major airports; before long most large fields will feature high-speed turnoffs.

The resultant saving in time is of tremendous importance to passengers as well as to the airlines. But this increased tempo also makes for frenzied activity in the cockpit where, if pilots are not provided with proper tools, much of this valuable time, to say nothing of safety, can be lost. Controls which are clumsy to use, instruments hard to read, poor map lights and a host of other items can all waste precious seconds.

Rube Goldberg In Cockpit

All this wordage is a longwinded way of getting around to mentioning one of the most Rube Goldbergian innovations that has come along in many a day. In a sales brochure recently I came across pictures of the control panel on the latest model Automatic Direction Finders. Lo and behold it had, not the usual one, but three tuning knobs. The first cranks in hundreds of kilocycles; the next tens; the last, units.

My comment was unprintable, but I was soon informed that the manufacturer had simply been following instructions from Aeronautical Radio, Inc. It seemed impossible that such a monstrosity could come about deliberately until I received ARINC's specifications for airborne ADF systems. But it's true; page 31 clearly shows three tuning knobs. Furthermore—and as an airline employe I'm almost ashamed to admit this—the title page points out that these specs were "Prepared by the Airlines Electronic Engineering Committee."

It would be impossible for this poor pilot to properly describe the myriad cockpit duties involved when coming into a metropolitan area. New York, for instance, has three major airports served by a complex system of airways with cross-overs, "tunnels," holding points, feeding stacks, etc. A plane may pass Stroudsburg, Pa., at 20,000 ft. and land at LaGuardia 15 minutes later. In this time, the "wireless operator" has to tune in and identify at least six VHF navigation facilities. And, since these are not "fail-safe" devices, he must also tune in and identify about nine low frequency stations. This averages one per minute. There are also communications and the problem of "keeping the beast right side up." There is the problem of reading a map to find the right numbers. There are also several other things.

Time Lost

Ever since I can remember, an ADF had one "coffee grinder" handle. You simply reach without looking and crank until you are in the rough vicinity of your frequency. Then, when time permits, you "fine tune" and identify. Now, instead of two knobs on my ADFs, I have six. Now, because of the proximity of six knobs, I can't reach blindly and crank; I must either look down or take time to consciously count by fingertip to arrive at destination.

Most of our major airports are served by low frequency radios at holding points as well as ILS markers. The ADF is an important cockpit tool. Why on earth it had to be redesigned for added complications I'll never know. But if the airlines are interested one of their committees has just lost some of our valuable speed.



ARMY H-37A helicopters fly over Ft. Rucker, Ala., in formation. Lead ship of five in Vee was used in 1,000 hr. test. As a result of intensive flying, nearly all major dynamic components have had life raised to at least 300 hr.

Army Begins Cost Cutting Program Based

By J. S. Butz, Jr.

Ft. Rucker, Ala.—Army Aviation is creating the means to make a major reduction in its helicopter operating costs, officially described in the past as high enough to force the Army to stop using helicopters in large numbers.

Unique type of accelerated service test just completed here is a vital part of a new approach to more economic rotary wing operation. During this test the Army succeeded in putting 1,000 hr. of service type flying on a single Sikorsky H-37A helicopter (S-56) within six months after its delivery. Major components on the aircraft (e.g. transmissions, rotorheads, etc.) got 500 hr. or more of running during this period.

Utilization High

This is a high for utilization of an untried helicopter and greater than that achieved by most commercial operators of proven equipment.

By contrast it has taken as long as four years in the past for the Army to put this much time on major helicopter types.

For instance, the first Vertol H-21 Workhorse to fly 1,000 hr. reached that figure just last month although the Army began to receive this aircraft in 1952.

Originally the Army planned to put as much as 100 hr. per month on each operational helicopter, and recommendations for changes and improvement would be made on the basis of field experience with a large number of aircraft. But maintenance and personnel difficulties reduced flight time to 20-30 hr. per month. This low utilization had two expensive effects on the helicopter program in general:

- **Spare parts** were generally overbought in anticipation of greater usage.
- **Information** on the durability of parts under many hours of operational use did not become available for two or three years after first delivery. Much costly retrofit and modification were necessary.

Information about parts suitability is especially vital to accurate spare parts buying for helicopters. Experience with the vibrating qualities of rotary wing aircraft has not reached the point that designers or maintenance men can predict part life with much certainty. Test bed data is not completely acceptable in many cases because service conditions are not understood well enough to be duplicated.

Spares Errors

Each design has brought its own peculiar problems and attempts to buy spares on the basis of past experience with other helicopter types have resulted in many errors of several hundred per cent.

One definite Army purpose was served by the overbuying of parts. That was to be absolutely certain that helicopter units were not grounded through an unexpectedly low service life for any part. However, the cumulative result of overbuying, plus high parts cost and low life, high skill required for proper maintenance, and personnel shortages was to raise the cost of the helicopter programs to a nearly disastrous level according to Army officials.

This was illustrated when the Army reported to the Congress that spare parts costs for its Sikorsky H-19Ds were $42.83 per flight hour.

This same item cost New York Airways $15.37 for similar aircraft, which is typical for a commercial type of operation.

Biggest Expense

Parts replacement is the biggest expense of operating helicopters and for the H-19D this costs the Army roughly three times as much as a civil operator. A good portion of this difference can be accounted for by much rougher treatment Army equipment gets on tactical exercises, the lower level of experience of the average Army pilot and maintenance man, variations in accounting procedures, etc. However, a major part of it is due to errors in buying spares.

Army's new program for accelerated service testing is designed to reduce aircraft operating expenses by attacking virtually every source of cost except the personnel re-enlistment and transfer problem. The tests are handled by a recently formed command, the United States Army Transportation Aircraft Test and Support Activity (TATSA), which was activated during July 1956 and became operational last January. Objectives of the TATSA program are:

- **Determination** of spare parts consumption.
- **Rapid transmission** of information about defective design to the manufacturer to reduce the need for modification and retrofit.
- **Development** of component service life.
- **Determination** and development of inspection cycles and improvement of maintenance publications.
- **Determination** of manpower, tool, equipment, and skill requirements.

Results of the 1,000 hr. H-37A tests indicate that these objectives were met and that operating costs will be substantially lowered.



ARMY H-37A used in accelerated 1,000 hr. test. Program disclosed many spares buying errors which increased operating costs. Use of civilian contractor to perform maintenance made it possible to get around shortage of trained military mechanics.

On 1,000 Hr. Test Results

Service Life

Service life of every major dynamic component on the aircraft was raised and all now have a life of 300 hr. or more except the tail rotor hub which is still at 150 hr. Typical improvements were:

- **Main gear box** raised from 100 to 300 hr.
- **Main rotor assembly** raised from 150 to 300 hr.
- **Tail rotor blade** raised from 150 to 700 hr.

Gains in the usable life of these very expensive assemblies (e.g. main gear box costs $37,249 for the H-37A) is one primary route to economy. Some other helicopters which have been operating for three years have not yet reached the service life of the H-37A components. Another element of the test which promises great economy but is difficult to give a definite dollar value was the direct contact between the Army test unit TATSA and the Sikorsky engineering department. Military procedure in the past has usually placed at least one office and its red tape between service field testing unit and the contractor.

Sikorsky personnel were present during the entire test and data was transmitted through them to the main plant. This information was used for immediate design changes in the helicopters under production at Bridgeport. These aircraft will then be much more suitable for field use when delivered to the Army and the modification requirements reduced.

Initial order for spare parts for the H-37A test was found to be less than 20% accurate. Some parts were overbought, others underbought, and many not purchased at all. Experience from the test will make more realistic parts purchase possible for production machines and, more important during war, will guide the proper parts to tactical units in the field.

Manpower Shortage

Maintenance problems of keeping a completely new aircraft flying an average of more than 5 hr. a day for six months cannot be overstated. TATSA was not authorized Army maintenance personnel for the test because of the current shortage of manpower in Army Aviation. A civil contractor, Test and Development Co., of Atlanta, Ga., was brought in to do the line maintenance under Army supervision. The employes of this company had never seen an H-37 before and most of them had never worked on a helicopter.

Early maintenance was closely supervised by Sikorsky representatives but the learning curve proved to be steep and maintenance times went down sharply as the mechanics gained experience. This was encouraging in view of the great number of complex systems on the H-37A compared to other helicopters used by the Army.

Maintenance was originally planned for the night while flying was restricted to the daytime. However, as the test wore on flying was accomplished whenever the aircraft was ready so that the schedule could be maintained.

Plant Coordination

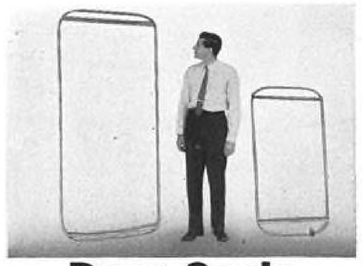
Overhaul of major assemblies was performed at the Sikorsky plant. These assemblies were air expressed in many cases between New England and Ft. Rucker so that they could be used in the test for a large number of hours. It also gave Sikorsky engineers a chance to inspect the component parts during the breakdown.

Original maintenance manuals and procedures for the H-37A will be modified considerably as a result of the accelerated test. Tasks of servicing and performing periodic repairs on the aircraft have been reduced by many manhours.

For instance, landing for refueling and attendant inspections took one hour when the test started but this time was reduced to 20-30 minutes by last month.

TATSA's experience during the H-37A test may possibly lead to a completely new type of maintenance program for Army aircraft. These new procedures were tried during the last twenty days of the test and cut maintenance manhours required nearly in half while doubling aircraft reliability.

This accomplishment was primarily the result of performing a small portion



Door Seals for the 707

Passenger door seal (left) and galley door seal (right) are produced by CHR for the Boeing 707. Materials: High tear strength silicone rubber reinforced with Dacron fabric. Result: tear, abrasion, ozone and weather resistant seals, non-sticking, flexible at extreme temperatures.

CONNECTICUT HARD RUBBER

THE CONNECTICUT HARD RUBBER CO.
NEW HAVEN 9 CHR CONNECTICUT

AIRFRAME SEALS
SILICONE RUBBER SHEET & SPONGE
SILICONE RUBBER COATED FABRICS
SILICONE RUBBER MOLDINGS & EXTRUSIONS

DYNAMIC ALTITUDE SIMULATOR

FOR TEST AND EVALUATION OF FLIGHT CONTROL EQUIPMENT AND INSTRUMENTS

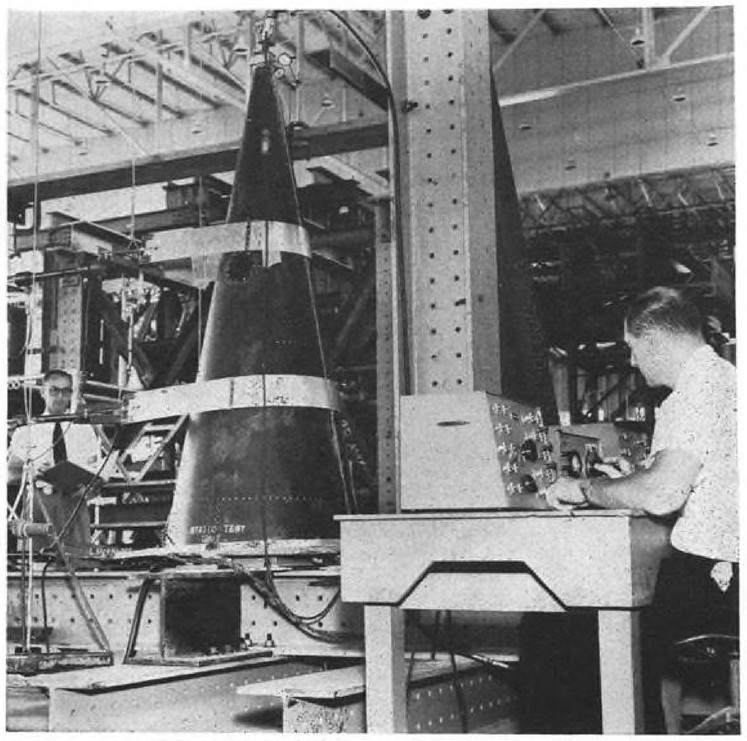


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Max rate — 50,000 ft/min
Max response 10 cps

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BELMONT 6, CALIFORNIA
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Vanguard Nose Cone Tested

Static tests are carried out on the nose cone of the Vanguard earth satellite launching vehicle at the Martin Co. plant at Baltimore. Structural trouble, a computational suspicion that vibration would set in within the vehicle frame, has been corrected (AW Aug. 26, p. 29). Two Vikings and five Vanguard test vehicles will be launched before the first of six Vanguard launching vehicles is fired.

of major overhaul each night. As this was done the aircraft was also torn down enough to perform many routine inspections and periodic changes. In this manner the aircraft was never down several days for a major overhaul and many overhaul and inspection items were consolidated.

Overhaul Schedule

This type of overhaul procedure is common among civil operators adhering to a schedule, but the Army had not tried it before. One of its requirements is that time on the various aircraft components be staggered so that all do not become due for overhaul simultaneously.

Lt. Col. Charles E. Hollis, TATSA Commander, is recommending that the new procedures be investigated for possible tactical use.

Another finding during the accelerated test was the usefulness of a third crew member for the H-37A. TATSA used an experienced man as a flight engineer to move about the aircraft continually during flight to check the conditions of structure and dynamic components. He was in constant communication with the pilots by intercom and is credited with averting serious damage or complete washout of the aircraft several times.

Typical emergency occurred during a long cross country flight when structure failed around a bracket supporting the tail rotor drive shaft. The shaft began whipping and striking other structure, but the cockpit was so far away that the pilots were completely unaware of it.

The flight engineer discovered the condition and a landing was made before another more critical failure could occur.

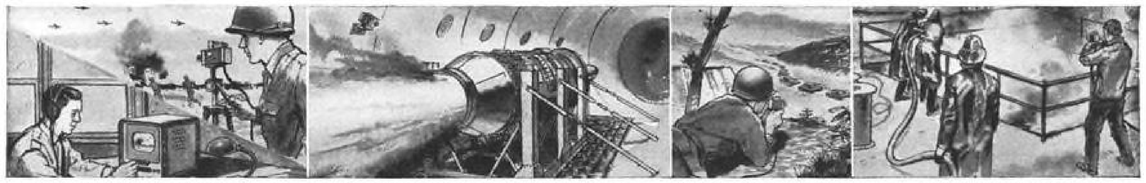
Third Crewman

Duties of the flight engineer are probably most necessary during a test program when failures are common. But TATSA is recommending his inclusion in operational crews because of the great size and complexity of the H-37A, compared to current helicopters.

The accelerated 1,000 hr. service test is but one phase of TATSA's work. Shorter tests are performed on designs that are not far enough along to appear capable of the longer trial. TATSA evaluated three helicopters during its first



MIRACLE IN MINIATURE



Observation and control of amphibious and airborne landings.

Close observation of jet or piston engine test performance.

Surveillance of assembly areas and movements of forces.

Observation of danger areas, where exposure would involve danger to personnel.

Brand new! RCA "Telemite" (model JTV-1) a 1-pound ultra-miniature television camera, makes possible direct observation of sites and events never before accessible by TV

It fits lightly into the hand; it can be carried in a pocket; it weighs about a pound; it will go places too small for ordinary cameras, too dangerous for man; it will observe without being conspicuous; it may be mounted on a tripod, fastened to wall or bulkhead, hand-held by a pistol grip. Size: 1⅞" x 2⅜" x 4¾".

By means of a transistorized circuit and the new RCA half-inch Vidicon, the "Telemite" actually surpasses standard Vidicon-type industrial TV cameras in sensitivity. It produces clear, contrasty pictures with a scene illumination of 10-foot candles or less.

The "Telemite" operates with up to 200 feet of cable between it and the control monitor, and this distance can be further extended by using a repeater amplifier. This is the first TV camera to employ photoelectric sensitivity control, which provides automatic adaptation to widely varying scene illumination.

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CAMDEN, N.J.
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year, the Doman YH-31, Hiller YH-32 and H-37A.

Scheduled for next year are the Hiller H-23D, Bell YH-40, Cessna YH-41, Hughes 269, and the French Sud Djinn.

Two aircraft are actually used for the 1,000 hr. test. One receives 1,000 hr. and the other will usually receive about 500 hr. so that each of the major dynamic components will be run at least 700 hr. before the end of the complete service test. TATSA also has maintenance responsibility for two other H-37As assigned to CONARC Board 6, another test unit, so that its findings are based on the performance of four aircraft.

Flying program for TATSA tests closely resembles service use. Some time is devoted to pilot familiarization, autorotation and maximum performance maneuvers are practised, flights are made in the mountains and in the desert, and usually at high gross weights.

Industry Response

One important aspect of the TATSA program is the favorable reaction it has received from industry. Sikorsky, which was directly involved in the first accelerated test has high praise for Col. Hollis and his command. Other manufacturers are pleased over the tests and feel they will improve the service performance of all new aircraft.

Disagreements between manufacturer and customer seem to be part of the development of complicated equipment and helicopters are no exception.

Generally, the Army's position has been that helicopters were needlessly costly and most designs were very poor from a maintenance standpoint. Civil operators echoed the Army strongly on these points.

Industry's answer has been that the Army's test procedures and utilization have not been adequate for rapid development. Col. Hollis has stated that TATSA is an outgrowth of these complaints. Presumably it will be up to the industry to use TATSA data to simplify helicopter maintenance.

Cost Source

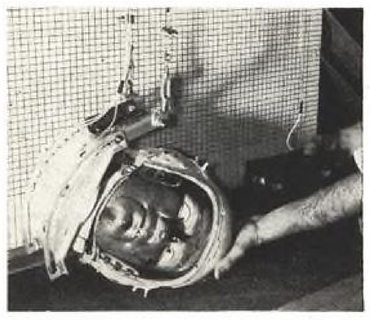
At any rate, Army and the industry believe that the accelerated tests will eventually result in a large improvement in operating costs.

Unfortunately the TATSA command is not the complete remedy for high operating costs for Army Aviation. Even if it were able to bring the materiel expense of service helicopters down to civil level, one primary source of high cost would remain.

That source of cost is common to all U.S. military services, but it is essentially out of their control and is the responsibility of the highest level of command.

It is the much talked of problem of retaining competent technical personnel to operate and maintain the increasingly complex machinery needed by the services.

Army Aviation is in a very bad spot in this respect. Most of the men entering helicopter mechanic training



Helmet Test

Aluminum model of human head is used by North American Aviation Electro-Mechanical Laboratory to test three types of pilot helmets. A 12½ lb. weight was swung in measured arcs against helmets, striking with velocity of 17 fps. Pickups inside head measured force of impact.

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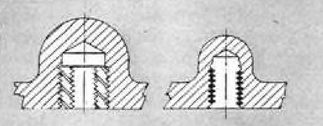




HELI-COIL
Stainless Steel Screw-THREAD Insert

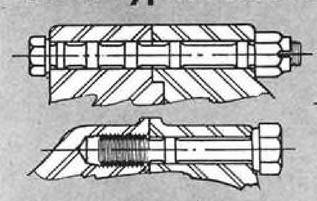
This is the insert that permanently protects threads against wear, stripping, corrosion, galling, seizing, vibration and shock. Made of (18-8) stainless steel wire, cold-rolled into a diamond shaped cross-section, this ***Heli-Coil*** Insert is work hardened to a tensile strength of approximately 200,000 psi . . . conforms to military standards MS 122076 through 122275 (ASG) and MS 124651 through 124850 (ASG) . . . conforms to standard commercial and industrial thread forms, including coarse, fine, pipe-thread and MM sizes . . . permits use of standard boss configurations.

Here Are

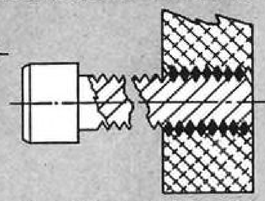


Save Space, Weight and Costs
Substantial savings in materials, weight, space and costs are possible, as against solid bushings, because smaller (or standard) bosses, flanges and threaded fasteners can be used.

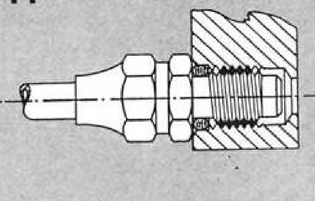
Some Typical *Heli-Coil* Screw-THREAD Applications



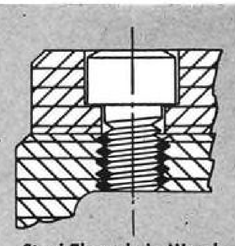
Compact Design
Improves design features by elimination of nuts, washers and extra-length bolts.



Stronger Thread Connections
Under excessive tension, torsion and impact loads in standard proportion bosses, the screw will break but the ***Heli-Coil*** Screw-THREAD Insert will remain undamaged . . . even in light alloy metal.



Leak-Proof Connections
In lightweight, high pressure hydraulic equipment, stainless steel inserts, regular and pipe thread, protect threaded pump and valve ports sealed with "O" rings.



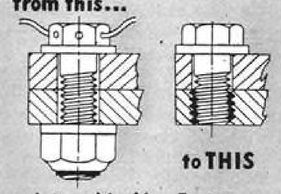
Steel Threads in Wood, Plastics and Fiberglas
Provides permanent, strong, corrosion-resistant and wearproof threads in soft materials. Especially valuable where frequent assembly and disassembly is necessary.



New HELI-COIL
Stainless Steel Screw-LOCK Insert
Pat. Pending.

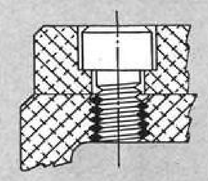
Conforming to military specifications for locking torque and vibration, this notable new ***Heli-Coil*** Screw-LOCK *one-piece* insert provides all the thread protection of the Screw-THREAD Insert, **PLUS** an exclusive internal locking feature that eliminates the need for clumsy protruding lock nuts, lock wiring and other supplementary locking devices . . . saves cost, space and weight . . . permits simplified streamlined design. The Insert is a permanently integrated part of the component—permits repeated service repair disassembly and reassembly, *with locking action remaining unimpaired.* Available in sizes from 4-40 up.

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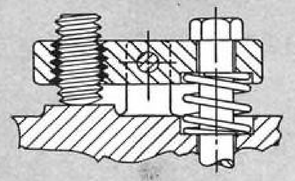


Internal Locking Feature
Insures positive internal locking action—eliminates lock nuts, lock wiring and other protruding locking devices—saves space, weight, cost. Yet screw may be easily disassembled with no loss of locking torque.

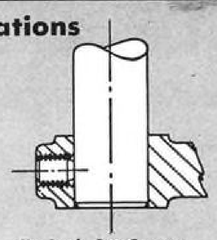
Some Typical *Heli-Coil* Screw-LOCK Applications



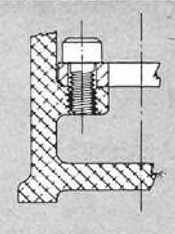
Flush Nut Assemblies
Permits a securely locked, flush assembly, because its internal locking feature eliminates need for drilled head bolts and other protruding locking devices.



Lock Adjustment Screws
This simple design allows permanent, positive adjustment of screws in any position, secure against vibration or impact.

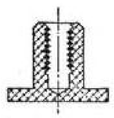


To Lock Set Screws
Positively locks assembly against loosening at desired adjustment—protects threads against stripping under high torque—permits use of light housing materials.



Inaccessible or Miniaturized Assemblies
Heli-Coil Screw-LOCK Insert permits installation of the locking feature from front or top. No blind fumbling for assembly of locking devices inside or behind.

➡ ***Heli-Coil*** **Field Engineers are at your service for design consultation—without obligation.**



CUSTOM LOCK NUTS

The ***Heli-Coil*** Screw-LOCK Insert is adaptable to special-shaped lock nuts, shells, spacers and fasteners and can be engineered to meet your torque or performance requirements. ***Heli-Coil Corporation*** is fully equipped to manufacture these special lock nuts to your specifications.

Note: Custom nuts, with Screw-LOCK Inserts, meet military specifications for lock nuts.

HELI-COIL CORPORATION

A Division of Topp Industries, Inc.

*Reg. U.S. Pat. Off.

HELI-COIL CORPORATION
209 Shelter Rock Lane, Danbury, Conn.

Gentlemen: Please send me further information on

- ☐ ***Heli-Coil*** Screw-THREAD Inserts.
- ☐ ***Heli-Coil*** Screw-LOCK Inserts.
- ☐ ***Heli-Coil*** Custom Lock Nuts.
- ☐ Have a ***Heli-Coil*** Thread Engineer call—without obligation.

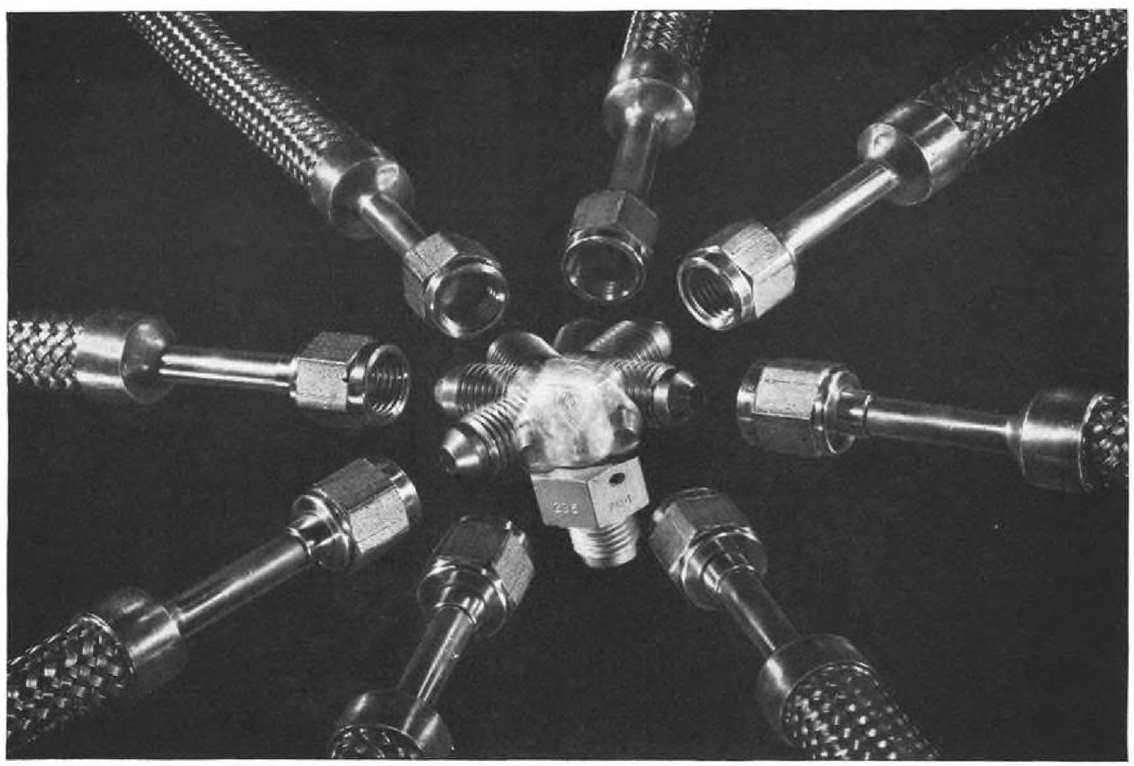
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New fittings speed installation of aircraft plumbing lines

Dunbar Kapple **SWIVEL FITTINGS** *can be adjusted a full 360°*

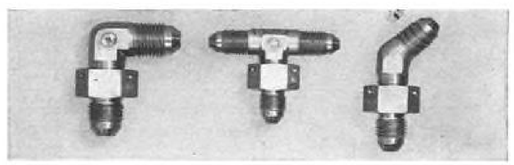
Here's a new idea in fittings that speeds installations of hydraulic, fuel, air, and refrigerant lines in aircraft. And it's often the only good answer for tight spots where ordinary fittings are difficult, if not impossible, to install correctly on rigid tube lines.

It's a new Dunbar Kapple line of swivel and alignment fittings that can rotate a full 360°.

SPEED HOOK-UPS — Fittings can be aligned *after* one end has been tightly fastened in a pressure line or assembly. This simplifies making tight connections in tight spots.

ELIMINATE TORQUE, LEAKAGE — Swivel fittings can rotate while under pressure without leaking. They automatically maintain alignment as piping expands or contracts and prevents leakage due to strained connections or mis-aligned piping.

FIT IN TIGHT SPOTS — Smaller envelope and swivel action permits wider choice in location of fittings.



SPECIFICATIONS—Swivel and alignment fittings conform to MIL-J-5513A requirements. Available in aluminum, stainless steel or aircraft carbon steel properly plated as individual units or attached to rigid piping or flexible hose assemblies.

Models for pressures to 3,000 psi, temperatures—100°F. to 600°F.

Sizes: 3/16" to 4" I.D.



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MAKERS OF SWIVEL FITTINGS, FLEXIBLE METAL DUCTING, FLEXIBLE METAL HOSE, AND RIGID METAL LINES FOR AIRCRAFT USE

have no previous experience and about the time they attain proficiency their enlistment is up and they leave for higher paying civilian jobs. This is an old story but the Army maintenance units are hurt more than average because they do not have as many upper grade enlisted rates available as the other services. Corporals and privates handle much of the work in Army units. Reenlistment rate among these skilled people is 20-30%.

Helicopter pilots leave the Army at much the same rate, further raising training needs and costs.

Command Policy

The injurious turnover rate among mechanics and pilots is carried over by basic Army policy into the higher ranks of technical officers who lead and are responsible for its multi-million dollar aviation programs.

Current Army procedure is to prepare every officer for major command. A man who reaches field grade rank is usually shifted every three years or so to a new type of assignment. Even though an officer has an advanced degree and experience in a particular field he is usually transferred to broaden his background.

It is therefore difficult for an officer to reach the technical competence of representatives he must deal with in industry.

British Money Cuts Delay VTOL Project

London—Government cuts have delayed development of the Short SC.1 VTOL project, Short Brothers and Harland Ltd. report.

All overtime work has been suspended and failure to procure two sets of Rolls-Royce engines has prevented use of two aircraft on simultaneous hover and forward-flight trials.

The company had previously hoped to demonstrate a free transition cycle at the SBAC display at Farnborough But, owing to the cuts, only the forward flight trials have been completed. Hovering trials will start soon.

The hovering gantry is basically similar to that used by Rolls-Royce in the development of the "flying test bed" on which the control system of the SC.1 was established.

Tethered trials will be followed by free vertical takeoff and finally by complete takeoff and conversion.

The gantry is in effect a portal frame 75 ft. wide with a clear ceiling of 45 ft. above the aircraft platform. The aircraft has three dimensional freedom, can be contained within limits by a cable system which also limits descent rate should the control system or thrust fail.

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MODEL 3115

- SMALL SIZE
- HIGH STABILITY



New, improved model designed for extreme environmental conditions (100g shock; 2000 cps vibration,—55 to +75°C). Subminiaturized and crystal-stabilized with telemetry band spurious output better than 60db below carrier.

Frequency Range: 215-235 mc
Frequency Stability: 0.01%
Power Output: 2 watts
Weight: 1.7 pounds

RF POWER AMPLIFIER

MODEL 3052

- RUGGED
- COMPACT
- RELIABLE



Provides 50 watts output from 2 watts input. Rugged construction and the use of a stacked ceramic tube makes this amplifier stable and reliable over a wide range of environmental conditions:

Temperature:	*—55° to +75°C*
Shock:	*100g*
Vibration:	*20g, 20-2000 cps*
Altitude:	*0-70,000 feet*

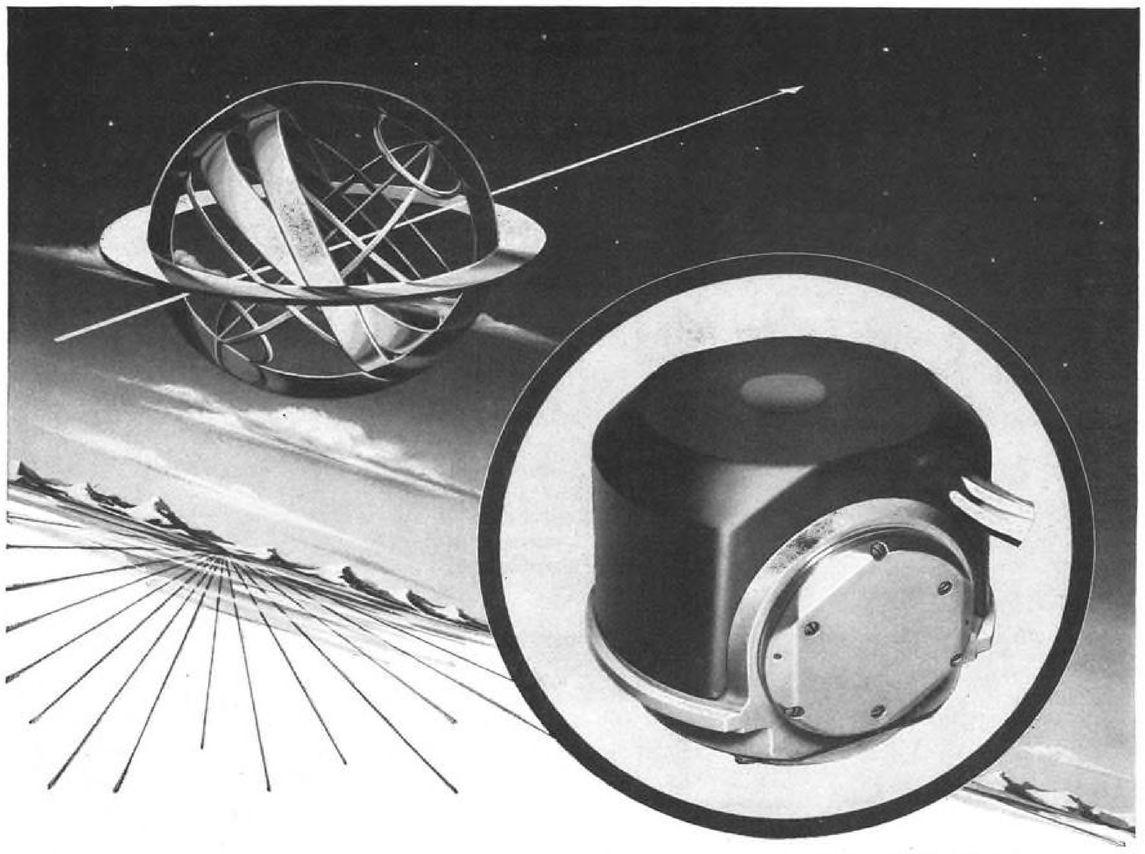
Write Box 37, Melbourne, Florida for complete data and prices.

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Model II B Accelerometer

INERTIAL GUIDANCE...

a Breakthrough by Bell Aircraft

The high precision, II B linear accelerometer, now in quantity production, is one of many examples of the recent dramatic progress of the *Avionics Division* of Bell Aircraft Corporation in the field of inertial instrumentation. With a range of ±25 g's and a frequency response of 0 to 350 cps, its performance is rated by leading authorities as exceeding all others now available.

As one comparatively small detail in Bell's overall inertial guidance program, the accelerometer is indicative of much broader more advanced accomplishments by Bell's team of instrumentation experts. This and their other successful developments ... the knowledge they have gained in over 20 years of work on inertial components ... are available to other missile and guidance system builders in advancing the frontiers of technological achievement. For information write: Sales Manager, *Avionics Division*, **BELL AIRCRAFT CORP., Post Office Box One, Buffalo 5, N.Y.**

BELL Aircraft CORP.

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BUFFALO, N.Y.

Revised Organization, Staff Cut Mark Changes in Defense R&E

Washington—Reorganization of the office of the Assistant Secretary of Defense for Research and Engineering will be completed in about a month with a staff reduction from 184 to 157. All but five of the 27 to be removed from the payroll already have left their desks.

The reorganization is not part of the Pentagon's current effort to find new budget economies. It is the result of the amalgamation of the old offices of the Assistant Secretary for Research and Development and the Assistant Secretary for Applications Engineering, which was ordered last March by Defense Secretary Charles E. Wilson.

Reorganization Table

New table of organization for Research and Engineering provides for two deputy assistant secretaries and an executive assistant. Also at the top level are offices to handle foreign programs, planning and review and services.

There are seven technical offices in a simplified setup that should ease the burden of contractors engaged in research and development work for the Defense Department. They will specialize in the fields of acronautics; atomic, biological and chemical warfare; electronics; fuels, materials and ordnance; guided missiles; maintenance engineering and sciences.

Providing overall advisory guidance and help to the Assistant Secretary will be the Defense Science Board, Research & Engineering Policy Council, Coordinating Committees, Advisory Panels and the Weapon Systems Evaluation Group.

It is expected that WSEG, which has been working almost exclusively for the Joint Chiefs of Staff, now will be asked to undertake specific evaluation tasks for the assistant secretary. In the past, there has been some criticism of WSEG, based on the charge that it was involved for the most part with paper studies that did not result in decisive action.

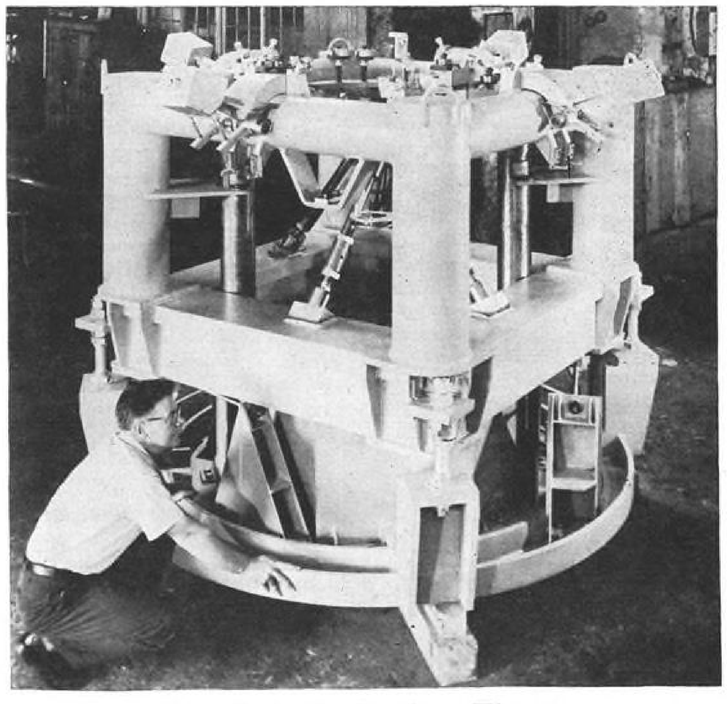
Under the new organization the office of planning will recommend problems for WSEG study.

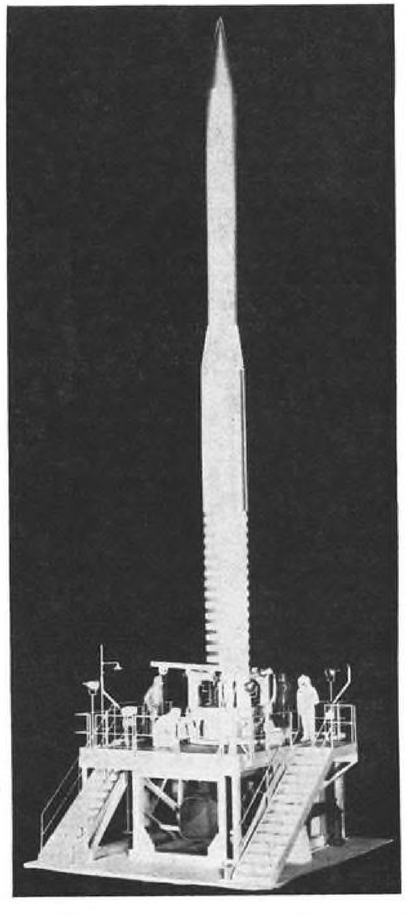
Decision to give responsibility for research and engineering to a single assistant secretary was made following resignation of Dr. Clifford C. Furnas as Assistant Secretary for Research and Development. The action was taken by Secretary Wilson in spite of advice from Dr. Furnas that the R & D function should not be combined with Applications Engineering.

Newbury Appointment

First effect of the order to combine the offices was to give top executive authority to Frank D. Newbury, then Assistant Secretary for Applications Engineering.

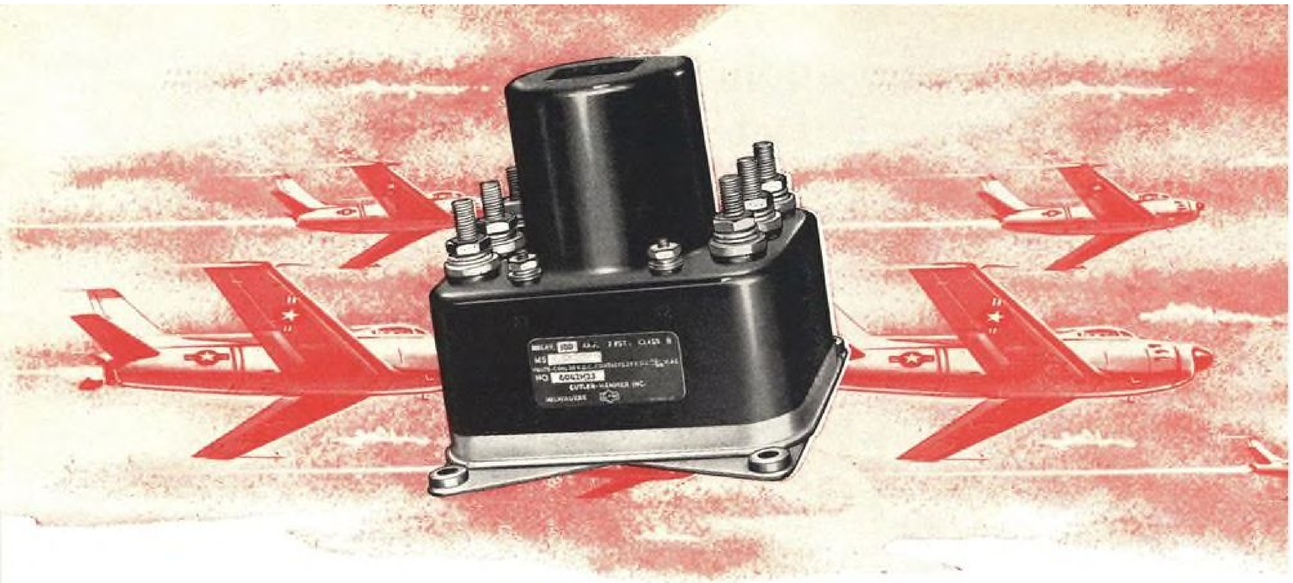
Newbury had the new combined job only about six weeks. Getting it amounted to victory for him in a four-year running fight to control the research program but he met a quick nemesis in a clash with the Defense





Stand Tests Rocket Thrust

Weighing and thrust measuring stand for the Vanguard rocket is shown assembled prior to shipment to Patrick Air Force Base. The stand, a product of the Baldwin-Lima-Hamilton Corp., measures missile weight and thrust to an accuracy of 1/10 of 1% (AW Apr. 8, p. 50). Measuring stand also supports the rocket under wind loads. Its location on top of the launching platform is shown in the model (right). The stand was designed to withstand numerous full scale rocket motor tests as well as the launching of all of the Vanguards.



Cutler-Hammer Hermetically Sealed Relays Set the Pace for the Jet Age in Aircraft Control Design and Performance

As man travels faster and faster, the importance of dependable control becomes greater and greater. The advances in rocketry point clearly to the rapidly shrinking tolerances permissible as speed rises. Inconsequential variables in control performance under the flight speeds of yesterday become intolerable errors in the jet age!

Working with the leading builders of aircraft for nearly 40 years on their increasing needs in specialized electrical control, Cutler-Hammer design and development have steadily anticipated *future* control requirements. The line of Cutler-Hammer Hermetically Sealed Relays is a good example of such leadership.

Cutler-Hammer Hermetically Sealed Relays not only were designed to meet the high standards of Mil-R-6106; but also repeated tests prove they exceed many of the requirements with a wide margin of safety. Their performance under the most adverse test conditions has resulted in their adoption as the standard for "special use" by leading aircraft builders. And this *family* of Cutler-Hammer Hermetically Sealed Relays is not a mere dream for tomorrow; it has been in mass production for more than three years!

Cutler-Hammer Hermetically Sealed Relays, designed for either 28 volts D-c or 115/200 volts A-c, are available in a wide range of types and capacities. Be sure you have the latest data. Write *now* on your company letterhead for Pub. EE-140. CUTLER-HAMMER, Inc., 1471 St. Paul Avenue, Milwaukee 1, Wisconsin.



50 amp. single pole, single throw Class A power relay.



100 amp. three pole, single throw Class B power relay.



200 amp. single pole, single throw Class B power relay with N.O. and N.C. auxiliary contacts.



25 amp. three pole, single throw Class B power relay with N.O. and N.C. auxiliary contacts.



50/25 amp. single pole, double throw Class B power relay.



25 amp. three pole, double throw reversing duty Class B power relay.

Cutler-Hammer Power Relays Finest in Flight

Cutler-Hammer Hermetically Sealed Relays are designed to meet Spec. Mil-R-6106. Operate at 80,000 feet. Class A can operate in ambient temperatures to 71°C; Class B in ambient temperatures to 120°. Class B are available with or without auxiliary contacts.

CUTLER-HAMMER
AIRCRAFT CONTROL
C-H

Science Board (AW Apr. 15 p. 26; Apr. 29, p. 27).

The post has been vacant since Newbury's departure. Dr. Paul D. Foote, former executive vice president of Gulf Research and Development Co., has been nominated to succeed him, but congressional approval of the choice is not expected until the next session. Meanwhile, Deputy Assistant Secretary John B. Macauley is acting as head of the staff.

Algae Hazard Found Facing Space Travel

Ordinary flowers and vegetables can be poisonous, according to Air Force scientists, and space travelers could be menaced by their own food and air supply. It has recently been determined that the normal photosynthesis process can be disrupted so that the damaged plants produce carbon monoxide instead of oxygen. Dead plants also contain carbon monoxide.

This discovery has created the need for more study of one of the techniques for keeping crews alive for weeks or months in a space ship. This is to grow algae in the ship to replace the carbon dioxide given off by the flyers by oxygen.

Dr. Syrrel S. Wilks, of the Air Force School of Medicine, was the physiologist who tracked down this information.

His interest was aroused during the investigation of a fatal flight accident. Pieces of muscle tissue from the pilot's body were sent to him to see whether some abnormal condition might disclose the cause of the accident.

The tissue showed a high concentration of carbon monoxide and some embedded vegetation. Carbon monoxide was not present in the tissue without vegetation and this discrepancy caused Dr. Wilks to begin his study.

Company Formed to Study High, Low Temperatures

Plans for research and development in areas where environments of high or low temperature necessitate an unorthodox approach have been made by Zahorski Engineering, Inc., newly formed research and development firm at Santa Barbara, Calif. Emphasis will be on work in structures, electronics and mechanics.

Company indicates it is developing new type structure for fuselages adapted to operation at elevated temperature surroundings and which show considerable weight saving compared to conventional designs.

President and chief engineer of the company is Dr. Adam Zahorski, formerly with Aerophysics Development Corp.



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Photographs of an entire state in a couple of minutes ... Chance Vought's F8U-1P Crusader, which recently set a new coast-to-coast speed record, literally photographs the earth at 100,000 feet a minute...better than 1000 miles an hour!

Sharing the honors for this remarkable, record-breaking performance are many of America's manufacturers of aircraft parts and accessories who supplied Chance Vought with vital components to build this "supersonic eye." Camloc is proud to be numbered among them, as the supplier of quick-operating, sure-holding fastening devices.

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Vickers Flow Sensitive Pressure Regulator permits ram air turbine to generate needed hydraulic flow down to minimum airspeed by regulating the pressure to that which the turbine can produce.

Vickers Thermal Operated Relief Valves protect the primary and secondary hydraulic systems from overheating by automatically depressurizing the circuit at a preset temperature.

Vickers 3000 psi Variable Displacement Piston Type Pumps supply power to the primary and secondary hydraulic systems on the Convair F-102A Interceptor.

Vickers 3000 psi Constant Displacement Piston Type Pump operated by ram air turbine supplies both emergency hydraulic and electric power through the constant speed motor driven alternator in event of engine failure.

Vickers Constant Speed Hydraulic Motor drives the emergency alternator from either the ram air turbine or the secondary hydraulic system.

The Convair F-102A all-weather supersonic stratospheric interceptor depends on Vickers Hydraulics for the following important functions:

- Primary and secondary hydraulic systems
- Ram turbine operated emergency hydraulic system
- Emergency electrical system

The components shown here were selected by Convair for their outstanding dependability and the additional advantages they offer in superior performance. Their technological advancement keeps pace with aircraft development. The pumps are characterized by minimum heat rejection and highest overall efficiency . . . all units shown have small size and light weight. For further information, ask nearest office listed below for Bulletins A-5200-D and A-5209.

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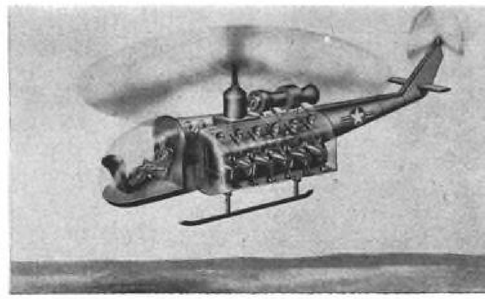
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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921







CONCEPT of an unmanned drone helicopter lifting Honest John rocket (left). Bell H-40 (right) could be troop transport, flying crane.

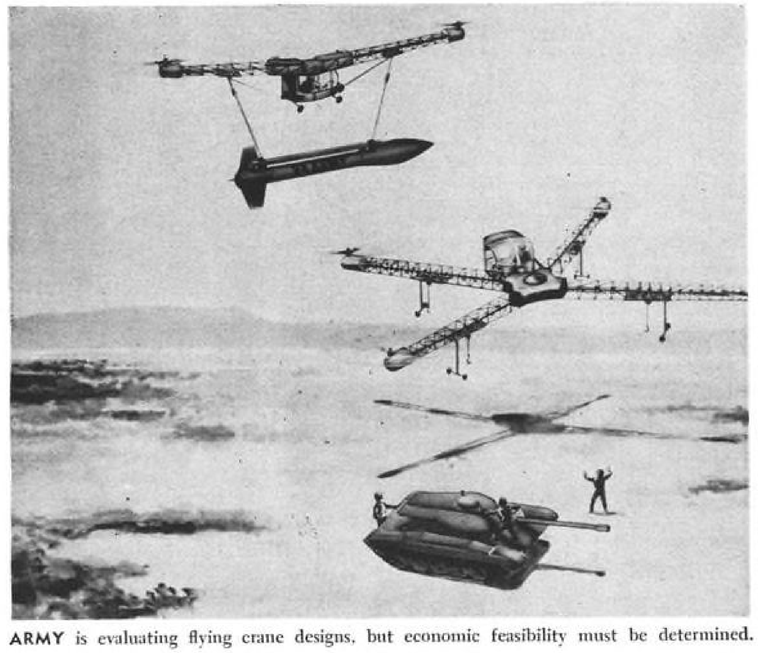
Army Seeks Equipment for Nuclear Era

Ft. Rucker, Ala.—U. S. Army is making new appeals to the aircraft industry in hopes of stimulating interest in voluntary development of equipment to meet the demands of Army Aviation in the decade 1960-1970.

Army pressure to meet the demands of nuclear warfare has resulted in new emphasis on surveillance and mobility, with recognition of five factors, all relatively new in the establishment of Army Aviation requirements:

- **Distances and areas** over which the Army must operate will be considerably larger because of the atomic threat.
- **Landing areas** will be unprepared and hastily selected.
- **Anti-aircraft measures** will be lethal against aircraft within radar line of sight.
- **Effective and sometimes** deep observation will be vital for accurate employment of missiles and atomic weapons.
- **Logistical support** will meet frequent and unpredictable interruptions.

By 1962, Army hopes to replace all its present aircraft with new designs that will meet the nuclear challenge. There are basic capabilities that must



ARMY is evaluating flying crane designs, but economic feasibility must be determined.



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40,000
Servo Valves

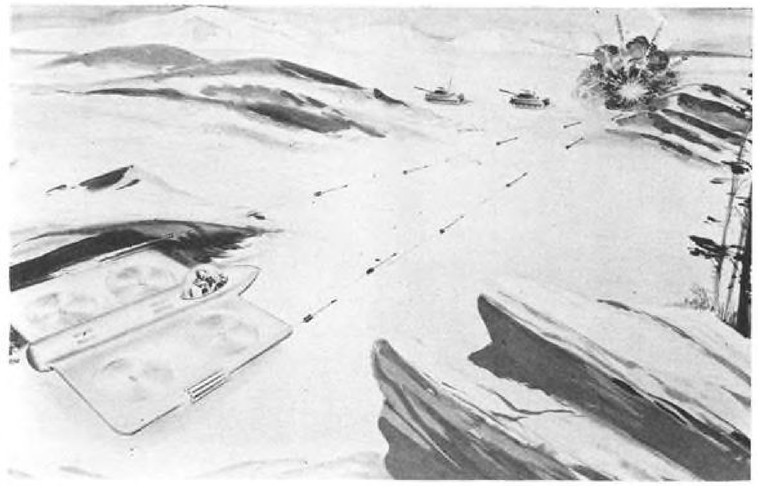
Over 40,000 Moog electro-hydraulic mechanisms . . . comprising more than 700 specific models . . . have been produced. Each model has been designed to definitive specifications by Moog's highly creative engineering staff. This quantity affirms the high quality, reliability and efficient volume production through which Moog Servo Valves have achieved industry leadership. For competent assistance in solving your hydraulic servo problems, call on Moog's experienced design engineering team.

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Research Laboratory, Paramus, New Jersey



AERIAL assault vehicle, a sort of aerial tank, is next step anticipated after perfection of aerial Jeep. Armed with rockets, it would provide punch for cavalry unit.

be included and all of which will require development of new approaches by the industry.

These include STOL and VTOL capabilities, operation from unprepared fields, low maintenance costs and all-weather operation.

Work already is proceeding on some of these problems through the development of new concepts. An example is the possible use of drone helicopters capable of providing an unmanned aerial conveyor belt. It could be used to move supplies to isolated ground units, flying over ground obstacles or an area that is "hot" with radioactivity.

Development also is under way on a "Flying Crane." The external load will run up to 12 tons; the range from 25 to 50 miles.

Fixed Wing vs. Helicopter

Army's attitude toward the helicopter continues to include a good many reservations that lead to the assumption that high-performance fixed-wing aircraft will replace the helicopter on many missions.

Rotary-wings will remain only for those specialized jobs that cannot be done by STOL and VTOL aircraft. This does not close the door on the enthusiasm for helicopters and the Army's ambition to see them improved.

It is reasonably certain that large helicopters will have no place in the Army of the future, and interest is centered on larger numbers of small rotary-wing aircraft. Improvements still are needed in stability, speed and simplicity. They must be easier to fly and maintain.

Recent award of test bed contracts for the aerial Jeep may be the first step toward further refinements of this concept. One possibility is an aerial



MULTIWING test bed, proposed by Beech Aircraft, is undergoing wind tunnel test.

assault vehicle, a sort of flying tank that would carry heavy armor and be capable of hitting enemy bunkers or tanks with high-velocity rockets.

In the field of fixed-wing aircraft, Army anticipates a requirement for a replacement for the Beech L-23 and de Havilland L-20. So far, there have been no proposals along this line and none are expected until there is some advancement in the state of the art. Nevertheless, development on a new utility-command aircraft may be started by 1959.

Aerodynamic Training Offered By NATO

Second opportunity is now available to obtain an extensive training in experimental aerodynamics in an international atmosphere under NATO sponsorship. Applications for the second class of the Training Center for Experimental Aerodynamics at Rhode-Saint-Genese, Belgium, beginning October 1, 1957, are now being accepted.

Course of study includes incompressible and compressible flow and covers a period of 180 days. About 75% of the time is devoted to experimental



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.

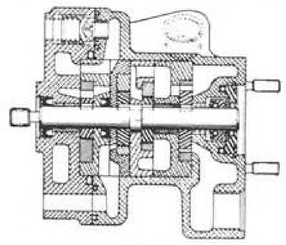


Fig. 2

• **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).

• **Technical information** plus complete custom engineering and precision manufacturing facilities are available to help you obtain the *right* pump to meet your performance specifications, operational requirements, envelope configuration and optimum plumbing. Your inquiry is invited.

W. H. NICHOLS CO.
48 Woerd Ave., Waltham 54, Mass.

work with each student receiving a project that affords an opportunity to design, develop, and operate some type of experimental aerodynamic equipment. The purpose of this educational plan is to give each student the chance to develop scientific leadership through organizing and directing experimental work.

Staff of five professors and five technical engineers operates the center. Their efforts are augmented with lectures and demonstrations by scientists of international repute. All lectures are presented in French and English.

The center was started at the suggestion of Dr. Theodore von Karman of AGARD and is maintained by the governments of Belgium and the United States.

There is no tuition fee and a limited number of scholarships are available for students who would not otherwise be able to cover their subsistence expenses.

Application forms and more detailed information may be obtained by writing to Dr. R. P. Harrington, Technical Director; Training Center for Experimental Aerodynamics; 72, Chaussee de Waterloo; Rhode-Saint-Genese, Belgium.

Mag-Thorium Is Used In B-58's Structure

Progress in research on machining of magnesium-thorium at Convair-Fort Worth is leading to wider use of this lightweight, heat-resistant alloy and has already permitted its use in parts of the B-58 Hustler.

W. R. King, Jr., of Convair's manufacturing research and development, said progress has been made which may change future metal forming methods.

This metal, which is one-third lighter than aluminum, more rigid and much more heat resistant, has been slow to find uses because of machining difficulties. When it was bent, it tore or broke; with improper heating, it warped.

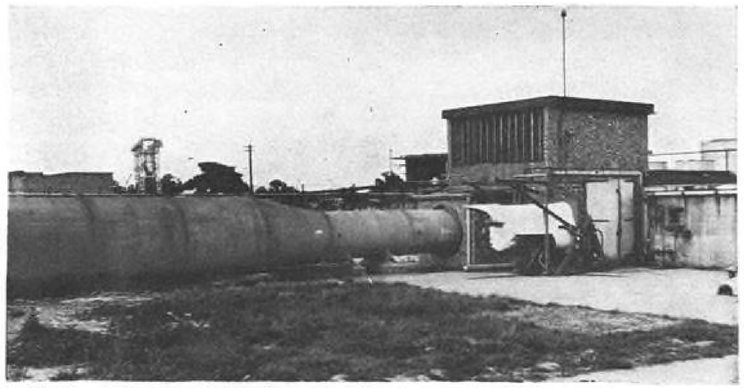
Convair experiments under King led to development of a system in which dies and material are heated to 700 F in an oven beside a press, then quickly formed while they are hot.

"We now have established that we can produce straight-line bends," King said. "Several detail parts have been produced satisfactorily.

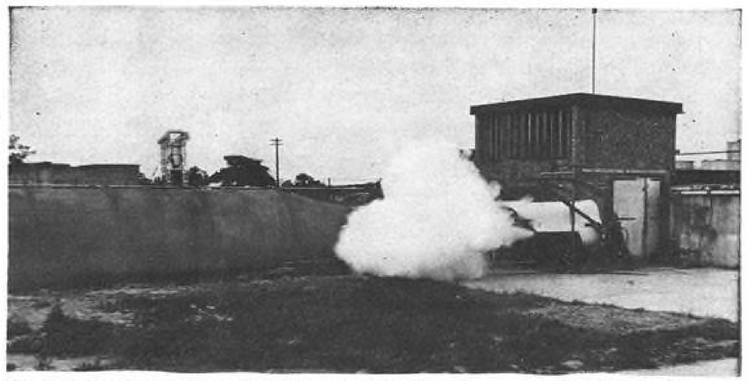
"We also have learned how to form the alloy to comparatively critical angles and shapes."

Noting that "hot forming" is difficult, King predicted that new alloys soon will demand machines with "built in" heat to "press" metals into shape. Mag-thorium alloy is slightly radioactive, and health physics crews at Convair continuously monitor the metals to insure they do not endanger health.

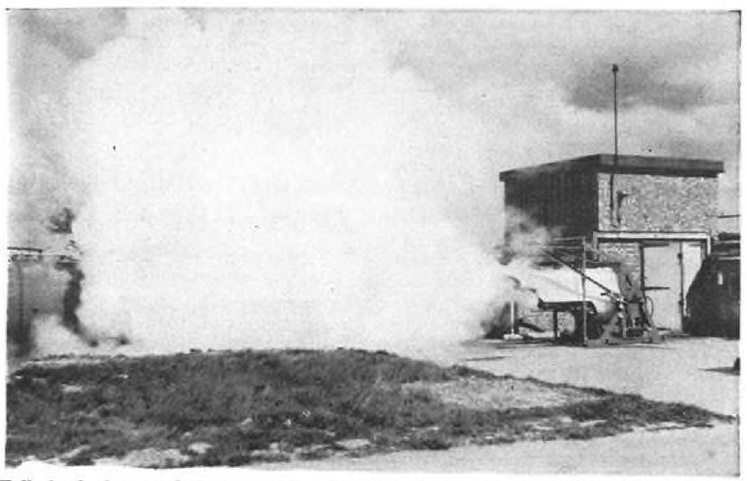
Spectre Fired for Test on Mockup of SR.53 Rocket-Jet Fighter



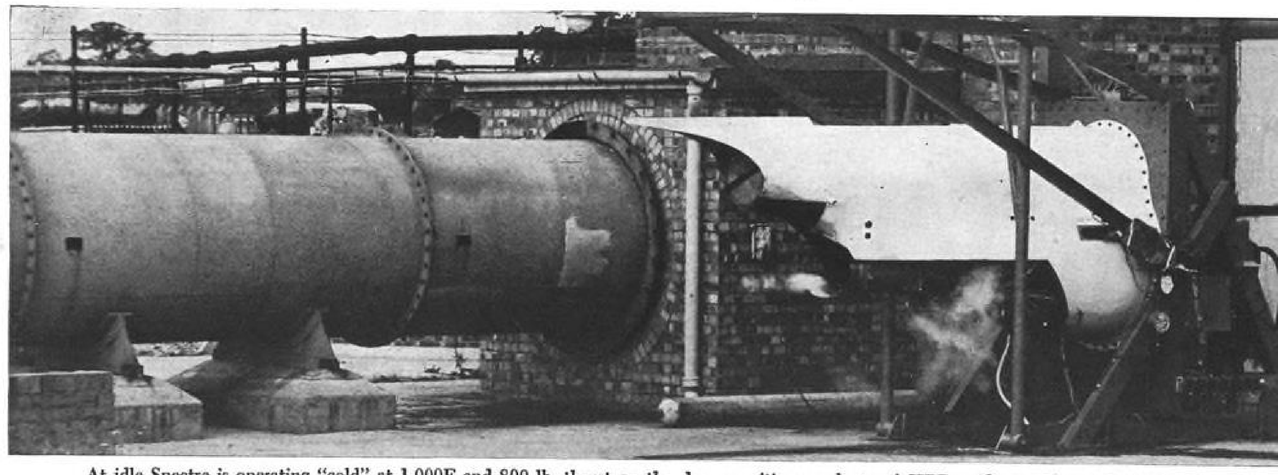
De Havilland Spectre rocket engine puffs white steam as it is fired on static test in mockup of aft section of the SR.53 interceptor. Turbojet to be installed above the Spectre will be an Armstrong Siddeley Viper.



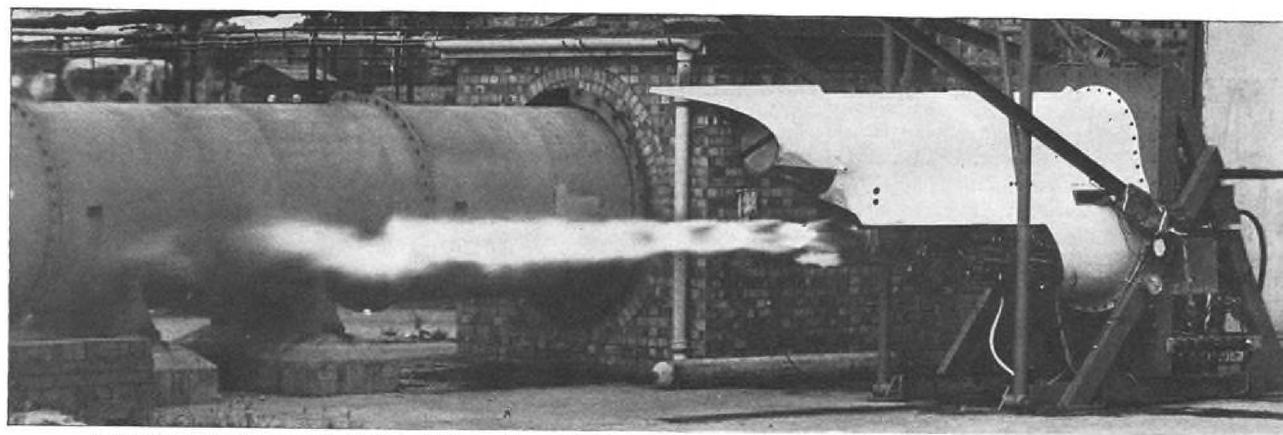
Cloud of superheated steam from decomposition of oxidant grows. The high test peroxide (HTP) oxidant works as a monopropellant in this phase to drive the pumps and provide modest thrust.



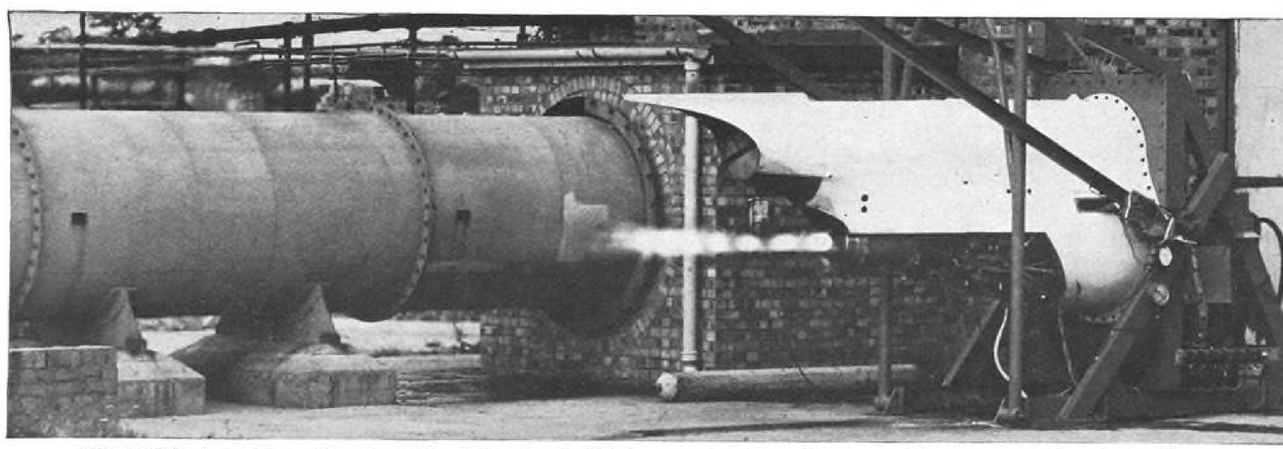
Full cloud of steam during start. The airframe test installation appears to be located outdoors alongside the exhaust pipe of a rocket or small jet engine test cell.



At idle Spectre is operating "cold" at 1,000F and 800 lb. thrust on the decomposition products of HTP oxidizer. Clear exhaust is due to silver catalyst.



At full thrust the Spectre adds jet fuel which combines with the oxygen released by the HTP and boosts the combustion temperatures to 4,000F and the thrust to 8,000 lb.



Throttled back to intermediate thrust, Spectre's exhaust still shows typical diamond patterns of hot supersonic flow slowing down.

NEW CONTINUOUS HIGHLY SELECTIVE, FIRE DETECTOR RELIABLE, ACCURATE

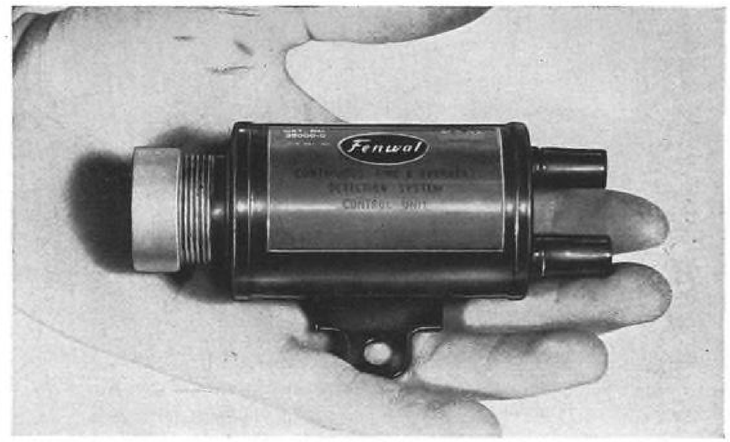
Light, Simple System Overcomes False Alarming

ASHLAND, MASS. — Tubes, transistors, relays, and moving parts will give no trouble in Fenwal's new Continuous Over-Heat and Fire Detector, because the Detector uses none of these. The bugs are not only out of it — they never were in it.

This radical improvement in continuous detection is a small, flexible, seamless tube filled with an inorganic compound, with a nickel wire at its center, and a control unit that receives and amplifies electrical changes anywhere in the tube. Excessive heat anywhere along the tube lowers the resistance of the tube, and promptly triggers an alarm.

The Detector can be called a radical improvement for a number of reasons, but the basic reason is this: *the salt filler used by Fenwal gives such startlingly sharp drops in resistance with rising temperatures that the length of the loop hardly matters.* The temperature responses of a one-foot length and a twenty-foot length of the Detector tube are actually within 10° F of each other!

In short — the bugbear of almost all previous continuous fire detectors, so-called *averaging*, has been licked. With that bugbear licked, look at all the things Fenwal's new system can mean to aircraft safety!



CONTROL UNIT — Contains no components subject to wear or breakdown. Not bothered by shock and vibration. Not position sensitive. Hermetically-sealed. Weighs only 9 ozs.

No longer do alarm systems have to be set to trigger at dangerously high temperatures in order to minimize false alarming. Set to give the alarm at realistically low temperatures, the Fenwal system will not false alarm, and will give a true alarm instantly — giving precious seconds for remedial action.

Wide-spread fire or over-heat conditions and localized hot spots trigger alarms at virtually identical temperatures.

Aircraft can now have continuous fire and over-heat detection that is, in effect, a network of unit detectors, monitoring a widely varying series of temperature situations. Lengths of sensing tube, each set to trigger the alarm at a different temperature, can be joined in a single loop, without one segment's affecting the performance of any other segment.

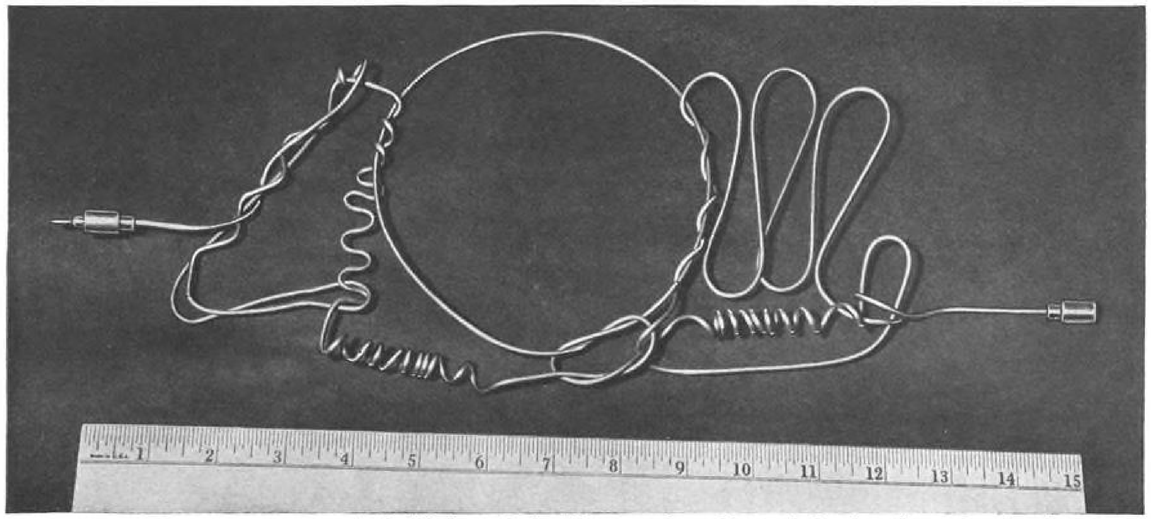
Fenwal has developed and tested exhaustively a large family of detectors for service over a range from 350° F to 2000° F.

The reliability and durability is due, in large measure, to the novel design of the control unit. The unit, small enough to fit in the palm of a hand, is a hermetically-sealed magnetic amplifier which, when the alarm temperature is reached, amplifies the changes occurring in the detector loop and actuates alarms. It is light, tough, and not in the least position sensitive.

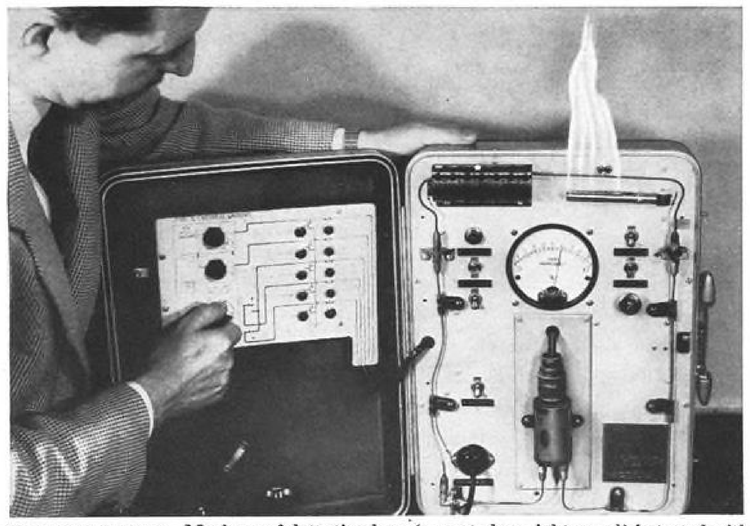
Write for full details to **Fenwal Incorporated, Aviation Products Division, 131 Pleasant Street, Ashland, Massachusetts.**

Fenwal

Controls Temperature
. . . *Precisely*



SELECTIVE, ACCURATE DETECTOR — So flexible it can be bent into any shape. Extremely low impedance virtually eliminates continuous-fire-detection bugbear of false alarming.



EXHAUSTIVE TESTS—Mock-up of detection loop (mounted on right panel) is tested with flame, demonstrates conclusively that it triggers alarm at same temperature despite variable ambient temperatures along loop and regardless of the length of loop exposed.



TACAN unit shown with covers removed; plane is a composite model.

tube
78-~~page~~ road map for jets

An 800-foot carrier may be as hard to find as a needle in a haystack, when the plane seeking it is at 20,000 feet and the time is 0200 hours.

To make the homing plane a homing pigeon, we build the "ARN-21" TACAN equipment illustrated above. Its 78 tubes and associated components add up to a self-contained transmitter and receiver, rugged in its ride-resistance and accurate to pin-point tolerances.

The manufacture of equipment as important and complicated as this demands *perfection*, and nothing less. On the military as well as the home front, Stromberg-Carlson has long displayed the ability to take such problems in stride.

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General Offices and Factories at Rochester, N. Y.—West Coast plants at San Diego and Los Angeles, Calif.
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Temco Orients To System Management

By Craig Lewis

Dallas—Temco Aircraft Corp. has reorganized its engineering department along weapon system management lines in an effort to make the company a stronger contender in the increasingly competitive battle for military business.

To an engineering department organized along functional lines, Temco has added a program management group. This move produces an integrated organization designed to bring a project through engineering from initial concept to production readiness under a single manager system.

Latest move in the organization of engineering operations under the system management concept was the appointment this month of Brig. Gen. Robert E. Galer, USMC (Ret.) as Manager of Engineering Programs. This makes Galer, who was director of the Guided Missiles Division of Navy's Bureau of Aeronautics, program overseer in Temco's engineering efforts to produce new weapons tailored to future military needs.

Six Basic Groups

This new management section is one of six basic groups in Temco's new engineering setup. All of these sections are functional groupings in which similar skills are gathered to do a specific type of job on any project that Temco enters. This is the reverse of the practice of grouping by project in which each project is assigned its own aerodynamicists, structures experts, electronics engineers and other experts.

Under the new Temco concept, the engineering department is split into six groups—research, development engineering, product engineering, engineering programs, experimental engineering and engineering administration.

Each of these groups performs its specific job on a Temco project as it moves through the engineering process from a design proposal to a finished design that is ready to go to the production line. Each project is guided through the various engineering functions by its program director, making the program director a sort of intramural prime contractor who parcels out engineering subcontracts on a project to the appropriate sections of the department.

Reorganization of Temco's engineering establishment along functional lines can be traced to two basic factors:

• **Character of the** engineering pattern has changed from a research and development effort to one of building and demonstrating reliable weapon systems.

• **Temco's corporate** structure was reorganized along functional lines earlier this year, and the new engineering setup follows the company pattern.

The new organization is chiefly a symptom of Temco's changing role in the aircraft industry. Where once the company was strictly a subcontractor, now Temco has three prime contracts of its own. The new systems management approach is designed to do a good development and design job on the three prime contracts now in the shop, and to make Temco a stronger contender for future prime contracts.

Changed Organization

Vice President for Engineering I. Nevin Palley points out that the kind of organization needed to obtain contracts isn't necessarily the best type to manage the programs once the military signs up for them. Now that Temco has some proprietary projects, Palley says, the job is to compete and "we have found the organization that really fits the problem."

Temco currently has a limited production contract from the Navy for 14 TT-1 primary trainers. The company also has a contract to develop the XKDT-1 target drone and an air-to-surface missile called Corvus that is being developed for the Navy.

The new engineering organization is also a good indication of Temco's thinking concerning the future form of the aircraft industry. It is designed to establish and maintain Temco's segment of the expanding missile market.

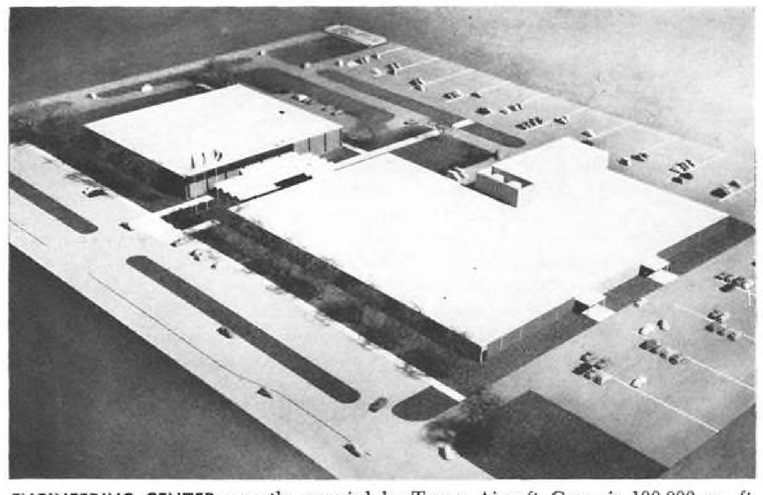
Most of Temco's income right now comes from aircraft subcontracting and from military aircraft modification work. The company figures it can maintain its present share of the aircraft market, but the aircraft share of the total military procurement dollar will be dwindling over the next five years. Money for modification doesn't come from procurement funds, and Temco feels this business will continue at about the same level.

With this major income item—aircraft subcontracting—bound to decline, Temco's future growth lies in maintaining its share in the rapidly growing missile market. And the company will depend heavily on its new engineering concepts to keep it competitive in this market.

Subcontracting

Temco feels that as it develops as a prime contractor, it will be mainly in the systems business—putting together subsystems in the most intelligent and economical manner. Thus, the company expects to be doing a lot of subcontracting in the future. This expectation is the reverse of theories currently popular in the aircraft industry that subcontracting will be declining as prime contractors tend to keep more of their work under their own roofs.

Temco's ideas about the future shape of the aircraft industry also run counter to widely held opinions that the industry will be contracting as it shifts to the more expensive, more complex missile production. The company's investigations indicate that the square area of plant space and the number of workers



ENGINEERING CENTER recently occupied by Temco Aircraft Corp. is 100,000 sq. ft. building depicted at right above in model of company's new Garland, Tex. facility. Office building is at left.



Convair's B-58 Hustler—the Air Force's first supersonic bomber

Bring your tough ones to Zenith

The supersonic speed and high-altitude operation of the Convair B-58 brought us new problems in thermodynamics and aerodynamics. The radomes for the B-58—made of resin-bonded glass-fiber—had to withstand new extremes of heat and stress. They also had to meet the special electrical requirements of this delta-wing bomber.

We solved the three-in-one problem by developing a new type of multi-wall construction, combining both laminate and sandwich structures. To anticipate the increasing speeds and altitudes of jet aircraft and missiles, we have expanded our research program on high-temperature materials, especially silicones and ceramics.

Here at Zenith we welcome problems that are beyond the industry's present technology. They're the kind we grow on. We've learned to form resin-bonded glass fiber in almost any shape and size and to produce it by modern production-line methods. In most cases, this modern material enables us to simplify the design and tooling that would be required for equivalent metal parts.

Zenith's reinforced plastics are the *only* answer for some structural components—and a better answer for many. We invite you to "bring your tough ones to Zenith."

World's Largest plant producing reinforced plastics components for the U. S. Air Force, U. S. Army, and U. S. Navy. Applications include Aircraft and Missile Radomes • Helicopter and Missile Fuselage Sections • Aircraft and Missile Wings • Fairings • Fuel Tanks • Fire Bombs • Rescue Containers • Bomb Casings and Fins • Rocket Launcher Pods • Antenna Reflectors • Arctic Shelters • Boats • Minesweepers • Landing Craft • Small Sailing and Power Craft • Naval Craft Components • Buoys and Floats • Ducting • Ground Rigid Radomes • Land and Aerial Mine Housings • Shipping Containers • Storage Tanks

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3M

FORM OF THE FUTURE: RESIN-BONDED GLASS FIBER



New Nose for Tiger

Operational Grumman F11F-1 Tiger has latest nose configuration and current air group markings on the empennage. The new radome replaces the air refueling boom formerly located in the nose of the Navy fighter. The aerodynamic shape of the nose has also been changed by the increased length. Note, also, the expended ammunition chute projecting from the air duct just aft of the guns. The flat-bottomed exhaust outlet is now standard on all Tigers. This airplane, based at Moffett Naval Air Station, Calif., is flown by Attack Squadron 198.

used per dollar sales is roughly the same in the electronics and the aircraft industries.

That would indicate that as long as military procurement remains at the same level, the industry will need about the same work force and plant space to handle the business as the concentration on missiles increases.

Industry Changes

Temco feels the changes will come in the nature of the aircraft industry, rather than in its size. With fewer, more expensive weapons being built, some companies will have to work as subcontractors on the projects of other companies, according to Temco. There may be an industrial consolidation of various functional skills for more economical subcontracting.

Temco began organizing an engineering department in the weapon system management style in 1954 when the company launched its effort to become a prime contractor. From an engineering staff of about 350 in 1954, the department has grown to its present strength of nearly 1,200.

While engineering has been developing along these lines since 1954, Temco really began concentrating on planning a new organization nearly a year ago. The new program concept is the result.

Big difference in the new department is Galer's Engineering Programs Section. Galer is in charge of the people who directly manage the various project managements. The approach is flexible, and the program management is set up to fit the magnitude and complexity of the program.

For instance, the TT-1 and XKDT-1 programs are in charge of project engineers under Galer's supervision. The missile program, on the other hand, is much more complex and involves a great deal of subcontracting, so it has a program manager.

Under the missile program manager are project engineers for various phases of the program, such as airframe design, support equipment, launchers, etc. Future Temco programs will be assigned to either a project engineer or a program manager, depending on their magnitude and complexity.

Actually, a project can move around in the new engineering organization without the management of Galer's section. This occurs when the project is just starting out in either the research or development engineering section.

Temco's research organization is involved in operations research, market research and development planning. The group applies the "mixed team approach" to complex systems problems, using scientific, technical and economic skills maintained in research to support this type of effort.

Design Proposals

Also working in the field of developing concepts and proposals for Temco's markets is the Development Engineering section. When an idea is developed by one or both of these sections into a definite concept, a design proposal is prepared. The vice president for engineering and the corporate officers decide whether to offer such a proposal to the military services. If the proposal is offered, and it results in a development

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Radiation studies



A Barnes OptiTherm Radiometer is essential for precise, quantitative infrared radiation studies of military targets or backgrounds. These instruments are so rugged and stable that they have been successfully used in airborne as well as field studies. Barnes equipment was the overwhelming choice of a majority of the participating groups in the pioneering ARDC Infrared Measuring Program.

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Are you on the mailing list for TECHNIQUES? This publication, devoted to developments in infrared detection, will be sent on request.



Power for the world's mightiest weapons:

ATLAS • THOR • JUPITER • REDSTONE

These are the names of the great new missiles of America—defense systems of unprecedented speed and striking power. To feed their monstrous thirst for power, a new kind of engine had to be created—an engine with enough propulsive thrust to drive tons of projectile in a colossal arc upward from the earth's surface to the bounds of atmosphere, and on through space itself at thousands of miles per hour.

The answer was the large, liquid propellant rocket engine. Only a few years ago ROCKETDYNE, directed by the Air Force, set out on a program to design and build these high-thrust propulsion systems—a job that meant starting from scratch, and writing the book as they went along.

Today, ROCKETDYNE can report that the power for these revolutionary new weapons is ready. Engines for the Armed Services' high priority missile programs are being built in quantity at two ROCKETDYNE plants—Canoga Park, Calif., and Neosho, Mo.

The possession of such weapons is of crucial importance to America. Free men everywhere are entitled to know that the power for our major missiles is being delivered—on schedule.

BUILDERS OF POWER FOR OUTER SPACE

ROCKETDYNE

CANOGA PARK, CALIF. & NEOSHO, MO. • A DIVISION OF NORTH AMERICAN AVIATION, INC.

contract, it comes back to engineering where a program manager is appointed to guide it through design and development and to coordinate outside subcontract work with Temco's engineering efforts.

In development engineering are grouped the skills used in defining the technical concept of a project. The section is divided into configurations, analysis, avionics and engineering flight test groups. Promotion of avionics to top level status is a good indication of Temco's increasing orientation toward missile work.

Engineering flight test is included in this group because it is essentially a quality control group, a service organization to development engineering.

An important factor in this early stage is the new reliability organization setup in the Engineering Programs section. This group has been formalized to work reliability into designs from their beginning. Palley points out that reliability can't be tested into a product after it has been developed, so Temco is going to work with reliability predictions and standards right from the start.

Design Analysis

When the technical concept of a program has been worked out in development engineering, the program moves to the Product Engineering section where it is translated into a specific design that can be built. In this phase, the design is analyzed for economy and produceability.

Product engineering includes design and production engineering groups. It also includes a modification engineering group which is involved with Temco's military aircraft modification contracts and is located at the Greenville, Tex. modification facility.

Next step is Experimental Engineering section which contains the basic laboratories for after-the-fact testing. Experimental fabrication is also done in this section with the building of models, mockups and prototypes.

With engineering management system, a project is designed and built



Regulus Inlet

Regulus II engine inlet is the 150 lb. thin-wall magnesium casting shown here. Thickness of walls and webs is nominally 0.24 inch and the solid leading edge tapers to a 0.015 inch cast radius. It is complete with a bleed and auxiliary ducts for fuselage boundary layer air which is eventually dumped under the wing. It is made for Chance-Vought by R. H. Osbrink Co. of Los Angeles.







30-channel, analog-digital converter connecting 300-amplifier analog computer to 1103A digital computer



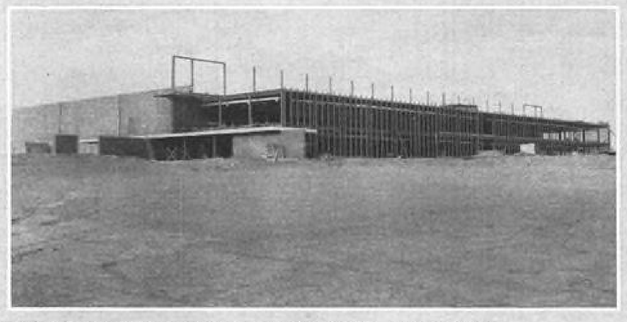
Production of communications equipment in new Los Angeles manufacturing plant



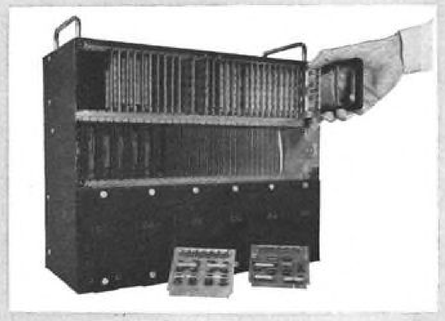
Data Reduction Center designed and built by Ramo-Wooldridge



One of three new research and development buildings completed this year



First unit of Denver manufacturing plant now nearing completion



Input-output unit of the Ramo-Wooldridge RW-30 airborne digital computer

Pictorial **PROGRESS REPORT**

The photographs above illustrate some of the recent developments at Ramo-Wooldridge, both in facilities and in products. Work is in progress on a wide variety of projects, and positions are available for scientists and engineers in the following fields of current activity:

Communications and Navigation Systems
Digital Computers and Control Systems
Airborne Electronic and Control Systems
Electronic Instrumentation and Test Equipment
Guided Missile Research and Development
Automation and Data Processing
Basic Electronic and Aeronautical Research

The Ramo-Wooldridge Corporation

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entirely within the engineering department as long as it is in the design and test stage. Basic skills and methods are developed in engineering and fed out to the production organization when the project is ready for production. Thus, engineering is a pilot plant for a new product.

On the policy level, Palley has the assistance of a new engineering policy committee composed of the heads of the six sections in the department. This group helps Palley with both planning and administrative problems.

Temco's engineering department began moving last month into a new, modern facility in Garland, north of Dallas. The new facility, which will be joined to Temco's new administrative offices, provides 100,000 sq. ft. of engineering space.

AMC Makes New Officer Assignments

Wright-Patterson Air Force Base, Ohio—Air Materiel Command has announced the assignment of 17 colonels in the Directorate of Procurement and Production.

Positions became vacant because of transfers and assignments to the Air War College and the Industrial College of the Armed Forces.

Those assigned to the Aircraft and Missiles Division as chiefs of the various Weapon System Project Offices are:

- **Col. Forest E. Hignett,** Interceptor-Missile.
- **Col. David D. Hutchens,** B-58.
- **Col. Horace Lanford,** Missile Branch.
- **Col. Paul E. Hoeper,** F-101.
- **Col. Roy A. Jaynes,** F-102/106.

Col. Robert J. Meyer will head the Production Office of the Aircraft and Missile Division, and Col. Walter E. Chambers will head the Bomber Aircraft Branch. Col. Frank E. Oliver will be assigned to a position within the Directorate of Procurement and Production.

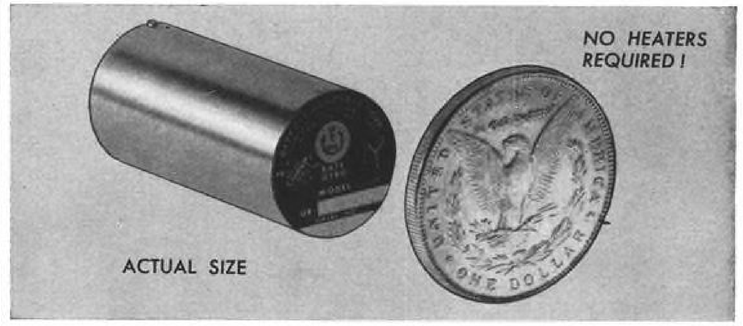
Col. Samuel Hale will be technical assistant, Aeronautical Equipment Division, Col. Edward McKaba will be chief, Communication and Reconnaissance Branch, and Col. Columbus E. Tootle will be in charge of the Accessories Branch of that Division.

In the Industrial Resources Division, Col. William H. Harrell, will be deputy chief, and Col. Stanley A. Dallas will be chief of the Resources Branch.

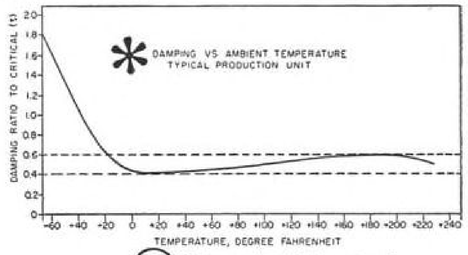
Col. Albert W. James will be the assistant deputy director procurement; Col. Wilbor R. Carter will be in charge of the Production Management Staff Division; Col. William R. Graham will be head of the Contract Management Staff Division; Col. Edward N. Odell will be technical assistant in the air-

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1. Constant damping (0.5 ±0.1 critical from −20° F to +220° F)
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3. Outstanding reliability (exceeds requirements of MIL-E-5272A Specs)
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5. Extremely high natural frequencies (up to 43 cps for 1 radian/sec; lower if desired)
6. Variety of motor characteristics available (3φ, 2φ, or split 1φ; 26V or 6.3V; 400 cps)
7. Wide variety of sensing ranges (from 0.5 radians/sec to 20 radians/sec, full scale)
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4130 GRADE		4135 GRADE	1025 GRADE
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• MIL-T-6736	• AN-WW-T850a	• MIL-T-6735	• AN-WW-T846

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Westinghouse Aircraft Gyro motor is rated 100,000 gram CM² radians/second at 12,000 rpm. Designed for use with 10 volt, A-C, 3-phase, 400-cycle power supply.

Multi-ton sky giants, defensively armed by a 3-ounce motor. That's precision! — and it's made possible by the Westinghouse Gyro Motor.

This "mighty-mite" spin motor is the heart of many super-sensitive aircraft gyroscopes. It's assembled in a temperature- and humidity-controlled room — dynamically balanced — thoroughly tested — and shipped in a hermetically sealed plastic bag and foil envelope.

This extreme care, plus 40 years of Westinghouse aircraft-electrical experience, insures a minimum of 1200 hours maintenance-free service from every motor.

If you would like additional information on the full line of Westinghouse gyro motors, please write Westinghouse Electric Corporation, Aircraft Equipment Department, Lima, Ohio.

All inquiries and information are kept in strictest confidence, to safeguard both your commercial interests and national security.

J-03039

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AIRCRAFT EQUIPMENT DEPARTMENT, LIMA, OHIO

lines, Maintenance and Service Contracts Division.

Those leaving for advanced schooling at the Industrial College of the Armed Forces are Col. W. A. Bennett Jr., Col. Oliver M. Scott and Col. R. M. Creech. Col. L. F. Tanberg, formerly deputy, Industrial Resources Division, assumes Col. Creech's former position as Chief of the Airlines, Maintenance and Service Contracts Division.

Col. T. B. Ardis, now head of the Resources Branch, Industrial Resources Division, will become Air Force Plant Representative at Allison Division, General Motors Corp. in Indianapolis.

Less Trouble In Jets, Ignition Group Told

Sidney, N. Y.—Detailed refinements in the maintenance of ignition systems for reciprocating engines continued to occupy the greater portion of this year's Bendix-Scintilla Division ignition conference. Attended by representatives of the maintenance departments of most of the world's airlines, the conference has been held annually to pool the knowledge gained by users of Bendix ignition systems.

Problems to be expected in the overhaul of jet engine ignition systems were also discussed. These will be less troublesome to the airlines in many ways, a Bendix spokesman told AVIATION WEEK, since in jet engines the ignition plays only an intermittent role in starting the engine cycle and not the continuous role of reigniting the combustion as it must on piston engines.

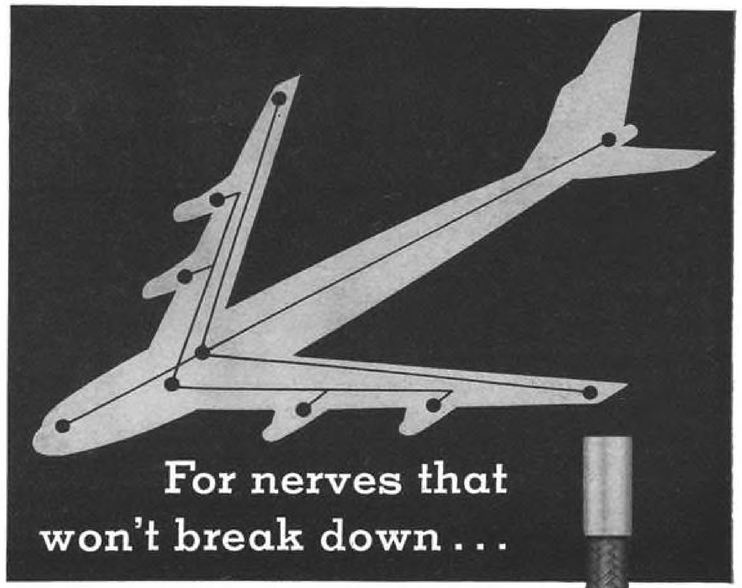
Bendix engineers said they had successfully surmounted most of the temperature and vibration problems peculiar to jet engines. For example, they produced an ignition system for the Curtiss-Wright ramjets used in the Navaho missile which has to operate in 600F ambient temperatures and up to 80,000 ft. altitudes.

The capacitator used in this case was composed of a stack of hermetically sealed mica plates.

Verbatim minutes of the meeting and the question and answer sessions will be available from Bendix-Scintilla.

81st Magister Delivered; Two Tested On Carrier

Air Fouga has delivered its 81st Magister from its Toulouse plant. Present monthly production rate of eight soon will hit 12. Company has orders for several hundred Magister jet trainers from French Air Force as well as orders from German Air Force. Meantime, two French naval versions of the Magister are at Cherbourg undergoing deck landing tests on the British aircraft carrier Bulwark.



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REVERE TEFLON* CABLE

Electronic cables, the "nerves" of monitoring and testing systems in missiles, rockets and aircraft, are constantly being stressed by the searing heat around jet engines . . . the sub-zero cold of the stratosphere . . . immersion in fuels, chemicals or solvents. Revere Teflon Cable meets these high service requirements . . . and those of computer and radar applications, too.

Revere Teflon Cables are available with 1, 2, 3 or 4 teflon-insulated, silver plated, stranded copper conductors, rated for continuous operation from —90°C. to +210°C. Cables are shielded with silver plated copper to give 90% coverage. Jackets to suit application — silicone treated glass braid, teflon, Kel-F**, vinyl, nylon, etc.

Conductor size: 24 to 18 gage in .008" (300 volt), .010" (600 volt) and .015" (1000 volt) wall thicknesses. Ten and fifteen mil wall conductors meet applicable requirements of MIL-W-16878, Type E and EE.



*E.I. du Pont trademark
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† Wire passes 500 hr., 250°C heat-aging test . . . also cold bend test

TYPICAL SPECIFICATIONS — Single Conductor Teflon Insulation

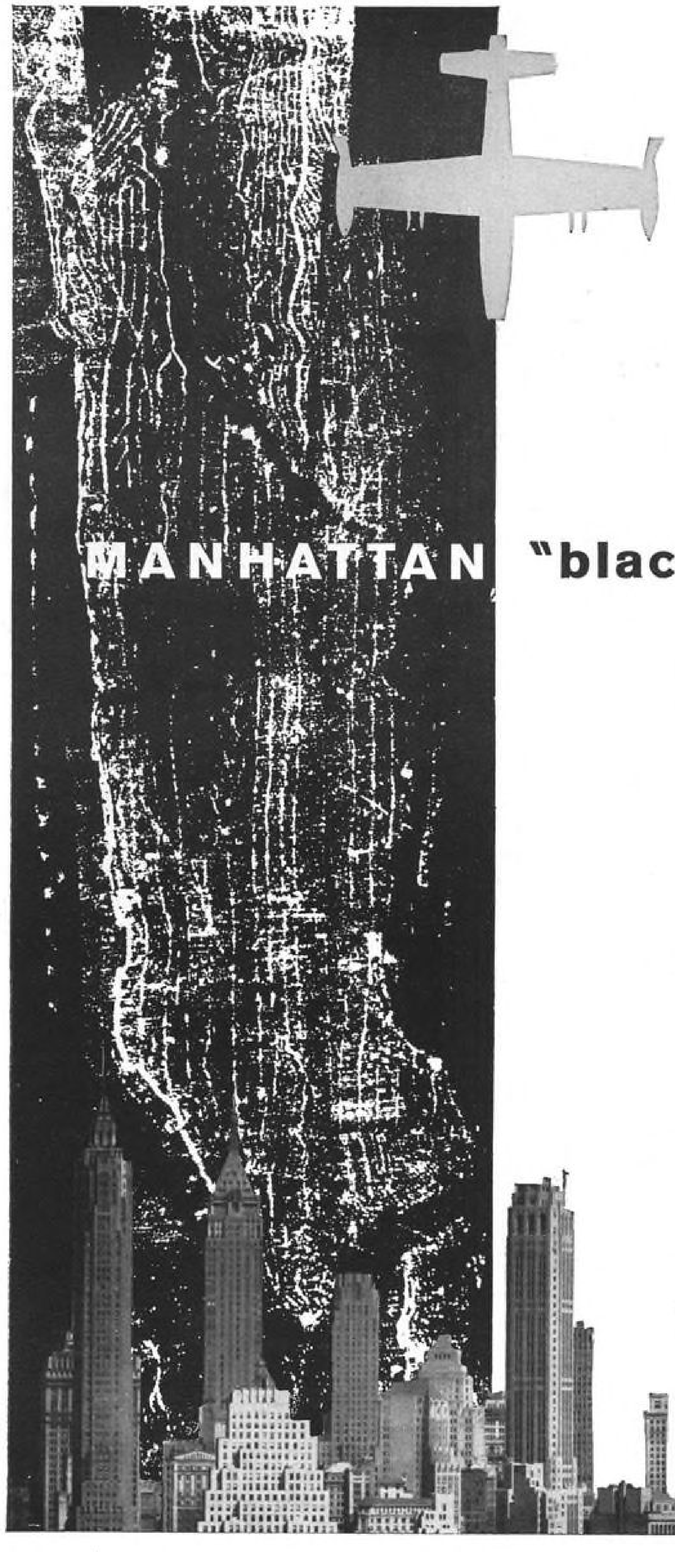
Spark Test Voltage	3000 volts
Insulation Resistance	Greater than 10^4 megohm/1000 ft.
Continuous Operating Range	—90°C. to +210°C. (†)
Dielectric Constant @ 1 MC/Sec	2.5 maximum
Power Factor @ 1 MC/Sec	Less than 0.0003
Flammability	Does not support combustion
Shrinkage	Less than ⅛" in 18" @ 250°C for 96 hrs.
Abrasion (per MIL-T-5438)	Passes 38" of 400 grit, aluminum oxide, ½ lb. weight
Moisture Absorption	0.0%
Specific Gravity	2.2 average
Chemical and Solvent Resistance	Excellent

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Passive INFRARED Systems End Need for Visible Light in Photomapping Objectives; Concentrations and Operations Show Through Concealment.

A lone photo-recon plane, slipping over New York one dark night in 1951 made this graphic shot of ground activity on the familiar island. And, had it been under **total** black-out conditions . . . the picture would be the same.

For this scene was not made with visible light; it is an infrared photo of the heat concentration on the ground—a dead give-away of the location of people, working machinery, vital installations.

"blacked out"

Any time a plane can get through to a target area, it can shoot a highly informative picture. Installations and concentrations of personnel show up sharply and vividly. Dispersion and concealment do not provide protection against passive infrared reconnaissance.

Infrared radiation is an exceedingly effective medium for detection—almost impossible to jam, mask, or conceal. It is an inevitable function of heat, becoming more intense as energy output grows. Passive infrared detecting devices do not reveal their own location in any way.

If infrared systems for reconnaissance, countermeasures, and bombing are important to you, then information on Servo Corporation of America infrared systems is vital. Your one best source of infrared information is the pioneer in infrared development—

builder of 23 different successful infrared weapons systems; introducer of commercial applications like the "Hot Box Detective" that spots overheated freight car journals as the train flashes by; and builder of industrial infrared systems that measure and control critical temperature.

Servo Corporation's remote radiation pyrometer systems are now serving the chemical processing, metal-treating and fabricating, plastics, and many other basic industries.

For information on Military Infrared Systems, send for Brochure IR 9902-56K. For information on industrial Infrared Systems, request TDS-IRPS-C.

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Exercises Prove TAC's Air Task Force

Foster AFB, Texas—Tactical Air Command has successfully concluded the most ambitious test yet conducted of its Composite Air Strike Force concept.

Combat exercises completed in the Southwest U.S. and overseas were designed to prove out the planning and organizational work done by TAC's 19th Air Force, formed here two years ago to develop a highly mobile air task force for use in "brush fire" war situations.

Success of the exercises proves that the Composite Air Strike Force can operate over a wide geographical area and that the U.S.-based force can get anywhere in the world in very short order, according to Brig. Gen. Henry P. Viccellio, commander of the 19th Air Force.

Stand-By Basis

Under the CASF concept, various combat-ready TAC units are assigned to the strike force on a stand-by basis. When the occasion arises, these units immediately come under the command of 19th Air Force for dispatch to the trouble spot concerned.

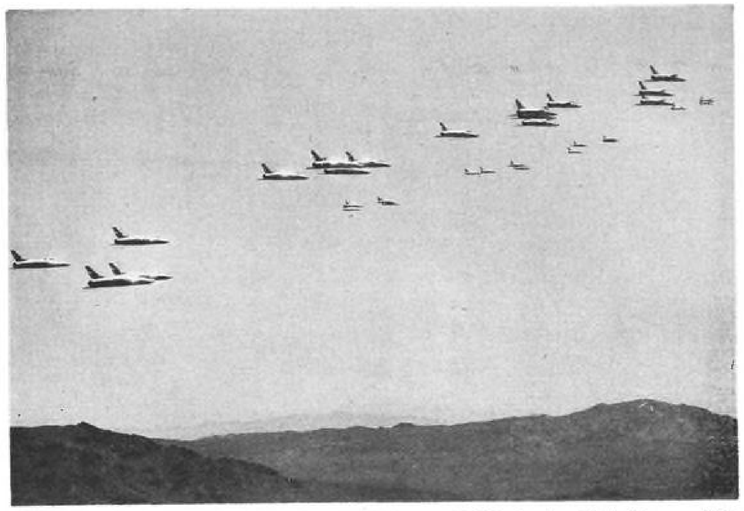
Designed for rapid formation and deployment in an emergency, CASF normally consists of a small management group—19th Air Force—plus a roster of units this management group can command at a moment's notice. Under this concept, 19th Air Force's day-to-day job is planning—the building and maintaining of a system into which the assigned TAC units will fit quickly and easily for rapid combat use.

TAC's biggest, most complex operational test of this management system was conducted in a series of exercises which included a ten-day combat exercise in the Texas area and flights to Atlantic, Pacific and Caribbean points.

Mobility Demonstrated

Using a variety of fighter, bomber and support aircraft, TAC demonstrated its mobility and readiness with these exercises:

- **Power Pack**—biggest operation, in which the Composite Air Strike Force worked out a ten-day combat exercise centering on Foster AFB in South Texas.
- **Sea Star**—group of F-100Cs flew nonstop to North Africa.
- **Sea Train**—group of F-100Cs flew nonstop from George AFB, Calif., to Honolulu, then nonstop from Honolulu to Foster AFB.
- **Vista Able**—two groups of B-57s flew nonstop from Brookley AFB, Ala., to the Canal Zone. This same B-57 group also made good will tours of Latin American countries.





FIRST LINE aircraft in TACs mobile organization are F-100s (top) . Refueling capability, as B-50, two F-100s and B-56 demonstrate (below), add to TAC mobility.

Each of these exercises highlighted an important facet of the CASF operation. Power Pack demonstrated how the task force can move into a troubled area and operate on a combat basis on short notice.

Sea Star and Sea Train showed how TAC can deploy tactical aircraft over long distances with the aid of aerial refueling. Vista Able demonstrated the deterrent feature of CASF—the ability to move into an area where trouble is suspected with a show of force, much as the fleet has been used as an instrument of foreign policy in the past.

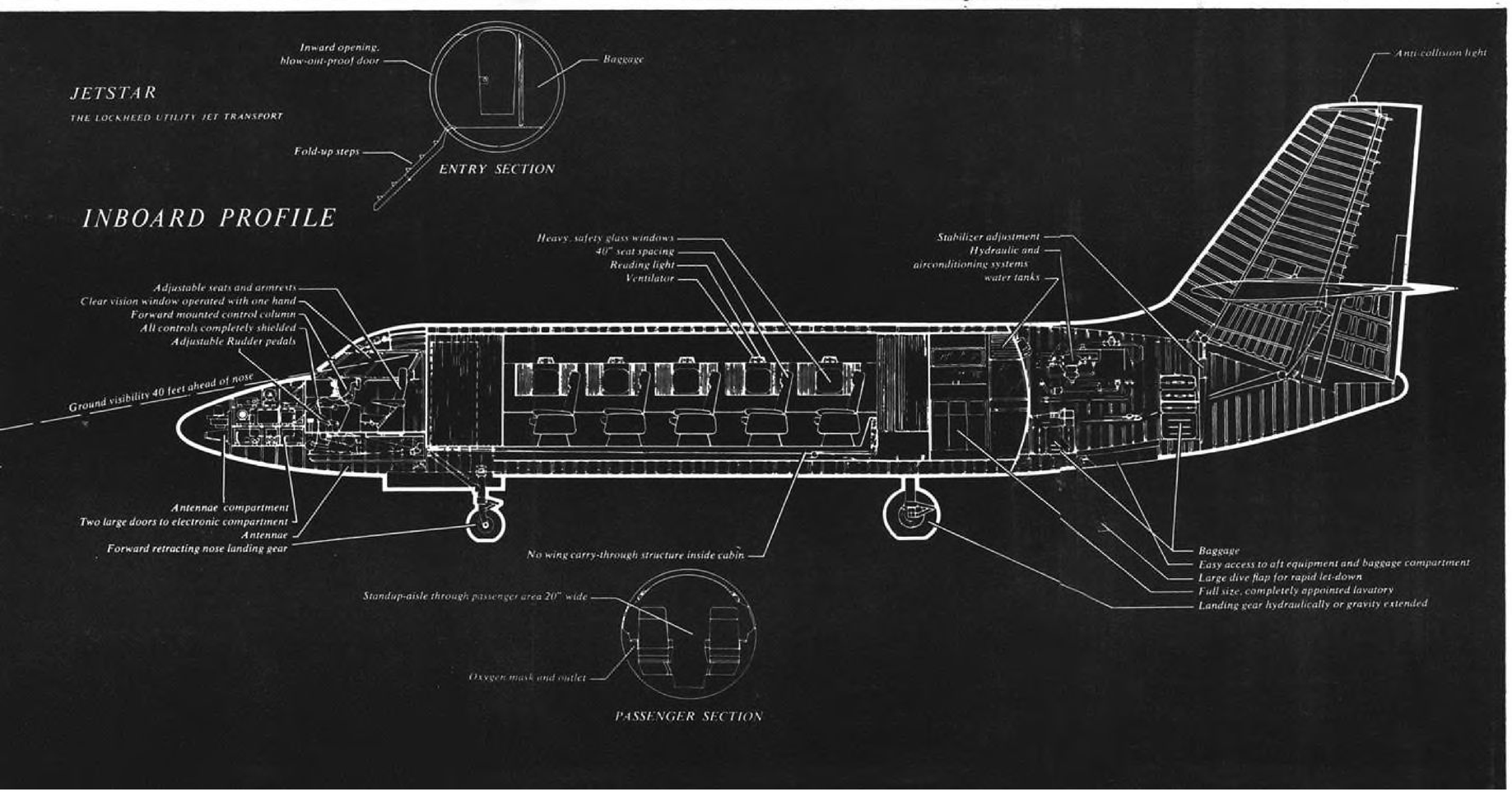
CASF concept grew out of the sort of situation it is designed to combat—the Korean War. Gen. O. P. Weyland, then air commander in Korea and now TAC commander, saw the need for a highly mobile task force, based in the U.S. for economy but ready to move into brush war situations anywhere in the world. Weyland thought overseas commands were too much oriented to the large-scale, strategic type of war.

Two factors contribute to the need



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a 10-passenger utility jet transport with 4 engines, designed to perform a variety of Jet Age military missions at low cost.



Able to match the performance of large jet transports, but at a fraction of their costs, the new swept-wing Lockheed JETSTAR will cruise 500/550 mph at altitudes from 25,000 to 45,000 feet—for ranges of 2,000 statute miles and more.

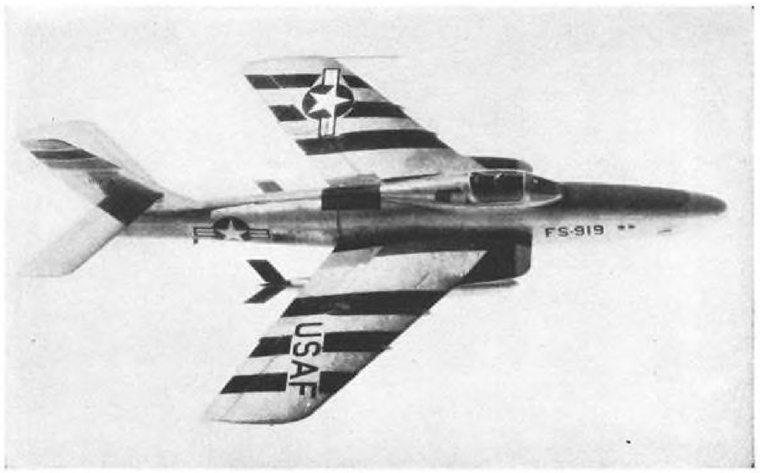
Amazingly quiet (due to the aft fuselage mounting of engine jet pods) the JETSTAR is ideal for transition pilot training, heavy bomber crew training, and testing ground navigational aids. High-speed navigation training and gunnery practice, in-flight refueling indoctrination, and high-priority cargo carrying are additional vital uses for which the JETSTAR was designed.

The JETSTAR carries a full complement of radio and navigation gear and is fully pressurized and air conditioned.

Like all Lockheed aircraft, the JETSTAR embodies simplicity of structure and functional systems—for high strength and reliability. Easy to maintain, economical to operate, the JETSTAR carries on the 25-year tradition of Lockheed's leadership in the design and manufacture of high-speed aircraft for the military, commerce and industry.

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Georgia Division
Marietta, Georgia



TAC markings are shown on Republic RF-84F of 363rd Tactical Reconnaissance Wing.

for CASF as an instrument of war. First is the massive destructive capability of the Strategic Air Command. Realization of the nuclear potential of SAC leads to the second factor, an apparent Communist decision to try a technique of small, peripheral wars—like Korea and Indo-China—which could expand the Communist sphere of influence without commiting the Communist world to total war.

Another factor in the creation of CASF was the development and perfection of techniques for delivering nuclear weapons by fighter aircraft, providing a significant modern weapon for such a task force.

With this background, USAF decided to use the CASF concept, and the 19th Air Force was established at Foster AFB in July, 1955, to provide the planning, coordination and training for the Composite Air Strike Force.

TAC Reorganization

At the time the 19th Air Force was formed, TAC had two groups under its command—Ninth Air Force and 18th Air Force. The new 19th Air Force was attached to Ninth Air Force. TAC was reorganized on July 1, 1957, and 19th Air Force is now directly responsible to TAC headquarters.

By January, 1956, the 19th Air Force had the first proposals for CASF on paper, and the job of organizing the force within TAC began. As the concept has been developed into an actual working force a series of exercises has been conducted to test the organizational concepts and to train the assigned units in the newly developed techniques.

In normal peacetime operation, 19th Air Force is a group of less than 100 officers and enlisted men headquartered at Foster. Their basic job is planning down to the last detail how CASF should operate and what it will do in each of a great number of theoretical emergencies.

CASF is given a number of specific areas in the world that could develop into trouble spots, and detailed plans must be developed to accommodate CASF's function to each possibility.

Moves Quickly

One of CASF's important features is its ability to move quickly over long distances. To maintain this ability, CASF planners must have a detailed inventory of equipment available to them at bases all over the world since CASF necessarily travels light and must depend on support in local areas. This means CASF must know what is available and also must educate units at these overseas bases so they will know how to give the task force effective support when it is either passing through or arriving to establish operations.

The force carries a 30 day supply of spares and is designed to end a developing brush war quickly. If a war develops that will last more than a month, TAC would move in with its larger regular forces to take over the tactical air function.

The 19th Air Force provides the management function that sets up and commands the organization. When the time to move comes, specifically assigned TAC units move quickly into the framework. The whole force, totaling more than 200 aircraft, consists of three fighter bomber squardrons, two day fighter squadrons, two tactical bomb squadrons, three troop carrier squadrons, a composite reconnaisance squadron and an air refueling squadron.

Supporting these air units are a command element, a composite air control, warning and communications unit and a tactical depot squadron, the unit that handles the nuclear weapons. The units

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The most important engineering assignments are now being placed with companies which can point to superior accomplishments not only in research and development, but in production of the end items. Because of this, engineers interested in aircraft and missile components and systems will find outstanding opportunities at the Garrett Corporation. Our prime areas of operation include the following:

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For further information regarding opportunities in the Los Angeles, Phoenix and New York areas, write today, including a resume of your education and experience.
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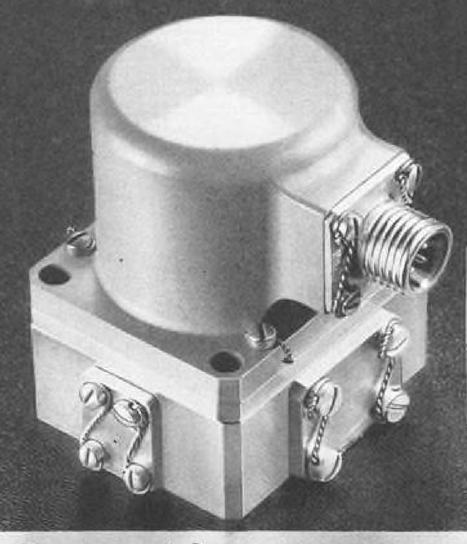
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For control system applications...

the AiResearch time dwell electro-hydraulic servo valve



SPECIFICATIONS:
Weight—1.25 lb.
Electrical input—10 milli-amperes
Operating pressure—200 to 4000 psi
Rated flow—0.12 to 5 gpm
Fluid—OS45-1 (or) MIL-O-5606
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The AiResearch Time Dwell Servo Valve is a two stage switching type electro-hydraulic valve. It converts low level electronic signals into hydraulic energy which actuates mechanisms to steer or control missiles, aircraft, and ground control and similar equipment.

Weighing only 1¼ pounds, this AiResearch valve has the following characteristics:

Spool velocity rather than position is the control parameter.
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which make up this force are elements of the Ninth and 18th Air Forces. These two air forces are responsible for maintaining the CASF units in top combat readiness.

When CASF is committed to a war situation, refueling arrangements are made and the units are dispatched to the combat area. When it arrives, CASF comes under the command of the local theater commander for employment with the other forces in the area.

CASF arrives in the local area piecemeal, and the first job is to insure survival. The group brings its own air transportable communication, control and warning systems, and these are established. Then day fighters arrive for defense functions. When the area is secured, the offensive aspects of CASF are brought to bear.

Power Pack was the exercise which demonstrated this combat aspect of CASF. The Texas area was established as a theoretical country under attack, and CASF was called in under its normal alert procedure to put out the fire.

CASF operations were concentrated at Foster, with some units assigned to operate from England AFB, La., Bergstrom AFB, Tex., and Eglin AFB No. 9, Fla. An Air Control and Reporting Center from the 507th Tactical Control Group, Shaw AFB, S.C. flew to Foster, and elements of the Eighth Communications Group, Shaw AFB, operated at Foster, Bergstrom, England, and Eglin No. 9. Air control elements of the 512th Tactical Control Group operated at their home sites at Foster, Randolph AFB and Ellington AFB, Tex.

Protecting the Foster operations was a squadron of F-100C day fighters from the 450th Fighter Day Wing at Foster. Also operating out of Foster was a composite reconnaissance squadron from 363rd Tactical Reconnaissance Wing, Shaw AFB. This unit included the RF-84F for day photo work, the RB-66B for night photo missions, RB-66C for electronic reconnaissance and WB-66D for weather reconnaissance.

F-100C Protection

A squadron of F-100Cs from the 450th Wing went to Bergstrom and another F-100C squadron from 450th Wing operated at England AFB. A squadron of F-84F fighter-bombers from the 366th Fighter Bomber Wing, England AFB, operated at Bergstrom AFB, and two squadrons of B-66 tactical bombers from 17th Bomb Wing operated under combat conditions from their home base at Eglin AFB No. 9.

During the ten-day exercise, the task force flew 1,034 out of a scheduled 1,158 sorties. Of the 124 aborts, 73 were due to aircraft scheduling problems and the rest were mechanical. Due to improved maintenance, mechanical aborts were cut about 300% from the level experienced in a similar exercise held in February.

Sustained flying in the exercise (the sortie rate) represented a heavier load than the units involved usually fly. The units met the expected rates, indicating their proficiency is at a high level. CASF aircraft flew 2,092 hours during Power Pack.

Power Pack gave CASF an opportunity to test out and practice its logistical arrangements. Results showed that plans called for too much of some equipment and too little in other categories.

One of the major problems indicated by the exercises, Gen. Viccellio said, is the shortage of spares and ground handling equipment accompanying newly received aircraft. CASF sees a need for more of such items in future operations.

Communications present another problem. Radio relay systems don't provide as efficient communications as CASF would like to have, and the group hopes to get single sideband systems to replace them. Radar in the warning system is another item CASF would like to see improved. The task force needs radar that can skin track approaching aircraft at a minimum of

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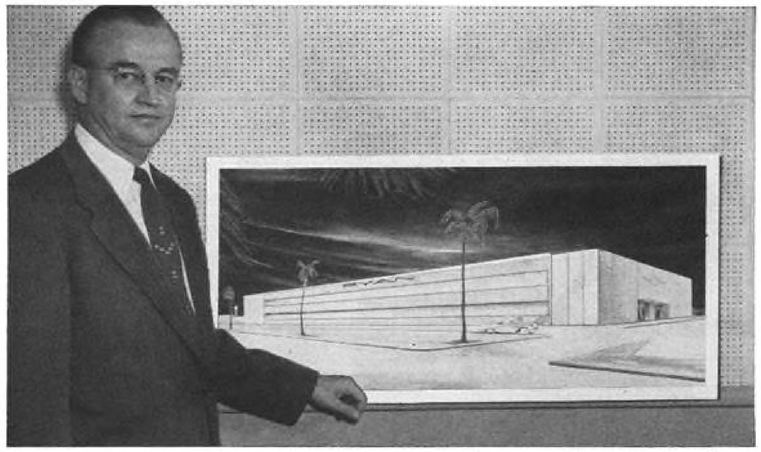
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REPORT FROM RYAN

New Engineering Opportunities Created as Ryan Projects Mushroom



FRANK W. FINK, RYAN VICE PRESIDENT AND CHIEF ENGINEER inspects architect's drawing of new Engineering and Research Center.

New Engineering and Research Center To Meet Ryan's Expansion

Construction of a modern two-story, engineering and laboratories building has begun at Ryan, to meet the company's expanding work in Jet VTOL—Automatic Navigation—Jet Drones—Missile Guidance—Jet Metallurgy—Rockets.

The new facility will provide additional quarters for many of the 1000 employees in Ryan's fast-growing engineering division. It will also house complex, new chemical, metallurgical, instrumentation, environmental and autopilot equipment.

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200 miles. This minimum radius will have to increase as aircraft speeds increase.

CASF fighters attempted 249 intercepts on various aircraft which entered their area during the Power Pack exercise. Effectiveness was 82%. Best scramble time for the exercise was two minutes; the average was six minutes. Shortest intercept was seven minutes from the time the blip appeared on the radar until the intercepting aircraft was in the kill position. Average intercept time was 12 minutes.

Moving Task

The job of moving this task force is complicated by the number of other groups CASF must work with. These include Civil Aeronautics Administration, Military Air Transport System, Air Defense Command, SAC and others. In Power Pack alone, 19th Air Force had to deal with nine of the numbered air forces, nine major commands and over 60 individual units.

In the Vista Able exercise, two flights of 12 B-57s each made separate flights from the U.S. to the Canal Zone, then made good will tours in Peru, Venezuela and Ecuador. They engaged in fly-bys, static displays and other air show activities.

The visit to Latin America was a friendly gesture, but it showed how CASF is available on short notice to "show the flag" anywhere in the world there might be trouble brewing.

To demonstrate the long range capability of CASF, operations were conducted in both the Pacific and Atlantic areas. In Sea Star, six F-100Cs flew nonstop from Myrtle Beach, S.C., to French Morocco, then returned via the Azores to England AFB. In Sea Train, four F-100Cs flew from George AFB to Hickam Air Base in Honolulu. They returned nonstop from Hickam to Foster AFB.

For its deployment overseas, 19th Air Force has chosen fair weather routes, even when they are less direct than routes through questionable weather areas. Eastward, CASF will fly to North Africa via Bermuda and the Azores. From North Africa, the task force can be deployed to Europe, Africa or the Middle East. To the West, CASF will fly by the Hawaii-Midway-Wake-Guam routing.

Long Range Problems

Development of this long range potential is one of 19th Air Force's chief problems, especially in an outfit like TAC which is adjusted to short range operations. It requires considerable training to give the normal TAC unit this long distance capability, according to Gen. Viccellio.

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that must be built to support long nonstop flights for the normally short range tactical aircraft. Over the past six months, CASF has been developing its tanker system around the KB-50 and its three-point probe and drogue refueling system.

Since SAC uses a boom system for refueling, the two forces can not integrate refueling operations, and TAC must depend entirely on the KB-50. An improvement in the KB-50's performance is planned for next year when the piston-powered tanker will be equipped with two J47 engines for refueling at 25-30,000 feet. This modified version of the KB-50 is being flight tested at Wright-Patterson AFB now.

Training is an important element in maintaining the proficiency of CASF, and 19th Air Force plans to conduct two overseas exercises a year. A Pacific exercise is scheduled for the fall. With the same personnel turnover that plagues the rest of USAF, continuous practice is necessary to make sure units are always capable, according to Gen. Viccellio.

TAC has switched from the F-84F to the F-100D for fighter bomber missions, and squadrons are just becoming combat ready with this new airplane. In reconnaissance squadrons, the RF-101 is replacing the RF-84F. This transition should be completed by the end of the year.

TAC expects to replace the C-119s now used as troop carriers for CASF with C-130s in the near future. Since heavy troop carrier functions were transferred to MATS July 1, CASF's troop carriers are now confined to local operations in the task force's immediate combat theater.

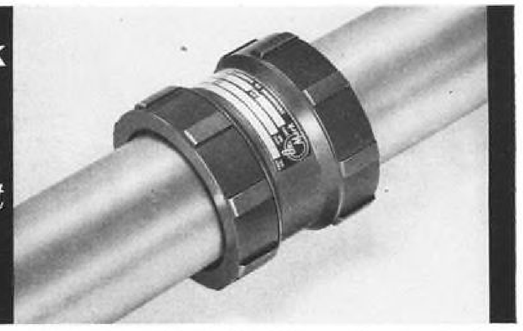
No other equipment changes in the CASF roster are expected by 19th Air Force for another 18 months. At that time, the F-104 may be phased in to replace the F-100C. Also in the indefinite future is the F-105 fighter bomber. Missiles do not figure in present plans for CASF.

Gen. Viccellio sees no need for new or specialized equipment for CASF. He said the CASF concept works well with what is presently available, and will function well "within present capabilities with normal expected improvement."

Plastic Motor Tested In Japanese Rocket

Japanese report successful testing of a plastic rocket engine. Plastic, reinforced with glass fiber, reportedly weighs only half as much as conventional motor, reports the inventor, Prof. Hideo Itokawa of the University of Tokyo. Engine will be used in a Rockoon launching later this year.

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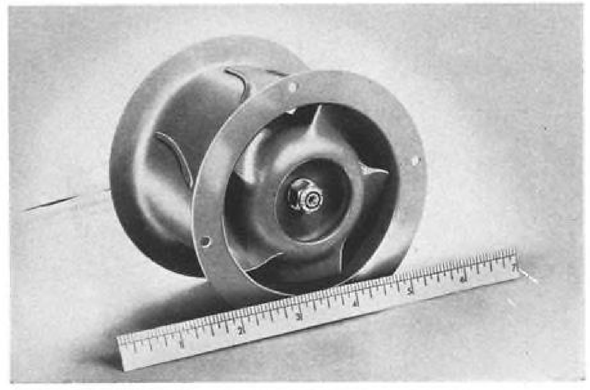
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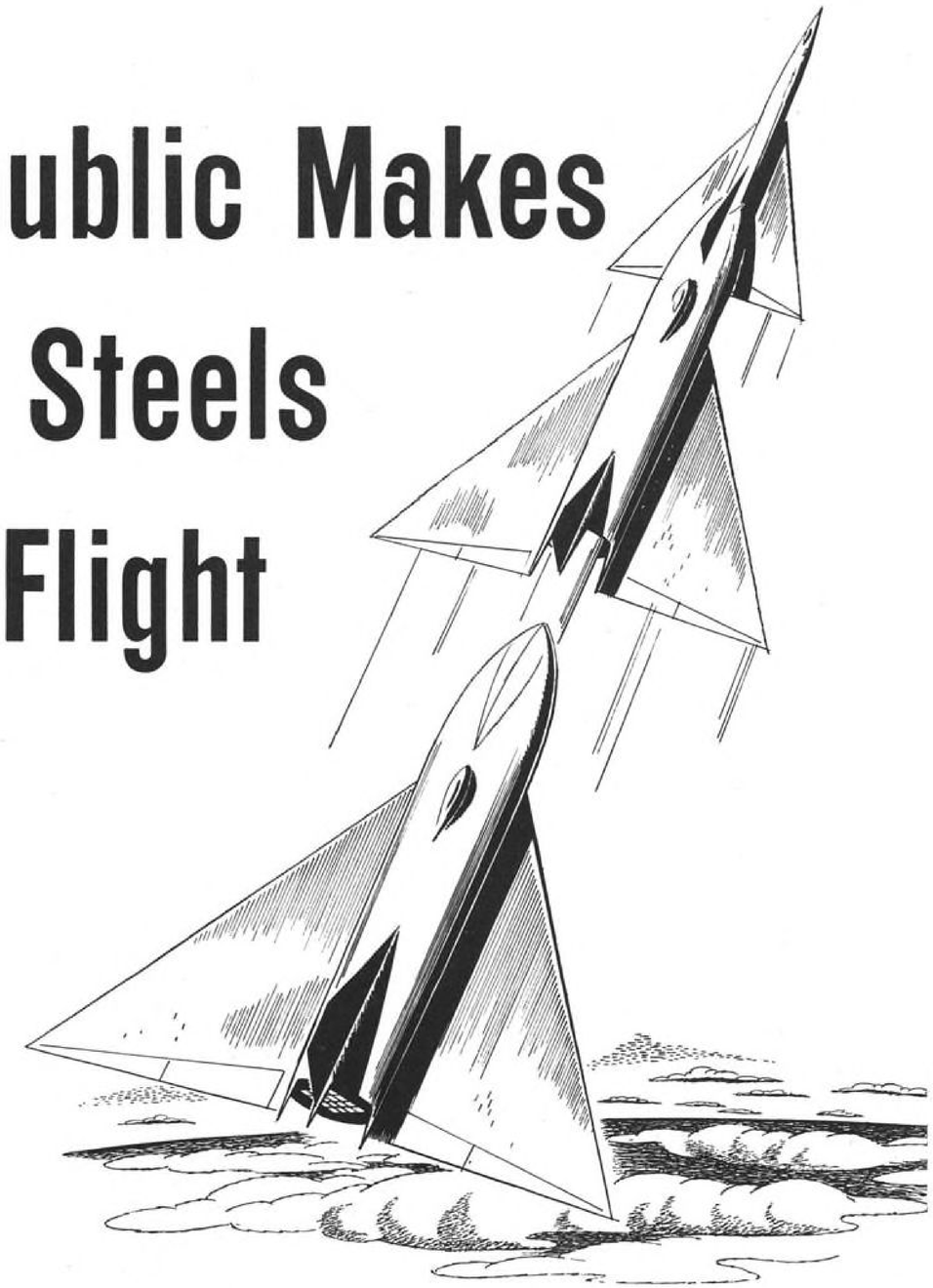


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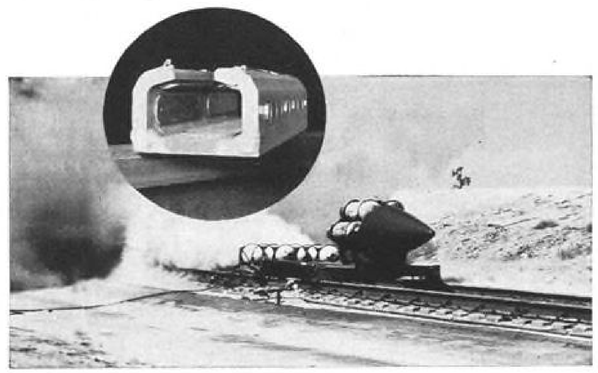
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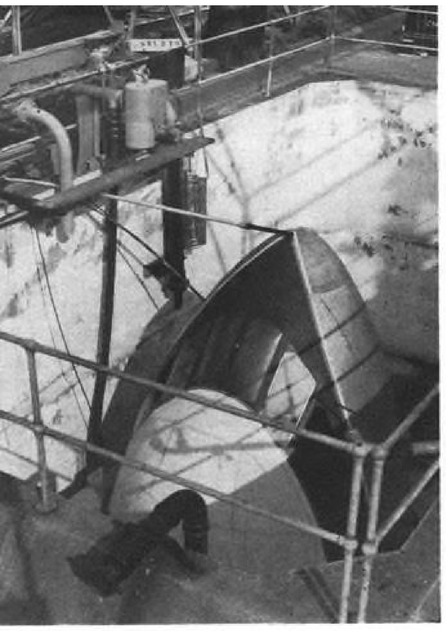
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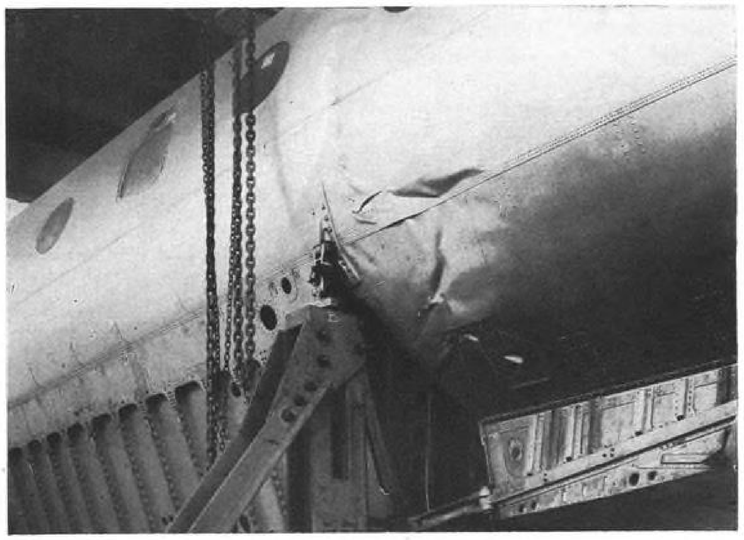
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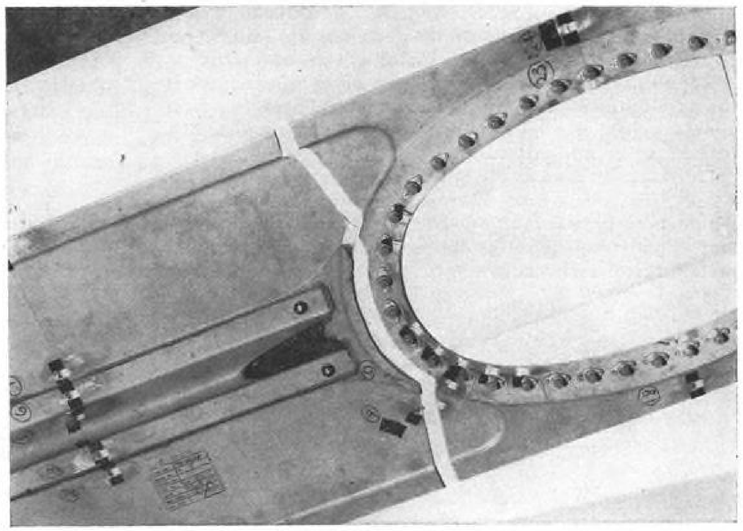
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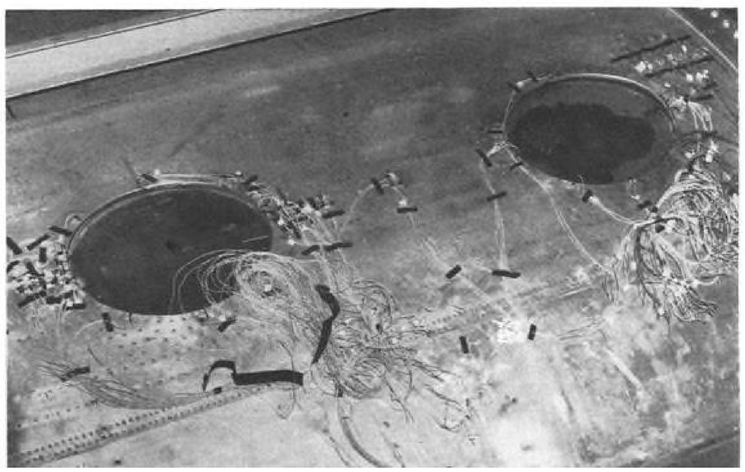


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Further technical data, prices and delivery information – on the 5490/5495 Console Recording Systems and two- to eight-channel 5475/5480 Systems are available on request from your Sanborn Sales-Engineering Representative or the Industrial Division in Waltham.

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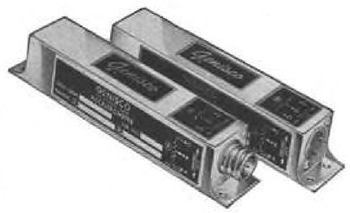
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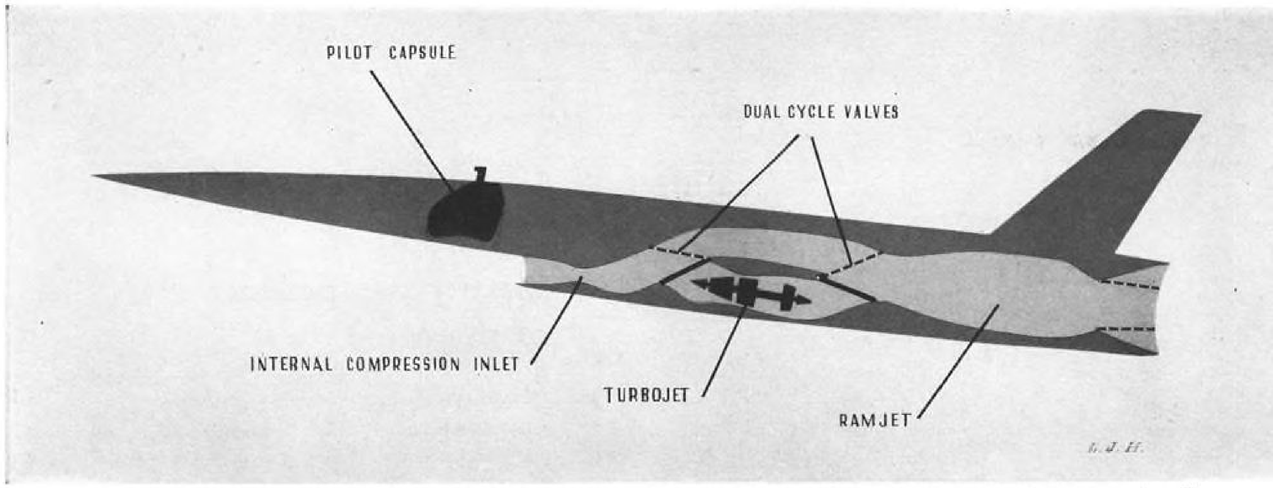
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POSSIBLE CONFIGURATION for Mach 2.5-4.0 interceptor shows how the airframe might be worked around a dual-cycle engine. The dual-cycle valves are shown in full ramjet position; the positions for either turbojet or turbojet plus ramjet are shown dotted in. Note the internal compression inlet and the divergent exhaust nozzle. The pilot is completely buried inside the airframe in his downwardly ejecting capsule. He could either use a periscope for landing or his capsule could be shifted up above the fuselage.

F-103 Demise Clouds Dual Cycle Future

Robert H. Cushman

New York—USAF's cancellation of the Republic Aviation Corp. XF-103 advanced interceptor leaves a question mark in the status of a possible Mach 2.5-4 fighter. Officially, USAF gave budgetary reasons for the cut (AW Aug. 26, p. 33).

Doubts as to the feasibility of the dual-cycle engined (turbojet-ramjet) Mach 3 fighter were not mentioned as a factor though some USAF sources at Wright Aeronautical Center, Dayton, Ohio, indicated that now there might be "better ways of doing the mission."

A Pentagon USAF source, while admitting that he did not like to see the XF-103 stopped before it could be put to use as a research vehicle, said that he expected that the void would soon be filled with a competition for another very-high performance piloted interceptor, accompanied by a parallel competition for a high Mach number turbojet powerplant. The new interceptor should be far superior to the XF-103 as a weapons system since is will be carefully tailored into the present U. S. air defense complex.

Republic Feeling

So far as Republic was concerned, one research engineer said that the company was shocked to hear of the cancellation for it was confident that the expensive nine-year program would produce a "tremendous" airplane and so far as he knew no other company was working on a comparable aircraft. There were no doubts, said this engineer, that the XF-103 would not have been successful in flight test.

Another engineer, not with Republic, but who has been associated with some of its high speed aerodynamics research, told AVIATION WEEK that he suspects recent developments in higher lift-to-drag ratios at speeds over Mach 2.5 coupled with the advent of exotic fuels now coming into production made the nine-year-old XF-103 obsolete. (The XF-103 was part of the same MX-1554 design competition which produced the Convair F-102 fighter now in production).

Aircraft Re-Engining

One possible indication of XF-103 performance is the interest that both Curtiss-Wright and Republic showed in re-engining the aircraft with Orenda's new 20,000 lb. thrust Iroquois turbojet. It was hoped that the larger engine might have improved the F-103 by overcoming the somewhat sluggish performance calculated for the interceptor when climbing to ramjet speeds and altitudes with the smaller Curtiss-Wright J67 turbojet. The J67, based on the Bristol Olympus, is in the 12,000-15,000 lb. thrust category. It is now without an airframe to power.

Otherwise the Curtiss-Wright dual-cycle powerplant for the XF-103 apparently had proved successful. The dual cycle arrangement was "flown" last year in the large Engine Test Facilities Section of the Arnold Engineering Development Center, Tullahoma, Tenn.

Inboard profile drawn by AVIATION WEEK artist approximates XF-103 design features, the airframe, like that of the also curtailed Navaho, dominated by the powerplant. Most of that portion of the airframe not occupied by propulsive ducting is used for the stowage of the tremendous amounts of fuel needed.

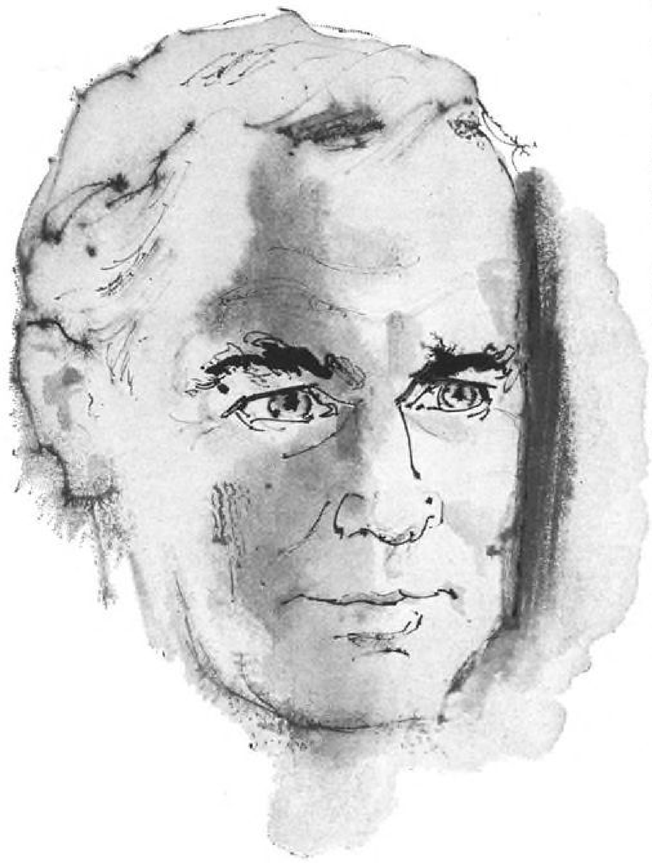
The XF-103 was essentially a "self-accelerating ramjet." The dotted-in positions of the dual-cycle valves and exhaust nozzles show positions of these members at takeoff. The solid positions show how the valves were to shut off the engine completely from flow during the high Mach operation, during which time the exhaust nozzle's final exit would be opened to full divergence.

With the airflow completely shunted around the turbojet engine the turbojet's afterburner becomes the burner for a ramjet cycle, hence the name dual-cycle.

Three Modes

As shown on the schematic graph of altitude versus Mach number, the dual-cycle can operate in three different modes: as a turbojet, an after-burning turbojet, and a ramjet. It would use the combination best suited to the flight regime up to the limits of air breathing powerplants. A drawback is that the dead weight of the engine has to be carried around during the high-performance ramjet flight.

There are two reasons for by-passing the air around the turbojet during the higher speed portions of the flight. At



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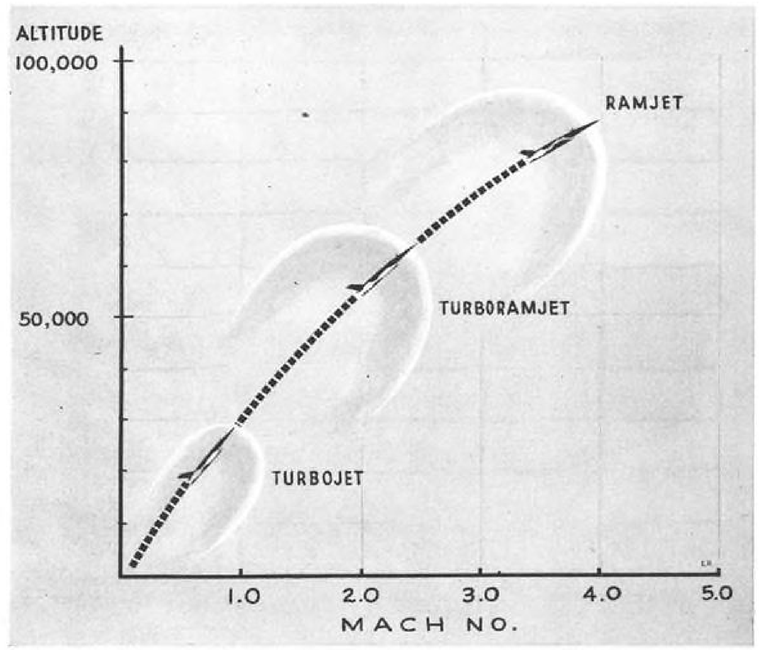
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ALTITUDE, SPEED PLOT shows how powerplant modes fit flight envelope. Able to intercept a B-58 type bomber coming from over the North Pole at Mach 2.2 and 75,000 ft., the interceptor would use its turbo-ramjet mode up to cycle change-over at 50,000 ft. and Mach 2.2. It would only use the turbojet mode on return to base.

higher speeds the turbo-ramjet cycle is inferior to the pure ramjet cycle and there are no available gas turbine materials which could either exist or operate efficiently in the temperatures which would occur when the 500-1,000F temperatures inherited from the ram inlet are superimposed on the turbojet cycle temperatures. These temperatures would make for a very heavy, short-lived engine and they would have a harmful effect on the compressor's efficiency by seriously cutting down on the mass flow.

Water Spray

One way for getting around this is to spray water in ahead of the engine letting the heat of the ram air vaporize it, thus lowering the air temperature and increasing the mass flow. If this or other means are not taken to cool the flow before it enters the engine compressor, what started out as an engine static compression ratio of 9 at sea level may end up as only 3 or 4 or less at supersonic speeds.

In operation, the XF-103 interceptor was to start much like the type of interceptor for which de Havilland built its Gyron engine (AW Aug 26, p. 62). The J67 turbojet is used to start the flow and feed the large afterburner. Both were to power the F-103 rapidly off the ground and to over 50,000 ft. and Mach 2.0 speed.

At some speed between Mach 2 and 3 where the turbojet would be feeling the effects of ram heat, the dual-cycle valves would switch the flow around the J67 and the XF-103 would be solely on ramjet power, a condition in which the powerplant would be able to continue (in theory at least) as high as Mach 4. In the Tullahoma runs, the valves were switched and the transition completed in about seven seconds without losing afterburner flame, it was reported.

Besides dual-cycle powerplants and low pressure ratio afterburning turbojets as the Gyron, other possibilities which the engine manufacturers have been proposing to USAF and the airframe manufacturers are bypass turbojets and mixed turbojet-rocket powerplants.

The bypass turbojet, while it has received most notice for its purported efficiency in subsonic cruise, can also be shown to be quite attractive for flight in the vicinity of Mach 2.5-3.

For supersonic use it would be designed to give large rates of bypass flow to feed an oversized afterburner. The bypass engine has the further attraction that it might be designed to give good subsonic loiter capability combined with reasonably sustained supersonic operation.

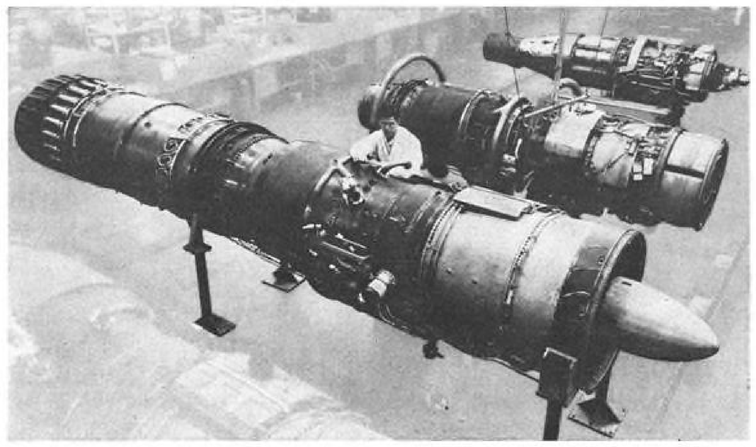
Ram-Fan Development

General Electric has considered a ram-fan development of its J79 type turbojet in which a large diameter fan stage ahead of the regular compressor section would be used to feed the bypass duct surrounding the main engine.

Possibility exists that during the higher speed operation the ram flow might partially "drive" the turbojet, thus making it less necessary to overtemperature the main turbine. The thrust of this engine configuration could be well over 20,000 lb.

Another reason why bypass engines with oversized afterburners may be popular is that while new high energy fuels foul turbojet nozzles and turbine blades they can be used in afterburners without harmful effects.

Curtiss-Wright, Allison, Pratt & Whitney and Westinghouse are also



Heavy Duty Powerplants

How engines powering Boeing bombers compare. Pratt & Whitney's J75 turbojet with afterburner, (front), is rated at more than 15,000 lb. of thrust, in contrast to its 10,000 lb. thrust J57 (center). General Electric J47 (rear) is rated at 6,000 lb.



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believed to be conducting serious design studies in this direction.

The mixed turbojet-rocket powerplant, though it has not been mentioned as frequently in this country as abroad, has the compelling advantage of being potentially able to transcend the altitude and speed limitations of air-breathing powerplants.

In the present budgetary competition between manned aircraft and guided missiles, some designers feel it will take at least the addition of rocket power to make the next generation of manned fighters able to swing the defense dollar back from missiles. Lessons which have been learned from the X-1 and X-2 programs coupled with the additional experience expected from the rocket powered X-15 high altitude research vehicle should pave the way for the rocket assisted mixed powerplant interceptor.

Mach 2.5-4 Airframe

The type of airframe which might be built around a Mach 2.5-4 powerplant is also shown in the sketch. The inlet probably would be an internal compression type as Republic is using on the F-105. This inlet is based upon the work done at NACA by Prof. Antonio Ferri, recently made head of Brooklyn Polytechnical Institute Aerodynamics Section.

The F-105 internal inlets have less



Gatling Versus Vulcan

Nineteenth Century Gatling gun, whose principle was adapted to arm Lockheed's F-104A Starfighter (background), alongside the six-barreled 20-mm. Vulcan (right), built by General Electric. Old weapon was manually cranked by infantryman. New gun produces 10 times the firepower of World War II fighter machine guns and is powered electrically. Both feature rotating cluster of barrels and are externally powered.

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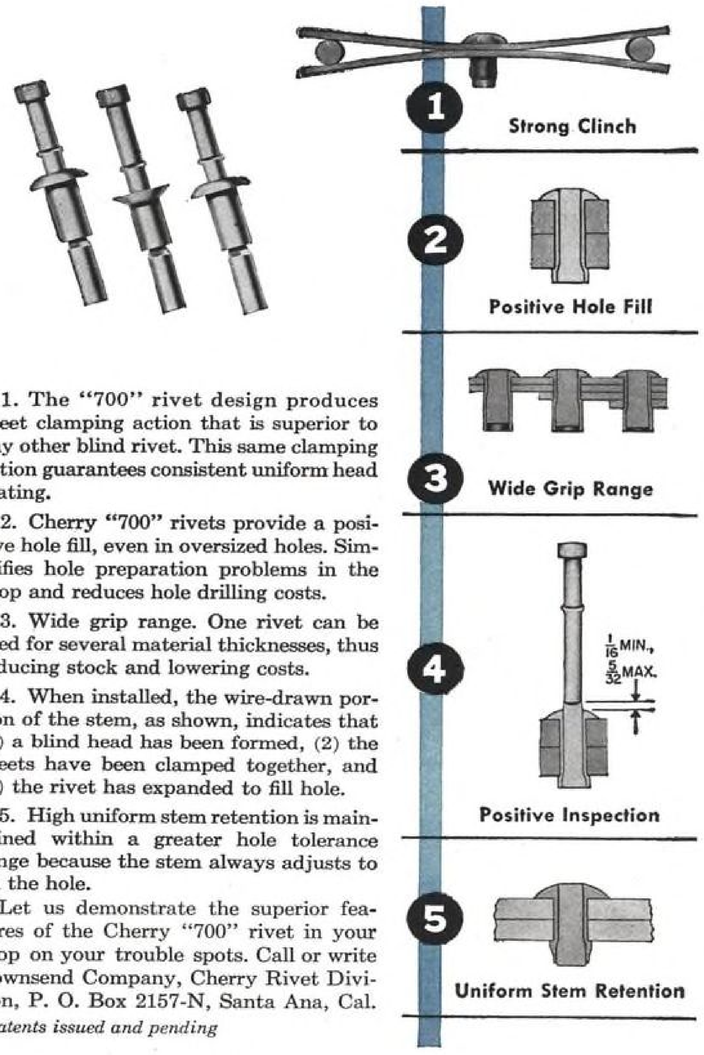


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cowl drag than the external types used on the F-104 and B-58 but are less stable therefore more difficult to control.

The problem of pilot protection is another important item. As shown, he is housed in his own capsule and uses a periscope for vision: ordinary cockpits with available windshield and canopy materials would be unable to exist in the stagnation temperatures which would build up around any protrusion into the windstream.

The capsule rides on rails, both to serve as an elevator for raising the pilot into the plane and as a guide for his downward escape ejection. Though a periscope has been shown for pilot vision, the capsule could also slide farther up the rails to bring the pilot's head above the aircraft fuselage for conventional vision during takeoffs and landings.

Army Contracts

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

REDSTONE ARSENAL, Huntsville, Ala.

E. I. Dupont de Nemours & Co. Inc., Wilmington, Del., hydrogen peroxide, 90% C. P. grade, 67,500 lbs., deposit on 250 lb. drums 270 ea., (Purchase Request: ME 20534-57 and ME 228-58), $41,850.

E. I. Dupont de Nemours & Co. Inc., Wilmington, Del., hydrogen peroxide, 90% C. P. grade, 52,500 lb., hydrogen peroxide, 76% C. P. grade, 52,500 lb., deposit on 250 lb. aluminum drums, 420 ea., (purchase request), ME 20665-57 and ME 20664-1, $59,718.

Emerson Electric Co., St. Louis, Mo., classified, (purchase request CS 5466-56), $84,652.

The Annin Co. Division, The Annin Corp., Los Angeles, Calif., eight items of valves, (purchase request ME 19676-57), $39,003.

The Ralph M. Parsons Co., 617 S. Olive St., Los Angeles, Calif., to constitute full and complete payment resulting from termination for convenience of the Govt. (Pur. Req. CS-335-56), $92,816.

Rohm and Haas Co., Philadelphia, Pa., continued research and development in the field of solid propellant rocketery (Pur. Req. CN-40-7), $232,750.

Thiokol Chemical Corp., Trenton, N. J., research and development of two-level thrust propulsion unit for Hawk X (XM-3) missile (Pur. Req. CN-38-7), $43,214; development of XM10 Lacrosse rocket engine (Pur. Req. CN-51-7) $151,828.

Edwin A. Koeble Associates Inc., 2000 Glen Echo Rd., Nashville, Tenn. compilation, drafting and supervision services for reproductable maps of Redstone Arsenal (Purchase request: CS 4833-57), $34,450.

U. S. ARMY ENGINEER DIVISION, New England Corps of Engineers, 150 Causeway St., Boston, Mass.

Lyman C. Morrill, d.b.a., Morrill Construction Co., 515 Crafts St., West Newton, Mass. Construction of water supply, location D, Portsmouth AFB, Portsmouth, N. H. (DA-19-016-ENG-5563), $27,581.

Atlantic Aviation Corp., Boston Division, Logan International Airport, East Boston 28, Mass. Charter (executive) airplane service, New England and vicinity. (DA-19-016-CIVENG-58-11), $36,800.

CORPS OF ENGINEERS, Jacksonville District, 575 Riverside Ave., Jacksonville, Fla.

Cambridge Corp., Industrial Park, Lowell, Mass., furnishing liquid nitrogen pumps for launching complexes nos. 15 and 19, Cape Canaveral Auxiliary Air Force Base, Fla., (ENG-08-123-(NEG-57-52) $41,960.

Chicago Pneumatic Tool Co., 6 E. 44th St., N. Y., 17, N. Y., furnishing four 500-KW diesel driven engine generator units and auxiliaries, Air Force Missile Test Center, Patrick AFB, Fla., (ENG-08-23-(NEG-57-50), $242,000.

CORPS OF ENGINEERS, U. S. Army Office of the District Engineer, Sacramento District, Sacramento, Calif.

Stolte Inc., Rancho Cordova, Calif., construction of two airmen's dormitories, dining hall, paving and utilities, Mather AFB, Mather Field, Calif., Contract No. DA-04-167-eng-1745, (IFB-Eng-04-167-57-50) $1,331,294.

Harbison and Mahoney, Sacramento, Calif., construction of a storage ammunition base and facilities, Mather AFB, Mather Field, Calif., Contract No. DA-04-167-eng-1756 (IFB ENG-04-167-57-60), $355,518.

Affiliated Engineers Contractors Inc., Florin, Calif., construction of nucleonics building, paving and related work, Sacramento Signal Depot, Sacramento, Calif., Contract No., DA-04-167-eng-1758 (IFB ENG-04-167-57-65), $324,614.

R. R. Todd, Santa Rosa, Calif., addition to operational building (Manual Portion) recreation facility, multipurpose building, Red Bluff AFS, Red Bluff, Calif., Contract No. DA-04-167-eng-1760 (IFB ENG-04-167-57-61), $240,306.

Gordon H. Ball and Gordon H. Ball, Inc., 300 Camille Ave., Danville, Calif. construction of runway primary extension and facilities, McClellan AFB, McClellan, Calif., Contract number DA-04-167-eng-1738 (IFB-04-167-57-41) $1,984,444.

ARMY ORDNANCE DISTRICT, Los Angeles, Pasadena, Calif.

Douglas Aircraft Co., Santa Monica, Calif., repair parts for Nike System, $35,-439.

PHILADELPHIA ORDNANCE DISTRICT, Philadelphia, Pa.

Radio Corp. of America Service Co. Inc., Camden, N. J., 900 man-months of installation, repairing, modifying and developing electronic and related equipment (re: guided missile program), $686,574.

Western Electric Co., Burlington, N. C., Nike spare parts and components, DA-36-034-ORD-2228, $26,079.

Western Electric Co., Burlington, N. C., Nike spare parts and components, DA-36-034-ORD-2228, $34,161.

CORPS OF ENGINEERS, Omaha District, Omaha, Nebr.

Mainelli Construction Co., Omaha, Neb., construction of elevators, Nos. 2, 3, 4, and 5, SAC control center, Offutt AFB, Omaha, Neb., Contract No. DA-25-066-eng-4507 (IFB ENG-25-066-57-104), $140,895.

Bison Construction Co., Grand Forks, N. D., construction of SAC utilities, Grand Forks AFB, Grand Forks, N. D., Contract No. DA-25-066-eng-4056 (IFB ENG-25-066-57-84), $351,811.

Flora Construction Co., Denver, Colo., construction of Nike electrical distribution, West site, Ellsworth AFB, S. D., Contract No. DA-25-066-eng-4502 (IFB ENG-25-066-57-118), $61,867.

CORPS OF ENGINEERS, Chicago District, Chicago, Ill.

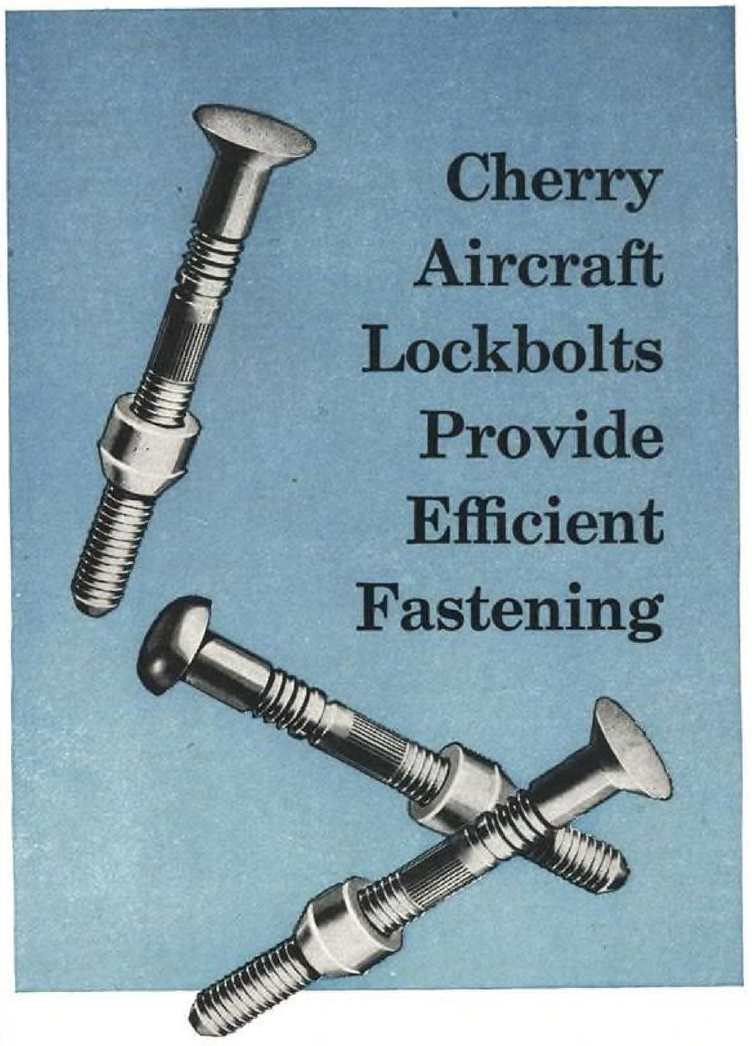
Roy E. Kippert, Madison, Wisc., foundations and related work for aircraft shelters, Truax Field, Madison, Wisc., (IFB ENG-11-032-57-99), $46,387.

CORPS OF ENGINEERS, Albuquerque District, Albuquerque, N. Mex.

Robert E. McKee General Contractor Inc., El Paso, Tex., construction of prototype Nike launcher, White Sands Proving Ground, New M., Contract No. DA-29-005-ENG-1975 (IFB ENG-29-005-ENG-58-1), $83,700.

ORDNANCE SUPPLY OFFICE, Mechanicsburg, Pa.

Fairchild Guided Missiles Div., Fairchild Engine & Airplane Corp., Wyandanch, L. I., N. Y. Radone assy, elevon panel assy., fin assy, and trim tab N-195-10264 (NEG 195-10264), $30,501.



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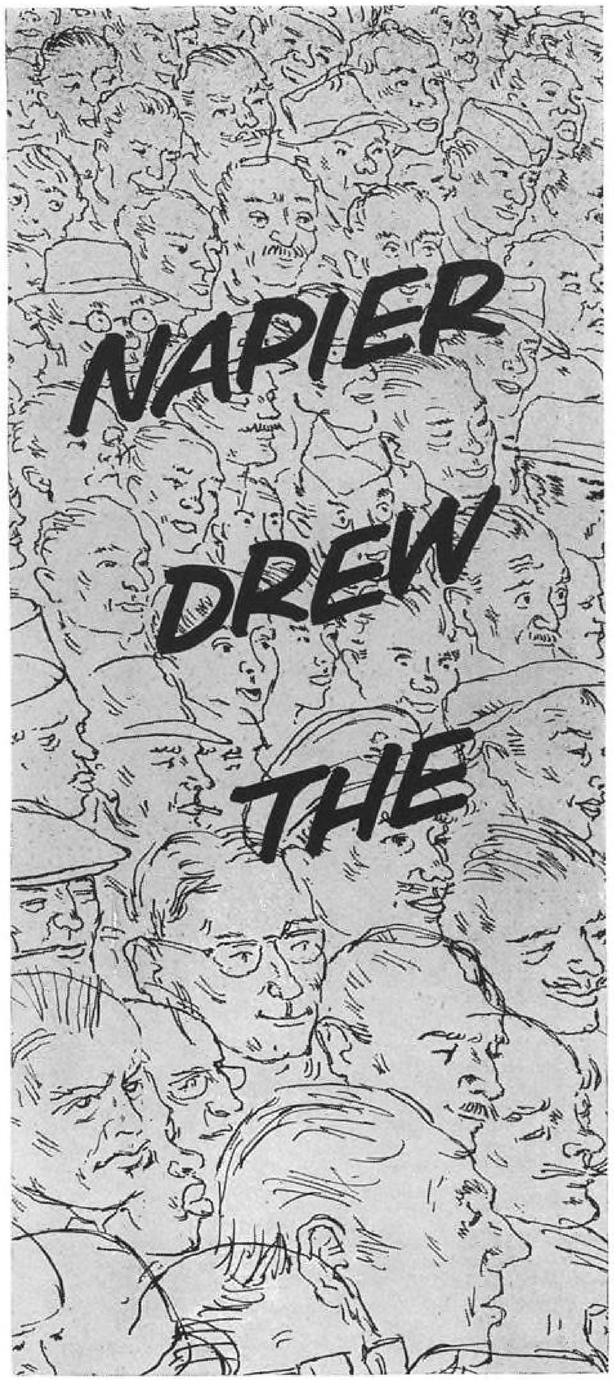
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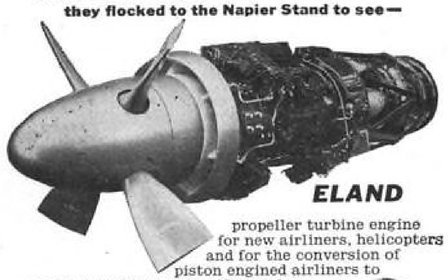
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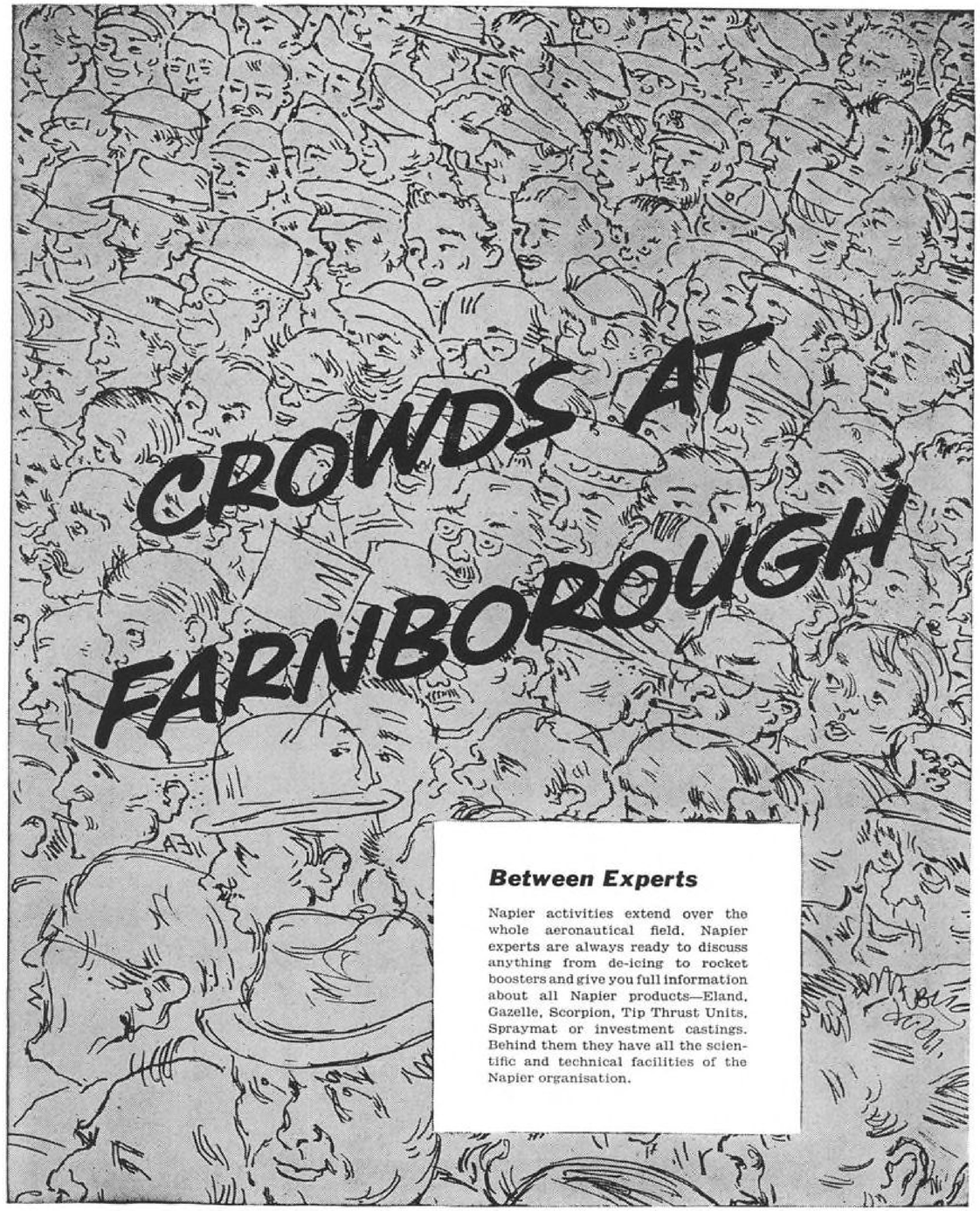
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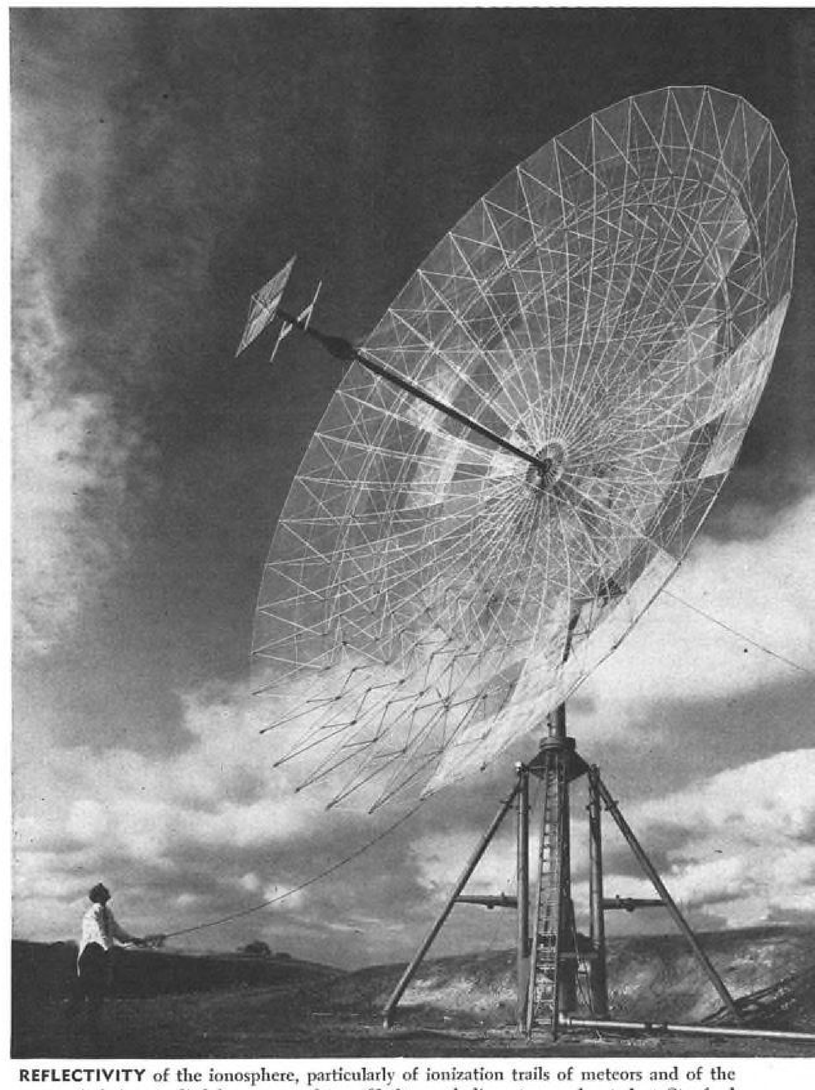
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Theory Explains F Region Heat Transfer

By James A. Fusca

New York, N. Y.—Atmosphere of the sun may extend into space well beyond the orbit of earth, according to a theory advanced by Dr. Sydney Chapman before a meeting of scientists here to discuss first results of the International Geophysical Year. Dr. Chapman headed the committee that organized the IGY.

Dr. Chapman's theory pictures earth's atmosphere as decreasing upwards in density until it merges with the solar interplanetary atmosphere, which is estimated to be at a temperature above 200,000 deg. Kelvin at earth's distance from the sun. This concept would explain heat energy known to be passed downwards by thermal conduction from upper to lower levels of the F region of the ionosphere (150-200 miles).



REFLECTIVITY of the ionosphere, particularly of ionization trails of meteors and of the aurora, is being studied by means of two 61 ft. parabolic antennas located at Stanford University in California and Geophysical Institute of University of Alaska in Fairbanks.

Solar Atmosphere Theory

The ionosphere has been explored extensively by signal reflection techniques through the F region which has a maximum height of about 200 miles. Very little is known about the regions above this height, although some information can be obtained from changes in polarization of signals reflected from the moon and from a study of whistlers and zodiacal light.

Theoretical speculations concerning these regions have attempted to explain the significantly large amount of heat that flows downward by thermal conduction from the upper level of the F region. Calculations have shown that heat absorbed from the sun is insufficient to account for it.

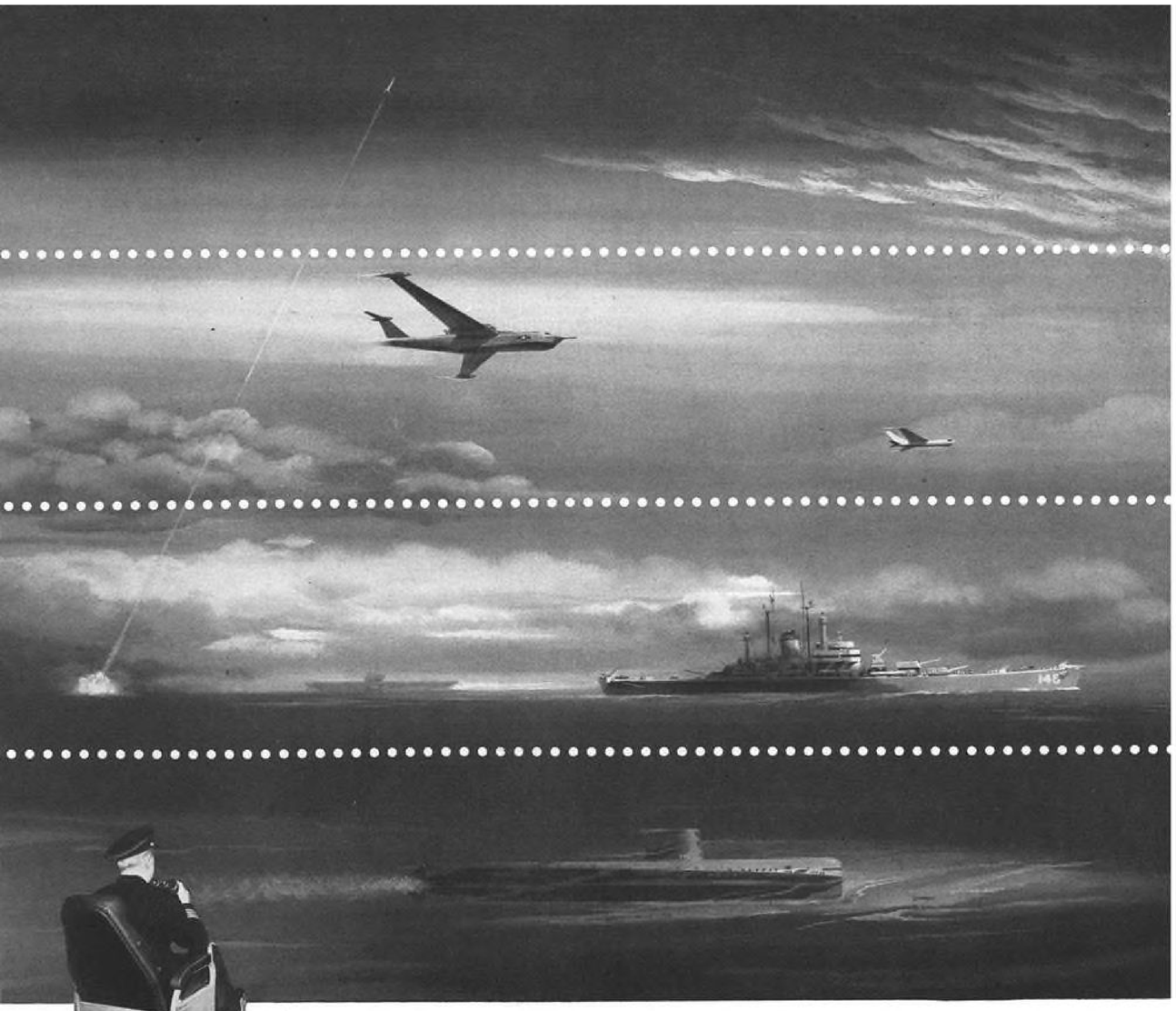
Dr. Chapman has proposed a picture of the outer ionosphere that explains this flow of heat as earthwards conduction from a hot solar interplanetary atmosphere. At the distance of the earth's orbit, he estimates the density of this solar atmosphere to be of the order of 1,000 particles per cc. (mainly protons and electrons) with a temperature above 200,000 deg. Kelvin. These figures are in agreement in order of magnitude with estimates obtained from whistler and zodiacal light observations.

At first glance it would appear that a satellite or rocket traveling through such high temperatures would be vaporized. Temperature is very high, but the particle density is very low and consequently the ability of the solar atmosphere to hold heat would be very low.

Therefore, a metal object such as a satellite would be able to radiate this heat without danger to itself.

Dr. Chapman formulated his theory by an approach using an idealized solar atmosphere. The solar corona, the high outer layer of the sun's atmosphere consisting mainly of ionized atomic hydrogen (protons and electrons) at a temperature of about one million degrees, can be simulated by a model corona that differs from the actual corona by being both static and spherically symmetrical.

The model corona was taken to have the same density as the actual corona at the point of the latter's maximum temperature which was assumed to be one million degrees. By estimating the thermal conductivity of the solar gas and assuming a constant outward flow of heat to infinity, a relationship between



Sentinel in Navy Blue

He goes down to the sea in ships, does business in great waters.

But no longer is the Navy confined to the sea's surface. It plumbs the depths, ranges through the skies, penetrates outer space. Its laboratories, even a thousand miles inland, are nautical battle stations.

Research by the Navy, and by the industries which serve it, anticipates tomorrow's needs. Among the industrial leaders contributing to that research and translating Navy needs into production realities, are eight companies of the GPE Group.

Typical of the significant contributions by GPE companies are Librascope's computers and anti-submarine devices . . . GPL's automatic bombing and self-contained navigation system for the Martin Seamaster . . . Griscom-Russell distillation equipment on every class of ship including nuclear powered craft. An indication of Askania's, Kearfott's and Link Aviation's involvement is given in the adjoining column.

Many GPE Group products serve vital defense needs today. The scientific advances they embody will one day benefit everyone.

GENERAL PRECISION EQUIPMENT CORPORATION

PRINCIPAL PRODUCING COMPANIES • Askania Regulator • GPL • Graflex • Griscom-Russell
Hertner Electric • Kearfott • Librascope • Link Aviation • Pleasantville Instrument • Precision Technology • Shand and Jurs • Simplex Equipment • Strong Electric



praenuntius futuri



"Portrait of The Future" is the well-chosen motto of this submarine. States U.S. Naval Institute Proceedings: "The *Albacore* will long be remembered as the pioneer design for flying under water." *Albacore's* revolutionary piloting technique was conceived and produced by Askania, a GPE company.



Link Aviation provides still another glimpse into the future with its F-11-F Flight Simulator in which pilots of the supersonic Tiger *pre-experience* flight conditions and maneuvers, "log" priceless familiarization time. Also "shipping out" with the Navy Air Arm is Kearfott, providing 400-cycle components for both planes and guided missiles.

The coordinated resources of the companies of the GPE Group, so effective in anticipating and meeting the needs of the Navy, serve with equal effectiveness other fields such as:

Automatic Controls and Instrumentation
Aviation
Chemical and Petroleum
Marine
Motion Picture and Television
Paper, Printing and Textile
Power Generation and Conversion
Steel. Mining, Transportation

For brochure describing the work of The GPE Group, write to: GENERAL PRECISION EQUIPMENT CORPORATION, 92 Gold Street, New York 38, New York.

temperature and radial distance was determined. At the distance of the earth's orbit from the sun, a temperature of 220,000 deg. was obtained.

Dr. Chapman noted that his ideas were speculative and open to criticism. He stated that he hoped that it would be possible to apply further observational checks during the continuing IGY investigations.

He presented his theory in a paper given before a joint meeting of the Mixed Commission on the Ionosphere and the Mixed Commission on Radio Meteorology at New York University attended by more than 100 scientists and observers from 15 countries.

Other Studies

Other developments discussed in papers presented at the meetings:

• **Whistlers.** Generated by lightning discharges, whistlers are very low frequency noise signals (sounding like the chirp of a bird) that appear to follow the earth's magnetic lines of force over a path extending many thousands of miles into the ionosphere to a conjugate point in the opposite hemisphere.

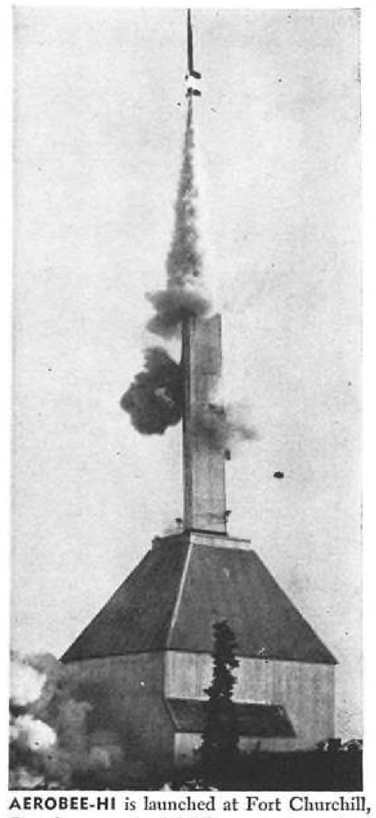
Recent studies of whistlers have shown that echoes of these signals may be reflected back and forth from one hemisphere to the other many times with little loss of power. Also, studies have been made of the tendency of whistler echoes to increase and then decrease in strength, known as "polar creep," which is believed to result from changes in the propagation path that cause the reflection points to shift to increasingly higher latitudes.

A French scientist, Roger M. Gallet, with the National Bureau of Standards in Boulder, Colorado, reported to the meeting that he had recorded twenty-one successive echoes from a single whistler. Since the path for each echo was about 30,000 miles in length, the signal traveled more than 600,000 miles during the recording period.

Gallet told AVIATION WEEK that although whistlers suffer from magnetic storms in the same manner as ground wave signals he had noted a marked enhancement of whistler signals beginning two or three days after a magnetic storm that diminished slowly over a period of weeks.

• **Radar Angels.** Spurious radar targets, called angels are believed to be caused by back scattering of a radar signal from convection turbulence associated with rising bubbles of warm air. This phenomenon is considered responsible for the "flying saucers" occasionally reported by military and CAA air traffic control radar operators.

Forward and back scattering of radio waves by atmospheric inhomogeneities in the troposphere (as opposed to ionospheric scattering) have received extensive scientific attention recently. Tropospheric forward scattering is being used for over-the-horizon communications in such systems as the arctic Distant Early Warning (DEW) line.



AEROBEE-HI is launched at Fort Churchill, Canada, as part of IGY upper atmosphere research. Doors at bottom of the special launching tower allow escape of rocket gases.

•**Solar Flares.** Particle streams ejected from flares erupting on the fringes of sun spots apparently penetrate the earth's atmosphere much deeper than had formerly been suspected. These particle streams are responsible for auroral displays and magnetic storms and are believed by some to influence earth's weather, although this has not been proved.

Particle Detection

Detection of these particles (electrons and protons) from the sun was by a balloon-borne Geiger counter floating at an altitude of about 20 mi. over Minnesota. Identity of the particles was established by a sudden display of aurora in the ionosphere far above coincident with a rapid jump in the count, rate of the Geiger counter.

During the IGY (July 1, 1957–December 31, 1958), scientists from 64 nations will be collecting data in 14 different scientific fields related to



Every plane a weather station

The solution to the costly problem of unpredictable weather is inherent in GPL ground speed and drift angle measuring equipments. These airborne auto-navigation systems that tell fliers where they are every moment, coupled with weather-data-recording units, can make every plane a weather station.

With complete, continuous weather data and position reports globally from all altitudes, forecasters will be able to predict next week's weather. To aircraft operators, crew and passengers this means more economical, more comfortable and faster flights.

GPL self-contained auto-navigators were developed in conjunction with the USAF (WADC). They have already revolutionized military flight and hold the same bright promise for all aviation as they do for meteorology. The vast potentialities of the GPL Avionics systems have only begun to be explored.

GPL
A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION

GENERAL PRECISION LABORATORY INCORPORATED, Pleasantville, N. Y.

ENGINEERS — GPL achievements have opened up some unusual research and development opportunities. Send resumé to Personnel Manager.

knowledge of the earth. This data will be assembled at three collection centers: Europe, the U.S.S.R., and the United States. Each collection center will transmit copies of received data to the other two centers.

Investigations presently underway are seeking information in the following areas: determination of ionospheric charge densities, measurement of the earth's magnetic field (and location of ionospheric and auroral current flows), measurement of solar radiation and studies of the solar spectrum, correlation of low-energy cosmic ray intensities with solar and magnetic phenomena, meteorological investigation of the upper atmosphere, and related data.

United States participation will include the firing of 194 high altitude rockets from White Sands Proving Ground, Holloman AFB, Point Mugu, Fort Churchill (Canada), and shipboard launchings. Four types of rockets will be fired: Nike Cajuns, Nike Deacons, Aerobees and Rockoons.

FILTER CENTER

► **High-Power Silicon Transistor**—New silicon transistor rated for 85 watts dissipation at 25C mounting base temperature is now in pilot production by General Electric. New type 2N451 is slated for full-scale production early next year. General Electric quotes following operating characteristics.

- **Maximum collector current:** 5 amp.
- **Input impedance** at collector current of one amp: 25 ohms (with 25C base temperature.)
- **Collector saturation resistance:** 2 ohms.
- **Beta:** minimum of 10.
- **Beta cutoff:** 400 kc.

► **Long-Range Tropospheric Scatter**—Recent tests indicate that range of tropospheric scatter communications can be more than doubled, providing single-hop multi-channel voice transmission circuits at ranges up to 600 miles. This conclusion, based on more than 16,000 hours of propagation tests conducted at 400 mc. by Lincoln Laboratory and Naval Research Laboratory at distances up to 830 miles, was reported during recent Western Electronic Convention (Wescon) in paper jointly authored by James M. Chrisholm, Walter E. Morrow, James F. Roche and Alfred E. Teachman of Lincoln Laboratory. Highlight findings of the tests include:

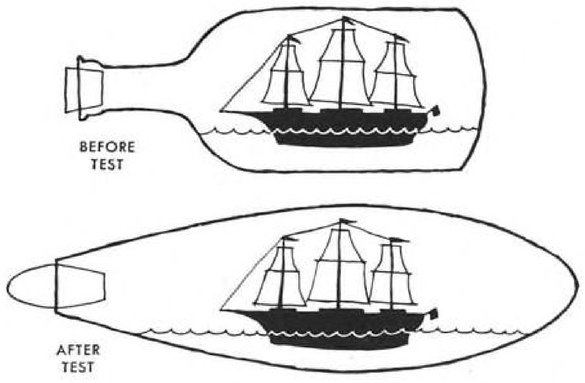
- **Overwater transmission** appears to be 5 to 10 db. better than overland transmission.
- **Fading rate and fading range** vary more widely at distances less than 250 miles.
- **Parabolic antennas up to 60 feet** in diameter show no significant gain degradation and it appears that much larger antennas can be used.
- **Rate at which path loss increases** varies considerably with distance. Rate is as low as 0.1 db. per mile between 350 and 450 miles for winter months, but runs nearly twice this figure (0.19 db.) between 600 and 830 miles.

► **Air-Ground Meteor Scatter**—Standard Research Institute is outfitting PBY to investigate possibility of long-range VHF communications employing meteor-burst scatter techniques. (AW June 17, p. 96.)

► **Reducing Antenna Size**—Number of small radio-radar antennas on an airplane can be substituted for single large one by utilizing multiple transmitting frequencies instead of one, according to "space-frequency equivalence" concept proposed by Drs. W. E. Kock and J. L. Stone of Bendix Aviation's systems division at Wescon. This permits system designers to swap off antenna size and complexity for greater equipment complexity in number of frequencies transmitted simultaneously. One example cited: performance of 10-foot parabolic dish was duplicated by three small wideband receivers arranged in an equilateral triangle six feetd on a side.

NOTABLE ACHIEVEMENTS IN WIND TUNNEL TESTING – NO. 1

CWT engineers are a dedicated group, spending many extra-curricular hours in the pursuit of basic scientific information. The result of a recent test is shown below.



Basic Aerodynamics

CWT—The Southern California Cooperative Wind Tunnel—is a $14 million developmental testing facility dedicated to the solution of aerodynamic problems of high speed aircraft and missiles.

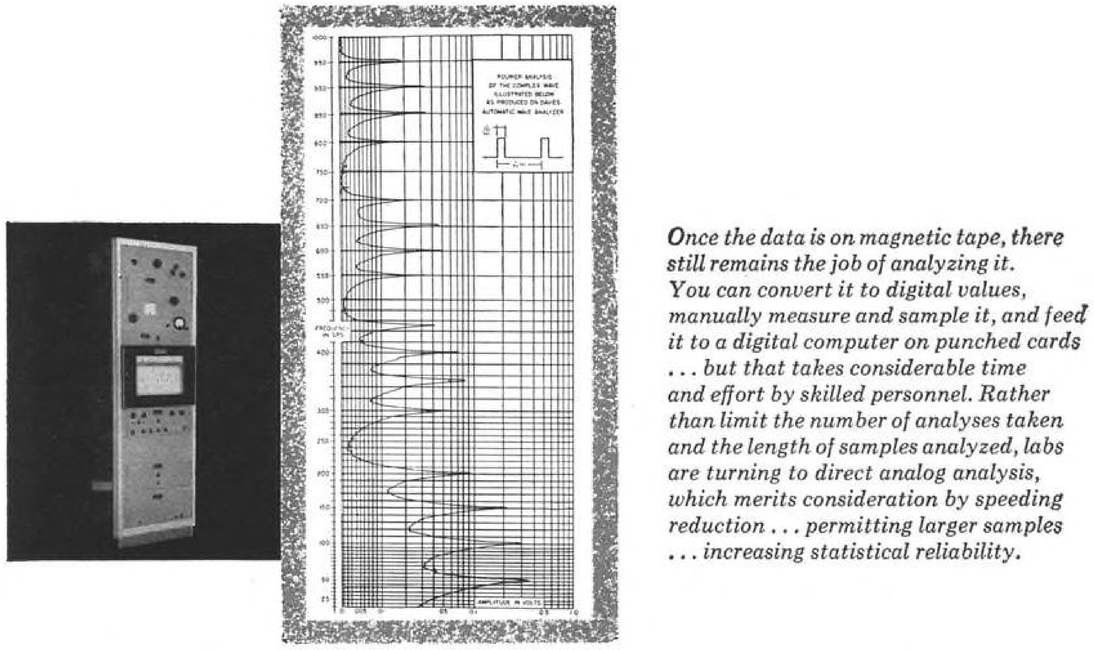
Established in 1942, CWT has been concerned with the development of such aircraft as the Hustler, the Super Sabre, and the DC-8 jet transport. Today, with a staff of 240 people, the Wind Tunnel continues to concentrate on projects vital to tomorrow's air superiority.

In addition to its owner companies, the CWT also serves other leading firms and government agencies.

If you would like more information regarding the CWT, you are invited to write us.

CWT — SOUTHERN CALIFORNIA COOPERATIVE WIND TUNNEL
950 S. Raymond Ave., Pasadena, California

Operated by the California Institute of Technology. Owned by Convair, Douglas, Lockheed, McDonnell and North American.



Once the data is on magnetic tape, there still remains the job of analyzing it. You can convert it to digital values, manually measure and sample it, and feed it to a digital computer on punched cards . . . but that takes considerable time and effort by skilled personnel. Rather than limit the number of analyses taken and the length of samples analyzed, labs are turning to direct analog analysis, which merits consideration by speeding reduction . . . permitting larger samples . . . increasing statistical reliability.

how automatic wave analyzers speed analog data reduction, improve statistical reliability

Automatic wave analysis is probably the least complicated technique for reducing analog data. Feed the taped data to an analyzer, flip the switch, and a complete Fouriér series is automatically plotted and printed in permanent record form. There are no intermediate steps, and what little the operator has to do can be trusted to relatively unskilled personnel.

Both of the two models available from Davies can accurately plot Fouriér series data as either *amplitude* versus *frequency* or *power* versus *frequency* at the flip of a selector switch. Both are also equipped with a "quick look" facility. Model 9020A provides a quick analysis across its frequency range of 3 cps. to 2 kc in 6 minutes; Model 9050A across its range of 3 cps. to 10 kc in just 15 minutes. Linear or square law output, as desired, is recorded by a Brown *ElectroniK* Potentiometer as a large, easily readable plot. You can visualize results immediately without any further curve tracing.

Multichannel inputs permit you to analyze as many as seven channels of data simultaneously. But the ultimate in automation is provided by the addition of a Davies Automatic Channel Selector, which you can program for serial analysis of up to 14 channels, changing tape speed, bandwidth, and output as you desire . . . all without any further attention.

It must be conceded that, while Davies Analyzers do provide high amplitude accuracy across wide frequency ranges, no analog analysis equipment could provide the *point* accuracy of manual and digital computer methods. But too often, that point accuracy is only achieved at the expense of reliable results. The speed with which Davies Automatic Wave Analyzers can run through data—in as little as 3% of the time required by digital methods—permits such large samples to be analyzed that the statistical reliability of the overall result remains unequalled.

That's why Davies Analyzers, first designed for aircraft studies, have since been successfully applied to vibration, noise, shock, and flutter analysis in vehicles, aircraft, missiles, and ships . . . seismic interpretation . . . power-line disturbance analysis . . . noise analysis . . . and any number of other phenomena characterized by randomly fluctuating data.

You'll find considerable additional information on Davies Automatic Wave Analyzers, how they operate, and what you can expect from them in the way of specific performance characteristics in Bulletin 9001. Write Minneapolis-Honeywell Regulator Co., Davies Laboratories Division, 10721 Hanna Street, Beltsville, Maryland, or call Webster 5-2700.

MINNEAPOLIS **Honeywell**

DAVIES LABORATORIES DIVISION

USAF Pilots Favor Centerline Lighting

Centerline approach lighting system and flush-mounted threshold lights were strongly endorsed by Air Force and Navy as a result of recent airport approach lighting system evaluation by these services.

Tests were conducted at March Air Force Base, Calif.

General conclusion of the report was that "test proved conclusively that centerline approach lighting is a basic requirement for an accepted national standard on approach lighting. With the addition of flush mounted lights within the landing area . . . a zero-zero landing capability would exist for most aircraft."

Civil interest in flush lights is indicated by Civil Aeronautics Administration's plans to test various combinations (AW Aug. 26, p. 45). But CAA said a possible civil-military standard is not now in prospect.

Test Equipment

March AFB tests were made with standard USAF airfield lighting equipment with the exception of Sylvania Stroboscopic Condenser Discharge Lights and the Elfaka Flush lighting Units, manufactured in this country by Structural Concrete Products Corp. Elfaka units use either Sylvania flasher or a General Electric lamp.

Military tests were made with many types of aircraft, including high performance planes which have a very high angle of attack during landings, such as the USAF F-102A and Navy's F4D. Here are some of their conclusions:

• **Configuration recommended** consists of 3,000 ft. centerline lighting with stroboscopic flashers and flush lighting units within the 1,000 ft. under run area.

By use of the centerline system with flashers, the pilot is capable of determining at a safe distance out, or at his normal GCA minimums, whether he is properly aligned with the runway, although he may not yet have the runway in sight.

• **Centerline system** adds to the confidence of the pilot and considerably reduces the mental hazard of minimum weather approaches. It is believed that this system should also increase the safety of any type of instrument approach, particularly following a prolonged flight.

• **Centerline lights** have a tendency to prevent the pilot from landing short of the runway, since these lights provide a positive reference for depth perception purposes.

• **Over-the-nose** guidance obtained from the centerline system by both USAF and Navy aircraft was excellent. Centerline was followed to the threshhold even in extreme nose high attitude approaches.

• **Flush-mounted lights** in the landing area would greatly improve landing capability during minimum fog conditions. Lack of this lighting is the primary reason that the Air Force's landing minimum should remain at 100 ft. and a quarter of a mile. With the addition of flush-mounted lights within the landing area, to supplement approach lighting, a zero-zero landing capability would exist for most aircraft.

• **Flush green threshold** lights should be added to mark the end of the runway. Present threshold lights are not as predominant as the flush lights and are difficult to distinguish. Furthermore, present semi-flush threshold lights extend slightly above the runway and have caused damage to landing aircraft.

• **Sylvania and Elfaka** fixtures performed exceptionally well.

An advantage of the stroboscopic lighting system installed at March AFB is that if one tube in the strobe system fails the rest keep firing. In some other systems, if one tube fails, all go out.

Here are excerpts from the Strategic Air Command report:

• **Test installation** at March AFB was operated constantly during the hours of darkness when the instrument runway was active. It was also operated during daylight periods of reduced visibility.

• **Test aircraft,** in addition to SAC planes, were provided by: Military Air Transport Service, Air Defense Command, Tactical Air Command, Air Training Command, Continental Air Command, Air University, Air Force Academy and U. S. Navy.

• **Types of aircraft** included: B-52, B-47, B-57, KC-97, C-97, F-86, F-100, F-102, T-33, T-29, B-25, C-47, F3D, F4D, and S2F-1.

Some 395 approaches were made and evaluated. Total of 364 were made under actual instrument conditions, and 303 by aircraft from comands other than SAC.

Test Results & Analysis

Strobeacon light could be seen at a distance of approximately three times that of reported visibility—when pilot reported one mile visibility, Strobeacon was normally sighted at three miles.

Centerline lights were visible to the runway threshold, even during runs in which aircraft were to the side of the approach centerline as far as the GCA wave-off point.

All approaches made with the centerline lights on could have been terminated in safe landings.

Pilots of jet aircraft, such as B-47s and B-52s, were able to judge position sufficiently by reference to the center-



FOUR Elfaka flush light units are shown under construction in under run area at March AFB prior to tests. Lights are housed in far end of each concrete "box." Floor under grid slopes down toward sump under lights to provide drainage.

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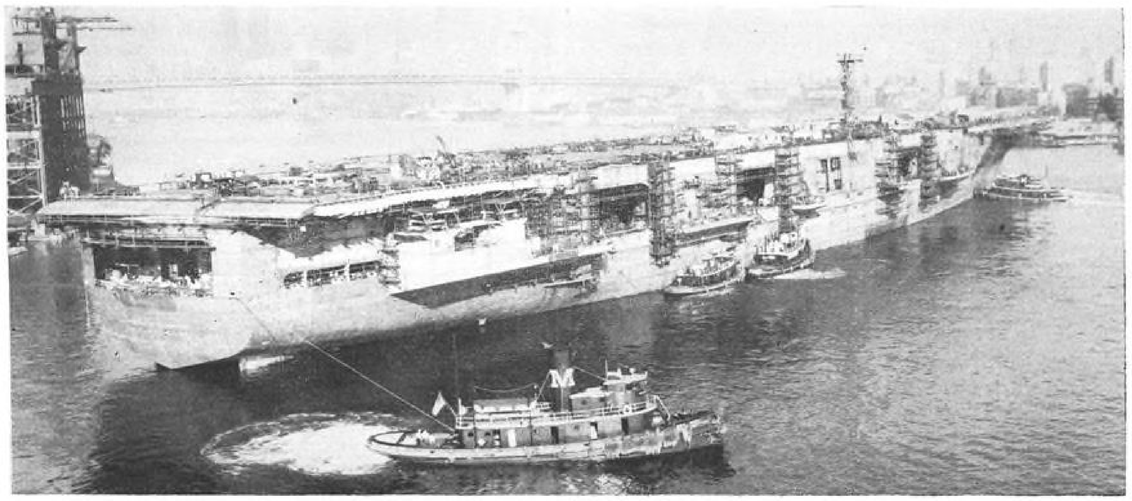
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Independence 65% Complete

Fourth of the Navy's 60,000 ton Forrestal class carriers, the Independence, is towed by tugs from one drydock to another where construction on its flight deck will be speeded. Ship, now 65% completed, is under construction at Brooklyn Naval Shipyards.

line lights to complete a roundout so close to the flush approach lights that the aircraft arrived over the end of the runway in a landing attitude.

Possibility of touching down short during the approach is greater in an aircraft of the B-47 type, as the initial approach speed is close to the stall speed. It is easy to overcontrol slightly, which increases the stall speed very rapidly on swept wing aircraft, resulting in inadvertent touchdown short of the runway.

Depth Perception

Flush centerline lights give excellent roundout assistance for depth perception.

The flush lighting fixtures within the under run area have allowed pilots to retain the much desired centerline guidance to the threshold. The lights have far exceeded Air Force expectations and are proving to be remarkably trouble-free.

Since installation, over three inches of rain have fallen with no drainage problems encountered. Moreover, B-47s have touched down short and rolled over the flush lighting units in the termination bar with no damage resulting.

As to the Strobeacons, "the lights provide added initial identification at the most critical time on the approach and give more maneuvering space for increased safety."

Navy pilots participating in the flight evaluation tests commented that the centerline system was completely adequate and over-the-nose visibility of the centerline could be followed to the threshold, even in extreme nose-high attitude approaches. Each pilot remarked that the Strobeacon lights were excellent.

These are sample comments made by pilots participating in the lighting system tests, listed by type of plane they were flying:

• **F-102:** "Strobes sighted at 10 miles turning final; circling guidance from Strobes turning base. Flush lights a little brighter. Sat in cockpit so that centerline was directly over nose. Had centerline in sight 'till about ¾-mi., but no sweat, because you never sit and look over the center, you always look a little to one side. Then centerline is in view all the way to the threshold."

Another F-102 pilot added, "Centerline in sight over-the-nose on complete approach. Never did see side lighting, centerline is so outstanding."

• **B-52:** "At 30,000 ft., when visibility was reported as less than 4 mi., top of haze 6,500 ft., Strobe lights could be seen 15-20 mi. slant range on heading 275 to 360 deg. and up to and abeam of field."

• **F4D:** "Centerline and Strobes adequate over nose. They are excellent. Flush lights brighter, but O.K. Real fine system."

• **F3D:** "Centerline O.K., that's all I need. Side lighting not needed."

• **C-97:** "Strobe lights were seen a minimum of two miles before any other lighting." Another C-97 MATS pilot added, "In low ceilings, it was noted that there was considerable glare associated with the Strobe lights while still in the overcast. This can prove distracting to a pilot. Also, perception seems to be affected immediately before landing with the Strobe lights on. Recommend Strobe lights be dimmed on last ¼-mile of approach to landing end of runway. Strobe lights most effective in this condition, 3-5 mi. visibility with twilight."

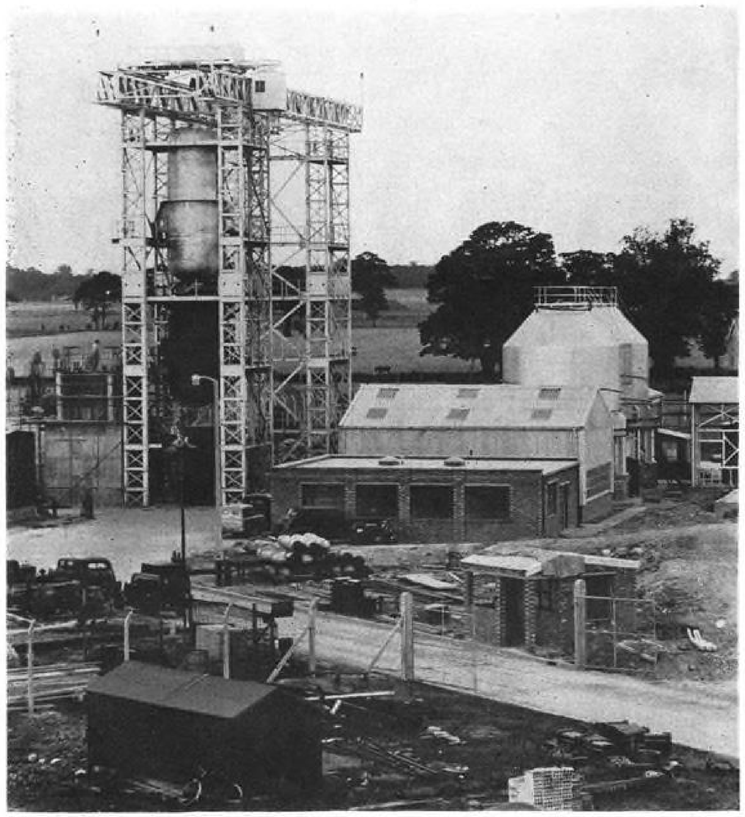
Conclusion regarding roll bar lights was, "In most cases, pilots were not sure whether the roll bar and/or extended edge lights were on or off during run, thus indicating that they are definitely not a necessity but rather a luxury. If installed, they should be white instead of red."

OFF THE LINE

Airwork Corp. has been appointed East Coast distributor for New York Air Brake's line of Stratopower aircraft hydraulic pumps, motors and electric motor-driven pumps. Stocks of units and spares are available at all five of Airwork's branches: Millville, N. J.; Miami, Fla.; Atlanta, Ga.; Cleveland, O. and Washington, D. C.

Assets of Precision Components, Inc., New Cassel, N. Y. have been acquired by Servomechanisms, Inc., designers and producers of electromechanical control equipment for aircraft and missiles. Precision Components produced a precision tachometer generator which has been incorporated in the line of products of Mechatrol division of Servomechanisms.

Contracts totaling nearly $800,000 for power generating equipment and automatic generator sets have been received by Consolidated Diesel Electric Corp. from the Civil Aeronautics Administration and the Navy. CAA's order is for 57 units of 30,000 watt capacity and 23 of 60,000 watt output. Units supply electric power automatically in case of commercial power failure. Generators feature a special



British IRBM Test Stand

Test stand at de Havilland Aircraft plant at Hatfield is for British intermediate range ballistic missile being developed by de Havilland Propellers (AW Aug. 26, p. 23). Tankage appears to be for fuel and oxidant, but it is unlikely any firing of engine of this size would be done at Hatfield. Rig probably is systems testing installation. Rolls-Royce reportedly is building the powerplant.

"exerciser" which automatically starts and runs each unit for an hour a day to keep mechanism in constant state of readiness. Navy's order is for 24 units of 100,000 watt output to be installed at points where commercial power is unavailable.

On Mark Couplings division, On Mark Engineering Company, manufacturers of flexible and quick disconnect couplings and custom valves for aircraft and missiles, has moved into larger quarters at 4440 York Blvd., Los Angeles 41, Calif.

J. A. Keeneth Co., Glen Head, N. Y. will represent Eastern Rotorcraft Corp., manufacturers of cargo release hooks, nets, tie down, slings and other TYZEM cargo securing equipment, in the Northeastern sector of the U. S.

New adhesive to bond dacron and nylon to uncured natural rubber, GR-S, neoprene, butyl and Buna N elastomers has been put on the market. Called Chemlok 401, the cement's room temperature adhesion value exceeds 100 lb. per linear inch, depending on the strength of the elastomer compaund. Chemlok 401 is a non-flammable liquid which may be applied by spraying, brushing or dipping and print roll padding. Manufacturer: Special Products division, Lord Manufacturing Company, 1635 W. 12th Street, Erie, Pa.

Fabrics coated with Viton A, a new fluoroelastomer synthetic rubber possessing excellent resistance to deterioration by heat, chemicals, fuel and lubricants are available for testing from Fabrics division, E. I. du Pont de Nemours & Co. An addition to the Fairprene line of elastomer coated fabrics, Viton A will withstand immersion in most fluids at temperatures exceeding 300F and is almost impervious to ozone and weathering. Du Pont is offering three Viton A cooled Fairprene fabrics: glass fiber, Dacron and glass fabric coated with teflon. Price for 36 in. width, fully vulcanized is $25-$60 per yard depending on gage. Manufacture is at present limited.

Fairchild Camera and Instrument Corp., Syosset, N. Y., earned $255,000, or 65 cents a share, in the second quarter of this year. A 7 cents per share loss was posted for the first quarter. New orders booked by Fairchild increased from $13.7-million in the first half of 1956 to $18.4-million in the same period of this year.

Construction on a $9-million air separation plant which will have a daily capacity of 75 tons of liquid oxygen, nitrogen and argon was started recently at Acton, Mass. by Air Reduction Sales Company division of Air Reduction Company, Inc. Facility will be the fifth large air liquefaction plant to be built by Air Reduction. Completion is scheduled for summer, 1958.

WHAT'S NEW

Reports Available:

Recognition and Identification of Complex Visual Forms as a Function of the Labeling System Employed—by H. W. Hake and C. W. Ericksen, The John Hopkins University for the Wright Air Development Center: $.75; 28pp. (P.B. 121358).

Compatibility of Greases—by F. S. Meade, Rock Island Arsenal Laboratory, U. S. Army Corps: $1.75; 67pp. (P.B. 121737).

Climatic Extremes for Military Equipment—by N. Sissenwine and A. Court, Office of the Quartermaster General, Department of the Army: $1.75; 70pp. (P.B. 121741).

Devices for Damping Mechanical Vibrations, A Bibliography—by M. Benton, Naval Research Laboratory: $2.75; 101pp. (P.B. 121299).

Radiological Health Handbook—by S. Kinsman and others, Robert A. Taft Sanitary Engineering Center, Public Health Service, U. S. Department of Health, Education and Welfare: $3.75; 356pp. (P.B. 121784).

Development of Subminiature High Temperature Capacitors—by Balco Research Laboratories for Wright Air Development Center: $2.00; 79pp. (P.B. 111729).

Basic Research on Sintered Titanium Power Analogous to "Sap" for High Temperature Strength—by E. P. Weber,

GENERAL ELECTRIC ANNOUNCES

Two Constant Speed Drive Advances Save Fuel, Improve System Performance

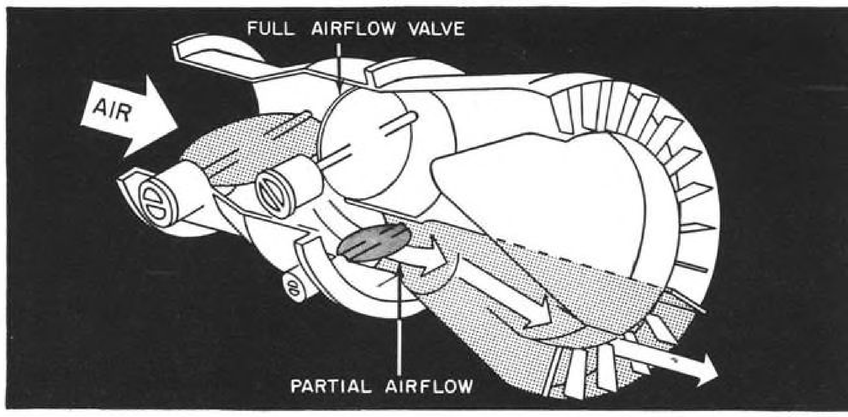
A 35% reduction in power consumption, plus frequency control within ±.1% of 400 cps, are obtained from two air-turbine constant speed drive improvements made by General Electric. With jet-age aircraft reaching for higher levels of operational performance, these new design features permit air-turbine drives to satisfy, with higher efficiency, accessory system demands for precisely controlled a-c power.

FUEL SAVINGS are accomplished by using only a small arc of the turbine nozzle area at cruise conditions. During this period—about 75% of a long-range flight—electrical loads are relatively low and available engine energy is far more than is needed to drive the turbine. A small valve controls air flow to this partial segment of turbine nozzle for adequate drive output, yet reduces air extracted from the engines more than 35% over earlier models. This reduced cruise-air consumption saves fuel, extends aircraft range.

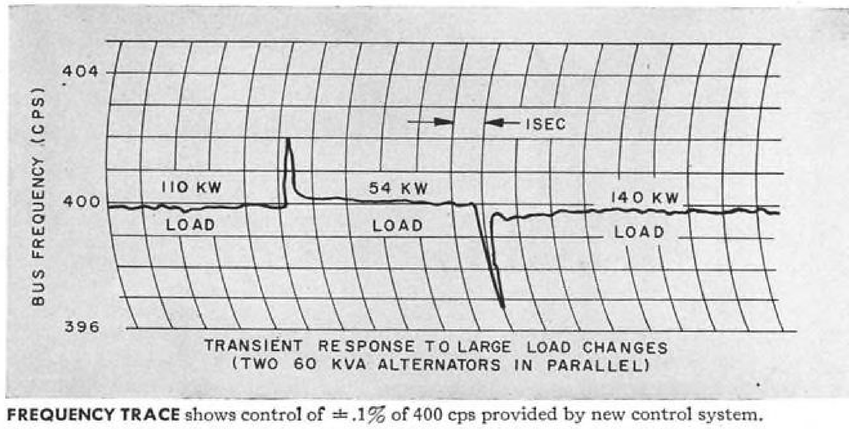
Matching turbine nozzle area to varying load and energy conditions adds new flexibility to air-turbines. Drive efficiency is improved and better aircraft performance results.

CONSTANT FREQUENCY STABILITY within ±.1% of 400 cps through a complete range of turbine inlet energy conditions is provided by a General Electric-developed control system. This accuracy enables electronic and electrical equipment to function with a greater degree of reliability at precise performance levels over wide ranges of aircraft operation.

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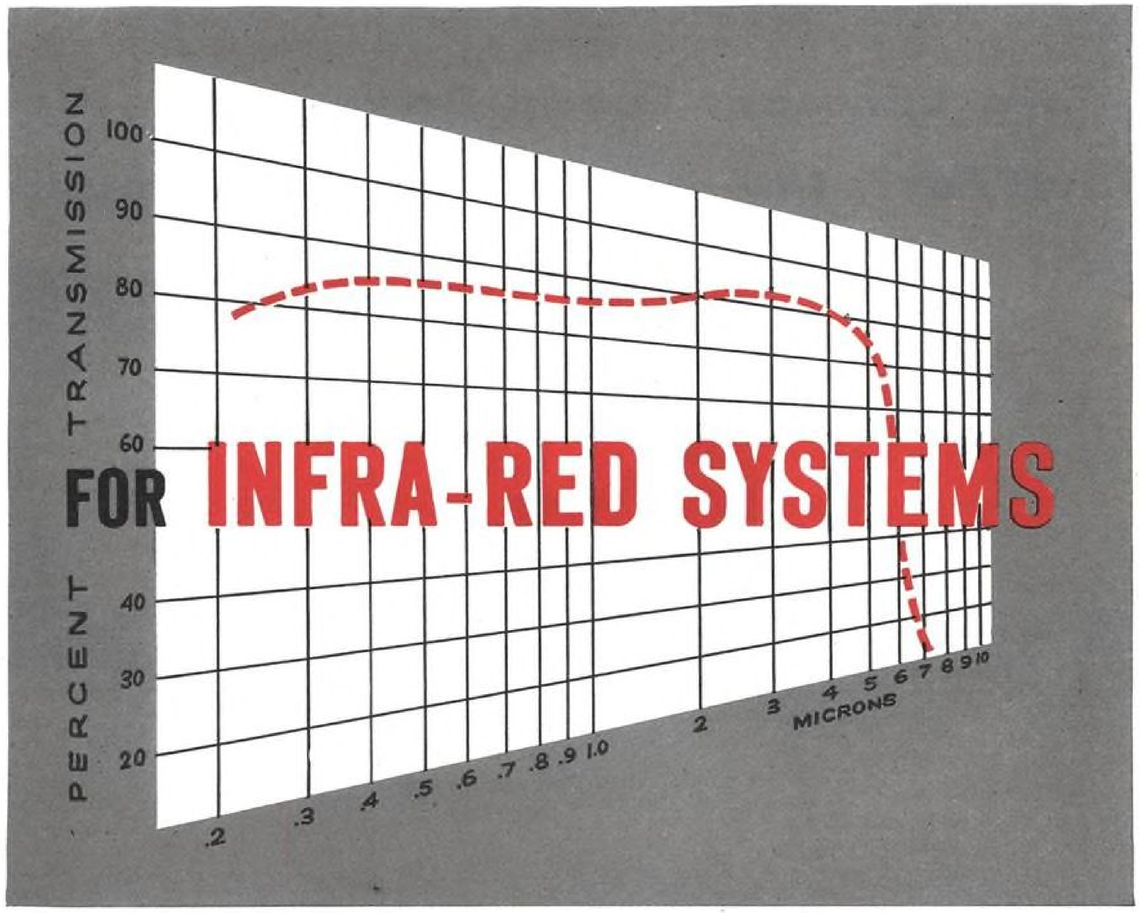


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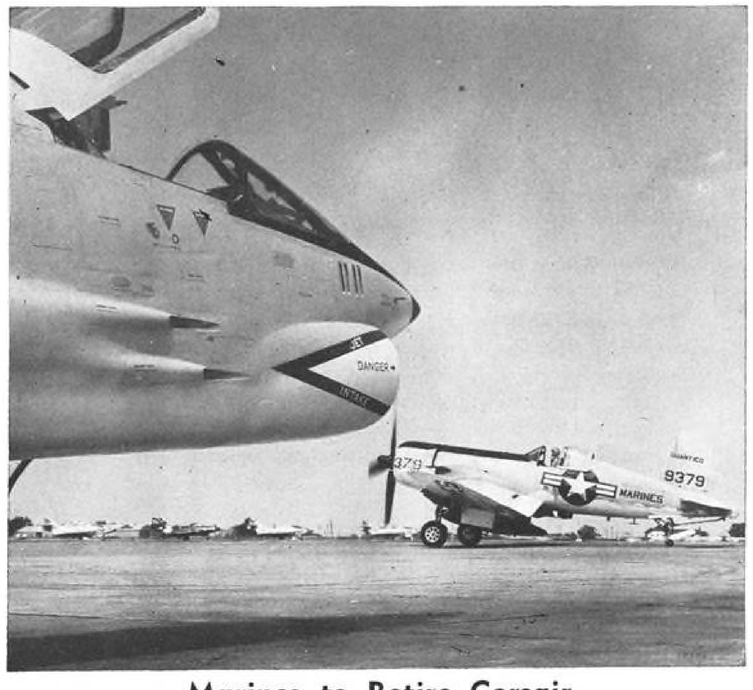
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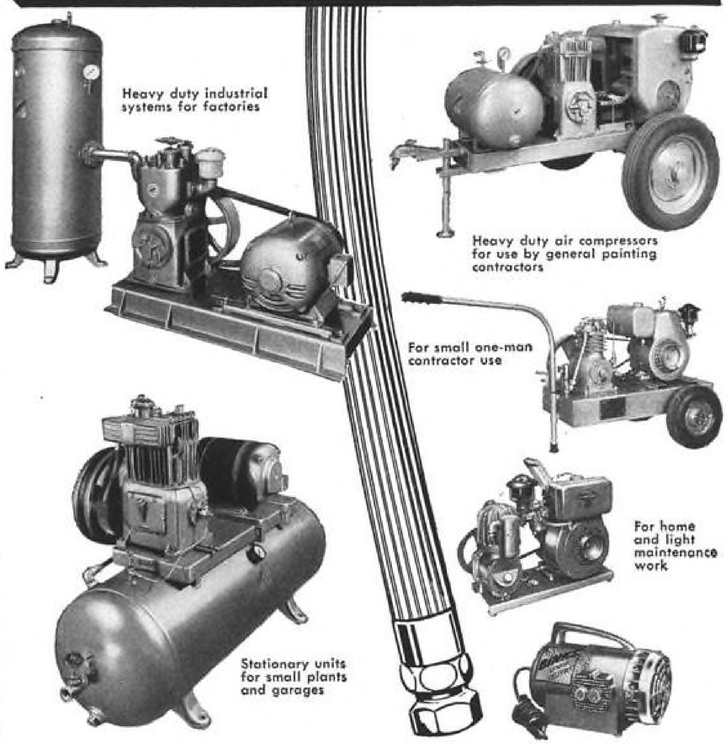
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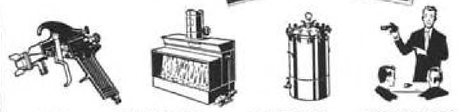
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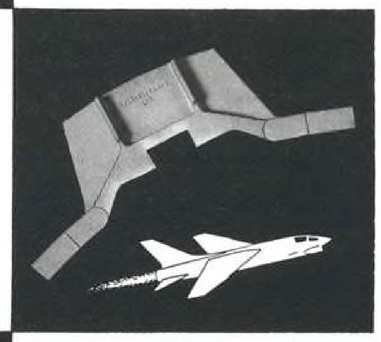
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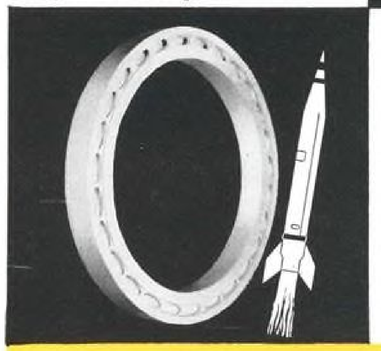
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FOR THE LOCKHEED STARFIGHTER
A flow divider and fuel selector for the afterburner of the J79 jet engine, CAST BY LEBANON in a precipitation hardened stainless steel. Lebanon foundry engineers developed a special coring material to achieve the close tolerances and smooth surfaces required in the internal passages. This casting must perform at high pressures and elevated temperatures.

FOR THE CHANCE VOUGHT CRUSADER
A support fitting for a jet engine removal track, CAST BY LEBANON in precipitation hardened stainless steel for the close tolerances, dimensional accuracy and surface smoothness required by the design. A significant example of how Lebanon foundry engineers were able to successfully produce a casting which substantially retained the original characteristics of a machined part, at a major cost saving.



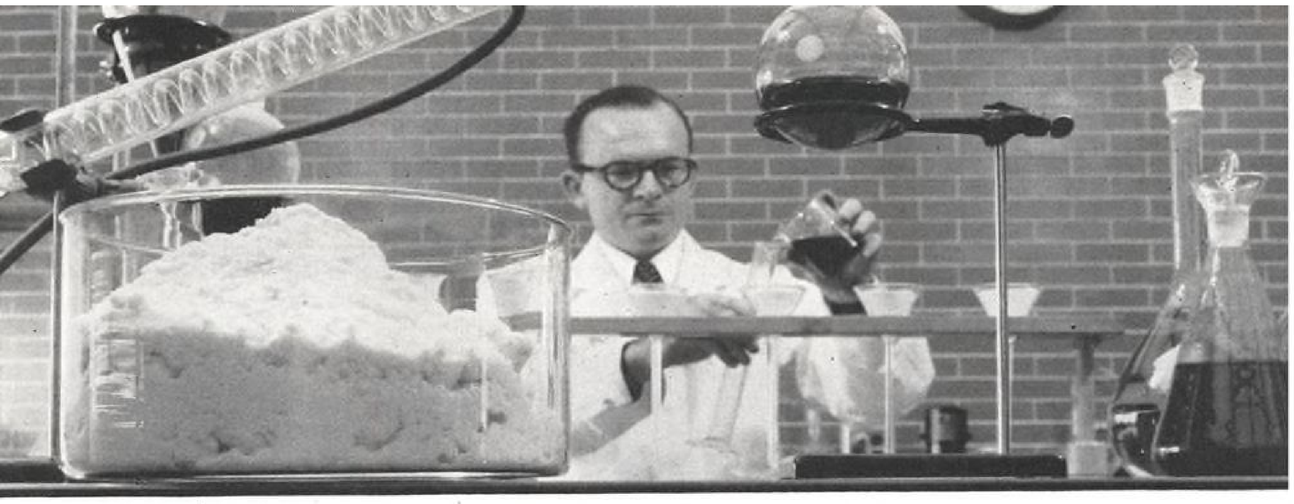


FOR A ROCKET YET UNNAMED
A nozzle ring for a prototype rocket engine by Reaction Motors, Inc., CAST BY LEBANON in stainless steel. Representing the ultimate in casting design and production, this casting requires absolute accuracy of core placement, close tolerances, and thin metal sections. These exacting requirements foreshadow the foundry techniques of the future, now being employed at Lebanon *today*.

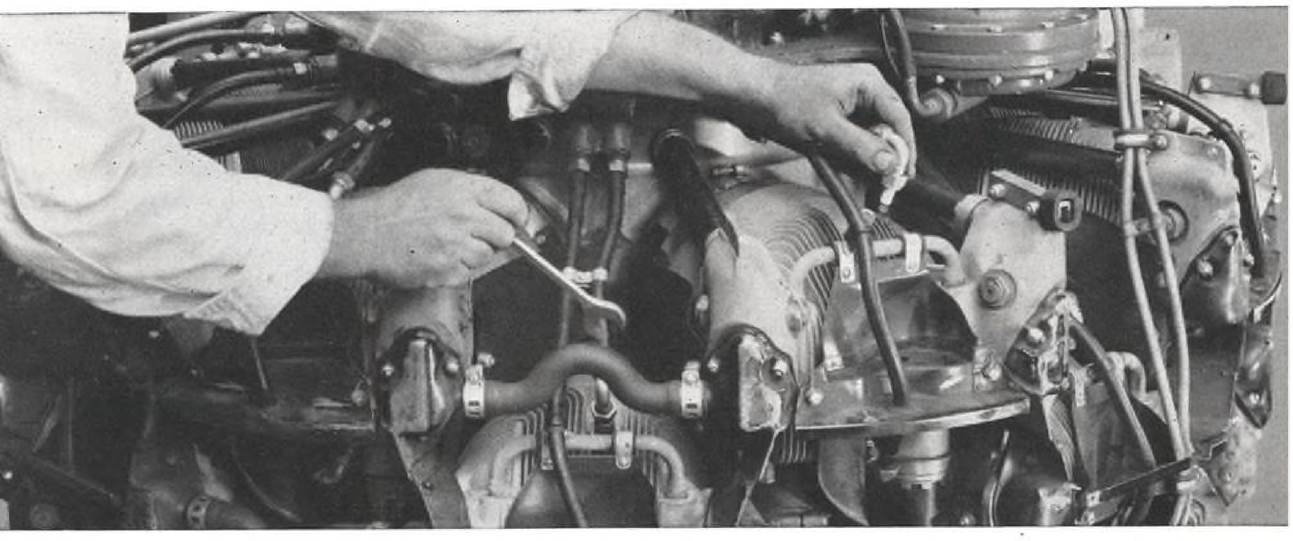
DESIGN AND PRODUCTION ENGINEERS: If you would like case histories of these castings, together with the metallurgical data, process development and applications to your design project, write to Lebanon and ASK FOR DESIGN FILE F.

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This remarkable new cable is made with either copper or stainless steel core insulated with entirely new Packard silicone compounds. It's flexible, easy to handle, and it's strong enough to withstand the rigors of installation.

The new brick-red sheath is tough, dense and compact and has high abrasion resistance. Added density throughout the insulating layers helps overcome almost all problems of compression set and there are no signs of the soft sponginess so typical of ordinary silicone cables. What's more, the insulation has great uniformity in dielectric strength.

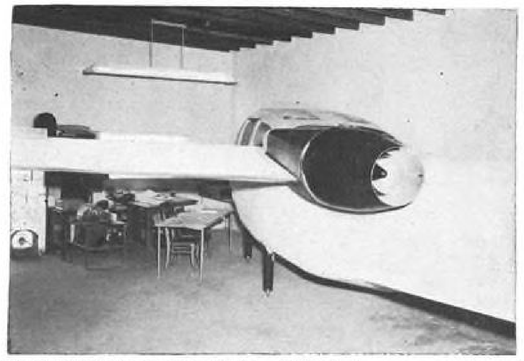
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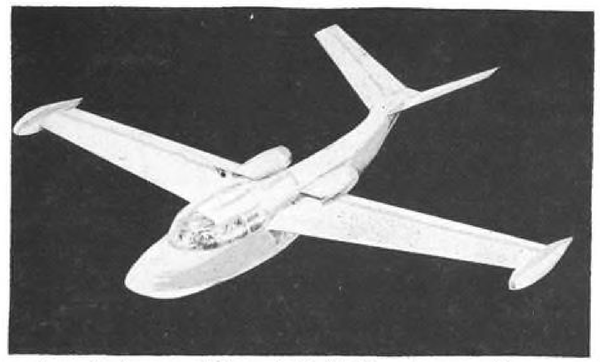
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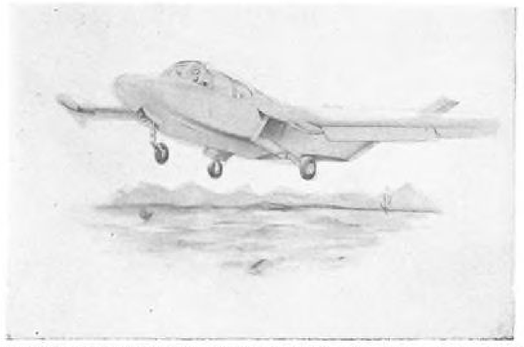
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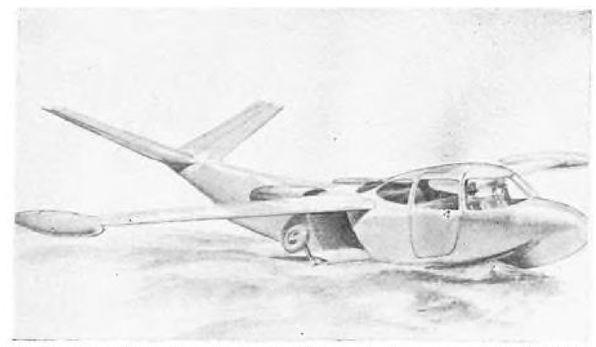
"Live Wire" division of General Motors





TURBINE NACELLE installation (left) is shown on mockup of new Acme business amphibian; sketch (right) points up wide range of cockpit visibility, V-tail located above jet nozzle exhaust. Turbofan engine inlets are located high out of water spray area.





FOR WHEELS-DOWN LANDING (left) main gear wheels are rotated downward from top of sponsons (shown in dropped position). Sketch (right) shows sponsons in normal position for stabilizing plane on water. Main gear is rotated up to keep wheels clear of water.

Turbofan Seaplane Will Fly Next Year

By Irving Stone

Van Nuys, Calif.—Twin-turbofan-powered, 340-mph.-cruise, 8-place amphibian with unusual refinements is being designed as a cooperative enterprise by a group of West Coast engineers organized as Air Craft Marine Engineering (AW, Apr., 1, p. 34).

Present plans, seemingly ambitious, anticipate that a prototype will be flying by middle of 1958. Mockup of the plane will be displayed at the 10th Annual National Business Aircraft Assn. Meeting, Denver, Oct. 2 to 4.

Design Features

Design highlights of this new executive and utility transport include:

- **Advanced hull design** incorporating latest NACA tank test data.
- **Boundary layer control.**
- **Passenger crash-survival** structure and seating layout.
- **Wide range** of cockpit visibility.
- **Retractable outboard motor** to aid taxiing plane in confined waterways.

Mid-1958 flight date is dependent on sales acceptance and additional financing, as well as extensive use of subcontracting on tooling and assemblies, and full-time participation by most of the now part-time staff.

Estimate is that engineering is now about 50% completed.

Target price is $125,000 for basic airplane, based on production of 50 craft per year.

Plane is being designed to meet CAR 04b requirements, to make it available for commercial transport.

Twin-jet amphibian design was selected for its increased versatility and to meet need for high speed performance in this category. Top speed of the amphibian is projected at 370 mph., cruise at 340 mph.

Design philosophy was to narrow the gap between water-and-land-based aircraft, exceed performance of contemporary light twin-engine transports in this general weight and place category.

Principal refinements, to minimize drag of typical waterbased configuration are incorporation of retractable step fairing for an eight percent reduction in hull drag, and elimination of wingtip floats through use of sponsons, which are also elements of main landing gear.

NACA Hull

Hull is designed in line with latest National Advisory Committee for Aeronautics tank test configurations. Rounded non-trip chines give better displacement seaworthiness and considerably reduce hull drag, according to president and chief engineer Robert M. Berns.

Full-length spray dams control the green water during takeoff and landing runs. This permits operation in such rough water as would be prohibitive with an undammed hull, he claims.

NACA data, on which hull is based, indicates that takeoff could be effected in 3½-ft. waves, Berns declares.

Engine location has inlet lip above

S.S.White

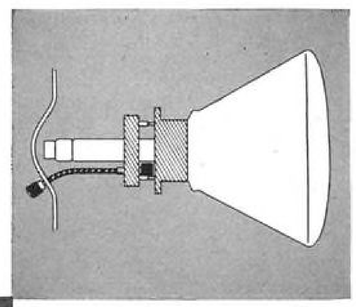
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wing leading edge to prevent entry of spray and foreign matter.

Body is mathematically lofted on all longitudinal and sectional lines to insure maximum aerodynamic cleanliness.

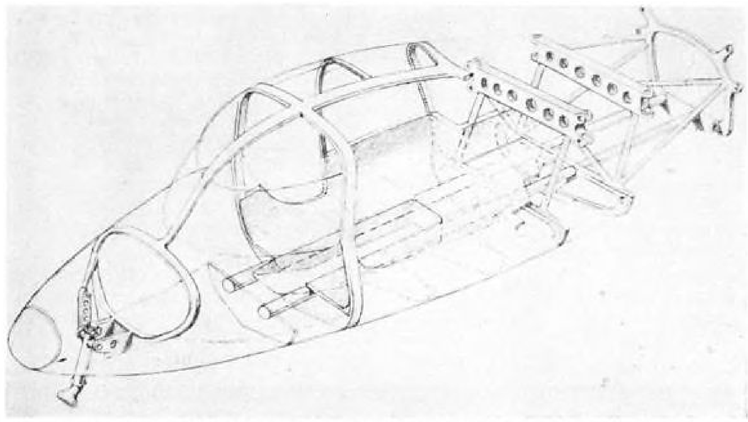
Nose is contoured to incorporate a radome for 80-mi.-range weather avoidance and ground surveillance. Radar compartment overhangs a generous forefoot which gives ease of water entry and also accommodates the forward-extending nose gear. Nosewheel doors are above displacement water line to eliminate possibility of fouling by flotsam. Sloping nose deck affords good downward visibility.

Cabin Pressurized

Cabin is pressurized, has NESA-heated wrap-around birdproof windscreen. Top-vision canopy over pilot and copilot heads even affords visibility aft of vertical. Pilot seats are separate, fully articulated airline-type units.

Two large windows are provided on each side of cabin aft of wrap-around windscreen. Rear of cabin also is glassed with an oval window also serving as an emergency-escape panel leading to turtledeck.

Passenger seats are in two rows spaced at 40 in. and accommodating three people each. Front row middle seat can be folded between units on either side to permit entry to rear row and convenient moving from rear to front seats in flight. With front row middle seat folded, full standing headroom is available in a depressed aisle.



HULL main structural members are shown in assembly drawing. Aft portion includes spar tie-through members, combination engine mount and tailcone attachment frame.

Cabin is lined with eurethane foam for sound suppression and shock absorption without rebound in hard or crash landings.

Cockpit instrumentation is laid out on a panoramic panel so that all instruments can be observed by each pilot by swiveling the head. This wrap-around configuration also provides space for electrical installations, communications and navigation controls, so that no overhead panel is required.

Instrument layout is not yet finalized, but is being studied with advice from experienced executive pilots, Berns says.

All cockpit controls—wheel, pedals and console—are suspended from forward bulkhead to avoid floor openings for watertightness and elimination of foreign object jamming.

Baggage compartment, aft of cabin, is accessible from cabin by folding down middle rear seat. Accessibility also is provided through sponson-well from outside.

Acme Amphibian

SPECIFICATIONS

HULL	
Length	38 ft.
Height	11.5 ft.
Cabin inside width	68 in.
Cabin inside length	120 in.
Cabin inside height	59 in.
Cabin volume	280 cu. ft.
Accessible baggage volume	65 cu. ft.
Displacement water plane beam	6 ft.
Deadrise angle, main step	15 deg.
Main gear tread	12 ft.
Wheel base	13 ft.
WING	
NACA series 7 section, high laminar flow airfoil, modified for BLC.	
Span	46 ft.
Thickness, root	15%
Thickness, tip	12.2%
Root chord	90 in.
Tip chord	48 in.
Sweep	11 deg.
Wing datum plane dihedral	1.5 deg.
TAIL	
V-type, symmetrical NACA 6400 series section	
Span	13.3 ft.
WEIGHTS	
Gross	9,000 lb.
Useful load	1,830 lb.
Fuel load, kerosene, 480 gal.	3,216 lb.
Range (480 gal. fuel, 1,830 lb. useful load)	1,160 mi.

Landing Gear

Main landing gear is located beneath wing, just aft of cabin area. It is a levered suspension type with Cleveland Pneumatic Tool Co. liquid spring shock absorber. Because of the low landing speed (45 mph.), it was felt that the extreme long travel available with the levered suspension would permit landing and takeoff from rough unprepared fields. The levered suspension produces lowest dynamic loads during rough field landings, and high mechanical advantage is compatible with the small piston travel of the liquid spring, Berns says.

Sponson has two positions—drooped for wheels landing, in which wheel rotates from upper surface of sponson, and horizontal position in which sponson is used for static and low-speed water stability. In horizontal position the wheel linkage lever, which is mechanically programmed with sponson movement, raises to a position out of the water.

Speed brake, also acting as a fairing

for sponson leading edge when sponson is retracted, is hinged at forward side of sponson well.

Hull Structure

Basic hull structure is predicated first on a safety design, and second on producibility. Because of the higher impact requirement of a water-based body, the optimum arrangement for a crash-survival design were met with the same structure, Berns points out. Structure and seating equipment are designed in accordance with findings by Av-Cir (Aviation Crash Injury Research) of Cornell University. This provides a structural sled under passenger compartment, to which ductile seat structures will be anchored with 30G connections, Berns declares.

Main structural hull members include large magnesium castings on which a minimum amount of machining will be required, he says. Castings are tubular-form designs to give highest strength-weight ratios. This technique orients the material as far from the neutral axis as possible and offers highest bending moments with lowest material stresses.

These castings include wing spar tie-through members, step and auxiliary step frames, combination engine mount and tailcone attach frame, roof (turnover) bows and nose wheel canted attach frame.

Spar tie-through members, step frames, and engine mount frame are to be sigma-welded to a longitudinal tubular truss-type magnesium structure serving as an integrating arrangement. Roof bows and nose wheel attach frame also use sigma welding.

External skin from nose to step and from keel to windows is a single honeycomb panel with Fiberglas faces and cores bonded with epoxy resin. Left and right side skins are bonded to magnesium frames and keel. External stainless steel abrasion strip beneath keel protects the honeycomb panel skin in this area from accidental impacts with submerged or floating objects.

Separate tailcone assembly also uses all-Fiberglas honeycomb panels bonded to two cast magnesium frames, one for stabilizer attachment, the other at the rear step.

All-Fiberglas honeycomb skin paneling affords relatively light weight, high impact resistance, and leak protection. If outer skin is punctured, inner facing still affords closure. This Fiberglas panel construction is easily reparable in the field, Berns declares.

Flat all-Fiberglas honeycomb panel floor is bonded to upper sides of bottom frames to complete the longitudinal box structure.

Wing

Shoulder-height wing is joined to fuselage through three shear pin connections on each side—two on front spar and one on rear spar.

Wing structural breakdown includes three magnesium cast ribs—root rib, mid rib, and tip rib. Spars are bent-up sheet channel, members reinforced with additional angle caps.

Leading edge nose box on each wing serves as a 65-gal. tank, consisting of a single-piece Fiberglas skin and Fiberglas rib-baffles fitted with anti-surge flappers. This structure is bolted to the front spar.

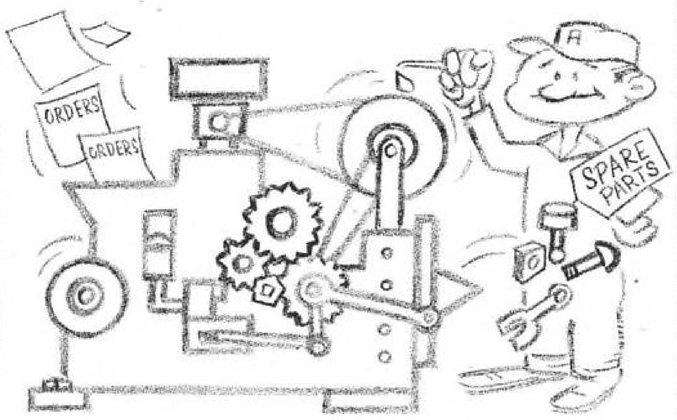
Lower skin of wing main box will be aluminum or magnesium alloy. Upper skin is an all-metal honeycomb panel.

Wing box is designed around a complete boundary layer control system including both distributed area suction and super-circulation over the flap and aileron. This BLC system will give STOL performance—less than 500 ft. ground run over 50-ft. obstacle, Berns claims.

If refinement of wing box permits carrying fuel in its confines, the 180-gal. bladder-type cell tentatively scheduled for installation in hull aft of cabin will be eliminated.

Simplified flap and aileron construction consists only of cast end ribs, sheet metal channel spar, wrap-around metal

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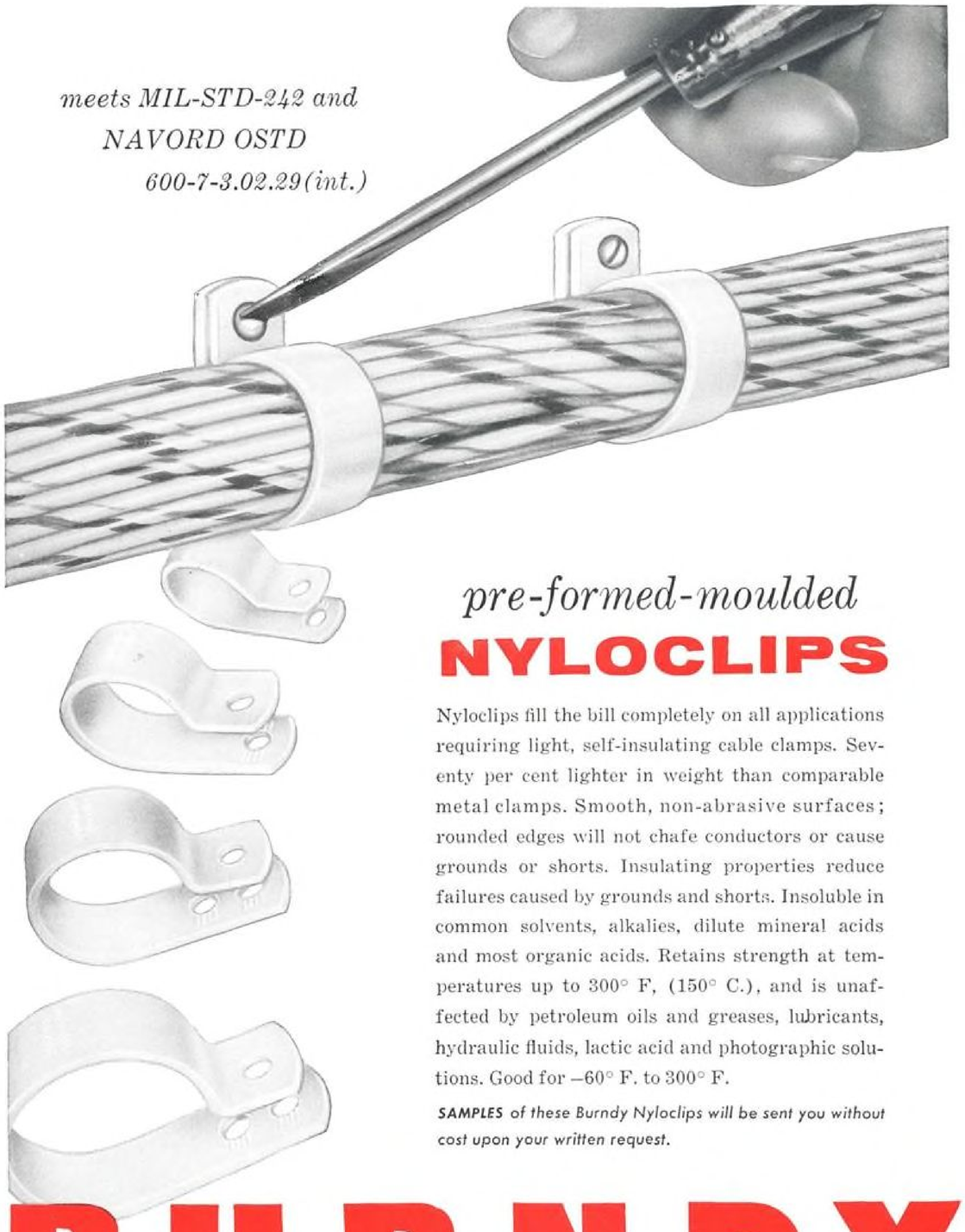
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Engines

Powerplants are Continental Model 420 (Turbomeca) turbofans rated at 790 lb. normal thrust. These were selected because of the high propulsive efficiency evident in the low specific fuel consumption at relatively high cruising speed (340 mph.), Berns declares. Also, the bypass feature effectively serves as a high efficiency pump for the BLC system.

Engine and nacelle will be installed as a plug-in power pack at junction of trailing edge and fuselage, Berns says. Engine will be handled with a dolly so that removal and replacement will be able to be effected in a total time of about five minutes, including hookups, he claims.

Engine position, behind cabin, will reduce noise and vibration.

Tail

V-tail was selected to take this surface out of the jet nozzle stream, also place it above the water planing rooster tail (spray). It also improves rearward visibility through cabin rear window.

Yaw control with the V-tail is sufficient in event of failure of one engine, because of the small displacement of the thrust centerline from hull centerline.

Construction of the stabilizer portion of the V-tail, as well as ruddervator control, is similar to flaps and ailerons.

Outboard Motor

Novel feature projected for the design, which has appealed to pilots who have been approached with the scheme, Berns says, is a retractable 20-hp. outboard motor, located in the tailcone, and remotely started and steered, to permit pilot to cut jet engines after landing and to taxi to dock or mooring.

Analysis has shown, Berns declares, that typical water rudders are ineffective in gusts at low speeds, and operation of jet engines in confined waterways or relatively congested harbors would be inadvisable from standpoint of jet noise and blast.

Outboard motor would give speeds up to 11 mph. in quiet water, could swing the craft on its axis, even permit backing up, Berns says. Weight penalty assessed for this installation, over a typical water rudder, would not be more than 30 lb., he claims.

If protracted land operation is anticipated, the outboard motor could be removed and stored.

Instead of hydraulics, the amphibian will be fitted with complete pneumatic system for actuation of landing gear, flaps, retractable step fairing, nose wheel steering, speed brake, and outboard motor. System will be a 3,000-psi. installation incorporating wound spherical plastic accumulators having sufficient capacity for five complete operations for various services before exhaustion. Pneumatic system was selected because of weight savings, safety considerations, ease of maintenance, and cleanliness, Berns declares.

Cabin pressurization (8,000 ft. pressure altitude at 25,000 ft.) will be fed by same boostrap turbine (fed by turbofan bleed) which powers the main pneumatic system.



Airpower Shows Its Progress

Formation of USAF Douglas B-66 jet bombers flies over Andrews AFB, Wash., during Golden Anniversary air show just as Fokker D.VII and Nieuport 28 replica World War I fighters which also took part in show (AW Aug. 19, p. 134) taxied to runway.

Organization

Acme's organization smacks of old-time ingenuity. It was formed in September, 1954, as a cooperative venture of 20 engineers with various major aircraft companies in the Los Angeles area. Since then about 25 more engineers and 12 shopmen have joined the enterprise.

All of these people, some of whom are engineers with considerable responsibility, participate on a spare-time basis in the design of the amphibian and receive equity in the company for their engineering services. Remuneration in the form of stock is tied to a scale reflecting their experience and present earnings.

Chief engineer and president Robert M. Berns, has been associated with Lockheed Missile Systems Division.

Member of the board of directors is Ernest G. Stout, well-known hydrodynamicist.

Director of customer relations is Jim H. Holley, well known in aircraft sales markets.

Project to date has been supported privately by some few of the participating group. Capital in the corporation is being subscribed by members of the group and interested outsiders.

Present work—engineering analysis, design, drawings and fabrication of test equipment, together with full-scale mockup—is being carried on in temporary quarters here. Construction of new facilities tentatively is scheduled to start this fall near San Fernando Valley Airport. This will give room for prototype development and initial tooling fabrication. Adjacent land affords room for quadruple expansion for production.



Dry ice and a sun reflector—these symbolize the ever-widening range of temperatures that now challenge air-borne electronic equipment.

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New Lockheed Jet To Visit NBAA Forum

Lockheed's new CL-329 10-passenger light jet executive transport is expected to be displayed at National Business Aircraft Assn.'s 10th Annual Meeting & Forum at Denver, Colo., Oct. 2-4. More than 700 business pilots and executives are expected to attend the forum.

Other new business aircraft that may show up at the NBAA meeting include the four-place Piper Comanche and tandem-rotor Vertol 44 helicopter.

Turboprop and jet operations will come in for large-scale discussion during the meeting. Among the manufacturers that will be represented are Lockheed, Grumman, Vickers, Fairchild, On Mark, Allison and Napier.

PRIVATE LINES

Lightplane nonstop record attempt will be made early in September by Tom McMurray, Jr., who plans to fly a Mooney Mk. 20 four-place business plane from Houston, Tex., to Rome via the Great Circle in approximately 40 hr. Mooney will have three of four seats removed to allow installation of 210-gal. fuel tanks supplementing normal 50-gal. capacity, providing an estimated 800-mi. reserve at the end of the approximately 5,000-mi. hop. Current official small plane record was set in 1949 by late William Odom who flew a Beech Bonanza nonstop 4,957.24 mi. from Honolulu, Hawaii, to Teterboro, N. J.

Aerial survey for radioactive minerals covering 6,000 sq. mi. of Southern Rhodesia is underway by United Kingdom Atomic Energy Authority. A Hunting Geophysics, Ltd., survey plane is flying the area at 450-ft. altitude recording radioactive emission; data on likely locations will be published in map form and posted in several public places for use by prospectors.

Lightweight oxygen system for small plane use weighs only 12 lb. and serves two persons two-and-a-half-hours to 20,000 ft. Builder is Scott Aviation Corp., 275 Erie St., Lancaster, N. Y. Cost is $115.

Trans-Canada Pipeline Co., Toronto, purchased a 14-passenger DC-3 conversion from Remmert-Werner, Inc., St. Louis, with P&W Super-92 engines, Edison fire detector system, Sperry H-5 gyro horizon and C-4 compass, Collins VHF receivers and transmitters, dual 51R VHF omni navigation receivers with radio magnetic indicators and Bendix three-light marker beacon receiver.

Beech H35 Bonanza was flown nonstop from Fresno, Calif., to Kingman, Kans., a trip of 1,226 mi. in 8 hr. 17 min., averaging 21 miles per gallon. Distance exceeded 1,170 mi. specified as range for H35 with auxiliary tanks in company's data sheets. Entire journey was made using plane's automatic mixture control; there was at least 14 min. fuel remaining after landing at Kingman.

ADF Stations is title of 80-page booklet listing more than 3,000 locations in U. S., Canada and Mexico prepared for private and business flyers by Lear-Cal Division, Lear, Inc., Santa Monica, Calif. Price is $1.

All Cessna OE-2 liaison planes ordered by U. S. Navy are fitted with Geisse crosswind landing gears to increase their utility.

Activities of Industrial Products Division, International Telephone & Telegraph Corp., including lightweight Federal autopilot work, is being transferred from New Jersey to the West Coast. B. V. Deltour is new sales manager for the autopilot line now certificated by CAA for Beech C35 through H35, Cessna 172, 180, 182 and 310, all Aero Commander models. Prototype installations are in process on the Piper Apache and Beech Twin-Bonanza.

Contract to resupply Eastern Dew Line sites on a year-round basis has been let to Kenting Helicopters, Ltd., Toronto, using three Sikorsky S-55s purchased from Petroleum Helicopters, Inc., New Orleans. S-55 type helicopters previously used in Dew Line support missions have each carried up to 6,000 lb. daily and averaged 39,000 lb. loads over two-week period.

Increase of $500,000 in operating capital has been arranged by Van Dusen Aircraft Supplies under a 10-yr. agreement with Prudential Insurance Co. and Northwestern National Bank of Minneapolis. Van Dusen forecasts record sales volume of $4 million this year.

Systematic maintenance contract on Boeing C-97s running through July 1958 has been awarded Temco Aircraft Corp.'s Greenville, Tex., facility. Award marks change in MATS overhaul and modification plans to provide periodic reconditioning, according to the company. Greenville also has an extension through October of this year on another USAF contract to modify and overhaul C-54s.

SaFeather automatic engine power loss indication system installation on Cessna 310 has been granted CAA Supplemental Type Certificate 2SA-125. Equipment is also approved for Beech 18, other certifications are pending.

Silver Anniversary party will be given by East Coast Aviation Corp. in its new $300,000 hangar at Bedford Airport, Lexington, Mass., Sept. 25. Firm started as a flying school, currently has several divisions covering aircraft and engine schooling, corporate and military plane maintenance, spray/dust operations, aircraft and equipment sales.



Cabin For Gyrocopter

Fiberglas cabin has been developed by Bensen Aircraft Corp., Raleight, N. C., for customer Ray Umbaugh's B-7M Gyrocopter, which uses pusher propeller to obtain forward thrust while 20-ft. rotor for vertical lift autorotates. Gyrocopter is marketed in kit form to homebuilders at prices ranging from $395 to $895, less engine. Takeoff speed is about 25 mph., landing speed 7 mph. Calm air landing roll distance is about 20 ft.

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CAB Accident Investigation Report:

Lodestar Spun In For Reasons Unknown

A Lockheed Lodestar, model 18-14, N 28366, owned and operated by the Phillips Petroleum Company, crashed and burned 6¼ miles southeast of the Bartlesville, Okla., Municipal Airport, Dec. 12, 1956, about 0850.[1] Both pilots and the six passengers were killed.

HISTORY OF THE FLIGHT

The purpose of this flight was to take six passengers, all Phillips employees, from Bartlesville, Okla., to Salt Lake City, Utah. Company Pilot Joe Mark Bower and company Copilot-Mechanic Robert Ellwood Ulrich were assigned to the flight by the Aviation Department of Phillips.

When the aircraft was loaded and prior to leaving the ramp Copilot Ulrich called the company radio station, located on the airport, requested taxiing instructions, and asked for an IFR clearance to Salt Lake City, nonstop. The company radio operator obtained the desired clearance from ARTC through Tulsa, and immediately relayed it to the aircraft. A flight plan previously prepared contained the following information: Proposed time of departure 0805; estimated elapsed time 5 hours, 15 minutes; fuel on board 6 hours.

Departure was at 0826. At that time the gross weight of the aircraft was 19,284 lb. (maximum allowable was 19,500 lb), and the load was properly distributed with respect to allowable center of gravity limitations.

Engine Trouble

About 14 minutes after takeoff, at approximately 0840, Copilot Ulrich called Bartlesville Radio and stated that the flight was having engine trouble, with an oil temperature over 100 deg., and requested that the IFR flight be canceled as they might return. The Bartlesville operator complied and notified Tulsa.

At the next contact, about 0845, the copilot again called Bartlesville Radio stating that they could not unfeather the propeller. At that time he asked the Bartlesville operator to determine the condition of the runways at Tulsa (about 40 miles to the south). This information was obtained and immediately relayed to the copilot, whereupon he said, "Going to Tulsa, changing over." Bartlesville's single 4,600-foot runway had patches of snow and ice while all runways at Tulsa Airport were clear. This was the last radio contact with the flight. None of the messages had mentioned which engine was giving trouble; none indicated any anxiety or stress. There is no known record of N 28366 having made radio contact with any ground station or aircraft other than Bartlesville Radio.

[1] All times herein are central standard based on the 24-hour clock; all distances are in nautical miles and all airspeeds are in knots.

About the same time as the last radio contact, the Bartlesville radio operator and Phillips' chief pilot saw the aircraft passing south of the Bartlesville Airport heading easterly. They estimated its altitude to be 3,000 ft. above the ground. The aircraft continued east for about 4½ miles, until beyond the more congested part of Bartlesville, and then turned to the right about 90 deg. toward Tulsa.

A number of persons saw the flight after it turned toward Tulsa. When it had been on this southerly heading for about four miles the aircraft was seen to plunge to earth in a manner described by several witnesses as a spin. Impact with the rolling terrain was on a heading of about 240 deg., while the wings were about level, and while the nose-down angle was close to vertical. An explosion and intense fire ensued, largely destroying the general structure of the aircraft.

INVESTIGATION

At the time and place of the accident the weather was generally good and readily allowed VFR flight. Specifically, the Bartlesville weather at 1850 (20 minutes before the accident) was: Ceiling 6,000 ft., overcast; visibility 10 miles; temperature 36; dewpoint 30; wind calm.

Early in the investigation the possibility of collision with, or encountering of violent wash from, other aircraft was advanced as a reason for the seeming loss of control. Accordingly, this possibility was thoroughly probed. It was learned that there had been large military aircraft (B-36s) in the general area after the accident but it appears conclusive that they were not there before or at the time of the accident. Several weeks later a wheelwell door from a USAF jet fighter was found on the ground 3½ miles from the crash site. Investigation revealed that this door had fallen free on Dec. 17, five days after the crash of the Lodestar. None of the several witnesses who actually saw the Lodestar in apparently normal flight, and then descend in what appeared to be a spin, saw any other aircraft at the time or reasonably close to that time. In short, investigation determined that no other aircraft was involved in this accident.

Ground Witnesses

A consensus of ground witness testimony indicates that: The altitude of the aircraft decreased from an estimated 3,000 ft. as it passed south of the airport to considerably less altitude, possibly as low as 1,200 ft., as it neared the crash site; the speed of the aircraft decreased during this short interval; the final part of the flight was stable directionally toward the south and stable laterally with wings level; the aircraft fell off to its right and spun slightly more than two turns to its right before striking the ground.

Extreme localization and physical features of the general crushing and deformation of the wreckage indicated that the angle of impact was within 15 deg. of vertical. There was no evidence of rotation of the aircraft about the longitudinal axis. This, together with the step impact angle and the similar damage to both wing leading edges, suggests that there may have been an attempt to recover from the spin. No part of the aircraft was found elsewhere than in the wreckage area, indicating that no parts were shed prior to or during the final descent. There was no evidence of fire before impact.

Violent impact and fire had destroyed a great deal of the general structure. Aileron control cables remained attached to the steel chain and sprocket assemblies of both control wheels. Unmelted portions of the righthand rudder pedals remained attached to their torque tubes while the left rudder pedals were intact but broken loose at the floor brackets. All rudder control horns were broken at impact. Rudder control cables remained attached to their fittings.

The master ignition switch was "on." Both individual ignition switch levers were sharply bent to the left, the right one beyond the "both magnetos on" position, and the left one to the left of the "off" position.

Control Positions

The autopilot was "off." The landing gear handle was about midway of the quadrant and bent sharply to the left. The flap handle was at "up" position. The left fuel tank selector valve was turned to the right front tank and the engine selector valve to the right engine. This aircraft was not equipped with wing de-icer boots.

Impact and fire damage precluded determining the readings of any of the cockpit indicators of rudder, elevator, and aileron trim.

The engines' fire selector valve was positioned in the normal "off" position and the oil shutoff valves were in normal operating position. Fuel dump valve handles were broken off.

Wing flaps were fully retracted. The ailerons could be moved by their control cable at the wing roots. Both aileron push-pull rods were bent and the left bell crank was broken at its attached point. Balance weights in both ailerons were intact.

Examination of the aileron, rudder, and elevator control mechanisms disclosed no irregularities or breakage other than caused by impact and fire. All primary cables and trim tab cables had parted in the burned-out area.

No evidence of metal fatigue was found in any of the broken parts.

Impact had moved control tabs so that

CHECK !

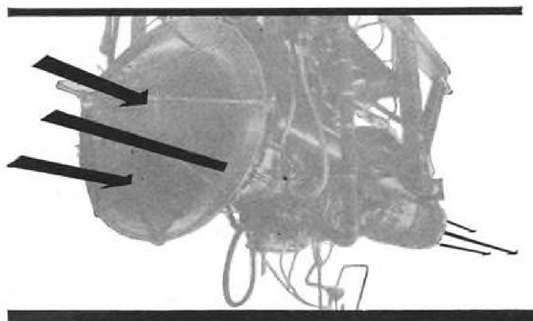
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their settings were incompatible and meaningless.

• **Number 1 (left) engine.** All cylinders were damaged at impact or by fire after impact and 5 were knocked off their pads; others were badly burned. Several rocker boxes were broken off.

Intake manifolds were severely crushed but all remained connected to their cylinders and were free of indications of foreign deposits or operating difficulties. Exhaust manifolds were also severely deformed. They were secure at the cylinders, but uncoupled at the collector ring. The exhaust stacks and the collector ring showed no burnouts or other indications of operating failures.

Examination of the valve actuating assemblies indicated that all valve adjustment screws were uniform in appearance. Valve guides showed no indication of burning or high operating temperatures. All rocker assemblies were apparently in normal condition prior to impact.

Cylinder interiors appeared to be in normal condition. Pistons were intact and free of indications of maloperation; piston rings were free in their grooves, and the piston pins were intact and free.

All link rods were free with their knuckle pins in normal condition. The rear master rod was seized to the crankshaft and the front one was immobilized by impact. Master rod bearing material was found loose in the rear power section. The rear master rod bearing had failed completely. All of the lead indium coating of this bearing and approximately 95% of its silver was worn away. Bearing oil holes were plugged with this material and bearing shells were blued by overheating. Approximately 45% of the bearing material was bonded to rear crankpin. Two of the rear crankpin oil tubes were completely filled with bearing material.

The front master rod bearing was intact with no indications of failure. A small area, approximately one-half inch wide, of the lead indium coating was slightly worn. Bearing and front crankpin oil holes were open and free of foreign material.

Both master rod assemblies were in place with only the rear rod showing signs of high operating temperatures. The crankshaft and its counterweight bore no evidence of operating difficulty. Both front and center main bearings were intact and free of failures; the rear main bearing had been severely heated by ground fire.

The rear support plate was entirely consumed by ground fire and melted metal from it filled the rear cam compartment. The rear cam assembly was in place although damaged by fire and impact. The cam lobes were not spalled or excessively worn and the cam tracks appeared normal.

Spark plugs were Bg Type RB27R. They had been in service about 22 hours since factory reconditioning, according to company maintenance personnel. None had fused or peened electrodes nor were there any deposits built up on the nose ceramics. The electrode gaps were properly set.

All engine-mounted accessories, with the exception of the propeller governor and carburetor, were destroyed by ground fire.

The carburetor, a Stromberg model PD12H-4, S/N 266279-A, was broken from the rear case. Its fuel control assembly had broken free and the mixture control was jammed in the idle cutoff position. The fuel strainer was broken and the fuel screen was free of any foreign matter. The throttle assembly was jammed in full closed position and the fuel discharge line had broken free.

The propeller governor, a Woodward model 4G8-C-23, had separated from the nosecase at impact. Its control cable was severed. This governor appeared to be in normal condition and with no evidence of foreign material.

• **Number 2 (right) engine.** This engine was also examined with great detail. Nothing was found to indicate any malfunctioning, or excess or abnormal wear was evident, and there was no sign of oil starvation. The accessory section of this engine was destroyed by fire. It was therefore impossible to determine whether or not a malfunction or failure in this portion of the engine had occurred.

Spark plugs in this engine were also BG model RB27R with 22 hours of service since factory reconditioning. No fused or peened electrodes or foreign deposits built up on the nose ceramics were found. The electrode gaps were properly set at .013". Examination of the firing ends of these plugs revealed no evidence to cause operating difficulty.

The propeller governor, a Woodward model 4G8-G-23, was broken from its mounting at impact. It appeared normal with no indications of foreign material or excessive wear.

• **Number 1 (left) propeller.** This propeller was tight on the shaft and two blades were tight in the hub; the third blade was broken off at the shank. As a result of impact all blades were bent in various amounts and the dome shell was deformed inward in the area of the dome plug. The dome retaining nut was secure and safetied.

The pitch-changing mechanism was in normal condition. The step rings were in place and set for a range from 88 deg., full feathering, to 24 deg., low pitch. The dome piston position corresponded to a blade angle of 81 deg.

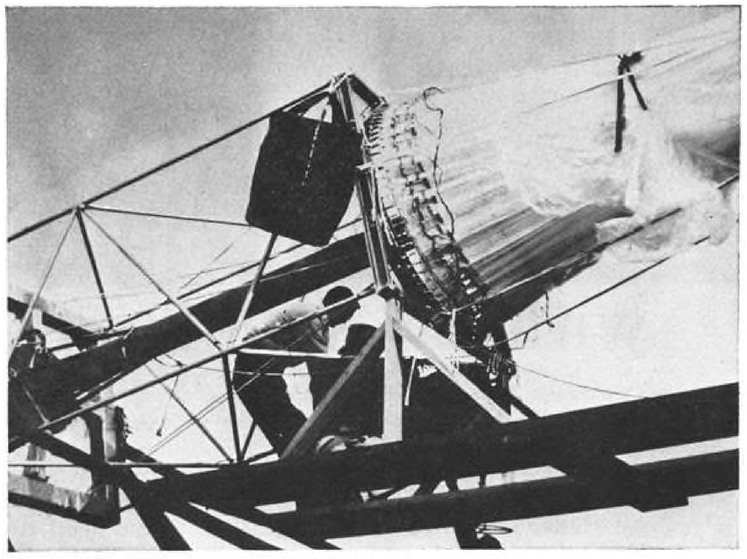
The barrel halves were intact and all barrel bolts were tight. All barrel blocks were in place although severely crushed by impact. The spider assembly and cones showed no damage. The propeller retaining nut was loose although the safety ring was in position. The distributor valve was in place although its lock ring was displaced.

The No. 1 propeller blade was broken off in the shank near station 5 and was bent toward its face side approximately 20 deg. at station 42. Thrust bearings, washers, and segment gear were free of damage or failure. The Nos. 2 and 3 blades remained tight in the hub. Both were bent slightly toward their face sides approximately 10 deg. at station 42. All blade bearings, thrust washers, and segment gears were free of indications of inflight failures. The shim plates of all three blades of the propeller were marked at impact, indicating a blade angle of 88 deg., and were broken along the impact loading lines.

Nothing was found during the examination of this propeller and its associated mechanisms to show why it could not have been unfeathered.

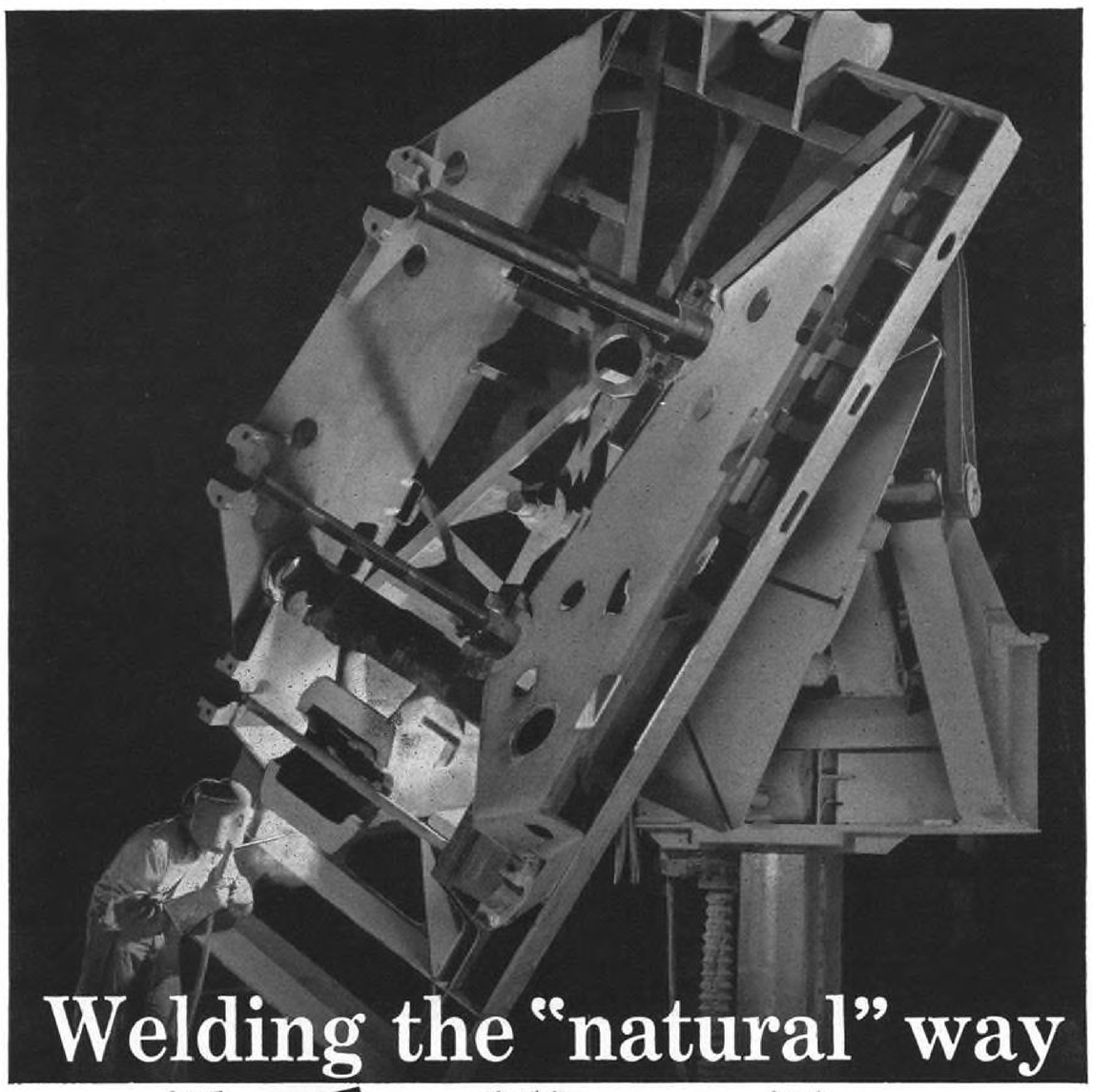
• **Number 2 (right) propeller.** The propeller was tight on the shaft with two blades broken off at the shank; the remaining one was tight in the hub. All blades were bent toward their cambered sides.

The dome shell was completely broken from the pitch-changing mechanism at impact. This mechanism exhibited no indi cations of maloperation prior to impact. The stop rings were installed for a blade



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Equipment for USAF's "Project Far Side" (AW Aug. 5, p. 76) is checked by project scientists. Tube at left is second stage of the test vehicle which balloon (right) will carry to altitude for firing. Third stage is hidden in folds of balloon; vehicle fires upward through the fabric.



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range of 24 deg., low pitch, and 88 deg., full feathering. The dome piston position corresponded to a blade angle of 24 deg.

The barrel halves were free of inflight failures. All barrel bolts were tight and all seals were in place. The spider assembly was in normal condition although its phenolic ring was severely crushed. All retaining nuts and cones were in position and free of damage. Barrel blocks were in place although crushed. The distributor valve was secure in the shaft, but its valve spring and housing were impact-damaged.

No. 1 propeller blade was broken off in the shank at station 5. It had a gradual bend toward the camber side of approximately 20 deg. at station 36, and a sharp rearward bend of 60 deg. at station 46. The blade segment gear was pulled loose from the blade butt by impact, as were four of the spring pack assemblies. Thrust washers were intact and thrust bearings were free of indications of failures. The blade chafing ring was severely mutilated. The blade shim plate was broken at impact and impact marks on it indicated a blade angle of 24 deg.

No. 2 propeller blade was broken off at the shank in a similar manner. It was bent toward its cambered side approximately 10 deg. at station 36. The blade segment gear, thrust bearings, and washers were intact and free of indications of operational distress.

The shim plate was broken at impact, and a measurement of the impact mahk indicated a blade angle of 24 deg.

The No. 3 propeller blade remained tight in the hub. It also was bent about 10 deg. toward its cambered side at station 36, and the tip was bent forward about 30 deg. at station 56. The segment gear, thrust washers, and bearings exhibited no evidence of failures or operating difficulties. The shim plate was broken, due to impact, along the unsupported section of the spider assembly. A measurement of impact mark on the shim plate indicated a blade angle of 24 deg.

• **Fuel and oil.** Samples of the fuel and oil were collected immediately after the accident. The fuel sample, 91/98 octane, was taken from the storage tank used by N 28366. Analysis of the sample indicated that it was considerably better than the specification minimums. An oil sample was taken from a barrel used in servicing N 28366.

It met, or was above, all requirements for SAE 50 oil. The analysis of this sample was compared with the oil from the No. 1 engine which also met required specifications. Spectographic analysis of the oil from the No. 1 engine was made for trace metals and it only reflected the presence of master rod bearing material.

Pilots Qualified

Pilot Bower had been employed by Phillips for more than eight years prior to which time he had been employed as a captain for a major airline. He held all necessary CAA certification and had flown some 8,800 hours, 700 in Lodestars. Copilot Ulrich, also adequately certificated, had some 3,000 hours of piloting, of which 500 hours had been in Lodestars. It was company policy to work pairs of pilots together as unit crews and these two had flown to-

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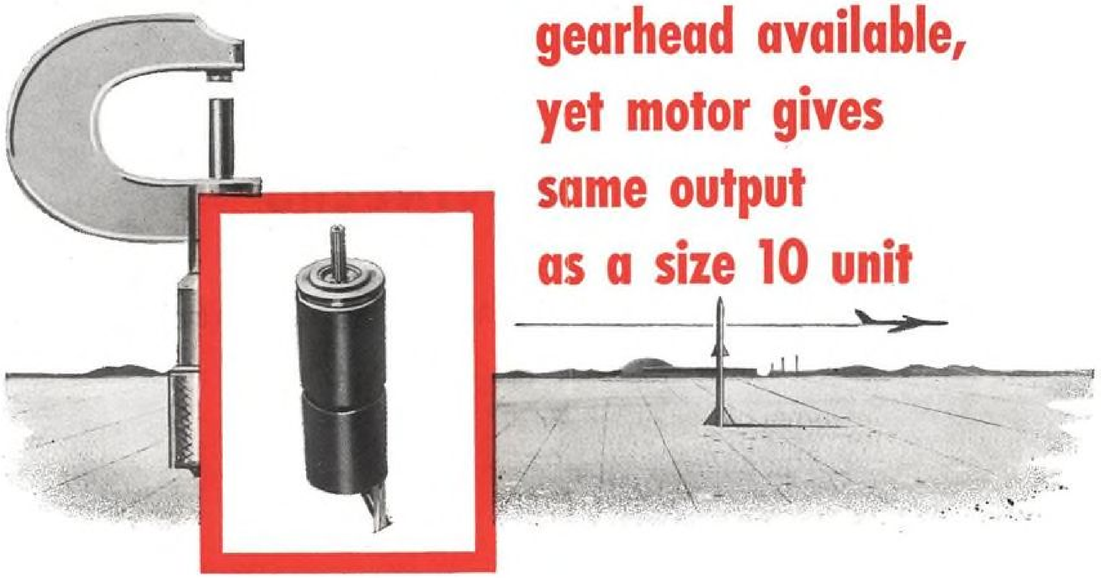
■ *A research specialist*, or higher classification, who is expert in all phases of airplane stability, control and basic loads analyses and estimation. A minimum of 10 years' experience is required.

■ *An aeronautical engineer* with a minimum of five years' experience. He must be experienced in aerodynamic analyses and capable of organizing aerodynamic data for use in estimating airplane performance, stability and control.

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- Duty: Continuous at stall

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gether quite consistently in the subject aircraft and in others.

Bower was flight checked in this particular Lodestar by Phillips' Chief Pilot Clark on Oct. 18, 1956. Bower sat on the left, Clark on the right. No other persons were aboard and the aircraft at that time grossed a computed 18,274 lb. The check flight lasted for 1 hour, 15 minutes. It covered a variety of unusual flight conditions including single-engine operation, single-engine operation at near stall speed, and the checking of speeds close to the stall point. Different flight configurations, involving landing gear and landing flaps, were also tried. At the conclusion of this flight, which was primarily to check the aircraft rather than Bower's flying ability, Chief Pilot Clark was completely satisfied with both. At the time of the flight check, the maximum gross weight of the aircraft was 18,500 lb.; authorization for an increase in maximum gross to 19,500 lb. became effective 22 days prior to the accident.

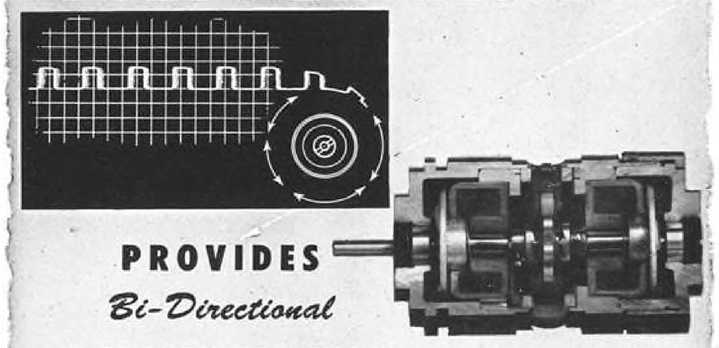
The Bartlesville Airport is at an elevation of 15 ft. m. s. l. and the crash site is at substantially the same elevation. Witnesses at varied locations and distances estimated that the aircraft was about 1,200 ft. above the ground when the spin started. Thus, it was at about 1,900 ft. m. s. l. at that time. The subject aircraft, grossing 19,500 lb., should have been capable of sustained single-engine flight at maximum continuous power at that altitude. This capability is a prerequisite of CAA certification. Its maximum single-engine operating altitude with en route configuration (flaps up, gear up, and inoperative propeller feathered) was 7,600 ft. This presumes sustained maximum continuous power.

ANALYSIS

There are a number of possibilities to account for the loss of control. Pilot Bower may not have been sufficiently alert to the somewhat critical single-engine flight characteristics of the aircraft grossing as much as it did. It has been mentioned that the computed gross at takeoff was 19,284 lb., quite close to the maximum allowable of 19,500 lb. The duration of the flight, about 24 minutes, would have lessened the fuel weight by possibly 400 lb. The aircraft would thus have grossed about 18,884 lb. at the time of the accident. Bower was quite familiar with the subject aircraft at a lesser weight. The check ride, mentioned under Investigation, was at a takeoff weight of 18,274 lb. gross. The fact that Bower decided to continue for 40 miles to Tulsa, over flat terrain and in good weather, rather than land at his home field indicates that he was not particularly perturbed. And yet within a few minutes considerable altitude had been lost as well as enough speed so that control was also lost.

Other possibilities remain. One is of an obscure irregularity of control although none was found in that part of the wreckage which could still be gainfully examined. Another was power reduction in the remaining engine. Again nothing was found to indicate or even suggest this. Of course, the single-engine flyability of the aircraft was dependent upon sustained maximum continuous power from the right engine, with the left propeller feathered, as this one was. As has been pointed out, it is impos-

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- Shock — 15 G's for 11 milliseconds duration each way along three major axes.
- Reliability — shall not fail to convert more than one pulse in 1,000,000 into equivalent angular rotation.

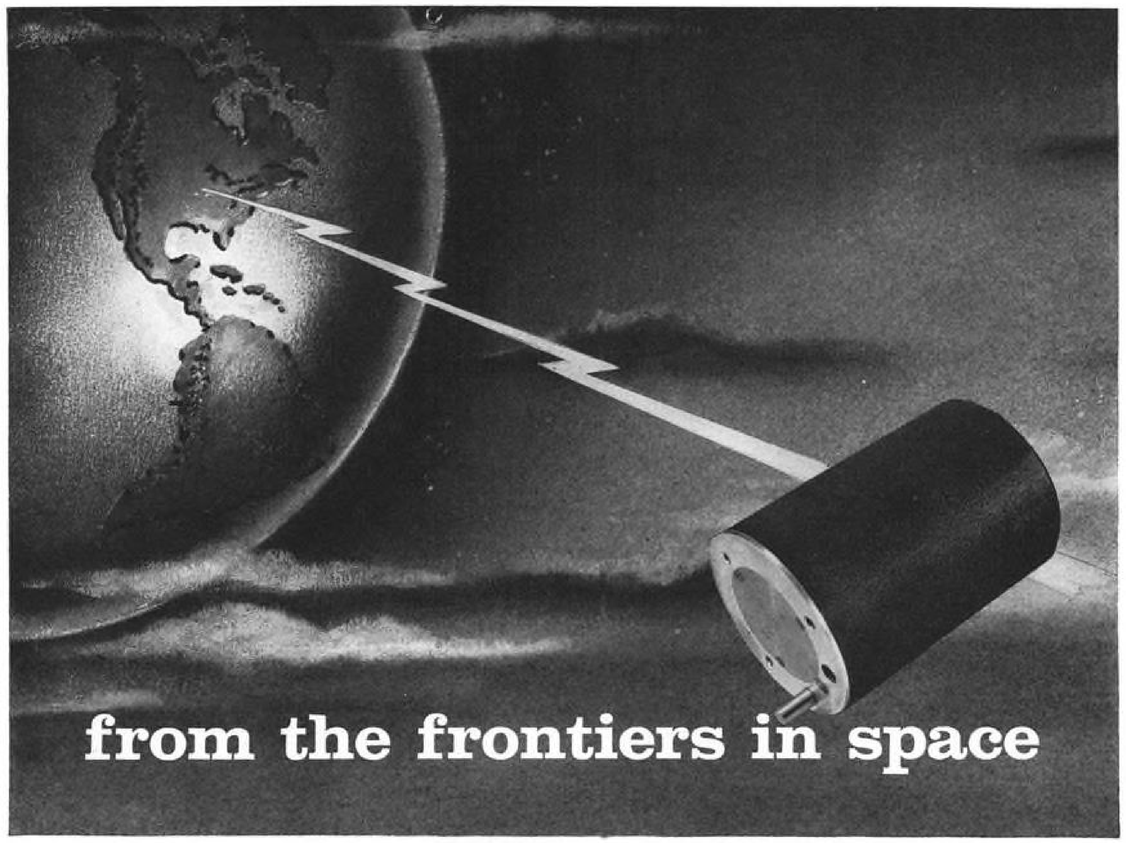
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sible to determine if maximum continuous power was sustained.

Neither induction nor wing icing appears to have been possible.

The reason for the inability to unfeather the left propeller was not learned. Had it been possible, and if the left engine could have been temporarily brought back into use (this does not necessarily follow because of the nature of the bearing damage), Bower undoubtedly would have landed at Bartlesville, as must have been his initial intent. Possibly there was an electrical defect in that propeller feathering mechanism; if so, it remains undetermined because of destruction by fire.

Obviously, the failure of the rear master rod bearing of the left engine was the reason for the reported rise in oil temperature necessitating shutting down that engine. The cause of the bearing failure cannot be determined because of a multiplicity of factors which could not be isolated due to the complete destruction of that bearing. It probably was not oil starvation because this would normally cause distress first in the front bearing which receives oil after the rear bearing; the front bearing was intact.

Master rod bearings sometimes develop hard spots on their lead indium coatings if stored for long periods. These hard spots can become foci of failure. The subject bearings were installed in the left engine in March 1954. The overhaul agency had no record of the length of time the bearings had been in stock prior to that time.

The failed bearing had been reconditioned by its manufacturer. However, the extent of the damage precluded analysis of the quality of the reconditioning process which requires high precision and closely controlled processes.

Master rod bearings must be fitted to extremely close tolerances. Engine overhaul records indicated that engine assembly was performed in accord with manufacturer's procedures. Since this engine had 791 hours of operation at the time of the accident, it is unlikely that the bearing was fitted incorrectly because if it had been it would have failed much earlier.

FINDINGS

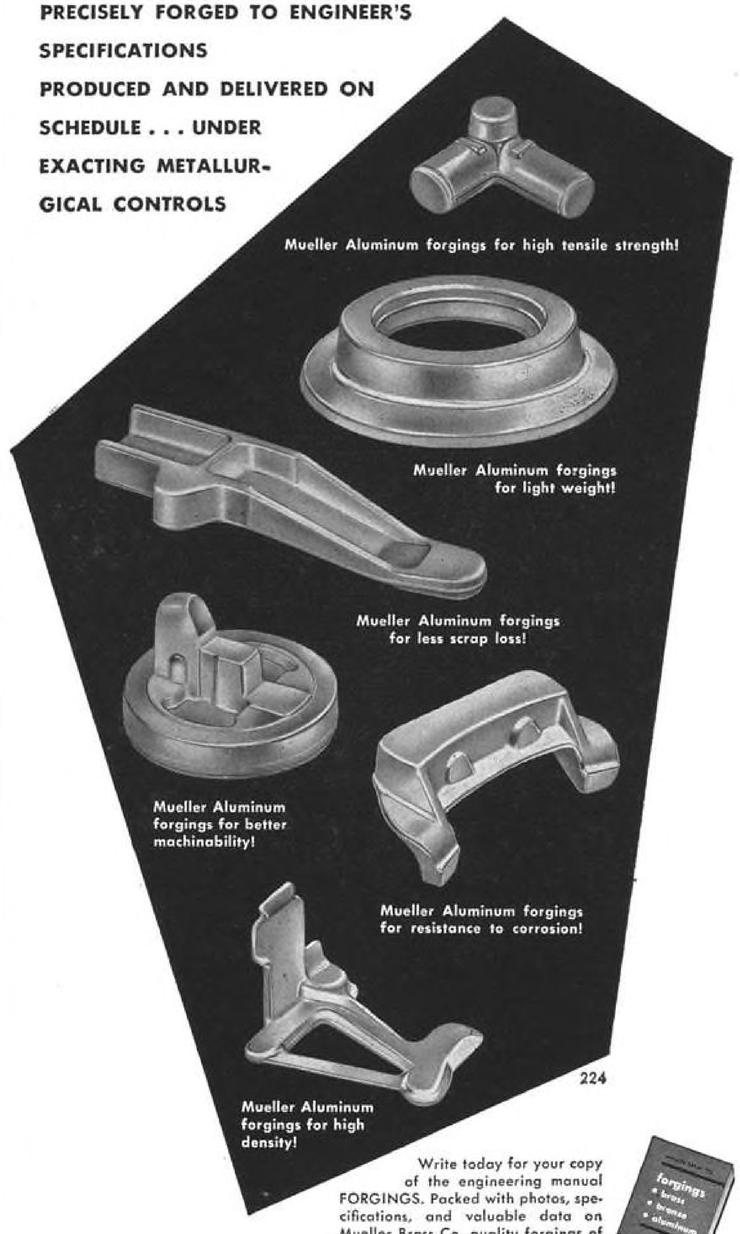
On the basis of all available evidence the Board finds that:

1. The aircraft and both pilots were properly certificated.
2. The gross weight of the aircraft at the time of the accident was approximately 616 lb. less than the maximum certificated gross takeoff weight of 19,500 lb.
3. There was no indication of unairworthiness in the airframe or its controls, as far as could be learned.
4. The No. 2 (right) engine, although not subject to complete examination due to the ground fire, exhibited no signs of malfunctioning.
5. Neither propeller nor their feathering mechanism showed any evidence of malfunctioning.
6. The left engine developed a bearing failure and its propeller was feathered.
7. The reason for the bearing failure cannot be isolated.
8. Single-engine flight was started for a distance of 40 miles.
9. Early in this flight altitude, speed,

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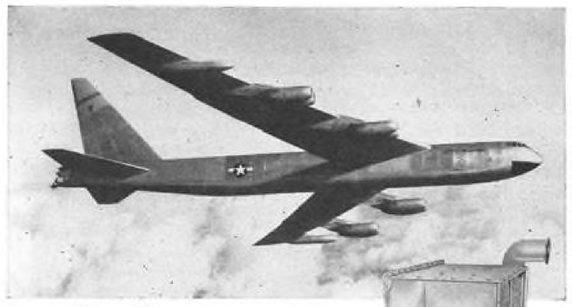
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and then control were lost, and the aircraft spun to the ground.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was loss of flying speed during single-engine flight for reasons undetermined, resulting in a spin to the ground.

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 this accident immediately after its occurrence. An investigation was started promptly in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended.

This investigation included examination of the physical evidence at the scene of the crash and examination of the company records.

Depositions were taken at and near Bartlesville, Okla., on Jan. 30 and 31, and Feb. 1, 1957, and at Washington, D. C., on Feb. 9, 1957.

OPERATOR

Phillips Petroleum Company is a Delaware corporation with headquarters at Bartlesville, Okla. The company owned the subject airplane, N 28366, as well as a fleet of nine other aircraft of various makes, all used in the furtherance of company business.

Phillips has owned and operated a total of 50 executive-type aircraft since 1927.

FLIGHT PERSONNEL

Joe Mark Bower, age 38, had been employed by the Phillips Company since April 1948.

Prior to that time, he had been employed by a major airline as a captain flying regular schedules. Mr. Bower had flown a total of 8,837 hours, of which about 700 had been in aircraft of the subject type. He had flown 24 hours, 20 minutes within the previous 30 days, and had not flown for 72 hours prior to the subject flight. His certification included a valid airman certificate with an airline transport rating and type ratings for several aircraft, including the Lockheed Lodestar. On Dec. 12, 1955, he passed his last physical examination, and on Oct. 18, 1956, his last competency check (described under *Investigation*).

Robert Ellwood Ulrich, age 36, had been employed by Phillips since July 1948. He had flown a total of 3,000 hours, of which some 500 had been in Lodestars.

Mr. Ulrich held valid certificates as a private pilot and as an aircraft and engine mechanic.

THE AIRCRAFT

Lockheed Lodestar, model 18-14, N 28366, serial number 2043, had been owned by the Phillips Petroleum Company since Jan. 22, 1941. The aircraft was initially certificated for a gross takeoff weight of 18,500 lb. However, 22 days before the accident the authorized gross takeoff weight was increased to 19,500 lb.

This authorization was contingent upon certain requirements which had been met for the aircraft.

Engines were Pratt and Whitney, model R-1830-92, the left (No. 1) having 791 hours since overhaul and the right (No. 2) having 756 hours since overhaul. Propellers were Hamilton Standard, model 23E50-473 with model 6379A-O blades. Both hubs and all six blades had had 800 hours of service since last overhaul.

Although many pertinent maintenance records were lost in the fire following the crash, it appears that all maintenance on the aircraft and its powerplants was adequate and current.

AMC Contracts

Wright-Patterson AFB, Ohio—Following is a list of unclassified contracts for $25,000 and over as released by the Air Materiel Command:

General Electric Co., Syracuse, N. Y., $5,002,354 for world wide depot level maintenance and supply support of G. E. radar equipment.

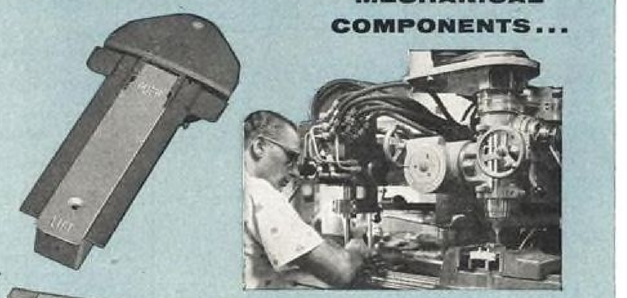
Machine Products Co. Inc., Aberdeen, Miss., $1,695,491 for operation of vehicle storage depot.

Ingersoll-Rand Co., Birmingham, Ala., $1,668,625 for compressors, power driven, reciprocating.

The Tumpane Co. Inc., Terre Haute, Ind., $2,970,015 for follow on maintenance and operation of storage site NR-7.

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$2,504,146 for maintenance and operation of machine tool storage site.

The Tumpane Co. Inc., Marietta, Ga., $2,286,431 for Fiscal 1958 operation and maintenance of storage site NR-6.

Machinery Overhaul Co. Inc., Palmdale, Calif., $1,187,901 for maintenance and operation of storage site NR-2 during Fiscal 1958.

Hayes Aircraft Corp., Birmingham, Ala., $8,915,379 for modification of B-50 aircraft to KB-50, Iran thereof, incidental maintenance thereto, (PR OC-732805).

National Broadcasting Co. Inc., New York, N. Y., $41,498 for 52 program kinescopes and prints of television program "Chapel of the Air."

Consolidated Diesel Electric Corp., Stamford, Conn., $4,812,040 for generator set, gasoline driven, type MD-3 (used in starting and pre-flight checkout of all major jet aircraft) and preservation, packaging and packing of IAW standard commercial practice.

Texas Instrument Inc., Dallas, Texas, $1,394,318 for AN/APQ-55(XA-2) radar sets.

Viewex Inc., Long Island City, N. Y., $38,171 for remote switching control, BP-1 (A), used with slide projector and ground equipment.

USAF Contracts

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

HEADQUARTERS, DAYTON AIR FORCE DEPOT, Gentile Air Force Station, Dayton 10, Ohio.

Leach Relay Division, Leach Corp., 5915 Avalon Blvd., Los Angeles, Calif., aircraft relays a/w spec. MIL-R-6106B (ASG), AN 3310-2, (IFB 33-604-57-64), $76,079.

Scintilla Division, Bendix Aviation Corp., Sidney, N. Y., switch assembly, P/N 10-5442V, PR's MD-7-5930-21746, MIPR R57-2884-TCSMC-E, $50,123.

Raytheon Manufacturing Co., Foundry Ave., Waltham, Mass., electron tube, glass envelope, Klystron type 6116 a/w Spec. MIL-E-1C, (ISS MIL-E-1/478A, (IFB 33-604-47-583)), $129,000.

Federal Telephone and Radio Co., Clifton, N. J., radio test set with antennas, model NUS 3156 w/antenna NUS 3157; radio test set, model NUS 3292; engineering data, a. Navdyke negatives, b. Blueline prints; descriptive pattern a/w DP 1745A; photographic prints, glossy, 8" x 10"; REP 33-604-57-2797; $570,153.

OGDEN AIR MATERIEL AREA, Hill AFB, Utah.

Nuclear Products ERCO Division, ACF Industries Inc., Hyattsville, Md., contractual maintenance of flight simulators, PR: 00-7-28A-406, $752,463.

Melpar Inc., Falls Church, Va., depot level maintenance of flight simulators, (PR: 00-7-28A-404), $91,945.

AIR FORCE CAMBRIDGE RESEARCH CENTER, ARDC, Laurence G. Hanscom Field, Bedford, Mass.

Radiation Inc., Melbourne, Fla., design and development of a portable electronics laboratory, AF19(604)-2654, $30,641.

Remington Rand Univac Division, Sperry-Rand Corp., Philadelphia, Pa., research directed toward the study of the physical, chemical and magnetic properties of thin ferromagnetic films, AF19(604)-2659, $120,-832.

Stanford Research Institute, Menlo Park, Calif., research concerning selection and development of a superfine organic microfiber material, AF19(604)-2644, $42,979.

DEPARTMENT OF THE AIR FORCE, HEADQUARTERS, Air Force Academy Construction Agency, Colorado Springs, Colo.

Robert E. McKee General Contractor Inc., El Paso, Tex., construction of the Cadet Academic Area, site improvement, retaining wall facings, (IFB 05-613-57-39), $2,157,300.

Boyle Construction Co., Sumter, S. C., construction of off-site utilities in support of the 800 unit Armed Services Housing Project, project MCP L1061 (IFB 38-806-57-42), $504,400.

2565TH NAVIGATOR TRAINING WING, James Connally AFB, Tex.

Hicks Construction Co., Waco, Texas, conversion of hangar 9-1 to jet engine overhaul. (IFB 41-611-57-74), $48,846.

TOPEKA AIR FORCE DEPOT, Topeka AFS, Topeka, Kan.

Carbide & Carbon Chemicals Co., Division, Union Carbide & Carbon Corp., New York, N. Y., Methanol, (IFB 14-604-57-717), $101,270.

Elwood Ivins Steel Tube Works Inc., Philadelphia, Pa., steel tubing (IFB 14-604-57-1311), $130,564.

MIDDLETON AIR MATERIEL AREA, Olmsted AFB, Pa.

Minneapolis-Honeywell Regulator Co., Minneapolis, switch fuel level control REP PR Oc-706099, $711,730.

OKLAHOMA CITY AIR MATERIEL AREA, Tinker AFB, Okla.

General Electric Co., Evandale, Ohio, overhaul of J47-GE-13, J47-GE-17B/33 and J47-GE-23 turbojet engines (PR OC-7-20A-J-47-MC2555, 2556 and 2557) $2,402,648.

Hydro-Aire Inc., Burbank, Calif., disc assembly, 4872-455947, (PR OC-7-031-1-SRO3-29), $29,366.

SAN ANTONIO AIR MATERIEL AREA, Kelly AFB, Tex.

Electrical Engineering and Manufacturing Corp., Los Angeles, Calif., aircraft accessory spare parts, PR: SA-7-03C1-1254, SA-7-03C1-125401 and SA-7-03C1-1254-2, $102,189.

The Pierce Governor Co. Inc., 1625 Ohio Ave., Anderson, Ind., aircraft accessory spare parts, PR: OC-MM2040, $123,256.

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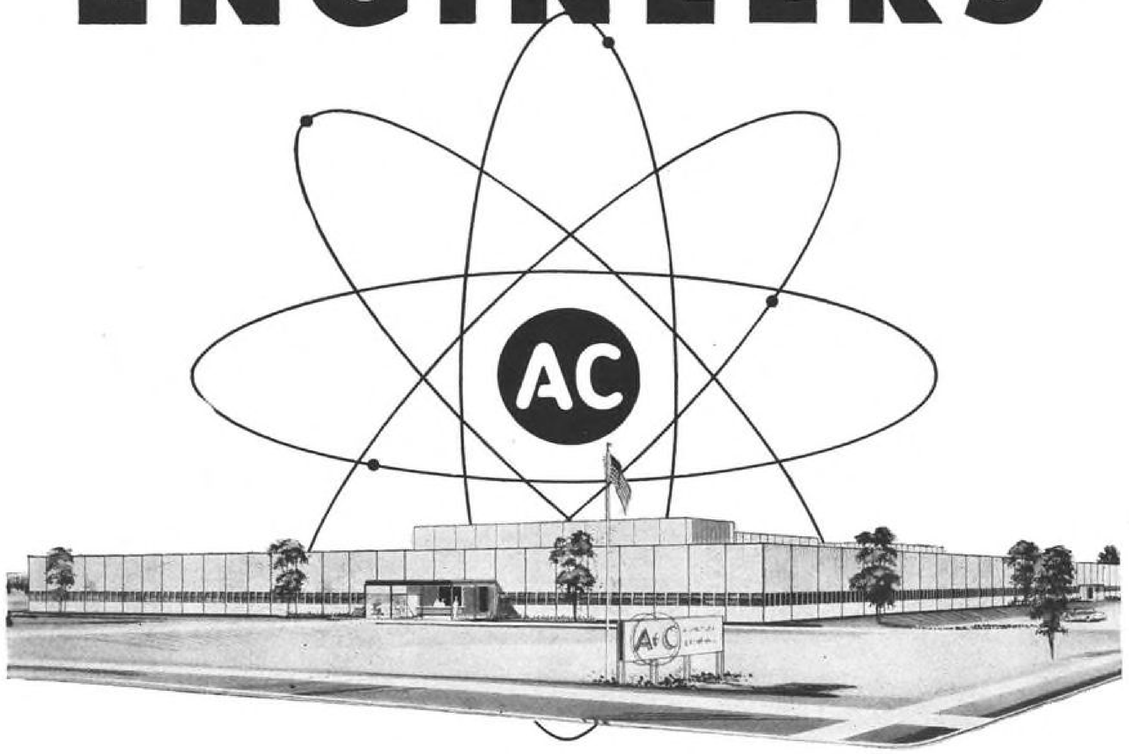
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Robert B. Hotz, editor; David A. Anderton, European editor; and Robert Farrell, Paris bureau chief (right to left) covering International Aeronautical Salon at Paris. Mr. Hotz also covered Russian Aviation Day (Moscow); SBAC displays (Farnborough, England), International Air Transport Association annual general meeting (Edinburgh).



Richard Sweeney, associate editor, preparing to board new jet bomber for a flight evaluation report. Mr. Sweeney recently covered inaugural of airline service via polar routes (Tokyo-Stockholm).



Alpheus W. Jessup, managing editor, (on the right) covering the Canadian Air Show in Toronto. Mr. Jessup recently was in Belgium for the inaugural of new air transports and airline helicoptors and covered European research and development activities.



Philip J. Klass, Avionics editor, at the Dew Line on the Artic Circle reporting the details of early warning radar system.



Claude O. Witze, military editor, feaving on first assault transport deployment flight to Europe. Mr. Witze's beat ranges from Pentagon to American bases overseas (Far East, Europe, Middle East, North Africa).



Robert I. Stanfield, associate editor, (on the right) shown flying a new jet trainer for one of several flight evaluation reports.



L. L. Doty, transport editor, in London covering BOAC introduction of Douglas DC-7 service.

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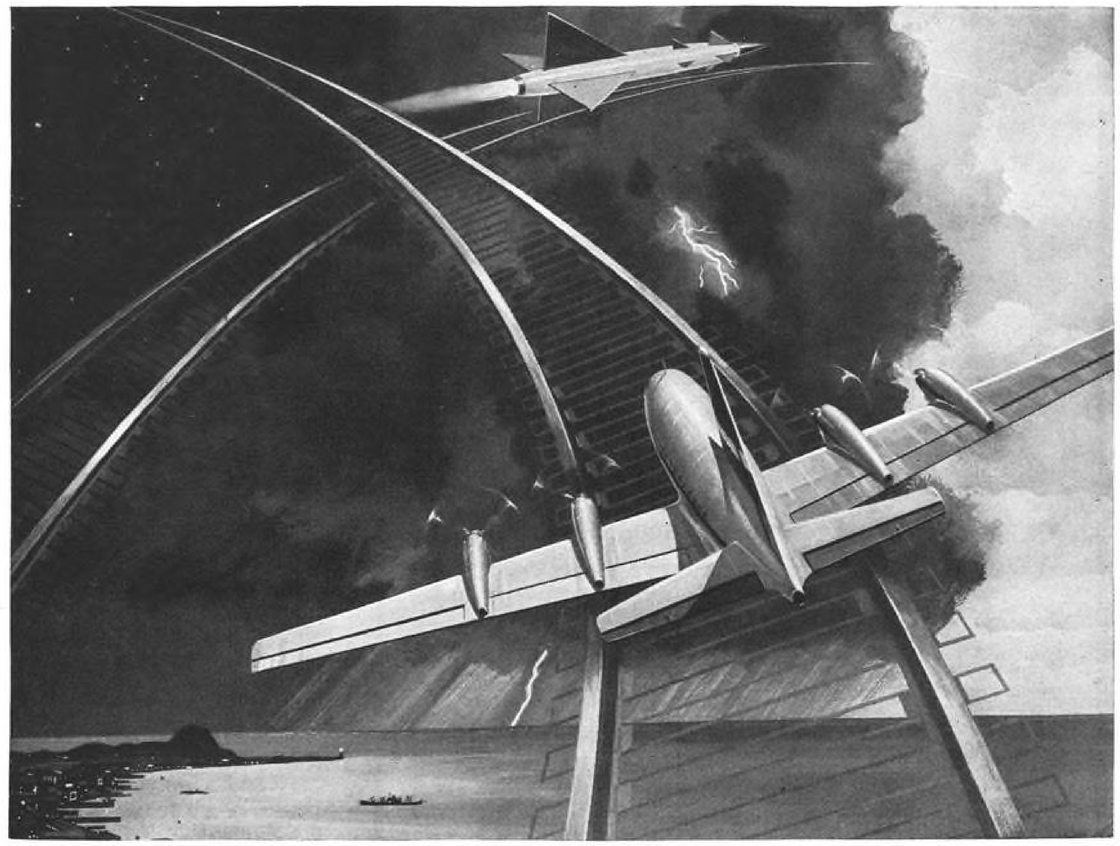
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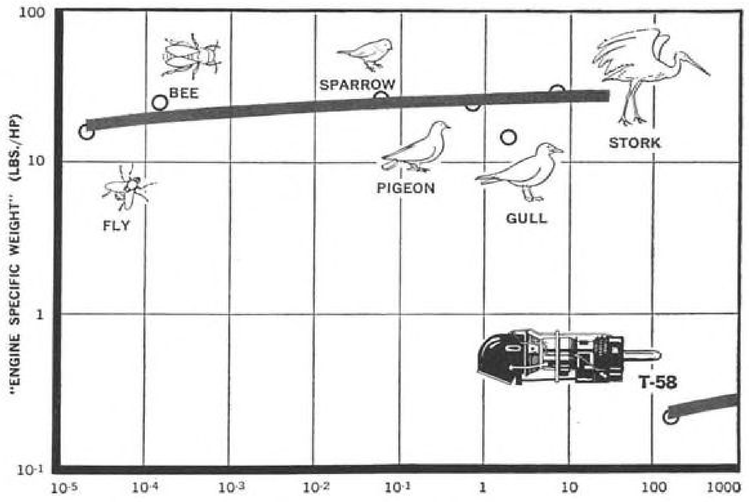
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NOTES AND REFERENCES

1. Values for the "engine specific weight" of the insects and birds were derived from Thompson . . . cf. "Growth and Form," 2nd Ed., 1942, Cambridge University Press; Chapter II on magnitude, especially pp. 45, 47. Birds were assumed to fly at 30 mph, insects at 5 mph.

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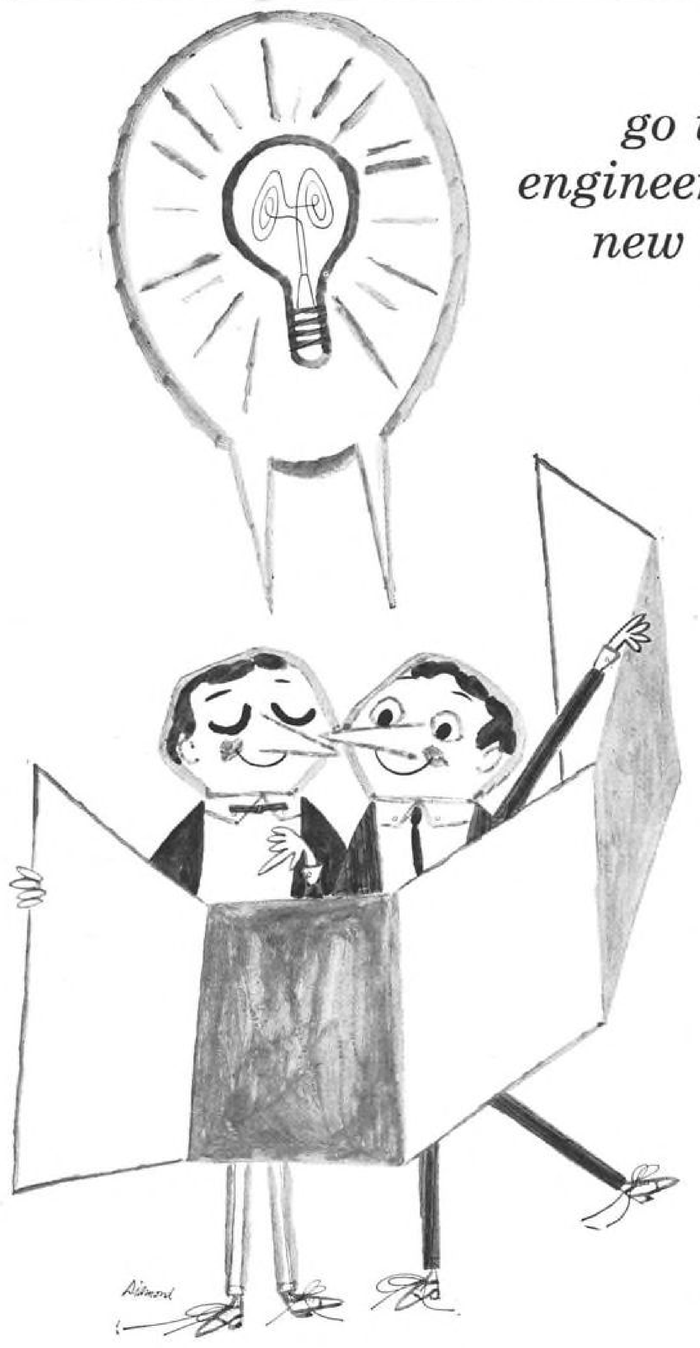
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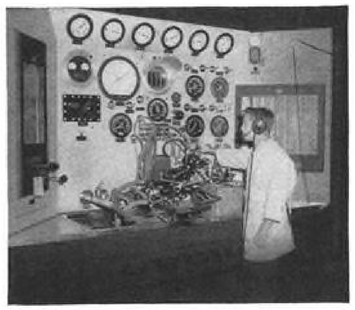
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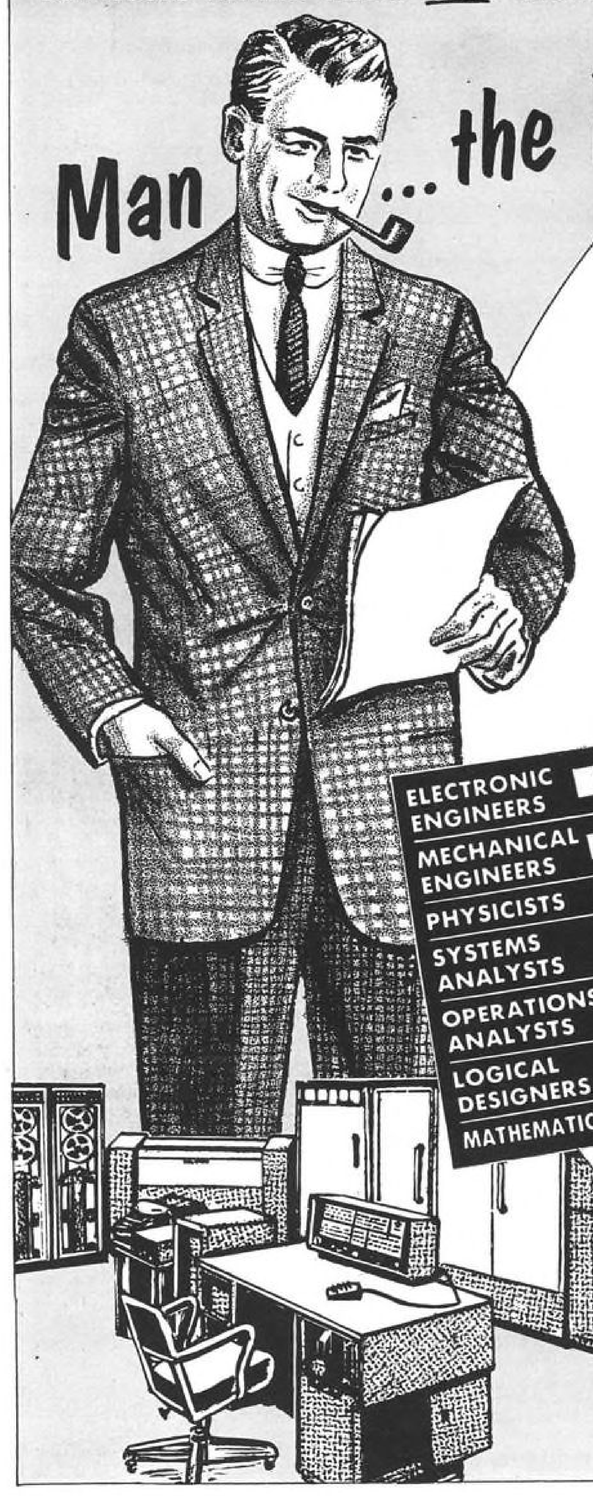
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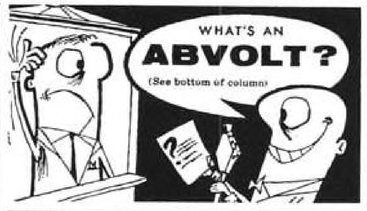
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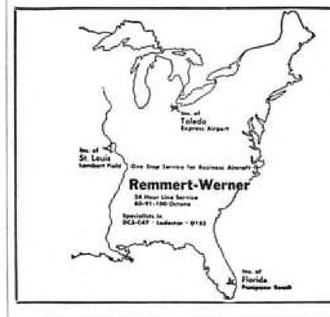
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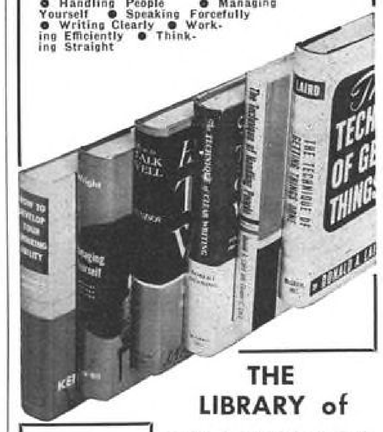
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LETTERS

Circulation High

Today I received No. 23 issue of AVIATION WEEK from June 10, and I noticed that the edition has now a total of 70,043 (copies).

As an old reader of this spectacular weekly I have watched ever since the constant rise of issues printed, so that I will take this opportunity to congratulate you and your fine outfit for the perfect job done. I know that it is not always easy to find the golden middle way between politics and the true fact, but what you have achieved in the past years symbolizes the free and uncontrolled will to write and think what the individual person wants and which is in the heart of each one for the benefit of all.

With many thanks and best wishes for the future, I remain, Dear Sir,

HELMUT HOREWITZ
Mercurbras Ltd.
Sao Paulo, Brazil

Another Salute

Your interesting editorial "Salute to the Sabre" (AW July 15) mentioned a few airplanes which have attained "a niche of immortality in aviation's annals." No doubt everyone enthused about aviation has a pet candidate for this list.

However, there is one airplane that definitely should be included—that is the Boeing B-17.

The vision and courage behind its original design and construction, along with its superb record of performance, are nothing short of magnificent. General of the Air Force Arnold once said of this airplane, "The Boeing Flying Fortress . . . had only one predecessor of equal importance in air history.

That was the first 'military aircraft' of the Wright brothers."

So next time some of the better airplanes are eulogized in your fine magazine, please do not forget the Boeing Flying Fortress.

JOSEPH H. ANDREWS
Spokane, Wash.

Engineer Surplus

In your July 15 issue you report that Lt. Gen. C. S. Irvine, USAF deputy chief of staff for materiel, criticized the aircraft industry for solving its engineering problems by "smotherization." The Engineers and Scientists of America has represented many thousands of engineers in the aircraft industry for some years. Our experience indicates that Gen. Irvine is completely correct in his criticism.

Although the "there is strength in numbers" approach in engineering problems, which, incidentally, lends credence to the engineering shortage myth, does not make sense from the economic standpoint, nor from a good management standpoint, there are, nevertheless, some extenuating circumstances for which the Air Force practices seem to be, at least in part, responsible.

It is generally understood that the Air Force gives careful consideration to the number of engineers an aircraft company has available when it is trying to decide the question of the company to which a contract should be awarded. Presumably, this is why some aircraft companies take steps to demonstrate that they have a surplus of engineers when the competition for a new airplane contract reaches the critical stage. Aircraft companies have apparently decided that a substantial excess of engineers is a prerequisite to their obtaining important future business.

If this is true, or if the aircraft companies believe that it is true, the companies have no choice whatsoever. They simply have to find some means by which to acquire a substantial surplus of engineers over the number currently required. If a company has a surplus of engineers on its payroll, the temptation to succumb to the use of the mass assault or "shot gun" approach to engineering problems is natural.

Few engineers believe that the "shot gun" approach is the best or most economical procedure. In fact, there is some question as to whether or not this is the quickest solution. However, if the Air Force seeks to discourage "smotherization," it would do well to be sure that none of its policies encourage the acquisition and maintenance of a surplus of engineers by any of its contractors.

JOSEPH AMANN, President
Engineers and Scientists of America
Munsey Building
Washington, D. C.

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. 42nd 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 withhold on request.

Taxpayer's Citation

In re "Army Man's View" (AW Aug. 19, p. 166), please recommend the Col. for the Pentagon shaped "Groundpounders" medal.

He is a very rare military man if he worries about us poor civilian taxpayers.

K. W. POORBAUGH, Civ.
Material Providers Team
Rated pilot, USAF Res.
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Office, Rear of Home
Somerset, Pa.

AGREE Program

We are extremely interested in your article regarding the AGREE program for the reliability of avionic equipment and components, "Defense to Stop Just Pleading; Reliability Will Go in Contract," which appeared on p. 34 of your Aug. 5 issue.

As you know, we feel quite strongly about the necessity for increased reliability in electronic equipment. Evidence of this is our proposal for handbook data on avionic components under the HELPR program (Handbook of Electronic Parts Reliability), which would provide a new tool for the upgrading of reliability.

Philip J. Klass' Aug. 5 story covers the findings of the AGREE group in a comprehensive, yet concise, manner. We would like your permission to reproduce this article as support for our continuing effort toward greater reliability in electronic components.

WILLIAM E. EGAN
Asst. to the General Manager
Inland Testing Laboratories
Morton Grove, Ill.

Psychology Course

I would like to correct an impression given in your July 29 issue of Aviation Week; the brief "Psychology in Air Force Academy" (box, p. 67) implies that the entire psychology course was taught by AFPTRC personnel from Lowry Air Force Base.

This is somewhat misleading in that the AFPTRC personnel presented, at the invitation of the professor of psychology, two hours on the mission of the Air Force Personnel and Training Research Center. These two hours were very valuable to the cadets, but comprised a small segment of the two semester psychology course.

The first semester course in psychology is similar to that presented in civilian universities and colleges. The second semester concerns psychology as applied in the U. S. Air Force. Of the 42 classroom hours nine were on Human Engineering, seven on Training and Personnel Requirements, fifteen on Leadership, and eleven on Problems of Military Adjustment.

Members of the teaching staff are assigned to the USAF Academy. They are chosen from among U. S. Air Force officers who have M.A. or Ph.D. degrees in psychology. They serve, on the average, a four year tour of duty.

LT. COL. FRED E. HOLDREGE, USAF
Professor Psychology
U. S. Air Force Academy
Colorado Springs, Colo.

B-57 Conversion

With respect to the article "CAA Tests Jet Age Navigation Aids" (AW Aug. 5, p. 43), I would like to add that the conversion of these B-57s into "flying laboratories" was accomplished by Radiation, Inc. here at our Instrumentation Division in Orlando, Fla. We are naturally proud of our part in this very significant program.

This conversion required the installation of 20 major pieces of equipment, more than 30,000 ft. of cabling, and control, recording and operating units. It was necessary to remove bombing photographic and quantities of other gear from the plane in order to effect this installation.

H. W. GETTINGS, Manager
Contract Information and Publicity
Radiation, Inc.
Electronic Research Development Production
Melbourne, Fla.



Giant landing gear test facility is 60 feet high. It simulates conditions that heavy, high-speed planes actually meet.

BENDIX SHOOTS LANDINGS INDOORS TO HELP PRODUCE BETTER LANDING GEAR SYSTEMS

When designing and producing complete landing gear systems it is vitally important to know in advance just how every component part will respond to the stresses and strains of flight conditions.

That's why the giant landing gear testing equipment pictured above plays such an important part in the development and production of Bendix* complete landing gear systems.

All major components that make up the system such as control valves, nose wheel steering, retractor actuators, power braking as well as wheels, brakes, shock absorbing struts and even tires are subjected to repeated tests of braking, dropping, twisting and vibration before final approval.

For Bendix has proven over many years that landing gear components that have been designed, engineered and tested to work together give better and more dependable performance than any arbitrary assembly system.

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.

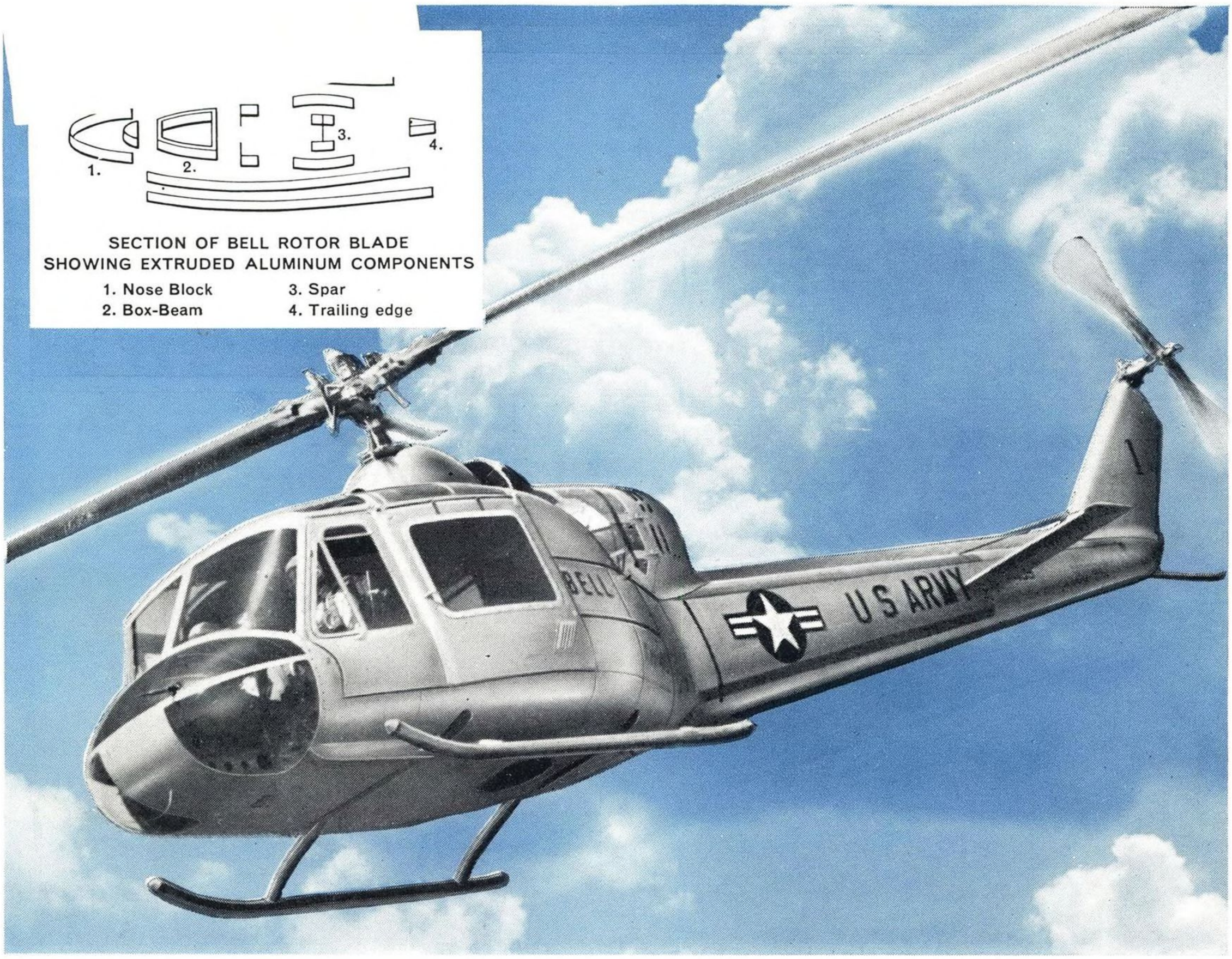
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SECTION OF BELL ROTOR BLADE
SHOWING EXTRUDED ALUMINUM COMPONENTS

1. Nose Block
2. Box-Beam
3. Spar
4. Trailing edge



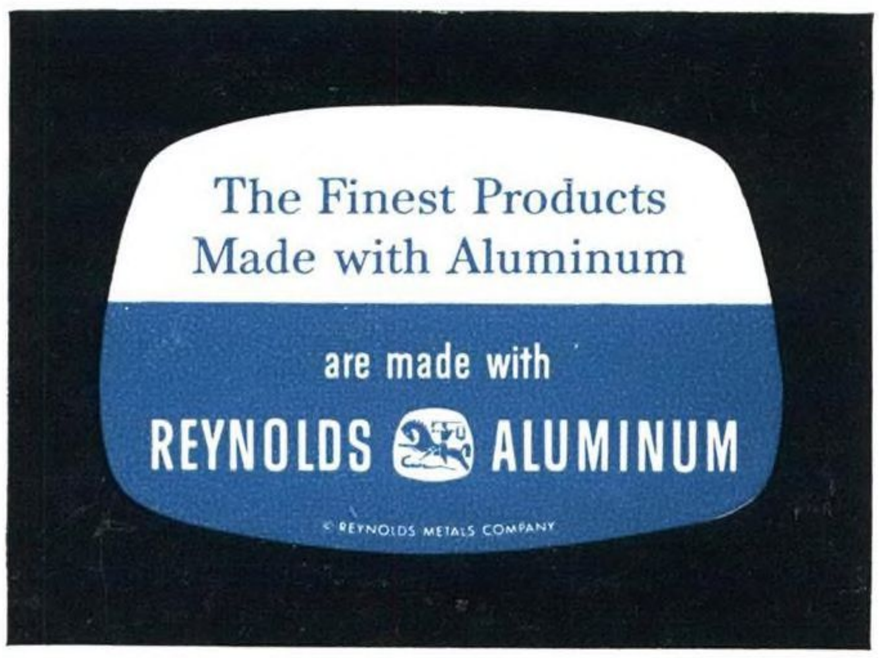
Aluminum Extrusions . . . Backbone for Bell's **LIGHTER, STRONGER ROTOR BLADE**

The rotor blade of Bell's new versatile XH-40 helicopter is a product of close teamwork between engineers at Reynolds and Bell Helicopter. This rotor blade has been engineered to withstand severe stresses demanded by improved helicopter performance. The use of Reynolds extruded components gives Bell a rotor blade of very high strength-to-weight ratio.

The extruded, tubular box-beam and other aluminum extrusions for the 270″ blade are supplied ready for bonding with no additional machining required. Careful weight control allows complete interchangeability between blades.

Bell engineers have cited Reynolds as the only company which has demonstrated its ability to supply these extrusions to meet their close tolerances on weight and dimensions. This outstanding performance, made possible by the unusual development services which Reynolds provided on this project, is one of many examples of how Reynolds Aluminum is serving the aircraft industry, and why aircraft manufacturers look to Reynolds for progress with aluminum.

For details on Reynolds technical services, or for an index of technical handbooks and films on aluminum, write to *Reynolds Metals Company, P. O. Box 1800-TJ, Louisville 1, Kentucky.*



For below-mill quantities of AND sections and other aircraft shapes, contact our specialty aircraft extrusion distributor, Pioneer Aluminum Inc., 5251 W. Imperial Highway, Los Angeles 45, Calif. Phone OREgon 8-7621.

Watch for Reynolds on "DISNEYLAND", ABC-TV.