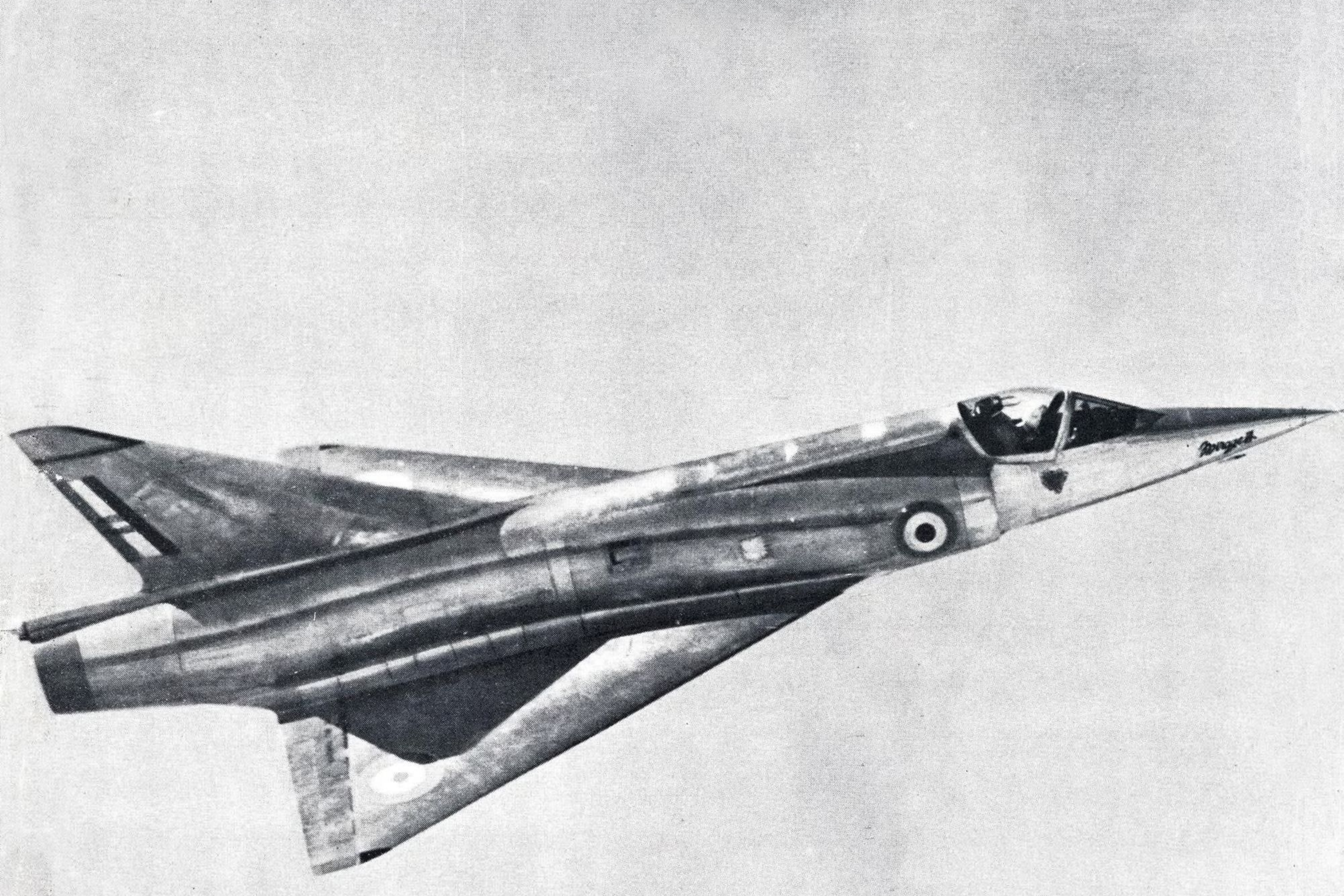
AVIATION WEEK

A McGRAW-HILL PUBLICATION

June 10, 1957 50 cents

Fiat Moves Fast To Develop G.91 For NATO Trials



Dassault Mirage III

Special Report on French Air Show



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Model 1660

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AVIATION CALENDAR

June 10-13—Semi-Annual Meeting, American Rocket Society, Hotel St. Francis, San Francisco, Calif.

June 10-14—Lecture Series on Vacuum Metallurgy, sponsored by New York University College of Engineering. Address inquiries to Dr. R. F. Bunshah, New York University College of Engineering, University Heights 53, N. Y.

June 11-13—3rd Western Plant Maintenance & Engineering Conference, Civic Auditorium, San Francisco, Calif.

June 13-15—21st National Applied Mechanics Div. Conference, American Society of Mechanical Engineers, University of California, Berkeley, Calif.

June 14—Plastics for Electronics, New England Section, Society of Plastics Engineers, Lowell Technological Institute, Lowell, Mass.

June 17-19—National Convention on Military Electronics, Sheraton-Park Hotel, Washington, D. C., sponsored by Institute of Radio Engineers.

June 17-20—Eighth All Women's International Air Race, McAllen, Tex.-Cuba. For details, write: Miss Irma Price, Entry Chief, 242 W. 8th St., Miami, Fla.

June 17-20—National Summer Meeting, Institute of the Aeronautical Sciences, Biltmore Hotel, Los Angeles, Calif.

June 22-23—Golden Anniversary of the Air Force, New England observance, L. G. Hanscom Field, Bedford, Mass.

June 23-25—29th Annual Meeting, Aviation Distributors & Manufacturers Assn., The Broadmoor, Colorado Springs, Colo.

June 24—Soviet National Aviation Day, Moscow.

June 24-28—American Institute of Electrical Engineers, summer general meeting, Sheraton Mt. Royal Hotel, Montreal, Canada.

June 27-29—13th Annual Meeting, Institute of Navigation, Sheraton-Park Hotel, Washington, D. C.

July 2-11—24th National Soaring Contest, Harris Hill, Elmira, N. Y.

(Continued on page 6)

AVIATION WEEK • JUNE 10, 1957

Vol. 66, No. 23

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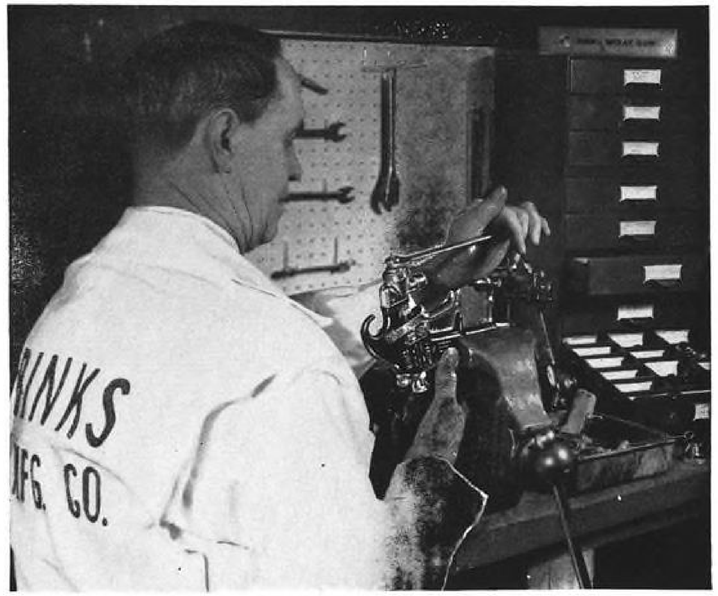
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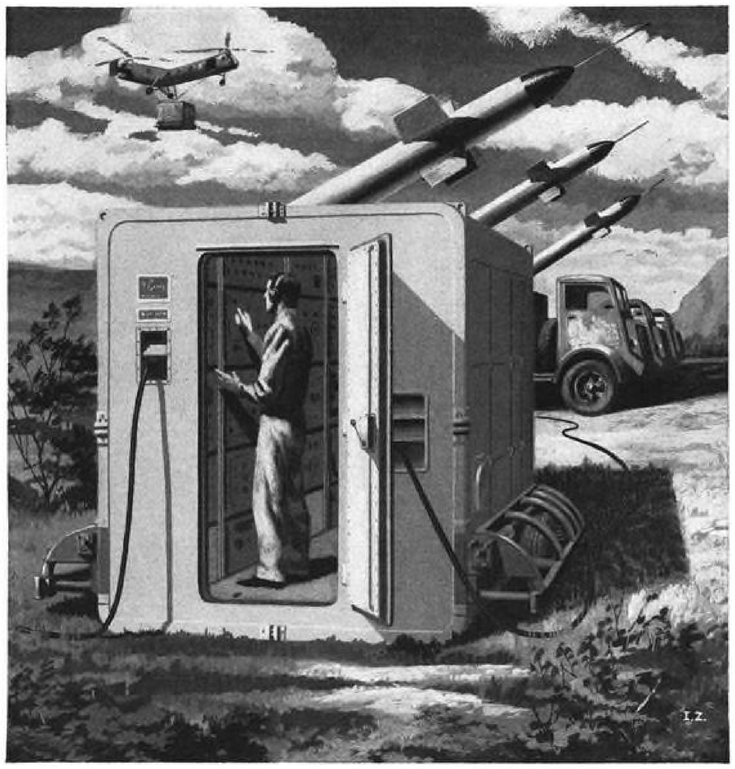

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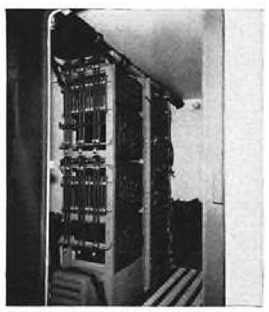
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AVIATION CALENDAR

(*Continued from page 5*)

July 6-10—Eleventh All-Women Transcontinental Air Race, from San Mateo County Airport, Carlos, Calif., to North Philadelphia Airport, Pa.

July 12-13—British Lockheed International Aerobatic Competition, the National Air Races (third round) and the King's Cup Air Race, Coventry Civil Aerodrome, Baginton, England.

July 28—Third Annual Jaycee Air Fair, sponsored by Portland (Oregon) and Junior Chamber of Commerce, Portland International Airport.

July 31-Aug. 4—Eleventh Annual National Convention, Air Force Assn., and Airpower Panorama, Sheraton-Park and Shoreham Hotels, Washington, D. C.

Aug. 1-2—Second Annual Exiborama and First Annual National Photo Instrumentation Symposium, Society of Photogrammetric Engineers, Ambassador Hotel, Los Angeles.

Aug. 5-10—National Naval Aviation Meeting, Institute of Aeronautical Sciences, U. S. Grant Hotel, San Diego, Calif.

Aug. 10-11—Midget Airplane Races, Oshkosh, Wis.

Aug. 20-22—Bendix-Scintilla International Ignition Conference, Sidney, N. Y.

Aug. 20-23—Western Electronic Show & Convention, Cow Palace, San Francisco.

Aug. 26-28—Gas Dynamics Symposium Transport Properties in Gases at High Temperatures and Pressures, Technological Institute, Northwestern University, Evanston, Ill.

Aug. 31-Sept. 1—Midget Airplane Races, Ft. Wayne, Ind.

Sept. 1-15—Sixth International Aeronautical Conference, Royal Aeronautical Society and Institute of the Aeronautical Sciences, Folkstone and London, England.

Sept. 2-8—1957 Flying Display, Society of British Aircraft Constructors, Farnborough, England.

Sept. 3-14—11th General Assembly, International Union of Geodesy and Geophysics, in conjunction with International Geophysical Year, University of Toronto, Canada.

Sept. 9—13th Annual General Meeting, International Air Transport Assn., Madrid, Spain.

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

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

Oct. 2-4—Tenth Annual Meeting and Forum, National Business Aircraft Assn., Cosmopolitan Hotel, Denver, Colo.

Oct. 7-9—13th Annual National Electronics Conference, Chicago, Ill.

Oct. 7-10—Triennial Inspection, Lewis Flight Propulsion Laboratory, Cleveland, Ohio.

Oct. 7-12—Eighth Annual Congress, International Astronautical Federation, Barcelona, Spain. For details write: IAF, 35 Lowell Rd., Concord, Mass.

Oct. 9-11—National Fall Convention, Society for Experimental Stress Analysis, El Cortes Hotel, San Diego, Calif.

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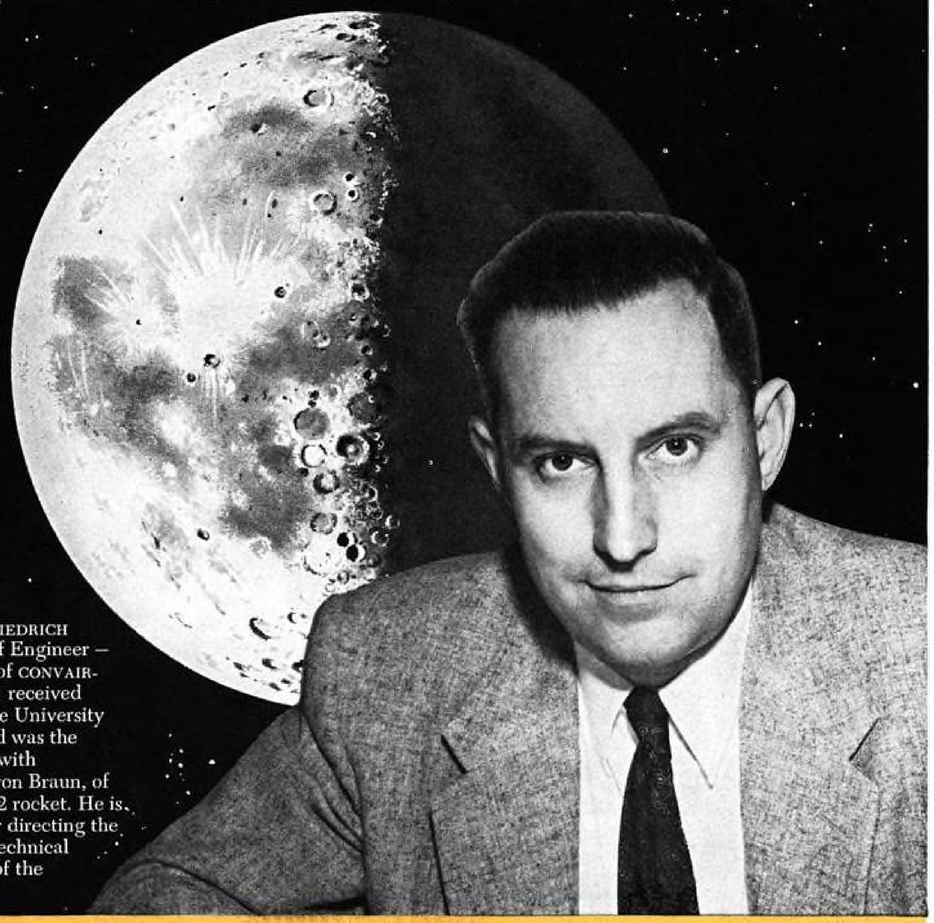
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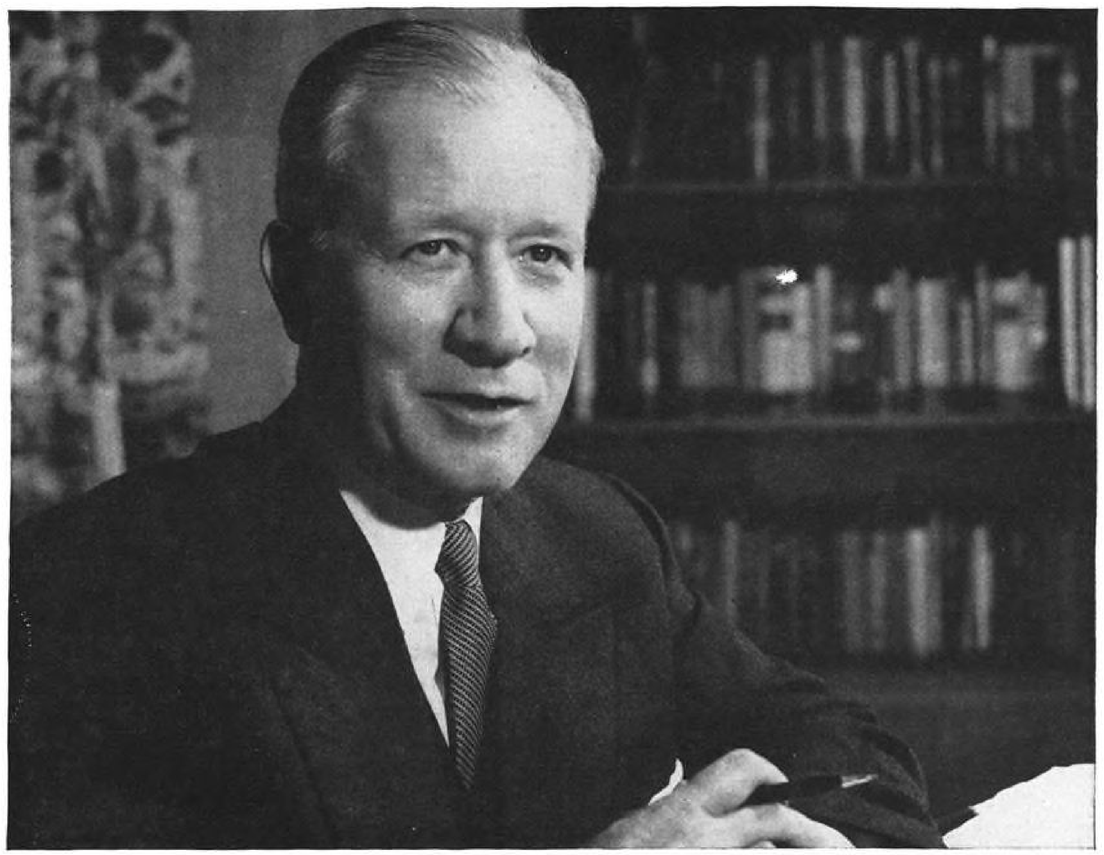
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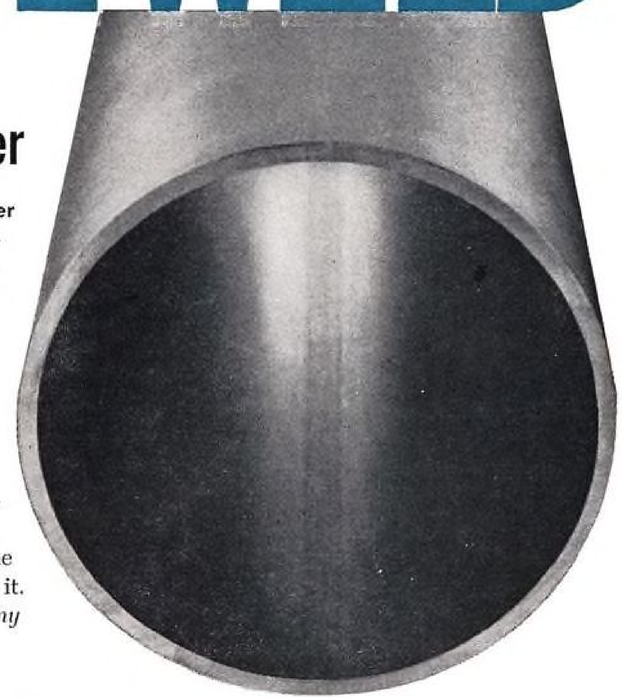
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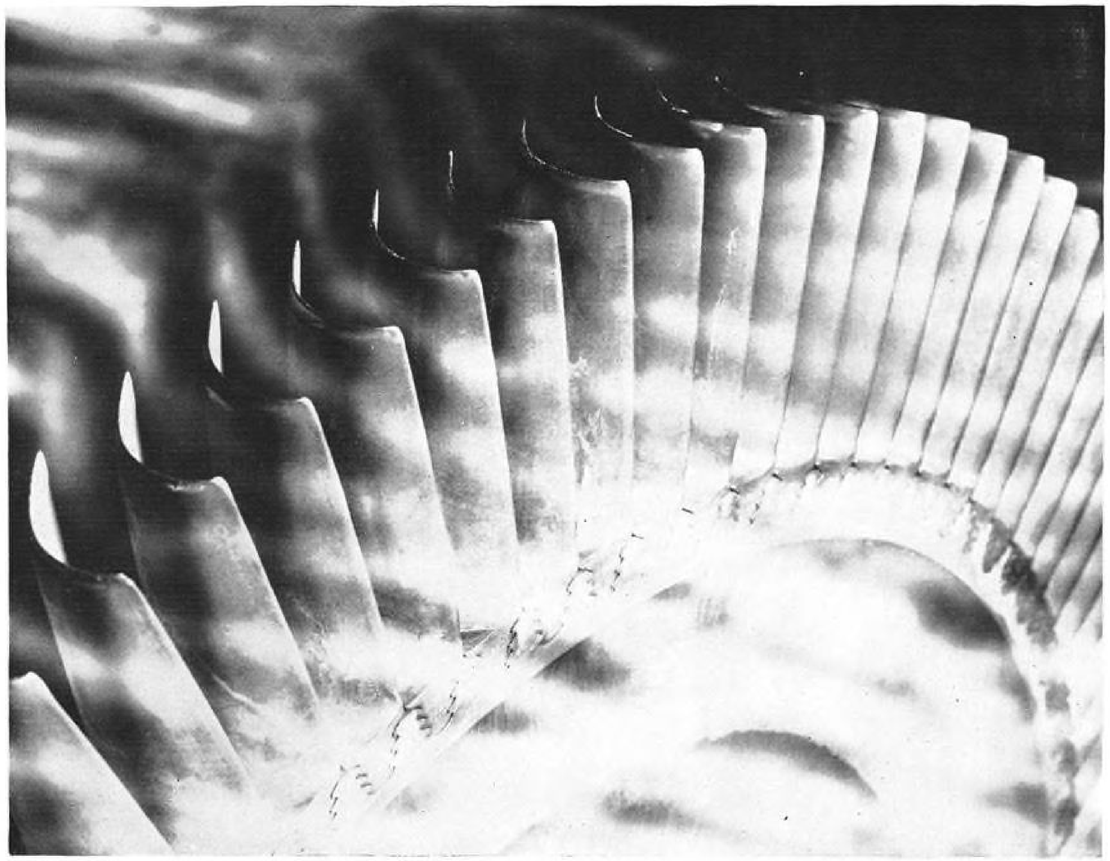


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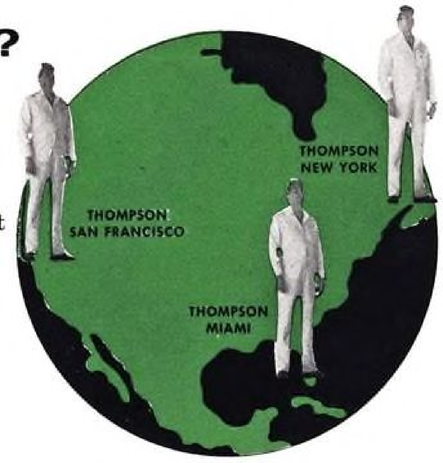
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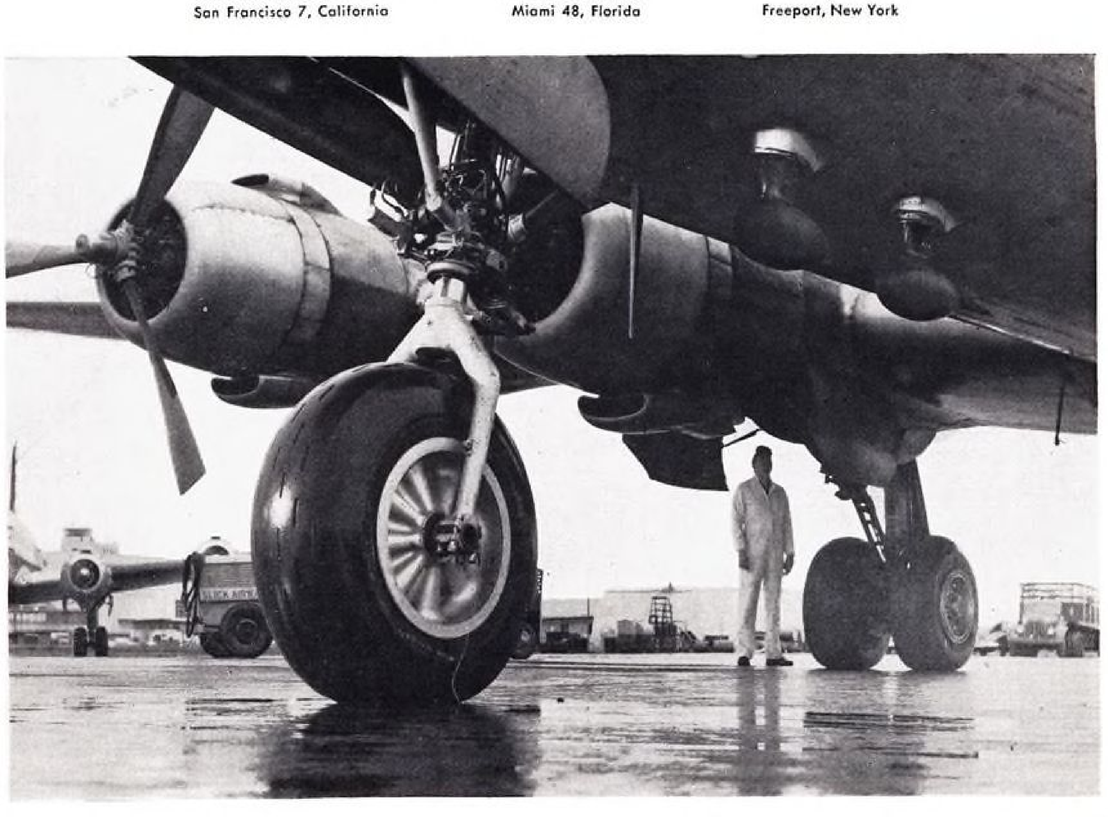
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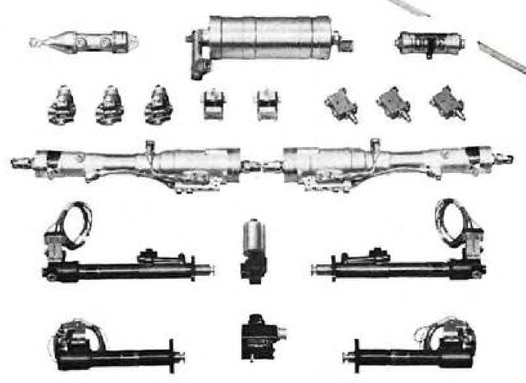
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June 10, 1957

AVIATION WEEK

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New York 36—330 W. 42nd St., Phone: LOngacre 4-3000 (Night LO 4-3035)
Washington 4, D. C.—National Press Bldg., Phones: NAtional 8-3414, REpublic 7-6630
Los Angeles 17—1125 West Sixth St., Phone: MAdison 6-9351
Dallas 1—1712 Commerce St., Phone: RIverside 7-5117

European Office—1 rue du Temple, Geneva, Switzerland

PUBLISHER.....Robert W. Martin, Jr.
EDITOR.....Robert B. Hotz

MANAGING EDITOR.....Alpheus W. Jessup
ASST. MANAGING EDITOR (TECHNICAL) David A. Anderton
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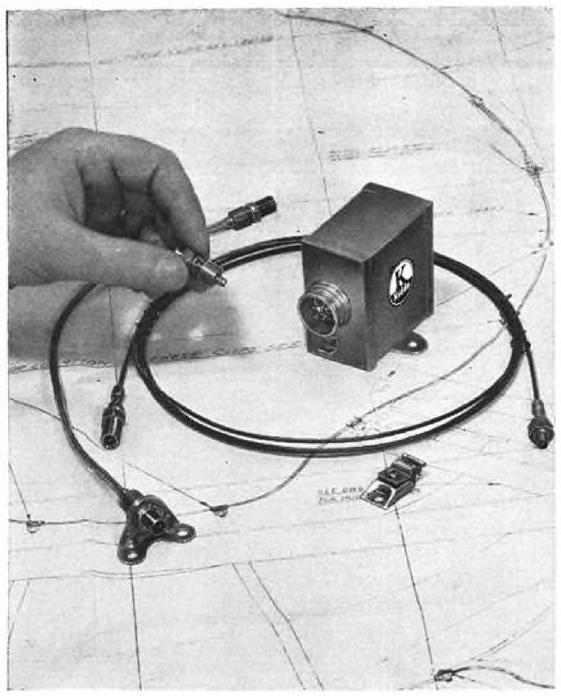
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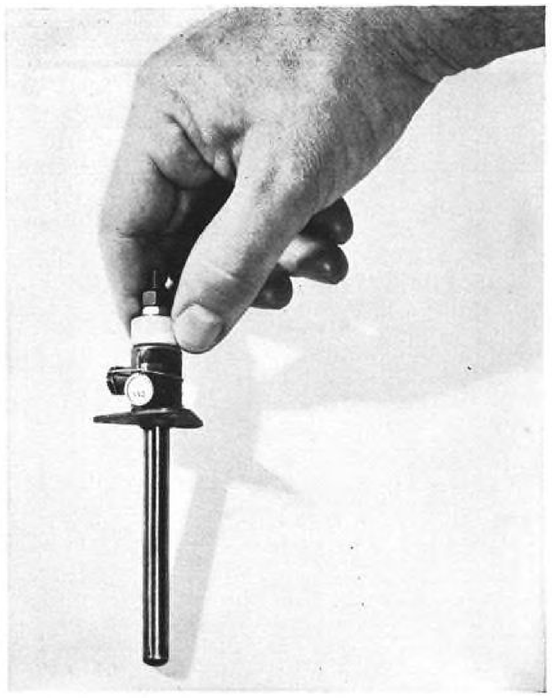
COVER: Displayed at the Paris International Air Show, Dassault's supersonic delta wing Mirage III fighter prototype exhibited the degree to which the French are keeping pace with modern aircraft design. Mirage III prototype, powered by Sneema Atar G-1 turbojet plus rocket, has flown at Mach 1.6. Production models will have Atar 8 engines, which correspond to prototype G series. Later series will have the Atar 9 of over 13,000 lb. thrust, giving the Mirage III Mach 2 capability.

Picture Credits:
37—Wide World; 41, 45—Erwin J. Bulban; 26, 27—Photo by Russell Melcher from Bristol Sycamore helicopter piloted by C. T. D. Hosegood; 28, 29, 30, 31, 32—Russell Melcher; 66—Howard Levy.

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Reflections on Paris Air Show

The end of a fine air show is always a sad occasion. No sooner has the last swift jet swished over heads of sunburned spectators than the complex forces that have been marshalled for a few days to create a spectacle of infinite splendor and variety begin to disintegrate. It is like a circus striking its tents after a final performance.

As crowds of cash customers stream homeward through traffic jams, transient aircraft are already taking off like homing pigeons for their native hangars. Prop and rotor wash of departing planes and helicopters stirs up paper clouds of discarded programs, torn tickets, and old sales pamphlets. Veterans who have fought together in shooting wars and now claw each other in brochure battles for sales gather in the striped, half-deserted hospitality tents for a final libation and mellow reminiscing before scattering across Europe and the Atlantic.

One of the Best

The 22nd Salon International d'Aeronautique that ended on a balmy Parisian Sunday afternoon at Le Bourget Airport was a fine show. We have seen all of the world's major air shows dating back to the pylon bending days at Cleveland through the migrations of the National Air Show. We watched Farnborough's rise to glory, and also stood at Tushino on the outskirts of Moscow as the massive Soviet airfleet thundered overhead. But we have to scrape our memory hard to find another air show that surpassed the current French one.

One of the most important factors that added flavor and import to the current French show was its strong international flavor. There were aircraft displayed from 14 countries, including machines from Czechoslovakia, Poland and Russia and the resurgent German aircraft industry. The French show is the only one left in the world today that retains its strong international flavor. This is a pleasant contrast to the narrow chauvinism of the Farnborough display that even barred aircraft from Dominions of the British Commonwealth and still refuses to allow anything to fly that contains equipment of foreign manufacture.

Another major factor in the success of the French show was the tremendous participation of the United States, both by the Air Force, celebrating its 50th anniversary, and the aircraft industry. Although none of the latest Mach 2 USAF fighter crop was displayed, the North American F-100Cs of the Skyblazer acrobatic team and the F-100D in the static display were the only truly supersonic aircraft in the show now in widespread operational service for the western allies. The aerial refueling technique that has given Strategic Air Command its intercontinental atomic striking power was demonstrated at low level for all to see. And the first intercontinental missile, subsonic Northrop Snark, was mounted with boosters on a field launching ramp ready for action. The USAF display created a tremendous impression of a powerful air force in being.

The strong representation of the U.S. aircraft industry was an impressive demonstration of the powerful effort it is making in the international commercial market. Contrast between the products now offered in the jet transport race by the British, who admittedly once had a commanding lead in this area, and those being sold by U.S. manufacturers provided observers with a good indication of how quickly the British advantage has been dissipated.

The British were hampered by treasury-imposed limitations on their participation. But there was an air of sour grapes and grumbling among the British industry contingent and their daily and technical press that tends to confirm the feeling that technical and financial rough air lies ahead for both the industry and military. The traditional British sportsmanship and stiff upper lip in the face of adversity were notably absent in the public and private blasts loosed at American competitors.

Perhaps the most significance emerged from the 10 day show in wares displayed by the French on the ground and in the air. There is little doubt that the French are now the dominant force in European aviation. They have always been noted for their creative and imaginative engineering approaches. There is no lack of evidence on this score now with their rocket and ramjet work, the coleopter, skid landing techniques, mixed power interceptors and STOL concepts. But even more significant is the production effort that is now backing up the brilliant prototype display. As examples, the Nord Noratlas twin engine transport, the Fouga Magister jet trainer and the Dassault Mystere fighter series are all solid production aircraft with good delivery records and an export sales record as proof of their technical excellence and operational serviceability.

French Advances

It is interesting to note that it was the French industry that put the first truly European supersonic fighter into production—the Dassault Mystere IVB2—which is now in limited operational service with the Armee de l'Air. The mixed power Trident developed by Sud Aviation was the first flying prototype in Europe to demonstrate the combination of turbojet and rocket power and an air-to-air missile. The Dassault Mirage delta wing interceptor is probably the fastest fighter prototype flying in Western European skies today.

On the commercial side, the Sud Aviation Caravelle has an excellent chance to break into the international jet transport market on a sizeable scale. It was impressive during its North and South American demonstrations where it satisfied both the airline technicians and the cabin-riding passengers. Sud faces a major problem in accelerating production sufficiently to satisfy airline demands if orders develop and in establishing an international service organization to bolster airline maintenance organization.

French aviation is driving hard along technically sound lines. Only a major political or financial crisis appears to be able to prevent it from fulfilling its present promise.

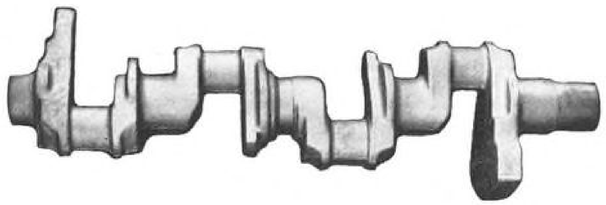
—Robert Hotz

whether you think in terms of

Horsepower

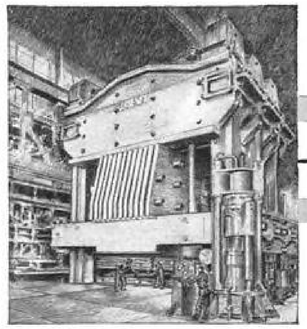
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Thrust



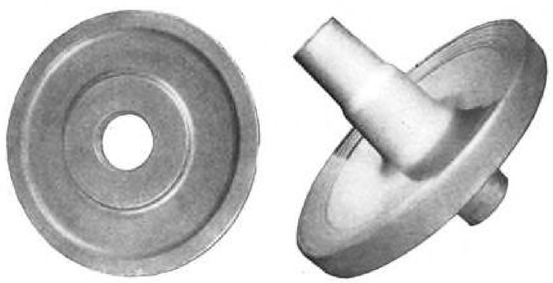
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T. F. Flood, vice president-sales and manufacturing and a director, The Frank G. Hough Co., Libertyville, Ill.

Preben K. Johnston, a director, Aircraft Armaments, Inc., Cockeysville, Md. Also: **Richard W. Sanford**, vice president and director of engineering, and **Harry F. Kniesche**, vice president-manufacturing.

E. Douglas Reddan, president, and **Norman C. Anderson**, vice president, Infrared Industries, Inc., Wellesley, Mass.

Eugene Caldwell, president, Baker-Raulang Co., Cleveland, Ohio. Mr. Caldwell succeeds **Percy L. Douglas**, who continues as a director.

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Volney F. Morin, executive vice president, and **William A. Clegern**, vice president-product development, Meletron Corp., Los Angeles, Calif.

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Fred H. Crank, vice president-customer relations, Radioplane Co., subsidiary of Northrop Aircraft, Inc., Van Nuys, Calif.

Fred A. Winzer, Jr., vice president-sales, The Waldorf Instrument Co., Huntington Station, N. Y.

E. B. Hathaway, vice president-trade sales, The Firestone Tire & Rubber Co., Akron, Ohio.

Honors and Elections

Presidential Assistant **Edward P. Curtis** has been awarded an honorary Doctor of Science degree by Stevens Institute of Technology in recognition of his outstanding contributions to the fields of business and aviation.

Carter L. Burgess, president of Trans World Airlines, Inc., has been awarded an honorary Doctor of Engineering degree by Worcester Polytechnic Institute.

Mrs. James H. Doolittle, the wife of Gen. James H. Doolittle, has been presented a scroll making her honorary commander of the Women's Squadron of The Air Force Association.

L. Eugene Root, vice president of Lockheed Aircraft Corporation and general manager of the Missile Systems Division, has received the Air Force Exceptional Service Award. The citation read in part, ". . . by exceptionally meritorious service to the Department of the Air Force. . . . In this era of progress, the singularly distinguished accomplishments of Mr. Root in the field of aerodynamics technology and weapon system development planning have earned him the gratitude of the USAF."

INDUSTRY OBSERVER

This column was written by AVIATION WEEK *editors attending the 22nd Salon International d'Aeronautique at Le Bourget Airport near Paris.*

► Rolls-Royce's latest version of its Conway bypass engine is rated at 16,500 lb. static thrust for civil use and 17,150 lb. thrust for military. These ratings were originally written on the Conway placard at the Rolls static exhibit at Le Bourget, but later were painted over presumably due to security restrictions. First attempts to run the late model Conway at full rated power failed at about 3,000 lb. thrust short of the proposed civil rating.

► **Dassault Super Mystere IVB2 is flying with SEPR 661 rocket engine. Development of this engine will be part of powerplant for Dassault Mirage III making a turbojet plus rocket powered interceptor. Rocket engine is rated 3,300 lb. thrust.**

► Motoimport, Polish foreign trade agency, quoted a price of $55,000 on its four place civil helicopter patterned after the Russian Mil-1 design. Model exhibited at Le Bourget featured a pilot's single seat forward with a long seat holding three persons across the rear of the cabin. Some Russian manufactured instruments were used in the display model although Polish officials said they were developing the capacity to build their own instruments.

► **Bristol and de Havilland are pushing hard to get either an advanced Olympus or the 25,000 lb. Gyron with afterburner into the Chance Vought F8U-3 Mach 2 fighter now being designed for the Navy.**

► Fouga has sold 48 of its Magister jet trainers to the Argentine. Most of these trainers would be assembled in the Argentine state aircraft factory from parts shipped from France.

► **British observers studying the picture display by Republic of its F-105 fighter-bomber already flying in the Mach 2 speed area were struck by its resemblance to the new Hawker supersonic strike fighter being designed by Sir Sidney Camm as a privately financed Hawker-Siddeley group venture.**

► Napier has purchased a Convair 440 for another experimental installation of its Eland turboprop. Meanwhile REAL, Brazilian airline, is planning the first system wide switch from Pratt & Whitney R2800 piston engines to Eland turboprops for its Convair-Liner fleet.

► **Baroudeur, Sud Aviation's skid landing gear fighter-bomber, has recently made skid takeoffs using 1,800 ft. of grass field. Baroudeur is now powered by an 8,000 lb. thrust version of the Snecma Atar turbojet.**

► Sud Aviation plans to double production rate of its Caravelle jet transport from four to eight per month in its French plants by 1960. Meanwhile stiff competition is going on among British and U.S. engine builders for installation in advanced versions of the Caravelle now being designed by Sud.

► **Radio-guided bomb designated BB.10 is part of heavy offensive armament carried by Sud Aviation Vautour ground attack version. Bomb has usual cruciform fins connected by an annular shroud wing and mounts canard control surfaces near the nose.**

► Engine cooling installation of Czech Avia 14 features recessed cowl flaps sealed at trailing edges for high speed operation of ejection system using engine exhaust as primary driving stream. In climb or other high power low speed flight regimes, opened cowl flaps do not protrude beyond cowl external contours and therefore keep cooling drag to a minimum.

► **Grumman F11F-1F has flown to 77,000 ft. altitude during tests at Edwards AFB. Plane has all-weather capability. Two-seat trainer version, designated F11F-1FT is 12 in. longer and weighs 500 lb. less than the fighter version. West Germany is interested in both versions.**



HOW THE SILICONES MAN HELPED...

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Accuracy that could hit a fly from a screaming roller coaster . . . so rugged that it can be used to drive nails without impairing its operation. That's the "impossible" fire control gyro built by Minneapolis Honeywell, Aeronautical Division. Known as the HIG-5 (Hermetic Integrating Gyro), lightweight and small enough to hold in the palm of your hand, it supplies the "sense of balance" necessary at supersonic speeds.

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Washington Roundup

Army Wins Missile Race . . .

Army, although apparently resigned to Defense Secretary Charles E. Wilson's order depriving it of using an intermediate range ballistic missile operationally, still managed to outstrip the Air Force in the race to gain this country's first successful IRBM firing. After two unsuccessful tries earlier this year, Army managed to fire a Jupiter over 1,500 mi., the limit of its designed range. The missile, fired from Patrick AFB, Fla., reached an altitude of approximately 300 mi. In one of the earlier attempts viewed by Secretary Wilson, the Jupiter was destroyed in the air at the end of its vertical flight.

Air Force thus far has made three attempts at launching the Thor, none of them successful. In the last attempt, fuel spillage touched off a fire that destroyed the missile prior to launch (AW May 27, p. 25).

. . . Looks to Future

While surrendering the Jupiter, Army is still not content to live under Secretary Wilson's orders of last Nov. 26 limiting it to missiles with ranges of 200 mi. or less. As reported in AVIATION WEEK (May 27, p. 23), the service is pressing development of a 750-mi. tactical missile. Already labeled the "gap" missile, it has now been mentioned publicly by Army Chief of Staff Gen. Maxwell D. Taylor. The Army, Taylor said, "is pursuing feasibility studies of a missile in range between Redstone (200 mi.) and Jupiter."

Other Army and Defense Department spokesmen have denied any consideration by Wilson of a request to grant an exception to his memorandum which effectively bans Army use of such a weapon.

Guaranteed Loan Progress

Probability of present congressional session continuing into August increases the chances for passage this year of the government-guaranteed equipment loan bill. Senator A. S. Mike Monroney (D.-Okla.) introduced the legislation last week at the request of the Civil Aeronautics Board.

CAB believes the legislation would help remove local service carriers from subsidy through the use of more efficient and economical aircraft. The bill has the strong support of the Assn. of Local and Territorial Airlines representing six of the local service airlines. Conference of Local Service Airlines, representing the remaining seven carriers, took no immediate action following a statement last December by CAB Chairman James Durfee that the Board favored equipment loan guarantees. However, the group indicated last week that it would lend its support to the measure.

Protest by Durfee

Watch for strong protests from the Civil Aeronautics Board against moves to transfer any of its present powers to the permanent Federal Aviation Agency recommended by Presidential Aide Edward P. Curtis (AW May 20, p. 26). CAB Chairman James R. Durfee told the House Interstate and Foreign Commerce Subcommittee that he will not support any legislation that would change the present structure of the Board.

Durfee said regulation of safety as well as economic jurisdiction of the airlines belongs in the legislative branch of the government through the CAB and should not be transferred to the executive department. Curtis has proposed the absorption of all but the economic powers of the Board into the Federal Aviation Agency which would, Durfee says, move accident investigations and the writing of civil air regulations into the executive department.

Durfee told the subcommittee that he supports the interim Airways Modernization Board which will confine itself to research and development of the airways system during the next three years under the Curtis proposal. Durfee, however, did ask for an amendment that would require complete coordination with the CAB before any "system, procedure, facility or device" is selected by the AMB.

USAF Round Robin

Planning for the long-proposed move of Air Research and Development Command headquarters from Baltimore to Andrews AFB near Washington is entering the final stage, although no firm date has been established.

As ARDC moves into Andrews, headquarters of the Military Air Transport Service will move out, transferring to Scott AFB, Ill.

This move will generate two other headquarter switches —Air Training Command from Scott to Randolph AFB, Tex.; Aviation Medical School from Randolph to Brooks AFB, Tex.

New USAF Under Secretary

Malcolm A. MacIntyre, New York attorney and a veteran of the wartime Air Transport Command, is new Under Secretary of the Air Force. He succeeds James H. Douglas, who recently became USAF Secretary.

MacIntyre resigned as corporate counsel for American Airlines, Inc., and from his law firm of Debevoise, Plimpton and McClean, which represents Ramo-Wooldridge Corp., technical manager of the Atlas and Titan intercontinental and Thor intermediate range ballistic missile programs. He also sold small stock holdings in American Telephone & Telegraph, Standard Oil of California and Phillips Petroleum, all of which do business with Defense Department. A graduate of Yale and Oxford Universities, MacIntyre spent 44 months in the Air Transport Command and was awarded the Legion of Merit and a certificate of commendation by the First Airborne Army.

Ticket Scalpers

Sharp upswing in the volume of airline ticket scalping coupled with the use of fictitious names in order to control hard-to-get airline seat reservations prompted the Civil Aeronautics Board to press for federal legislation that would impose a $100 to $5,000 penalty for each offense.

The Board emphasized that the resale of tickets at prices over established rates has created a "substantial burden" on the industry and predicted a continuing increase in the practice unless punitive action is taken. Airlines have long been protesting the use of fictitious names as a means of reserving large blocks of seats on popular flights for resale at premium rates after the flights are presumably sold out.

—Washington staff



U. S. STATIC AIRCRAFT DISPLAY at Le Bourget includes first foreign exhibition of Northrop Snark intercontinental guided missile (extreme right rear). Note lone Hawker in center background, the sole official Royal Air Force aircraft on display.



FRENCH QUARTER included Snecma Flying Atar (right foreground), Hurel Dubois high aspect ratio wing transport (center) and Air France mockup of Caravelle (left). Aircraft Industries Association permanent exhibit building in rear houses smaller static displays.

French Lead Europe Technically in Air, Show Proves

By David A. Anderton

Paris—Technical leadership of Western Europe's aircraft industry is now both the property and the responsibility of the French.

This shift in engineering power, first beginning to show about two years ago, was made evident and underscored by the dynamic displays of the French against tough competition at the 22nd International Aeronautical Salon at Le Bourget Airport near Paris.

Among the engineering evidence:

• **Light interceptors** such as the turbojet powered Nord Gerfaut II which can reach 50,000 ft. in about four minutes from a standing start, the rocket-powered Sud Aviation Trident II which blasts to 50,000 ft. in two minutes thirty seconds from release of brakes and the turbojet-plus-rocket Dassault Mirage.

• **Light fighters** such as the Dassault Etendard, the Sud Aviation Baroudeur and the Breguet 1100, designed to NATO requirements for a specialized ground attack type with a sea level speed of Mach .95 and capable of operating from unprepared airfields.

• **Wide range** of powerplants from the tiny Turbomeca Astazou turobprop unit rated at 320 hp. to the Snecma Atar 9 developing 13,200 lb. thrust with afterburner.

• **Snecma Flying Atar,** a pilot jet engine test bed with automatic stabilization, aimed at the development of a series of vertical takeoff aircraft based on the coleopter principle.

• **Variety of short-range** air-to-air missiles and other specialized types including the Nord SS.10 anti-tank missile which is the only postwar missile development to have seen combat use. The SS.10 was used by Israeli forces against Egyptian tanks in the Suez war.

• **Quick pickup** and use on prototype and operational airplanes of advanced aerodynamic features necessary in the transonic and in the supersonic flight regime.

French fighters have slab tails, low-set on the fuselage or high mounted on the vertical fin. They have vortex generators, leading edge extensions, blunt trailing edges, and wing fences to curb the unruly flow over swept wings. Structurally they have thin aerodynamic surfaces, made possible by the use of latest machine tools and fabrication techniques.

To an observer familiar only with U. S. aircraft, the French types on display may not have shown much new. But the fact is that the French designers are not lagging behind their contemporaries in the United States by a complete generation of fighters and bombers, but only a few months or a year of development time. In some cases, such as in the development of the light interceptors and ground-support types for the specialized French military position, the French technicians are matching the engineering output of the U. S. and Russian engineering teams.

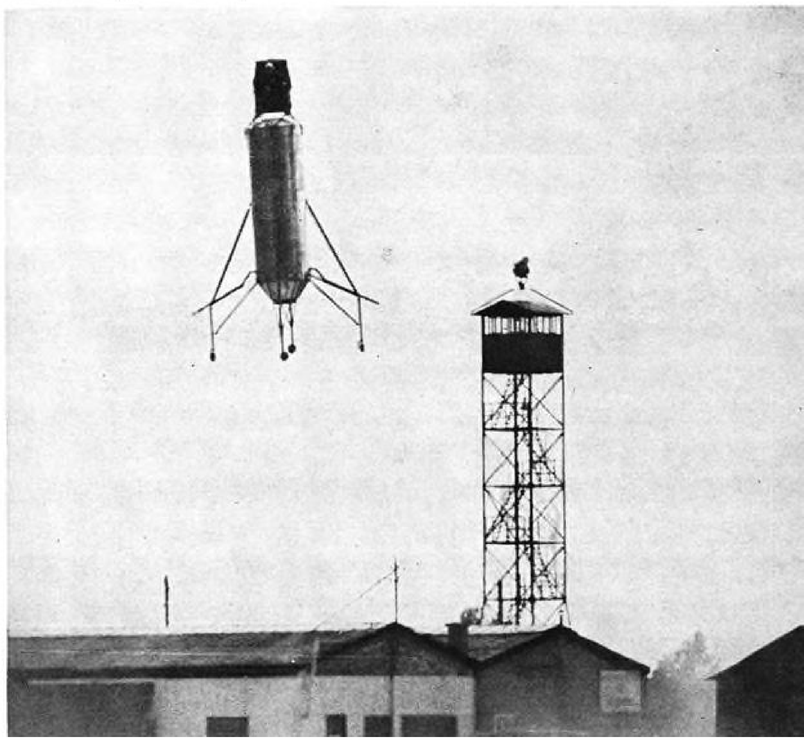
Only the reawakening German aircraft industry, represented at the salon by a handful of light aircraft and a group of grey-uniformed Luftwaffe officers, shows any capability of challenging the French technical position in Europe.

But all is not completely smooth going in the French aircraft industry. In spite of technical progress, some excellent types have been dropped for lack of development and production funds, or for other reasons. One example is the Sud Aviation Durandal interceptor which was originally developed by an engineering team at Sud Est Aviation. After the merger of Sud Est and Ouest into Sud Aviation, the Durandal was practically dropped in favor of the Trident, a Ouest design. As a budget decision, this cannot be strongly criticized because the two types were duplication of effort.

But technically these were different approaches to the same requirement, and to some observers were both worth development effort.

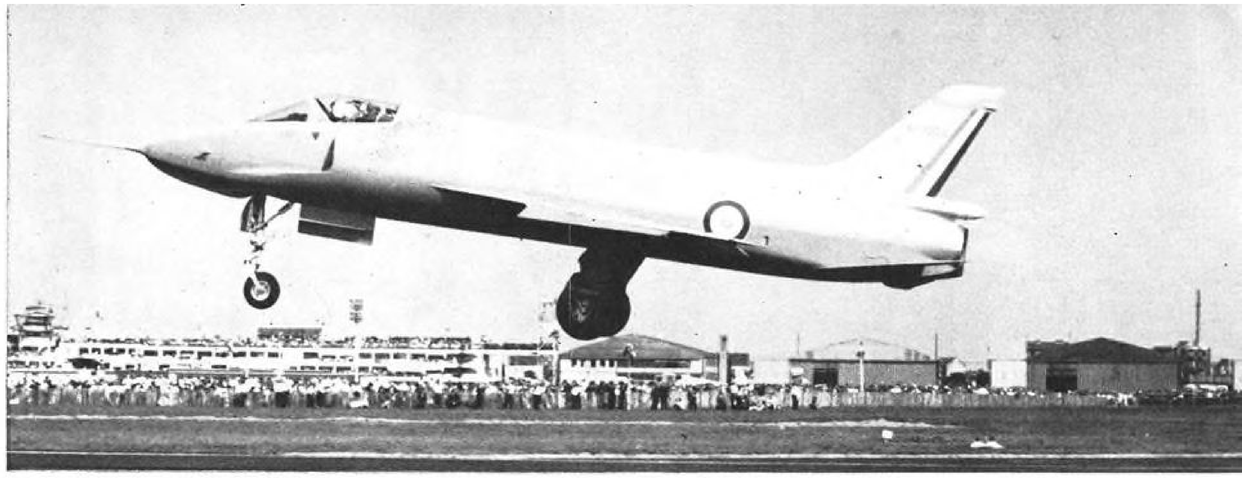
Budget worries which dog every aircraft industry also plague the French. Current orders for high speed aircraft such as the Dassault Super Mystere are not large enough to warrant a solid investment in elaborate production tooling. Instead these orders are stretched out and planes are delivered to combat squadrons over long months. Dassault's machine tooling and production facilities are among the finest anywhere available, but are restricted in

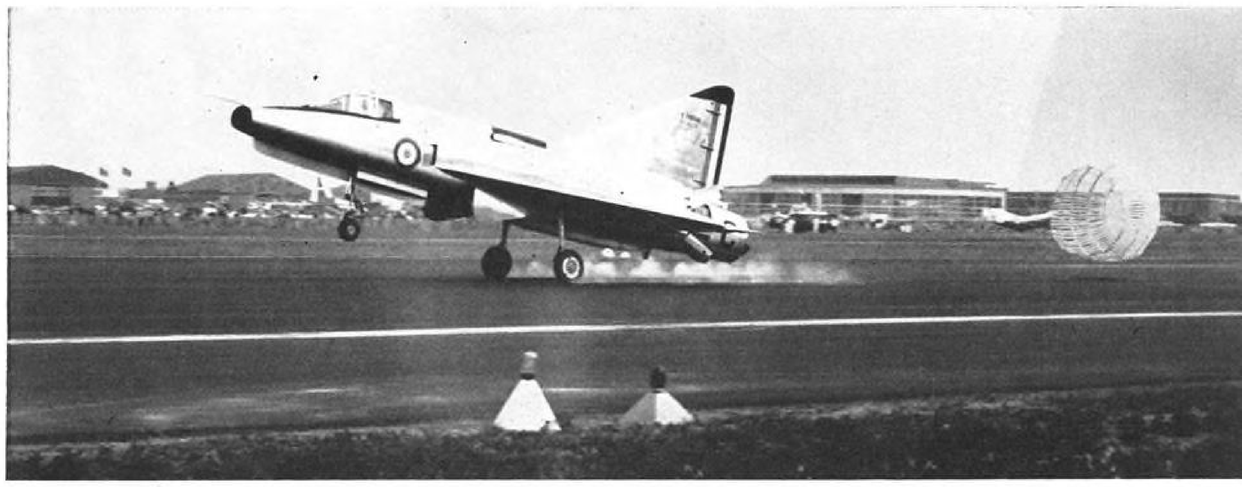
SNECMA ATAR P2, flying at Le Bourget, is test bed for coleopter concept in which annular wing will provide lift after transition to level flight. Outrigger landing gear includes bleed jets for stability and control.



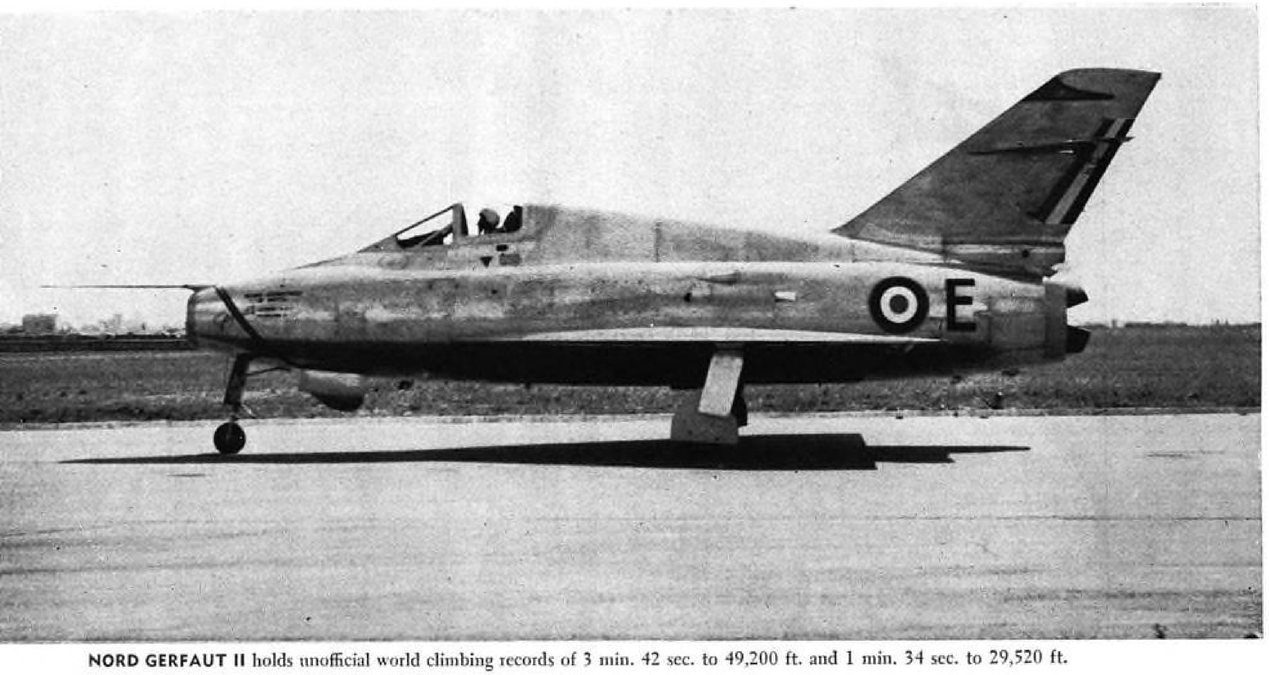








NATO COMPETITION entries are Dassault Etendard IV (left) and Breguet 1100 (above). Note external store containers and leading edge wing extensions on Etendard making a slow flyby with speed brakes and landing gear extended. Breguet 1100 shows low set slab tail, leading edge flaps deflected in landing position, ramped air intake for two Turbomeca Gabizo turbojets and large main landing gear wheels for operation from unimproved airfields. Durandal light interceptor (right) has petal type speed brakes extending from tail pipe, ventral strake fairing for mounting auxiliary rocket powerplant and plenum intake door between insignia roundel and wing root. Note high angle of attack for delta wing configuration landing and ribbon braking parachute.



NORD GERFAUT II holds unofficial world climbing records of 3 min. 42 sec. to 49,200 ft. and 1 min. 34 sec. to 29,520 ft.

their output by monetary considerations.

The French have come a long way since the early postwar plethora of prototypes that threatened to bog down the industry by sheer weight of numbers. Fortunately the French saw in time the folly of an indiscriminate policy of building airplanes simply to amuse the engineers. The next step was obvious and painful, but it reduced sharply the number of prototype aircraft and engines in France to a workable level. A master plan was formulated in Air Ministry for the air defense of France and on this basis the guide lines for aircraft development were drawn.

Flying Atar Impact

Snecma's Flying Atar test rig created a sensation among technical observers when Test Pilot Auguste Morel took the jet engine plus seat straight off the ground, hovered briefly at a few feet and then rocketed upward to about five hundred feet. He crossed the field and hovered in front of the stand.

Flying Atar is essentially a jet engine, an ejection seat, and a set of outrigger legs carrying bleed air control and stabilization jets. This vehicle is the third in a multi-step program planned by Snecma with the end aim of developing a vertical takeoff craft based on the coleoptor principle of Helmut Zborowski. Eventual designs will have the central powerplant surrounded by an annular wing containing fuel and accessories. These will all be tailsitter VTOL aircraft (see photographs on page 101).

This 22nd Salon was an aeronautical showcase for more than the French. In numbers and size of effort, the United States carried the show in the static displays. Boeing, Convair and Douglas showed models of their jet transports and promoted their entire passenger lines. Outside, the static aircraft park was headed by a scarlet Northrop Snark intercontinental missile, flown to the show in the belly of a Douglas C-124 Globemaster. Behind it stood a Martin Matador driven up from the forest positions of the 12th Air Force in Germany. Flanking the Snark were two North American F-100s, the two-seater F-100F trainer and the single seater F-100D version. Behind these were the Lockheed Hercules C-130 turboprop transport, Fairchild-built C-123 transport, Douglas RB-66, Boeing B-47 Stratojet, Martin B-57 and Vertol H-21 helicopter. All these military aircraft were exhibited by the USAF.

In sharp contrast was a lone RAF Hawker Hunter standing forlornly to one side.

Tu-104 Arrives

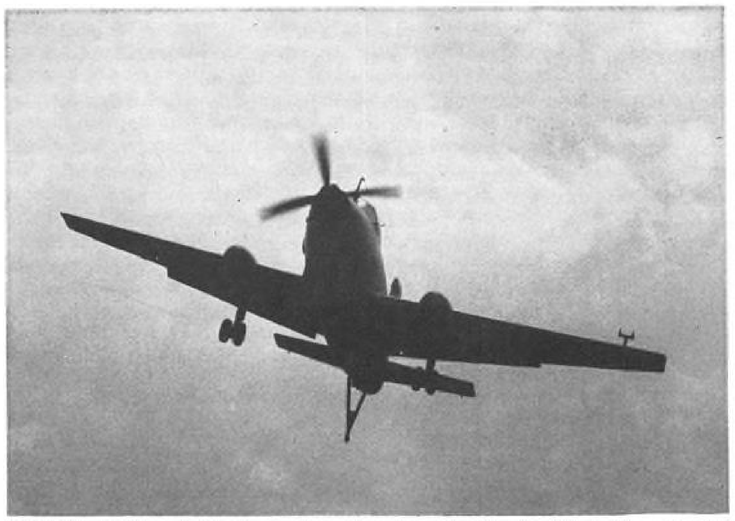
Russian contribution to the show was the graceful Tu-104 transport which flew in from Moscow in three hours thirty minutes. The plane was demonstrated by an Aeroflot crew both days of the flying display and surprised observers with its low level passes at unusually high speeds considering the thickness of the wing.

The Tupolev design looked solid and steady in its slow final approach and touchdown, due primarily to the large slotted flaps on the thick wing. The sweptwing twin-engined turbojet transport drew the biggest crowd of any airplane on display.

Polish section of the Salon included an SM-1 helicopter, basically the Rus-



SUD BAROUDEUR touches down in skid landing on grass surface adjacent to Le Bourget's main runway. Now being reconsidered in NATO light fighter competition to be held in August, Baroudeur shows small flap area and extended leading edge slats.



BREGUET ALIZE, antisubmarine warfare plane in production for French Navy, has tail hook extended, gear and flaps down on landing approach. Powerplant is Rolls-Royce Dart.

sian Mil-1 built in Poland. This machine was listed as available for export at a quoted cost approximating $50,000. Almost hidden on the Polish stand was a model of a four-engined transport which is to go into production "next year."

Czechs flew Avia 14, their name for the Ilyushin 14 transport built in Czechoslovakia, and announced that the airplane was available in four versions for export, complete with spare parts. A new version will seat 32 passengers. Current version is offered in a 12 place executive style and 24 and 28 passenger seating plans. Czechs also demonstrated the Brigadyr agricultural aircraft and the Trener Z-226 in flight.

Acrobatic Teams

Highlight of the flying display was a series of acrobatic demonstrations by five teams: four Dassault Mystere IVAs from the French Armee de l'Air, three Fouga Magister trainers from the French Ecole de l'Air, five Hawker Hunters from 111 Squadron RAF, four Canadair-built Sabre Mk. IVs from the Italian Air Force, and the USAF Skyblazers team flying four North American F-100C Super Sabres.

Individual flying acrobatic honors went to the Czech demonstration of the Trener Z-226 whose pilot did outside loops and inverted runs at what seemed like inches off the runway.

Top technical interest in the missile field was concentrated on the Nord ST.450, a supersonic ramjet test vehicle designed to explore the potentialities of ramjet propulsion at speeds of Mach 3 and altitudes above 65,000 ft. ST.450 is boosted to operational speed by a pair of JATO units and is rail-launched. The vehicle can be recovered by parachute.

Design of the ramjet engine is the familiar single spiked-inlet type in which a conical central body is surrounded by an annular cowling. The spike creates a single inclined shock which either impinges on the cowling lip or remains ahead of it so that the diffuser operates with spillage of the excess air. This engine probably uses the latter approach as a recovered ST. 450 which had hit a speed of 2,100 mph. at an altitude above 75,000 ft. was displayed. The vehicle, originally painted black and white for optical tracking, showed vividly where the effects of aerodynamic heating had burned and eroded the paint and blunted the sharp tip of the central spike. Heat transfer patterns could be clearly traced and the transfer of flow from laminar to turbulent could also be seen by the difference in paint burnoff.

Air-to-Air Missile

Nord's 5103 air-to-air guided missile was on display and shown photographically on the same company's Gerfaut II interceptor. The 5103 has a cylindrical body and ogival nose with four truncated delta aerodynamic surfaces at the rear. Guidance is by radio link



TU-104 PHOTOGRAPHED on high speed run over crowd at Le Bourget.



LANDING ROLL OF TU-104 (below) after approach (above). Note large slotted flaps and height of landing gear. Serial number is 5423.

RUSSIAN TU-104 JET AIRLINER drew largest crowds. Size can be judged by comparison with people and car.





Caravelle Latest Hughes Interest

Howard Hughes' unsatisfied desire to build a jet transport may still be smoldering, but most probable outcome of Hughes' talks last week with Sud Aviation officials will be an order for Trans World Airlines for six or seven twin jet Caravelle jet transports for delivery late in 1959.

Sud officials in Paris had indicated that Hughes also was interested in building the airplane. This is doubtful, Aviation Week learned in Los Angeles, though a larger Hughes-TWA order was rumored. Four Sud representatives met with Hughes in Los Angeles, including Secretary General Simonet.

Hughes last year asked the CAB to permit him to retain control of Trans World Airlines while producing a jet transport (AW May 21, 1956, p. 41). No hearings were held and the application was not followed up. Manufacture of the Caravelle presumably would be for TWA and would need CAB approval.

The French delegation conferred with Paris nightly. Mystery still clouded the results as Simonet slipped quietly back to Paris at mid-week and Hughes took off for Montreal with a TWA group to fly one of Trans Canada Airlines Vickers Viscounts. The inference was that Hughes might also be interested in buying Capital Airlines 15 deferred Viscounts.

from the launching aircraft. The missile weighs 297 lb. and is about 8½ ft. long.

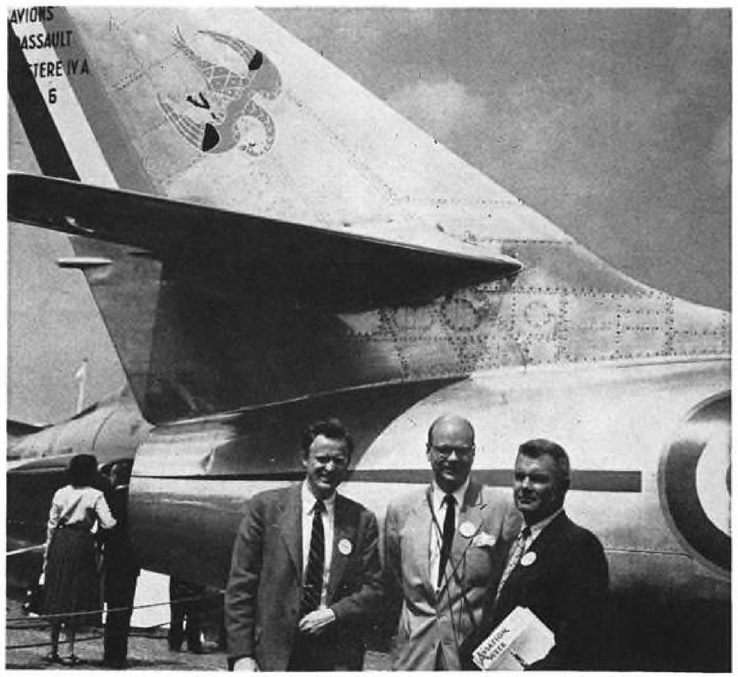
SEPR (Societe d'Etude de la Propulsion par Reaction) showed its two-cylinder acid-alcohol rocket engine developed for the Dassault Mirage. Engine thrust rating is 3,000 lb. Fuel is furfuryl alcohol with 98% white fuming nitric acid as the oxidizer. Most of the engine is constructed from aluminum alloy (French designation AG5) and an inhibitor is used in the nitric acid. Current life of the combustion chambers is about twenty five hours.

Two new Turbomeca powerplants were displayed. Astazou turboprop unit is rated at 320 hp. and weighs approximately 245 lb. without the propeller. Tramaontane gas generator has a pressure ratio of 3.5 and weighs 375 lb. It delivers about 1.1 lb. of air per second. Shown publicly for the first time was the Turbomeca Bastan turboprop rated at 750 hp. for takeoff and weighing 395 lb. less propeller.

Dassault, holding the license for the Armstrong Siddeley Viper turbojet, showed its own variant on that engine designated the R7. Thrust rating is about 3,100 lb. dry and about 4,100 with afterburner. Engine weight is about 750 lb. Thrust-weight ratio is about 4:1.

Hispano-Suiza's R804 turbojet was shown in its latest development, rated at 3,300 lb. thrust dry for a weight of about 680 lb. With afterburner, thrust rating will be about 4,500 lb. Thrust-weight ratio is about four.

Matra displayed a variety of belly tray rocket launchers which have been standardized on French combat aircraft. The Matra 101A carries 55 SNEB rockets of about 2.7 in. diameter. Cyclic rate of fire is about 1,800 rounds per minute. The launcher is installed on the Dassault Mystere IVA and modifications of the same unit are on the Sud Vautour, the Dassault Super Mystere and Etendard and on the Breguet 1100.



AVIATION WEEK editorial team covering International Aeronautical Salon includes (right to left) Editor Robert Hotz, David Anderton, European editor, and Robert Farrell, Paris bureau chief. Editorial team was assisted by photographer Russell Melcher who took this picture near Dassault Mystere IVA.

New Materials Needed Before Space Flight

Dallas—Ultimate development of new heterogeneous materials with an artificial combination of properties must be made as a prelude to space travel, according to Wolfgang Steurer, chief of materials research for the Army Ballistic Missile Agency.

Steurer said here last week that the achievement of high speeds is connected with the development of high temperature technology. Speaking at an Aircraft Industries Assn. symposium on high strength, high temperature materials for standard parts, Steurer said:

"At moderate temperatures, metallic materials can be used successfully . . .

"At higher temperatures where all metallic materials lose their strength, we may separate their stress carrying and heat resisting functions into two elements of design, namely as stress carrying substructure and heat protecting superstructures.

"This enables us to use materials close to the melting point. In a limited temperature range above the melting point of metallic materials, ceramics or cermets may be used successfully."

In intercontinental ballistic missiles, we are faced with temperatures which no material, metallic or non-metallic, can resist.

"This requires often a combination of thermal properties not commonly found in materials and we have to ultimately develop new hetergeneous materials with an artificial combination of properties."

Major Procurement Cutback Threatened

By Katherine Johnsen

Washington—Major slow-down in military aviation procurement programs—both in the letting of new contracts and in production already under way—now appears inevitable.

Air Force procurement will be hardest hit.

The basic fact is that military programs are being tailored by the administration to fit its over all fiscal program. The economy-bent Congress is not expected to raise any effective opposition.

Administration Plans

The plan was developed at sessions of the Senate Appropriations Committee with Deputy Secretary of Defense Donald A. Quarles, Assistant Secretary of Defense and Comptroller W. J. McNeil and Air Force Secretary James H. Douglas.

It is this:

• **Defense expenditures for Fiscal 1957** are running approximately $2 billion above administration estimates. An effort is now under way to hold expenditures down by slowing production, repricing contracts, and other steps. About $1 billion of the excess is with the Air Force. The administration had counted on $36 billion in defense expenditures for Fiscal 1957. The estimate now is that they will exceed $38 billion.

• **Big push for a slowdown in aircraft** and related expenditures—the major defense procurement program—will be in Fiscal 1958. The current rate of defense expenditures indicates an estimated $42 billion for the year. The Bureau of the Budget has set a "firm" ceiling of $38 billion. McNeil reported that the Fiscal 1957 ceiling of $36 billion was "not exactly firm."

• **In order to hold down expenditures** after Fiscal 1958, new contracting is being sharply delayed.

Two concrete steps to hold down the military aircraft procurement and other defense programs already have been taken, although their full impact is not yet known:

• **Defense Secretary Charles E. Wilson** has ordered a $500 million reduction in new defense obligations for procurement, research and development or construction between now and July 1—$250 million for USAF, $150 million for Navy and $100 million for Army. USAF reported that it plans to withhold $150 million in aircraft and related procurement contracting and $100 million in construction contracting. McNeil conceded that the order might postpone "even some needed" procurement. Quarles, however, characterized this $500 million slowdown as "minor" in the overall picture.

• **Another Wilson directive** terminating "partial" financing, which has been widely practiced by USAF, could have the effect of either postponing or canceling approximately $3.5 billion in USAF aircraft and related procurement contracts (AW June 3, p. 44).

Sen. Stuart Symington (D.-Mo.), first Secretary of the Air Force, charged at heated Appropriations Committee sessions last week that the Wilson order would result in a $3.5-billion stretch-out of USAF's aircraft and related procurement program.

If USAF is required to "fully" fund present procurement programs with new money appropriated by Congress for Fiscal 1958, Symington said, the net effect would be to reduce the planned $7.5 billion Fiscal 1958 program by $3.5 billion and necessitate a delay in this funding—and the letting of contracts against it—to Fiscal 1959. In effect, he added, this would effectively reduce the Fiscal 1958 new contracting to approximately $4 billion.

This, Symington challenged, would entail the wholesale cancellation or reduction of key programs:

• **Elimination** of the F-106, Snark, Navaho, Rascal, Matador and Falcon programs.

• **Sharp reduction** in the F-104, F-101B, F-105 and C-130 programs.

• **Slowdown** in the KC-135 program. It would also mean, he said, that "not a single" B-58 could be procured in Fiscal 1958.

USAF Secretary Douglas conceded that the $3.5 billion postponement "could" occur under the directive. But he said that at this point any figure is academic.

Lt. Gen. M. J. Asensio, USAF deputy chief of staff, comptroller, verified that the procurement cutbacks reported by Symington "could" result from a "most stringent" interpretation of the Wilson directive. McNeil testified that, if the directive were to entail these developments, he would ask Congress for additional funds to insure a basis of "full" funding.

Keys to Clarification

The two keys to the clarification of the situation, now being worked out between USAF and Wilson, are:

• **Delineation of the "gray area"** between "partial" and "full" financing. In the extreme, for example, there is no thought that simply because a 137-wing or 128-wing program is agreed upon, it should promptly be "fully" financed. McNeil, though a staunch defender of "full" financing, concurs that produc-

Fiscal 1958 CAA, CAB Funds

The $335 million Fiscal 1958 budget appropriated by Congress for the Civil Aeronautics Administration is almost $90 million above CAA's Fiscal 1957 appropriation but approximately $75 million less than that requested. Originally, the House voted CAA $328 million; the Senate increased the total to $352 million.

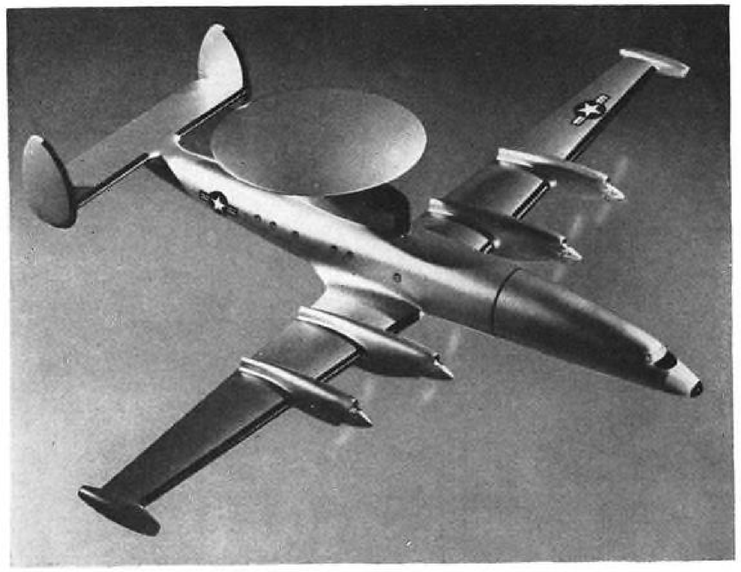
The $5.5 million appropriated to the Civil Aeronautics Board for operations will provide for a substantial expansion of CAB's staff during Fiscal 1958. This is $864,400 above CAB's Fiscal 1957 allocation; $235,600 below the amount requested. Following are details:

CIVIL AERONAUTICS ADMINISTRATION

	FY 1957 Appropriations	FY 1958 Request	FY 1958 Appropriation
Operations	$136,804,000	$195,000,000	$181,747,800
Establishment of Air Navigation Facilities	75,000,000	175,000,000	124,603,525
Federal Airport Aid	30,000,000	35,000,000	25,000,000
Washington National Airport Operations	1,500,000	1,800,000	1,566,000
Construction	.....	500,000	250,000
Alaska Airports Operations	618,000	1,250,000	700,000
Air Navigation Development	1,500,000	2,000,000	1,500,000
New Washington Airport	3,136	.....	.....
Total CAA	245,425,136	410,550,000	335,367,325

CIVIL AERONAUTICS BOARD

Operations	4,625,000	5,725,000	5,489,400
Subsidy Payments	16,200,000	42,340,000	37,228,000
Total CAB	20,825,000	48,065,000	42,717,400



W2V-1 Configuration Revealed

Pre-production planning has begun at Lockheed Aircraft Corp. of a turboprop version of its early warning Constellation series used by Navy. Designated W2V-1, the aircraft would resemble the latest Constellation 1649A series and use four Allison T56 turboprop engines. Notable changes, shown in model, are elimination of Constellation's middle vertical fin, addition of two Westinghouse J34 turbojet engines in wingtip pods for auxiliary power.

tion facilities should be contracted for, even though the follow-on aircraft production order has not been funded.

• **Extent to which "partially" financed** USAF programs are exempted from the order by Wilson. All research and development procurements are exempted.

Both Quarles and Douglas protested the issuance of the order. McNeil reported that "it was fully concurred in by the Departments of the Army and the Navy, but the Air Force had reservations. . . . Apparently the Air Force had planned to utilize the partial financing principle which would not be consistent with sound financing practices or consistent with our understandings with the Congress." House and Senate appropriations committees have consistently insisted since the end of the Korean war that appropriation requests cover the "full" financing of the proposed program.

Since its issuance, Douglas has again filed objections to provisions of the order with Wilson.

Symington charged that in 1953 when the Eisenhower administration came into power and wanted to cut USAF's budget $5 billion below the Truman request, it encouraged the Air Force to engage in "partial" financing to make this possible. He suggested that the order made a "goat" of USAF, because of the implication generally drawn that USAF was engaging in slipshod financial practices.

Quarles said that the Air Force—including the period he was USAF Secretary—was "being completely ethical and sound in its business practices." He added, however, that he is not now "certain we were proceeding in line with the intent of Congress."

It was also disclosed that both Quarles and Douglas objected to the $500 million reduction in Fiscal 1957 procurement commitments.

In addition to stretching out the military aviation procurement programs to solve the federal financial dilemma, there is also a major drive on to acquire funds through "recoupments"—through downward pricing of contracts and through cancellations of "old" programs. The pressure here is from Wilson's office and the Congress.

USAF estimates "recoupments" during Fiscal 1958 which can be applied to new contracts at $1 billion. House Appropriations Committee, however, has directed that "by better planning and management and by closer pricing" this amount can be increased "to absorb a sizable portion" of the $354 million cut made by the House in USAF's request for aircraft and related procurement funds.

USAF balks at this possibility.

Declaring that it will be "very difficult" to realize USAF's full $1 billion recoupment program, Douglas protested to Senate Appropriations Committee that "we have a good many more price increases than we have decreases. . . . As we do business on a tighter basis and as the program has leveled off considerably, it is just harder to find money that has not been needed in prior year programs."

Meanwhile, the stretch-out program—which has the effect of making additional funds available—adds to the unlikelihood that the Senate will restore funds clipped by the House from Defense Department's new money requests for Fiscal 1958.

Symington pointed out that the cuts in new contracting that will result from the two Wilson directives is more than the $474 million reduction made by the House in new money for USAF and Navy aircraft procurement ($354 million for USAF and $120 million for Navy).

An attempt by Republican leaders in the House to have $313 million of the $2.5 billion reduction in the defense budget made by its Appropriations Committee (AW May 27, p. 31) reinstated was overwhelmingly defeated on a 151 to 242 record vote. The $313 million included:

• **Army research and development,** $8 million to finance the Jupiter missile program and the anti-missile-missile.

• **Naval aircraft, $50 million** to permit Navy to move forward with both the McDonnell F4H-1 and the Chance Vought F8U-3 all-weather fighter.

• **USAF aircraft, $175 million.**

Points developed in connection with the defense budget were:

• **Symington reported that no new funds** are included in the Fiscal 1958 budget for the C-133 program as predicted by AVIATION WEEK (Jan. 21, p. 26). Douglas said he "would like to see more USAF airlift transports."

• **USAF's request for 240 KC-135** tankers in the Fiscal 1958 budget was reduced by the Department of Defense to 157. Douglas concurred with Symington that, with a shift from the longer-range B-52 bomber to the B-58, "more rather than less" KC-135s will be required.

• **USAF Chief of Staff** Gen. Nathan Twining, agreed with Symington that it would be "relatively simple" for an aircraft equipped with missiles to launch an attack without coming within the range of anti-aircraft missiles. Twining said that it would be "a very good idea to have some war gaming" to develop facts on such an encounter.

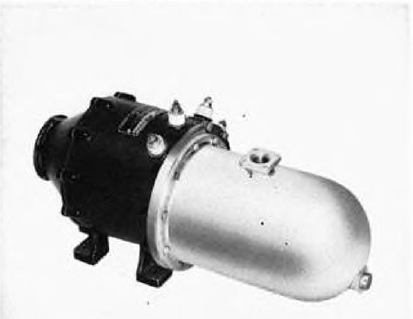
• **Rep. Dan Flood (R.-Pa.),** a member of House Appropriations Committee, said in a speech on the House floor on the Thor vs. Jupiter intermediate range ballistic missile controversy that the Army's Jupiter "is so far ahead of the Air Force's Thor. . . . that when the time comes, unless there is an extraordinary development of some kind that takes place at the Pentagon, it will be the Jupiter of the Army that will be adopted."



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The Heli-Rotor Compressor for the F-27's Freon refrigerator system.



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Painting by Chesley Bonestell from the book *The Exploration of Mars* by Willy Ley, Wernher Von Braun and Chesley Bonestell, published by Viking Press ($4.95). ©C.B.

How do you control temperature on space ships?

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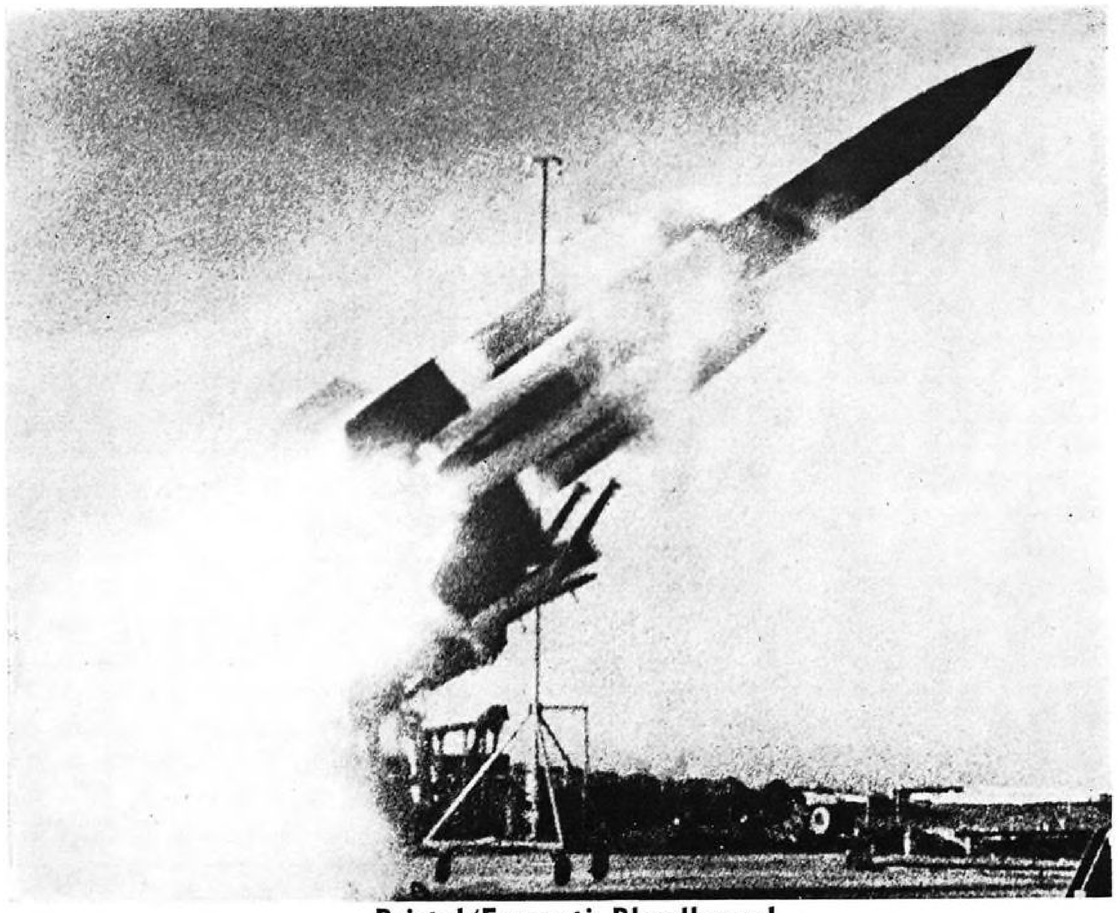
It would be easy to list here the part Fenwal has played in the ever-progressing field of aircraft temperatures, over-heat detection and other controls. But this would only be repetitious. The aircraft industry is well aware of it.

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Bristol/Ferranti Bloodhound

First picture of the Bristol/Ferranti Bloodhound shows the ground-to-air guided missile a split second after takeoff. Bloodhound, now in quantity production for the RAF, will become a mainstay of the United Kingdom defense system.

Army Negotiates With Radioplane To Operate Target Drone Service

Washington—Army is establishing a civilian-operated, high-speed target drone integrated service in connection with its Nike Ajax firing training program in a move to relieve itself of the necessity of conducting its own target operations.

Aviation Week has learned that the Army, after considering numerous proposals submitted in a competition in which various industry segments participated, has eliminated all but Radioplane Co., a subsidiary of Northrop Aircraft, Inc.

Value of Contract

Negotiations are now being conducted between Radioplane and Army leading to a contract under which the company will:

- **Supply drones.**
- **Provide drone maintenance** and repair services.
- **Operate drones** in missile firing trials.

The contract probably will have a value of between $7 million to $10 million, will provide for between 400 and 500 target drone flights, encompass drone speeds in the region of Mach .8 to Mach .9 at altitudes of 40,000 to 60,000 ft.

Contingent upon finalized results of the contract negotiations, the first flight under the new arrangement may be in seven months.

One of the key reasons behind selection of Radioplane, a pioneer in the drone field, probably was that its capabilities match very closely the Army bid requirements.

A little more than a year ago, it opened a 25,000 sq. ft. facility at El Paso, Texas, to maintain and modify target drones.

The plant is now rebuilding under contract drones brought in from the Army anti-aircraft ranges at Fort Bliss in El Paso. This Radioplane facility can be keyed directly to Army's projected new target drone operational arrangement.

The target drone initially used in the new integrated service arrangement for the Army undoubtedly will be the RP-76, Army version of Radioplane's RP-70 (AW Oct. 22, p. 35). Availability of this drone was another reason for selection of Radioplane by Army.

Under designation of SKD4R-1, the drone also is under development test at the Naval Air Missile Test Center, Point Mugu, Calif.

RP-70 Capability

The drone is powered by a single Aerojet solid propellant rocket exhausting through twin nozzles on the fuselage top just aft of the wing trailing edge. Thrust is about 35 lb.; weight

approximately 300 lb.; length about 9 ft.; wing span, 5 ft. Speed capability is about Mach .9 at altitude.

Since the Army will want recovery provisions in the drone, it would incorporate a chute installation. This additional weight may cut the speed slightly.

Among mother plane possibilities for the RP-76 is Radioplane's RP-77D, radio controlled aerial target powered by Boeing's 502-10 turboprop engine. This all-plastic configuration, which has not yet flown, would have sufficient payload capability to allow it to launch an RP-76 drone at altitude. Negotiations are now under way with the Army for flight evaluation tests of the RP-77D.

Soviet Manufacturing Techniques Lag Behind Electronic Research

New York—Soviet electronic research and researchers appear very competent by U.S. standards, but Russian electronic manufacturing technology is not so advanced, according to John N. Dyer, just returned from a 10-day tour of Russian electronic facilities at Soviet invitation.

Dyer, vice president of Airborne Instruments Laboratory, was one of four U.S. scientists who journeyed to Moscow to attend the annual Popov Society radio conference, comparable to the annual U. S. Institute of Radio Engineers convention. Axel Jensen of Bell Telephone Laboratories, Charles Roualt of General Electric and Robert Schulz of Sylvania were the others.

Although he emphasized that 10 days is a brief period to appraise accurately a foreign technology across a difficult language barrier. Dyer made these observations:

- **Laboratory equipment** at the Russian Radio Technical Institute in Moscow "equals or exceeds in both quality and quantity anything found in comparable U.S. laboratories," Dyer said.
- **In automatic production** techniques and high-quantity manufacturing facilities the Russians frankly admitted that they had much to learn from the U.S. however, Dyer visited a tube factory that used many semi-automatic assembly techniques.
- **Transistor manufacturing** and technology appears to lag behind U.S. One factory Dyer visited was turning out germanium transistors at a rate of only a few thousand a month and reported some difficulty in making silicon transistors. The Russians gave Dyer a 100 mc. germanium transistor to bring home for testing. It resembles the early GE transistors in its straw-hat shape and internal construction.
- **Dip-solder techniques** are used to some extent for wiring in components but Dyer saw no printed circuitry, widely used in the U.S. for both civilian and military electronics.
- **Sub-miniature deposited resistor**, made by semi-automatic techniques, appears equal to equivalent U.S. component.

The Popov Society convention was largely devoted to state-of-the-art reviews in radio and TV technology. There were no papers, so far as Dyer learned, on aviation or military equipment or techniques as such. These apparently are reported at conventions of other technical societies. The Popov Society convention was attended by about 1,000 persons, including a number of student engineers. (Attendance at the recent IRE convention exceeded 50,000).

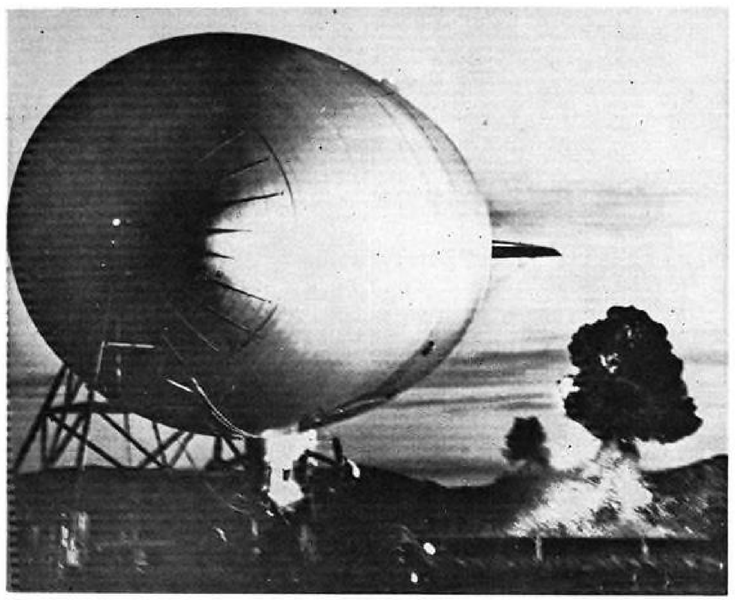
Unlike the IRE convention, there were no equipment or component displays except for small ones used by some speakers to illustrate their technical papers.

Dyer was very favorably impressed by the competence of Soviet researchers and their present facilities. However, many of these facilities are postwar vintage and many Soviet researchers previously were limited largely to study and analytical efforts. This relatively short heritage of team scientific effort, compared to the long heritage that exists in many U.S. industrial and government laboratories, may prove a temporary handicap, Dyer believes.

Russians appear to be well advanced in television. They showed image orthicon and super iconoscope TV cameras, both moderately complex devices, comparable to those built in the U.S.

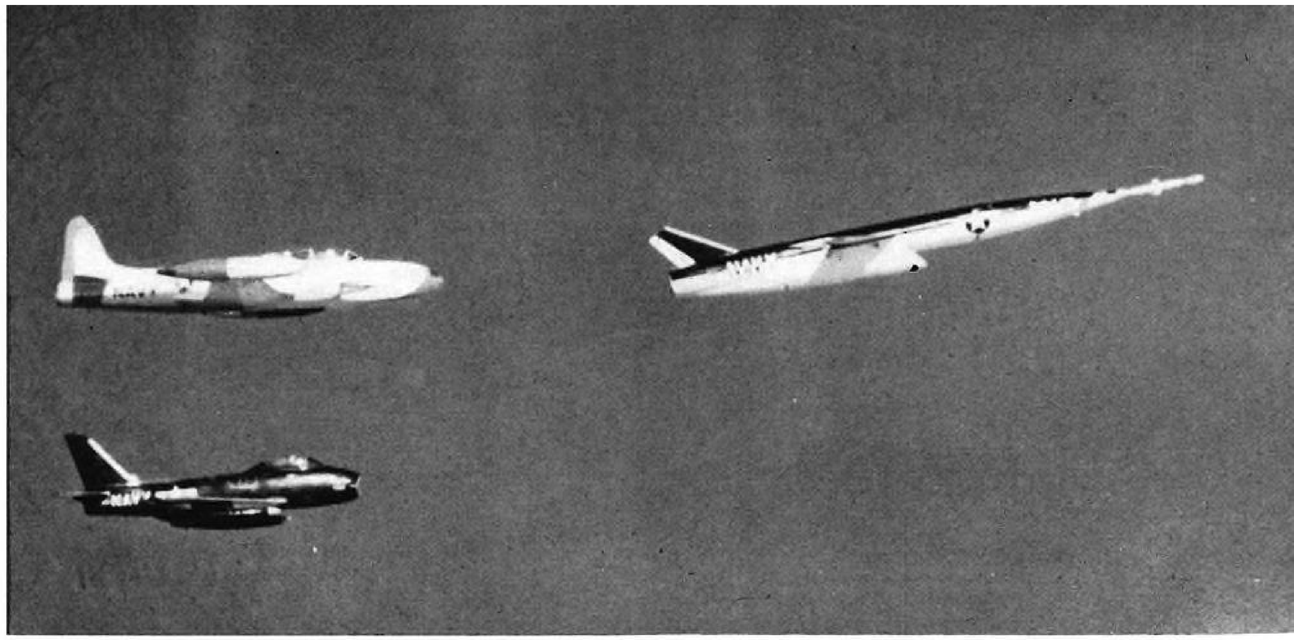
Meteor Burst Scatter

Successful voice radio transmissions over distances of more than 800 mi. have recently been received by bouncing the radio signals off meteor trails 60-70 mi. high, Air Force Cambridge Research Center has revealed. New meteor scatter technique, an outgrowth of earlier ionospheric scatter, should make it possible to obtain VHF ranges of 1,400 mi. or more without atmospheric interruptions that plague conventional long-range HF communications. First detailed report on new communications technique will appear in a following issue of Aviation Week.



Atom Blast Spares Blimp

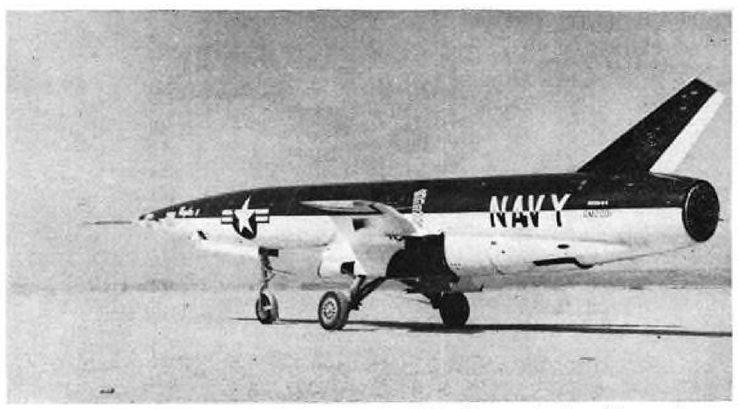
Navy ZSG-1 airship was torn from its moorings by explosion of small atomic device in background, but was otherwise undamaged. Blast was second in the 1957 Atomic Energy Commission series. Pre-dawn shot was fired at Yucca Flat, Nev. Purpose of mooring the unmanned blimp near the blast was to test effects of shock vibration, probably in connection with use of blimps to drop nuclear depth charges.



NOSE HIGH so as not to outdistance Navy TV-1 trainer and FJ-3 fighter, Chance Vought Regulus II is flight tested from Edwards AFB, Calif. Planes are used for controlling and photographing the J65 powered missile, which has flown at Mach 1.5 and above 50,000 ft.

Regulus II Flight Tested at Edwards AFB







REGULUS flight test vehicle is equipped with landing gear for launching and recovery. Later models of the missile will have the J79 engine. Fuel lines are attached to vehicle (right), which has canard control surfaces. Ultimate speed will be near Mach 2, range 800-1,000 mi. (AW Mar. 11, p. 28). One such test vehicle crashed and exploded in desert last week because of a guidance failure.

Aviation Writers Assn. Meeting:

TWA Airs Financial Ills, Remedies

Kansas City—Four-point program to aid Trans World Airlines in surmounting its current financial difficulties was outlined here by TWA President Carter L. Burgess before a gathering of aviation writers at the carrier's new $25 million overhaul base.

Noting that TWA has commitments for more than a quarter of a billion dollars in new equipment, plus large outlays for ground facilities, tools and equipment that must be forthcoming in about two years. Burgess said the airline's burden could be eased by:

• **Six per cent fare increase**—Both domestic and transatlantic—to meet rising costs. This year it will cost TWA over $14 million additional to provide the same services it provided in 1956, Burgess stated. Such an increase in operating costs cannot be overtaken by even the most efficient management, he added. A six per cent fare increase would provide TWA with about $8.5 million additional revenue annually, helping absorb some of these costs and also providing some foundation for the vast outlays scheduled for 1959 onward, he explained.

• **U. S. Government should demand** that British end their two-year refusal to approve TWA's 200-mile Frankfurt-Zurich link which, Burgess stated, is solely responsible for the airline's failure to make a profit on its international operation last year and also played an important role in the airline not paying Federal taxes in 1956.

• **Acquisition of military contracts** to overhaul a sizable portion of engines of the military Constellation fleet at TWA's Mid-Continent International Airport base and at the same time use by Military Air Transport service of available TWA space in flight to reduce the need for parallel transatlantic MATS flights. Burgess reported that TWA is soliciting a contract to overhaul military Constellation engines. He pointed out that use of such facilities would ease the military's problem of retaining skilled mechanics and technicians.

• **Granting TWA permission** to operate nonstop St. Louis-Miami service and in-flight service by way of Nashville, Atlanta and Tampa. In addition to providing additional revenues, this route would provide TWA with an additional diversion point for utilizing some of its transatlantic aircraft during the slow winter transocean/busy Miami seasons.

TWA's new overhaul base is still only on partial operation, the main activity being engine overhaul at a current rate of approximately six daily on a one-shift basis. Airframe overhaul is delayed pending settlement of a strike that is holding up completion of this section of the facility. Originally scheduled to be in operation early this year, it now looks as if it won't be phased in until late in 1957.

TWA plans to overhaul its own jet engines when it starts operation of its Boeing 707 and Convair 880 jet transports. New engine test facilities for these powerplants will be built adjacent to current piston engine cells.

Financial problems of the aircraft manufacturing industry engendered by a clear-cut government policy on renegotiation were discussed by Boeing Controller Clyde Skeen who told the writers that on the basis of percentage return on sales the aircraft industry makes approximately one-half to one-third the earnings of most industry.

Noting that Boeing is paying stock dividends at a rate considerably below industry across-the-board, Skeen stated the company this year will probably pay a smaller cash dividend than in 1956, supplemented with a small stock dividend. Boeing is working on a $100 million facility expansion program for the 1956-1958 period with $30 million going into research and development facilities at Seattle.

Bright outlook for business flying was forecast by Beech Vice President-Coordinator Frank E. Hedrick, who told writers that on the basis of the company's growth record thus far its commercial sales should be approximately $120 million annually by 1963. This would be approximately four times last year's business plane sales by Beech.

This year the company expects to register from $105 million in total sales—military and business planes—and over $109.5 million in Fiscal 1958.

Certification is expected soon on the new Beech 95 Travel Air four-place light twin price tagged at just under $50,000 and deliveries are scheduled to begin this fall. Beech expects that sales of this model alone next year will total about $12 million, Hedrick noted. Army will evaluate the new airplane at Ft. Rucker, AVIATION WEEK learned.

Beech unveiled its new Model 1013 photo and television reconnaissance drone designed for ground, ship or air launch. Externally identical to its earlier Navy XKDB-1 target plane, the new Model 1013 is heavier, weighing 800 lb., and has an operational speed of 260 mph. and service ceiling of nearly 23,000 ft. Powerplant is a 110-hp. McCulloch six-cylinder engine. Beech is currently developing a whole family of subsonic and supersonic rocket and jet powered drone designs with the basic missile design applicable to tactical operations. Classified projects also encompass special containers for high-energy fuels.

New Westinghouse private venture J54-WE-2 turbojet of approximately 6,000 lb. dry thrust was also shown publicly to writers at Olathe NAS, Kans. Engine is a single-spool design with 16 compressor and two turbine stages, variable inlet vanes. Important feature is a manifold air bleed designed to provide variable compression ratios to prevent compressor stall. Engine is about 35 in. in diameter and 10 ft. long, uses titanium to keep weight down. Other Westinghouse jet developments include:

• **Compressor housing** made of commercially available plastics which company has tested in its Kansas City plant and which it is evaluating under a Navy contract to study and select laminated plastic material to be used in fabricating J46-WE-36 engine compressor housings. Use of plastics can cut weight of compressor housings about a third compared to magnesium components.

• **Successful testing** is claimed with molybdenum jet engine parts which have withstood continuous operation at over 2,000F temperatures. Westinghouse metallurgists have developed a protective coating and method of fabrication that prevents catastrophic oxidization of molybdenum which it says usually occurs at over 1,500F. Discovery is called a Mach 2 plus breakthrough.

Convention Coverage

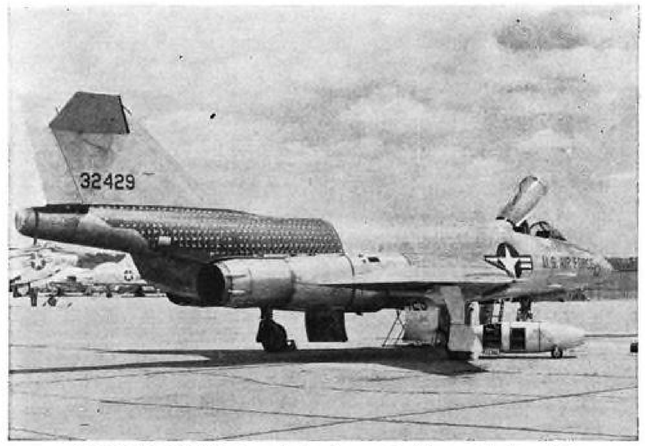
Coverage at the 1957 Aviation Writers Assn. Convention was accomplished by Erwin J. Bulban and Craig Lewis of Aviation Week's New York and Dallas bureaus respectively.

Wall Street Needle

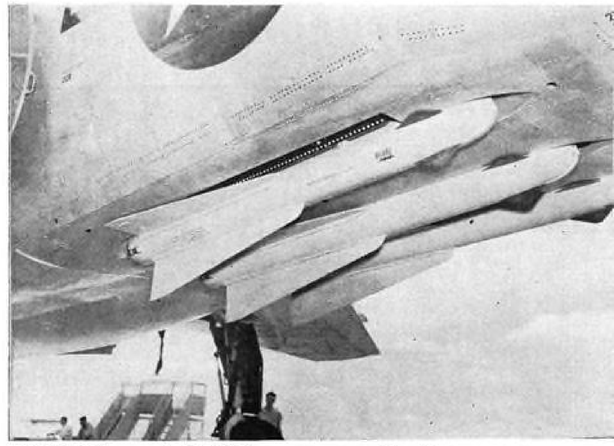
Trans World Airlines and its financial problems got some irreverent attention last week in the Bawl Street Journal, the New York financial district's annual satirical newspaper.

Amid the gibes at bond houses, security firms and even the subways ran a mock TWA ad, pleading:

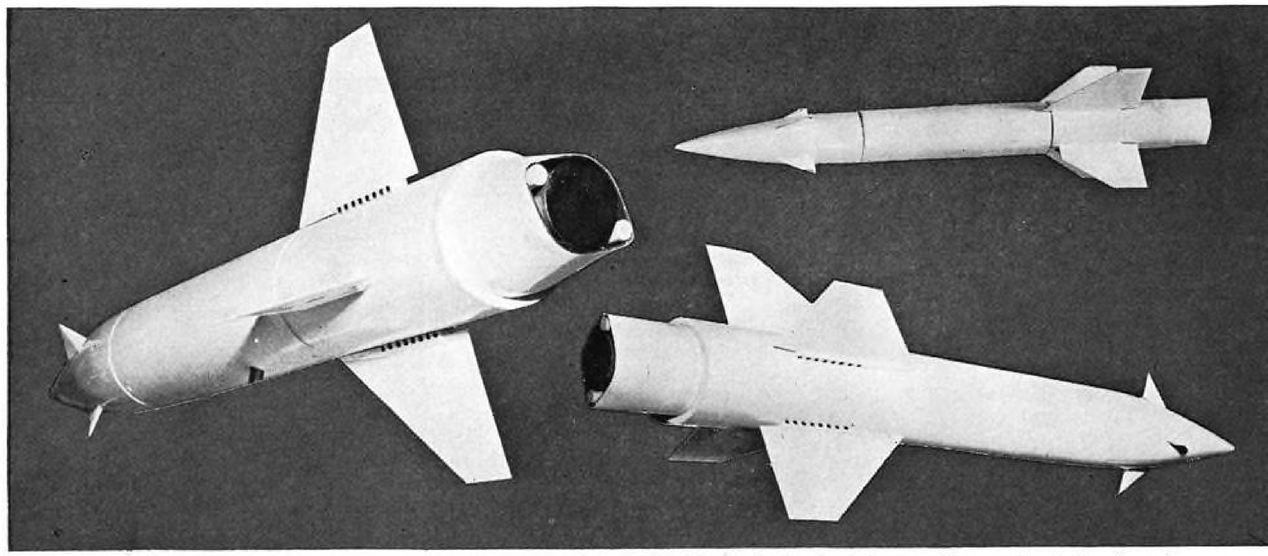
"Pay now! Fly later! We need the money."



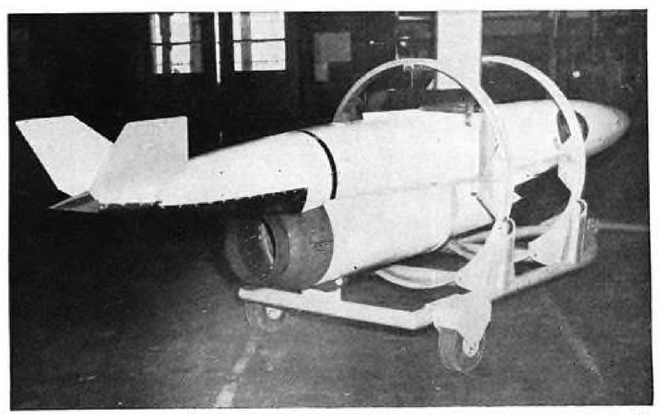
MODIFIED F-101A has aft fuselage tufted for evaluating airflow near new, larger afterburners being flight tested.

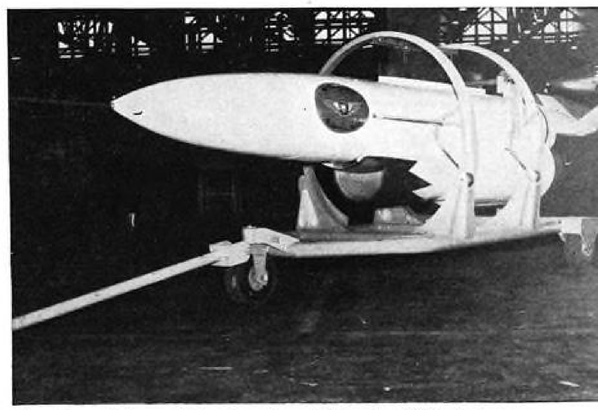


ROTARY door under F-101B can carry a variety of weapons on both sides. Here three Hughes GAR-1 Falcons are installed.



MARTIN Bullpup air-to-surface Navy tactical missile system is designed for light attack aircraft. It has movable canard control surfaces, is powered by a solid-propellant rocket. Length is 11 ft., weight 600 lb. Bullpup will be produced at Martin's Orlando, Fla., plant.





FLIGHT test pod containing Westinghouse XJ81 axial-flow jet (Rolls-Royce Soar license) is carried under wing of Douglas F3D. Instrumentation in pod's nose and center body records data on film. Evaluation for missile, target drone applications is being made.

Aviation Market to Outstrip U.S. Economy

Airborne Instruments survey serves as basis for Curtis report, sees healthy growth for 1957-75.

By L. L. Doty

Washington—Four-fold increase in airline passengers is part of a widespread expansion of aviation markets that will outstrip the anticipated growth of the general economy during the next 20 years. This is forecast in a comprehensive survey released last week to AVIATION WEEK.

The detailed study, one of the most exhaustive of its kind in the aviation field, was made by Airborne Instruments Laboratory as prime contractor to the Aviation Facilities Planning Group, with the Aeronautical Research Foundation and Cornell Aeronautical Laboratory participating as subcontractors. Its findings:

- **Private flying** will experience the healthiest gains in both aircraft sales and flying activity.
- **Airlines** can expect a four-time increase in the number of passengers carried in 1975 over 1956.
- **Military** expenditures will continue to increase in proportion to the predicted rise in the total level of economic activity during the next 20 years, although the volume of military traffic in the national airspace will decline slightly.

Basis for Report

The growth forecast is based upon the assumptions that the gross national product will jump from 1955's $387 billion to $745 billion in 1955 prices by 1975 and that the U.S. population will climb to 220 million during the period.

Only two important soft spots in the aviation picture are indicated by the survey—disposal of large piston engine transports may pose an acute problem for the airlines as early as 1962, and the use of the commercial helicopter may dwindle unless carrying capacity is substantially increased and operating costs are decreased.

Recommendations to the White House by Presidential Assistant Edward P. Curtis, head of the Aviation Facilities Planning Group, for air traffic control requirements during the 1956-1975 period (AW May 20, p. 30) were based on the findings of the study. The study itself was carried out under the supervision of George Litchford of Airborne Instruments Laboratory. The report will also serve a secondary purpose in providing managements with an updated, long-range planning guide.

Here are a few of the highlights:

- **Airline passenger-miles** will climb from 22.3 billion in 1956 to 66.7 billion in 1975; the number of passengers will increase from 41 million to 153 million during the same period. In terms of airframes, fleet increase will be slight, but available seat-miles will show a marked rise.
- **Business flying activity** will show the greatest growth in terms of airplane numbers and aircraft movements. Prospects are for an increase in the growth rate in excess of the present upward trend. A four-fold increase in hours of private business flying in the next 20 years is forecast.
- **Civil aircraft** will not undergo radical changes in design. Although there will be a pronounced shift from piston engine to turbine engine aircraft, all but a small portion of the common carrier fleet will consist of conventional types now in existence or in production.
- **Supersonic transport aircraft** may appear in operation between 1970 and 1975 although such aircraft probably will be in the prototype stage at that time. To meet airline economic requirements, these aircraft must operate at Mach cruising speeds at 50,000 ft., weigh 500,000 lb. and have intercontinental range.
- **Turbine-powered** VTOL or STOL aircraft with all-weather capability to sell at prices comparable to those of present-day luxury automobiles is technically feasible. However, such aircraft are not foreseen for the 1957-1975 period unless there are more massive population shifts from urban centers to create a market large enough for the mass production of such aircraft in quantities of 300,000 annually.
- **Military tactical flying** will show some decrease in activity. Military operations in the U.S. will follow present flight patterns with approximately 70% of all military flights occurring on or near civil airways. With the evolution of missiles, military aircraft fleets will remain relatively static in size.
- **Airways will become more crowded.** Aircraft operating within the U.S. airspace will increase from approximately 85,700 in 1956 to about 123,000 in 1975. The 1975 fleet will generate 112 million aircraft movements (takeoffs and landings) annually as compared with 65 million in 1956.



GEORGE LITCHFORD

Test Areas

The study, which began in May, 1956, was designed to provide the Curtis group with statistics that would show the number of airways, communications channels and facilities and the proper airport configurations necessary to handle the actual number of aircraft expected to be operating through the 1956-1975 period.

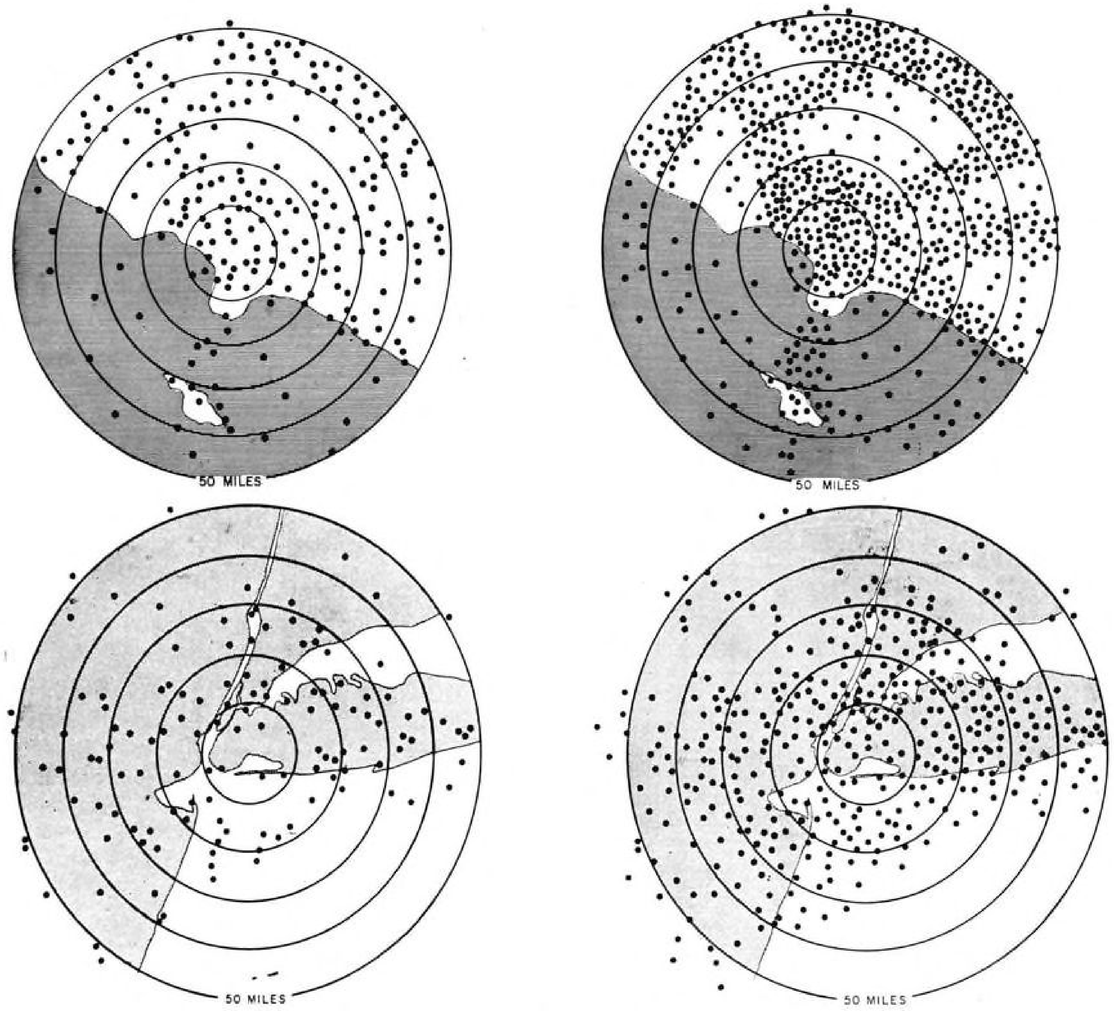
Eight representative terminal areas were selected for the purpose of the survey—Los Angeles, New York, Chicago, Washington, Norfolk, St. Louis, Oklahoma City and Albuquerque. The researchers defined a terminal area as the airspace within a 50 mile radius of a metropolitan area.

Findings at the eight representative terminal areas were used as a basis for measuring operations in 40 other terminal areas as a means of assessing the need for facilities on a national scale. A statistical analysis of the New York-Washington airways also was included in the study.

On-the-spot checks over a four-day summer weekend were conducted at the eight terminal areas. The surveys included counts of "instantaneous airborne aircraft," over the area at any given time and of "aircraft movements" at each airport within the area.

Operations were broken down into these categories: air carriers, civil and military itinerant operations and civil and military local flights.

The compiled statistics gathered from the count survey were translated into "composite days" which were used to predict the growth of different categories in terminal areas and on the airways in projecting the traffic situation to 1960, 1965, 1970 and 1975.



ACTUAL average daily traffic today at Los Angeles (top left) and New York (bottom left) is simulated on radar scope. Projected traffic in 1975 for each point is charted at right. Shading represents water on Los Angeles charts, land in New York chart.

The survey disclosed that on peak summer days as many as 175 aircraft were in the air at a given time within the 50 mile circle around Idlewild Airport. This is expected to increase to 360 aircraft by 1975.

Operations in the Los Angeles area are even more spectacular. Instantaneous airborne aircraft in this sector will increase from 280 at a peak instant in 1956 to 710 in 1975, while movements per hour will jump from 660 in 1956 to 1,680 in 1975.

Nationally, total air movements for business aircraft will climb from 6.6 million in 1955 to about 24.5 million in 1975. Air carrier movements will rise from a 1955 level of seven million to 14.9 million in 1975. All civil traffic, including pleasure flying, will increase from 45.3 million movements in 1955 to 93.9 million in 1975.

On the New York-Washington airways, annual air carrier operations will increase from the 219,000 recorded in 1956 to 430,000 in 1975. Civil itinerant operations will move from 253,000 annually to 960,000 in 1975. The number of en route aircraft flying the north-south airways is expected to reach 1,500 daily in 1975 with a peak-hour demand of 130 aircraft.

Under the overall program, Cornell Aeronautical Laboratory was assigned the task of studying future aerodynamics and aircraft powerplant trends.

Cornell found that the domestic scheduled aircraft fleet will consist of about 1,500 aircraft between now and 1975 and that 300 additional aircraft will comprise the fleets of U.S. international carriers, airfreight and nonscheduled operators.

The annual growth of airline passenger travel will be absorbed by an increase in passenger-mile capacity of individual aircraft, according to the Cornell study. A major shift to turbine aircraft of all sizes and a stronger trend toward aircraft of larger size than those in use today is forecast. However, no revolutionary change in design is expected.

Here is how the 1975 fleet will probably look:

- **Small piston-engine transports** will carry 40 to 50 passengers, cruise at 200 to 350 kt. at 5,000 to 20,000 ft. and will require runways less than 5,000 ft. in length.
- **Small turboprop transports** will con-

sist of the Vickers Viscount, Fairchild F-27 and turboprop versions of the Convair 440 and Martin 404.

• **Medium-range, piston-engine** transports will include the Douglas DC-6 and DC-7, Lockheed's Constellation series and the Boeing 377 Stratocruiser. Equipped with four reciprocating, turbocompound 3,400 hp. engines, these aircraft will remain in service through the 1960-1970 period but will be restricted to medium-range operations.

• **Medium-range turboprops** will include Lockheed Electra, Vickers Vanguard and Bristol Britannia. These aircraft will continue in use for medium and short-haul service during the next 20 years.

• **Medium-range turbojet transports.** The Convair 880, French Caravelle, Comet IV and possibly the DC-9 will provide similar service over the same period.

• **Large turbojet transports** such as the Douglas DC-8 and the Boeing 707 will serve all long routes and a large number of medium and short stage lengths during, and especially toward the end of, the 1960-1975 period.

Runways up to 10,000 ft. probably will be adequate to serve even the largest of transports.

VTOL/STOL Future

Production of VTOL and STOL aircraft with a passenger capacity of 50 or more and cruising speeds comparable to similar conventional aircraft is expected during the 1956-1975 period. The report warned, however, that although the state of knowledge is sufficiently advanced to produce such a STOL aircraft by 1965, the operators would suffer payload penalties in order to stay within helicopter terminal requirements.

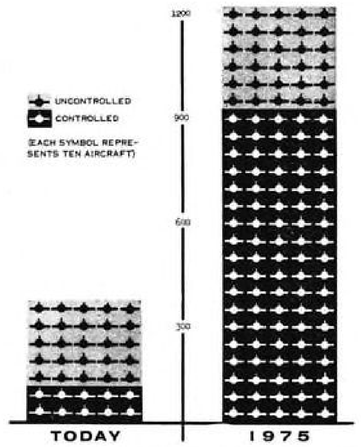
High cost of operation of the small helicopter makes its widespread use as an air taxi impractical. Helicopters required for interurban service will be 30 to 50 passenger, multi-engine, shaft-turbine-powered aircraft. They will have cruising speeds of about 150 kt. with a range of 200 to 400 mi. and will be capable of hovering with one engine inoperative.

Cornell found that most manufacturers indicate that such a helicopter will not be available commercially until at least 1965.

The large helicopters will also suffer from high operating costs and will comprise no more than 5% of the entire transport fleet.

Too Much Equipment?

The group warned that its studies disclosed that the actually planned airline fleet for 1962 has enough passenger-mile capacity to carry the predicted 1965 passenger-miles at a 60% load factor. "Thus," it added, "the problem of disposition of old aircraft becomes acute."



PEAK HOUR traffic at New York, controlled and uncontrolled, is to increase this way.

The Cornell Aeronautical Laboratory report said "present knowledge is not adequate to produce a supersonic transport economically competitive with subsonic aircraft, but the required extension, while difficult to attain, is not great." It added:

"Some common carrier supersonic transports may appear in operation between 1970 and 1975" but "the presence of these aircraft in the fleet would have a negligble effect on both the fleet size and the number of aircraft operations in a year."

Larger piston engines than those in current use will probably not be built because of bulk, weight and relative complexity. Except in ratings less than 750 hp., turboprop engines will replace piston engines in all future propeller-driven aircraft.

Small Piston Market

Smaller piston engine aircraft will continue to appear on the market for a number of years because of the fuel economy advantage over the turboprop in low speed, low altitude, partial power operations.

Short range, high capacity aircraft with the same useful payload as the DC-8 jet transport could be designed to have a 400 mi. maximum range and carry 294 passengers. Such large aircraft would be used as a means of reducing direct operating charges and of penetrating short-haul surface transportation markets.

Its performance, according to Cornell, would be similar to that of the DC-8 with only a moderate thrust increase to offset additional fuselage drag.

Local service carriers will retain the more advanced small piston engine transports through surplus purchases from the trunklines. It is expected that the local service airline fleets will comprise about 8% of the 1960-62 fleet of the transport industry.

By 1975, large turbojet transports will comprise 34% of the total fleet, or 510 jet transports out of a domestic airline fleet of 1,478 aircraft. Medium-range turbojets will make-up 13% of the fleet, medium-range turboprops 28% and medium-range reciprocating engine aircraft 3.6%. Small turboprops will account for 12% of the fleet; small piston engine aircraft for 9%.

In the general aviation field, the heavy single-engine aircraft will predominate and represent more than 66% of the total general aviation aircraft fleet in 1975 as compared with 32% in 1955.

The light single-engine plane will decline in use from 62% of the total in 1955 to 14% in 1975.

The light twin-engine plane will account for 19% of the total, and the transport plane will comprise less than 1% of the total general aviation fleet in 1975.

Economic Factors

The Aeronautical Research Laboratory conducted the study of the economic factors that may affect air transportation during the next twenty years.

They found that air transportation will grow faster than the general economy, that coach service will expand more rapidly than first-class service and that the medium and short-haul markets will experience a greater growth rate than the long-haul market.

In its forecast, the group assumed no radical changes in the economy or in the public attitude toward air travel. Acceptance of air transportation as a normal activity will continue to be a "gradual process," the laboratory reported.

An increase in the Gross National Product to $745 billion accompanied by a shift to a higher income per family with more people having more dollars of disposable income is expected by 1975. Aeronautical Research projected its forecast on an analysis of the competitive relationship of air travel to surface travel and on a study of national patterns of expenditure on air transportation. The results:

• **Domestic scheduled passenger-miles** will triple in volume from the 1956 total of 22 billion to 66.7 billion in 1975. Number of passengers will climb from 41 million to 153 million during the same period.

• **Number of consumer units** with incomes of $10,000 a year or more will increase from about four million in 1955 to over 12 million in 1975. Number of consumer units with incomes less than $3,000 yearly will decline from 20 million in 1955 to a little more than 10 million in 1975. Disposable income will increase from $275 billion in 1955 to $540 billion in 1975.

• **Movement of cargo and mail** will increase at a more rapid rate than movement of passengers. The report forecast, however, that about one-half the mail and cargo handled by the carriers will be moved in combination passenger and cargo aircraft with the other half in all-cargo planes.

• **Air carrier movements** will increase less rapidly than the increase in traffic volume due to the doubling of carrying capacity in the 1975 airline fleet. Penetration of the short-haul markets by the airlines is expected to only partially offset the payload increases.

Load factors will in all probability, remain static at an approximate average of 60%.

Assisting George Litchford in coordinating the final report of the surveys were Fred B. Pogust, R. C. Wheeler and J. S. Perry of Airborne Instrument Laboratory.

Cornell Aeronautical Laboratory was represented by Robert Shatz, Robert Stevens and Seymour J. Diechtman. The Aeronautical Research Foundation group consisted of S. E. Eastman, J. Reynolds and N. Sennent.

BEA Strikes Flag

London—British European Airways has removed the Union Jack from its tickets and timetables, hoping to eliminate a possible irritant to foreign customers. The airline has substituted a stylized aircraft silhouette which will emphasize European rather than British nature of its services and will cost less to print.

CAB Denies IATA Proposal For Transatlantic Fare Boost

Washington—After taking a look at transatlantic airline operating expenses, the Civil Aeronautics Board disapproved a 5% fare increase proposed by the International Air Transport Assn.

The Board said it recognized that the absolute costs of such items as gasoline, supplies and wages have increased but added that there has been no increased cost in unit operation upon which fares are based.

The CAB's action kills the proposal submitted by IATA as an emergency measure to offset increased operating costs of airlines flying across the North Atlantic. Approval of the governments of all airlines concerned is needed before it can go into effect.

Statements urging the CAB to approve the increase were submitted by Pan American World Airways, Inc., Trans World Airlines, Inc. and the Secretary of IATA's Traffic Conference 1. The Board said that the data submitted by IATA did not show that overall cost increases have not been absorbed through increases in operating revenue and improved load factor.

What CAB Wants

The CAB reiterated its position that a proper adjustment appeared to be an increase in the seating density of tourist-class services in order to efficiently exploit the capacity of modern aircraft.

Such a move, the Board believed, would make a fare reduction possible. The Board says the fare reduction would, in turn, strengthen the carriers' financial position through the development of a broader market.

John Brancker, IATA traffic director, said earlier that the plan to increase capacity had been approved by IATA members and that the higher density seating arrangement is expected to go into effect by April 1, 1958 (AW April 22, p. 40).

U.K. Boosts Fees

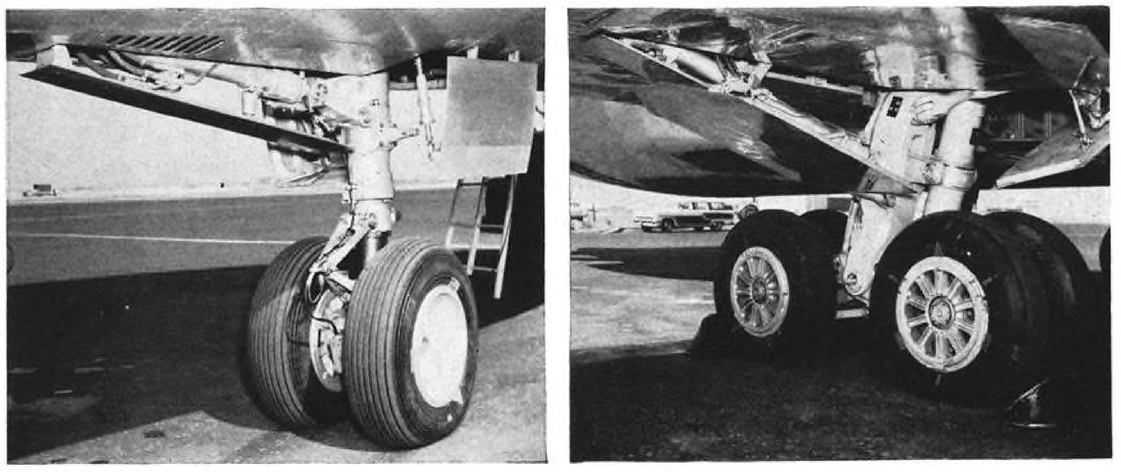
However, increased landing fees placed into effect by the United Kingdom on June 1 brought a new warning from IATA that if the trend continues it will soon cripple the industry.

Sir William P. Hildred, IATA Director General, said the 50% boost will cost airlines an additional $1.4 million a year. On July 1, Canadian landing fees will be boosted by about one third, adding another $100,000 a year to the cost of air transport between Canada and the U.S.

Hildred said airlines are subject at any time to arbitrary increases in these landing fees almost anywhere and that there is no way of knowing what will come next.

"The cumulative effect of developments such as these in the past year has already jeopardized the airlines' ten year policy of reducing fares and rates," he said.

"If the trend continues, it will



Caravelle Uses Hispano Suiza Gear

Melange of nations represented by component makers for French Caravelle jet transport includes Hispano-Suiza, French firm that was a big engine supplier for World War I aircraft but a relative newcomer to the landing gear field. Main four wheel bogie folds into fuselage (right). Cover for fuselage well (behind gear) is closed with wheels down, opens for retraction, then closes again. Nose wheel (left) retracts forward.

Airline Income and Expenses — First Quarter 1957

(IN DOLLARS)

	Passenger Revenue	Mail Revenue (U. S.)	Property Revenue	Federal Subsidy	Charter Revenue	Total Operating Revenue	Total Operating Expenses	Net Operating Income (before taxes)
DOMESTIC TRUNK								
American	61,214,259	1,674,358	5,686,229	.....	52,474	68,993,819	67,054,782	2,718,069
Braniff	11,407,353	303,982	550,740	.....	32,095	12,342,426	12,008,825	211,086
Capital	18,272,292	381,294	584,894	.....	3,861	19,269,371	20,261,598	**1,870,171
Continental	4,147,865	107,627	168,831	155,035	427	4,657,120	4,396,646	141,359
Delta	18,039,612	400,244	1,007,784	.....	19,928	19,521,623	18,108,344	1,254,203
Eastern	62,783,051	983,737	2,641,599	.....	34,852	66,443,239	59,855,581	7,383,303
National	15,930,806	294,344	946,210	.....	15,107	17,378,685	14,592,294	2,754,990
Northeast	1,922,908	32,585	89,722	589,886	182	2,654,621	3,498,358	**841,599
Northwest	9,427,530	377,763	902,367	.....	2,338	10,829,455	12,248,290	**1,418,835
Trans-World	36,439,455	1,042,977	2,577,982	.....	90,030	41,533,705	45,584,939	**4,051,234
United	50,514,064	2,212,926	4,070,351	.....	195,305	57,502,753	59,207,817	**331,917
Western	8,678,650	255,919	†72,975	.....	†	9,362,083	8,352,162	866,162
INTERNATIONAL								
American	1,443,236	13,264	210,310	.....	.....	1,720,285	1,493,329	226,620
Braniff	1,382,560	44,187	173,886	252,630	.....	1,908,730	1,615,095	276,571
Caribbean-Atlantic	506,867	5,662	20,994	.....	7,290	549,581	448,474	95,473
Delta	1,426,697	12,960	103,245	.....	.....	1,549,109	1,240,359	305,782
Eastern	3,749,095	89,331	54,452	.....	6,350	3,900,518	2,849,010	1,046,477
National	1,120,853	11,242	61,933	.....	3,412	1,201,151	861,607	338,251
Northwest	3,544,545	1,367,841	803,820	.....	18,652	5,932,509	5,860,169	.....
Pan American								
Alaska	736,225	45,096	121,471	.....	1,286	910,663	1,725,177	**793,638
Atlantic	18,583,000	1,805,000	2,715,000	.....	651,000	25,004,000	26,441,000	.....
Latin America	17,119,619	545,363	3,597,812	.....	1,540,835	21,750,009	22,906,773	**559,425
Pacific	12,947,489	1,333,310	1,960,567	.....	1,652,314	18,413,132	17,854,119	774,924
Panagra	3,864,311	115,583	541,102	.....	46,914	5,106,081	4,703,596	973,285
Trans-World	7,527,641	1,179,372	1,075,479	.....	83,961	10,569,088	13,810,317	**3,241,229
United	2,561,523	80,179	58,686	.....	.....	2,723,125	2,604,875	**101,157
LOCAL SERVICE								
Allegheny	951,359	19,087	56,279	438,789	1,119	1,476,919	1,919,859	**461,425
Bonanza	461,718	8,793	19,335	285,753	6,179	784,016	785,152	**1,068
Central	227,262	9,575	15,744	560,801	193	867,350	974,785	**110,172
Frontier	759,278	28,850	70,945	644,223	22,545	1,537,938	1,570,451	**35,987
Lake Central	319,875	9,075	17,886	359,531	12,730	719,834	786,796	**75,362
Mohawk*	.....	.....	.....	.....	.....	.....	.....	.....
North Central	1,537,323	50,993	47,331	344,928	69,501	2,054,479	2,244,058	**197,237
Ozark	758,270	26,070	45,307	767,235	14,380	1,613,429	1,627,448	**16,106
Piedmont	1,003,118	21,230	36,112	615,556	15,331	1,729,989	1,935,344	**190,381
Southern	504,833	23,459	16,969	447,093	10,344	1,005,799	1,081,318	**77,048
Southwest	815,148	26,340	21,016	346,205	9,716	1,221,865	1,406,392	**197,891
Trans-Texas	768,632	27,117	46,024	730,102	936	1,579,974	1,629,127	**51,849
West Coast	513,412	11,054	14,428	449,689	5,965	995,295	1,036,840	**57,329
HAWAIIAN								
Hawaiian	950,235	8,814	168,591	59,998	8,381	1,275,851	1,280,175	**27,409
Trans-Pacific*	.....	.....	.....	.....	.....	.....	.....	.....
CARGO LINES								
Aerovias Sud Americana	.....	.....	400,975	19,677	34,665	453,318	502,026	**53,660
Flying Tiger	.....	28,522	2,294,906	.....	2,842,629	5,737,710	6,036,166	**60,314
Riddle	.....	33,953	1,590,225	.....	37,123	1,729,873	2,095,929	**421,253
Seaboard-Western*	.....	.....	.....	.....	.....	.....	.....	.....
Slick	.....	53,122	2,480,375	.....	1,948,419	5,187,557	6,299,857	**1,948,419
HELICOPTER								
Chicago Helicopter	19,503	18,740	339	196,744	4,600	240,338	268,502	**30,966
Los Angeles Airways	37,875	28,019	20,319	234,331	1,012	321,559	296,599	22,561
New York Airways	91,773	10,149	13,337	315,470	4,395	439,098	606,811	**165,957
ALASKAN								
Alaska Airlines	280,545	114,159	160,167	392,721	238,568	1,199,696	1,412,506	**224,803
Alaska Coastal	105,721	25,287	14,798	88,710	11,438	249,879	301,601	**53,979
Cordova	30,045	21,335	14,713	87,950	68,018	232,935	268,765	**38,964
Ellis	82,301	11,812	16,083	67,327	4,393	182,060	229,690	**48,489
Pacific Northern	885,374	124,374	155,513	824,360	6,680	2,014,861	2,190,843	**210,222

* Not available.
** Net operating loss before taxes.
† Western property figure includes charter revenue.
Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board.

cripple the air transport industry at the very moment it faces its greatest venture yet into the field of low priced mass transport and its heaviest capital investment yet to meet the jet age."

Domestic Issue Extended

Meanwhile, the CAB extended the suspension period of the proposed domestic fare increases from June 29 to Sept. 27.

The Board said it now appears that the original 180-day suspension period would have expired before the conclusion of the investigation.

At the same time, the CAB ordered the examiner to certify the record directly to the Board for final decision at the end of the hearing in an effort to expedite the case. The hearing, now in recess is scheduled to resume on Thursday.

Seven airlines—Braniff, Capital, Delta, Eastern, Northwest, Trans World and United—have petitioned the Board for a 6% increase in passenger fares as an interim measure pending the outcome of the general passenger fare investigation. Other trunk lines have been made parties to the investigation by CAB order.

CAB Rules Against Trans-Continental

Washington—Civil Aeronautics Board ruled last week that Trans-Continental Airlines Agency Corp. engaged in "deceptive" methods of competition in nonscheduled air transportation and directed that a cease and desist order be issued.

The agency is incorporated in California, Illinois, Michigan, New York and Pennsylvania under the same name. The CAB action was directed toward the five groups which the Board said acted as ticket agents for a supplemental carrier.

The CAB said the five corporations violated the Civil Aeronautics Act by:

- **Representing themselves** to the public as air carriers engaged in air transportation.
- **Using, displaying, permitting** or allowing to be used or displayed their names, trade names or insignia on aircraft in connection with air carriers with whom they transact business.
- **Selling deceptive and misleading tickets** for air transportation in that the documents failed to state clearly the name of the carrier providing the air transportation.

The CAB also found that the corporate respondents are closely integrated with respect to their business operations and activities. "In fact," it said, "the entire evidence showing the similarity of the practices, activities, means and methods used by the respondents

AIRLINE OBSERVER

► Airline profit squeeze (AW May 13, p. 39) is providing effective ammunition in the industry's move for a fare increase, but it is also posing an unusual dilemma to individual carriers. While jointly presenting a pessimistic view of the financial future before the Civil Aeronautics Board to support the need for higher fares, airlines are forced to go their separate ways in expressing confident optimism to investors and bankers in order to attract additional capital for expansion plans and new equipment.

► **Douglas Aircraft will designate the DC-7D the DC-10. Engine specified for the turboprop version of the DC-7 is the Rolls-Royce Tyne. Douglas is stressing cargo use, and is showing specifications to Flying Tigers, Slick and other airlines.**

► Civil Aeronautics Board will conduct an air traffic rules conference in Washington June 13 and 14 to consider recommendations from civil and military aviation groups for improving the air traffic control system.

► **Watch for an increase in landing fees at a number of major U. S. airports. San Francisco recently dropped $6 million from its airport improvement program and announced that funds will be restored only after user fees are pegged high enough to put the airport on a self-supporting basis and yield a 2½% return.**

► France will spend close to $100 million for improvements of Orly and Le Bourget airports at Paris in preparation for jet transport traffic. Funds will cover lengthening of runways and a new $23 million terminal building at Orly. The government also plans a city-airport electric railway transportation system from Gare d'Orsay in the center of Paris directly to Orly.

► **Northeast Airlines has signed a contract with Shell Oil Co. for the annual delivery of 10 million gal. of 640 kerosene for the airline's fleet of Bristol Britannias scheduled for delivery this fall. Fuel facilities will be located at Boston, New York, Philadelphia, Baltimore, Washington, Tampa and Miami. Shell, which fuels Capital Airlines' Vickers Viscounts, is handling the Sud Caravelle jet transport during its U. S. tour.**

► General Electric CJ805-3 turbojet, advanced commercial version of the J79, will be designed to operate at higher turbine wheel temperature than the CJ805-1 which has been selected by Convair to power its 880 jet transport. Higher temperature would raise takeoff thrust to more than 11,000 lb. and could decrease the 880's takeoff field length requirements by about 8%.

► **Proposed Japanese medium-range turboprop transport will be designed to perform somewhere between the performance of Vickers Viscount and the Fairchild F-27. The projected transport, which will be designed and built in Japan, will be powered with Rolls-Royce turboprop engines.**

► Civil Aeronautics Board has extended the effective date of regulation requiring an independent electrical source for emergency exit illuminated markings of transport aircraft until Aug. 31 because of procurement and installation problems that confronted the airlines. The Board says, however, it is "greatly disturbed" that installation of the emergency equipment was delayed beyond the May 31 deadline.

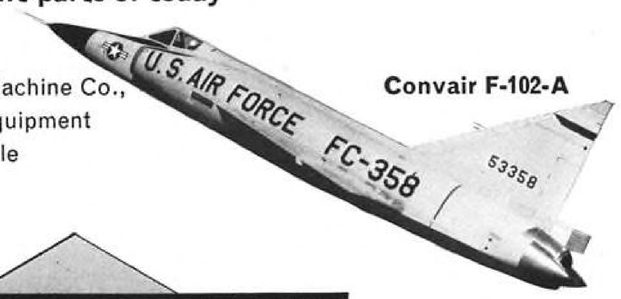
► **Radio Division of Bendix Aviation Corp. has been awarded a contract by USAF's Research and Development Command to conduct a research program on aircraft anti-collision problems. Program will include studies of the overall problem from the standpoint of commercial and military aviation, an investigation of collision-avoidance techniques and the construction of a model device based on the technique most likely to solve the collision problem.**

► Piedmont Airlines is conducting training classes for pilots and mechanics on the Rolls-Royce Dart engine in preparation for the introduction of the Fairchild F-27 turboprop transports scheduled for delivery early next year.

A SPECIAL BREED OF CAT...

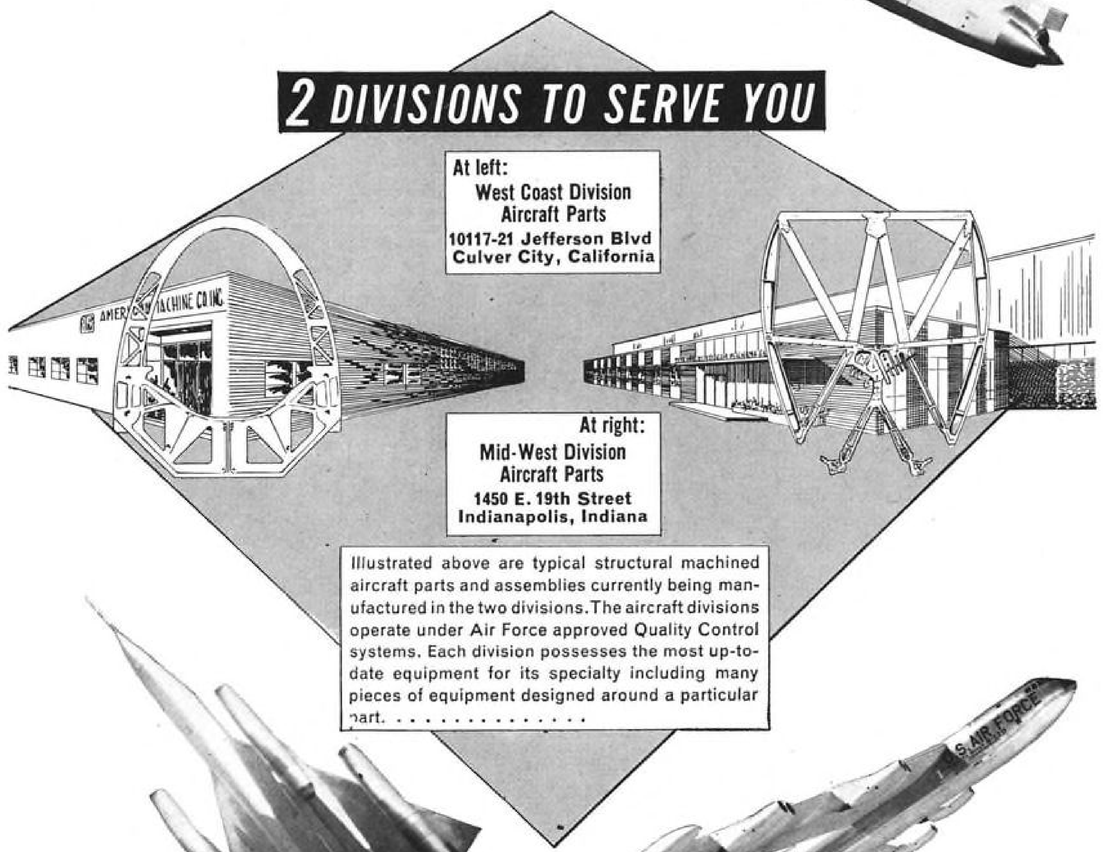
are the aircraft parts of today

...and the divisions of H & B American Machine Co., Inc. offer you the specialized skills and equipment needed to produce these parts on schedule and of the highest quality.



Convair F-102-A

2 DIVISIONS TO SERVE YOU



At left:
West Coast Division
Aircraft Parts
10117-21 Jefferson Blvd
Culver City, California

At right:
Mid-West Division
Aircraft Parts
1450 E. 19th Street
Indianapolis, Indiana

Illustrated above are typical structural machined aircraft parts and assemblies currently being manufactured in the two divisions. The aircraft divisions operate under Air Force approved Quality Control systems. Each division possesses the most up-to-date equipment for its specialty including many pieces of equipment designed around a particular part. . . . . .



Convair B-58 **Boeing B-52**

H&B AMERICAN MACHINE CO., INC.
General Offices: Prudential Plaza, Chicago 1, Illinois

proves the combine of them all. Since the respondents are in reality all parts of a whole, they should not be permitted to hide behind their separate entities to the end that the public interest may be defeated."

SHORTLINES

► **Japan Air Lines** reports a net profit of $1,167,000 for the six month period ending in March. During the six months, JAL flew 20,133,064 miles with international passenger revenues increasing 8% over a year ago.

► **Butler Air Transport,** of Sydney, Australia, will purchase three de Havilland Elizabethan aircraft from British European Airways as an emergency measure to enable the carrier to continue scheduled services. Butler is still interested in Fokker Friendship turboprop transports, but its current financial position makes firm orders doubtful.

► **British European Airways** carried more than 200,000 passengers in April, breaking all BEA records for that month. Passenger-miles were up 20% over the previous April; passenger load factor was 71.3%. Freight ton-miles were up 8.4%; mail ton-miles, 10.3%.

► **Emery Air Freight's** international service celebrates its first anniversary this month. The air-freight forwarder's revenue for March was double that for January, and April revenue went ahead of March by 15%.

► **KLM Royal Dutch Airlines** reports a ton-mile output for the first quarter of 1957 at 62,750,000 as compared with 53,187,500 ton-miles for the first quarter of 1956, an increase of 18%. KLM's load factor in the first quarter rose from 56.6% to 57.6%; the total number of flying hours was 43,800 as compared with 38,900 last year.

► **Sabena Belgian World Airlines** will increase the frequency of its Douglas DC-7C daytime service between Brussels and New York on June 23 from three to five per week. The new schedule calls for one flight on Monday, one on Sunday and one each on Tuesday, Thursday and Saturday.

► **Los Angeles International Airport** reported a total of 967,521 passengers handled in the first quarter of 1957 as compared with 798,755 in the first quarter of 1956. Air freight rose 18% over last year to 33,531,985 lb. and air carrier movements in the first quarter totaled 45,082 as against 34,296 in 1956.



How to keep informed on the "with what" part of your business

AT YOUR FINGER TIPS, issue after issue, is one of your richest veins of job information — advertising. You might call it the "with what" type — which dovetails the "how" of the editorial pages. Easy to read, talking your language, geared specifically to the betterment of your business, this is the kind of practical data which may well help you do a job quicker, better — save your company money.

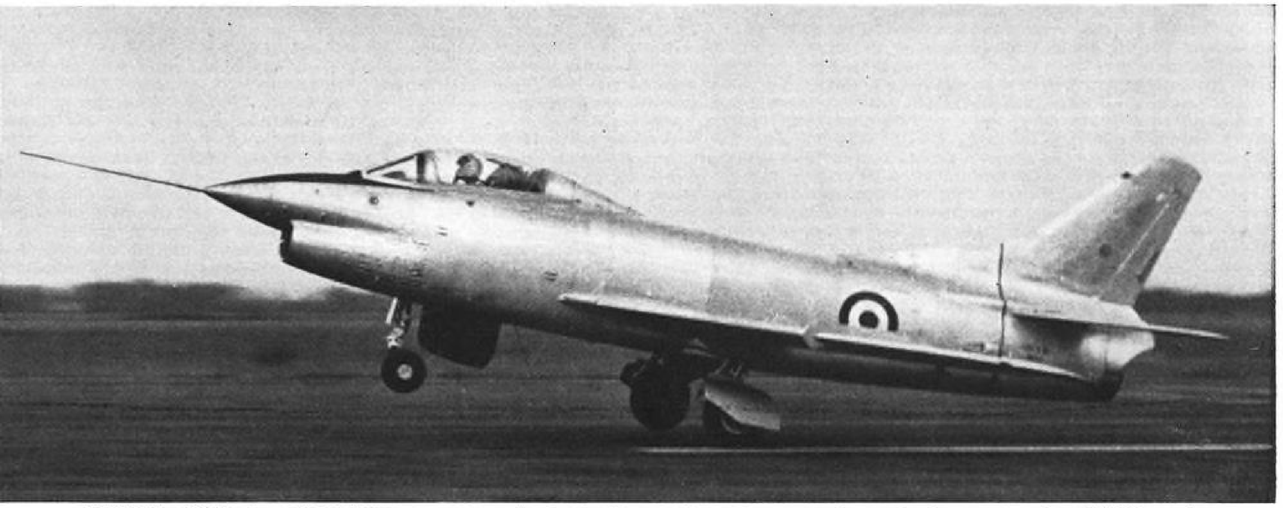
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McGRAW-HILL PUBLICATIONS

McGRAW-HILL FOR BUSINESS



TAKEOFF of G.91 from Fiat's flight test center at South Caselle near Turin shows normal attitude of sweptwing plane. NATO requirements for the G.91 and others competing with it call for operation from unprepared airstrips and rough fields.

Fiat G.91, U.S. Inspired Italian Design, Girds for NATO Trials

By David A. Anderton

Turin, Italy—Second prototype of the Fiat G.91 light ground attack fighter is nearing the flight test stage at the company's nearby South Caselle test center.

With Fiat's tough shakedown and flight test program behind it, the little plane will be flown to the French Air Force's test center at Bretigny in July for its final hurdle: competitive evaluation by a team of NATO pilots against the French Dassault Etendard VI and the Breguet Taon.

Winner of the evaluation is expected to receive a substantial production order. So far, 30 airplanes have been ordered from Fiat: three pre-production planes and 27 in a production configuration. Only prototypes of each of the French types have been ordered.

The basic requirement for the class of aircraft was laid down about three years ago by the technical teams of SHAPE. Fiat's first prototype G.91 was built and flown in approximately one year's time after the awarding of the contract, but it was lost recently when it developed tail troubles in a highspeed run at about 4,000 ft. off the ground. The pilot ejected safely, but was injured on landing because of gusty winds.

Analysis of the accident and the flight test data that was recovered has satisfied Fiat engineers that they know the cause.

Redesign of the suspected parts has been completed and the second prototype will benefit.

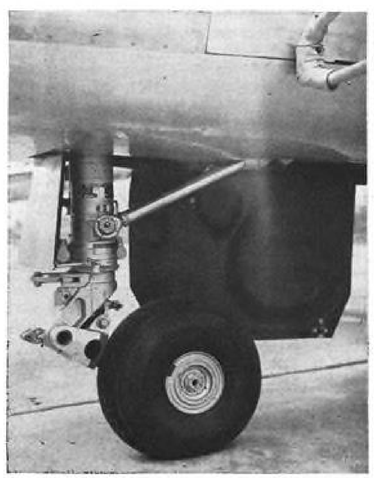
Other changes on the second prototype include a Mk. 3 Bristol Orpheus lightweight turbojet rated at 4,850 lb. thrust replacing the earlier Orpheus in the first plane; elevated cockpit, raised about two and one-half inches above that of the first prototype; some aerodynamic contour changes at the nose; a ventral keel strip under the rear fuselage; increased dimensions of the horizontal tail.

The second plane will also have a complete armament bay, where the first plane did not.

At first glance, the Fiat G.91 gives the impression of being a scaled-down North American F-86K like the ones Fiat produces under license for NATO deliveries. But a second glance shows that the G.91 is more like a non-identical aerodynamic twin to the Sabre.

The basic formula is the same: swept-back wings and tail, a chunky fuselage housing the powerplant, and a radome nose with the air inlet slung underneath. Furthermore, many of the details are the same: the Fiat design is built around American standard parts, alone among aircraft designed in the NATO countries. Bolt threads and sizes, rivet types and sizes, skin gages are the same that would be found in any American factory.

But the Fiat design team under Prof. Giuseppe Gabrielli worked to an entirely



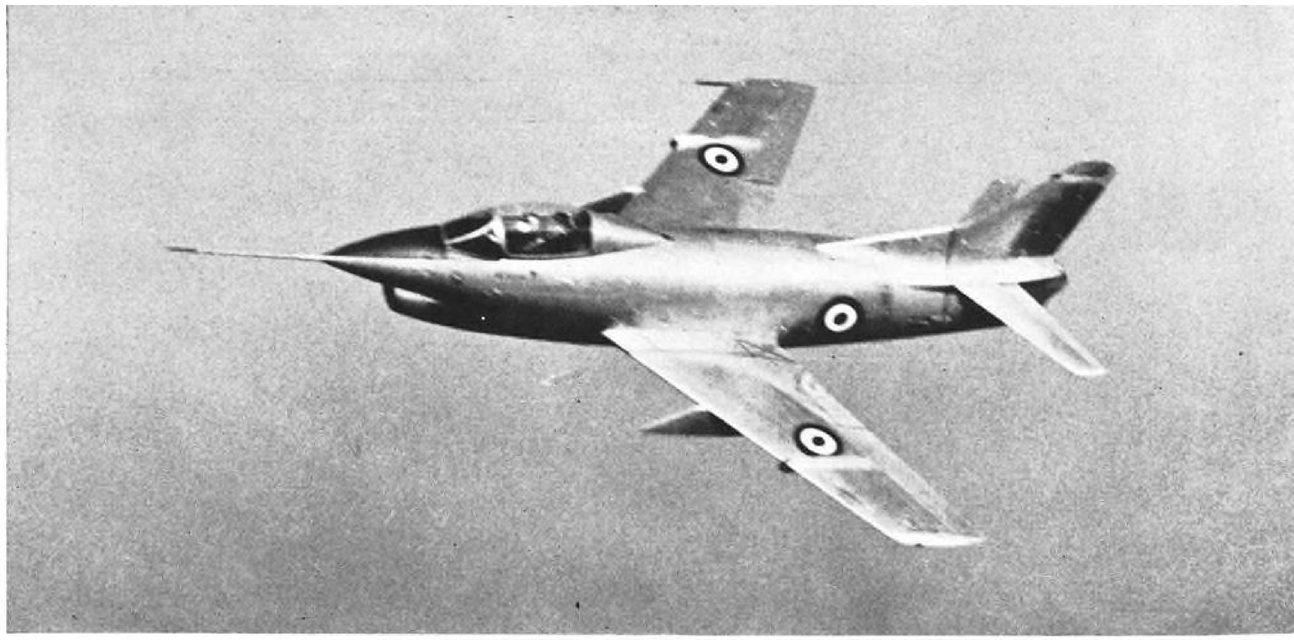
NOSE GEAR of G.91 is French Messier design and fabrication. Suspension is cantilevered, and nose tire pressure is 45 psi.



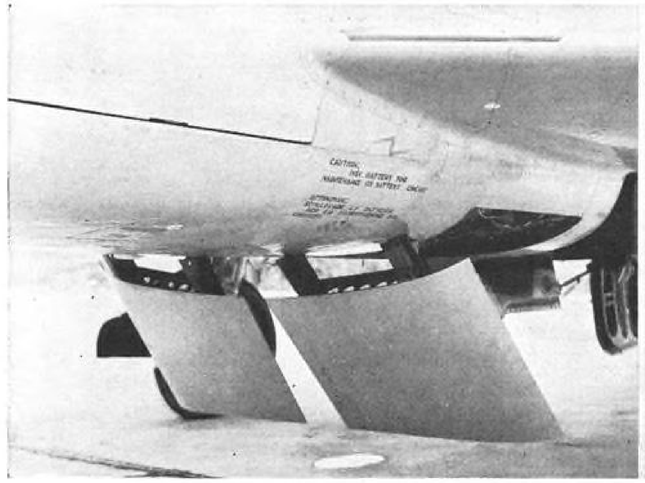
MAIN GEAR of G.91 was designed and built by French firm of Messier. It features cantilevered suspension, low-pressure tires.



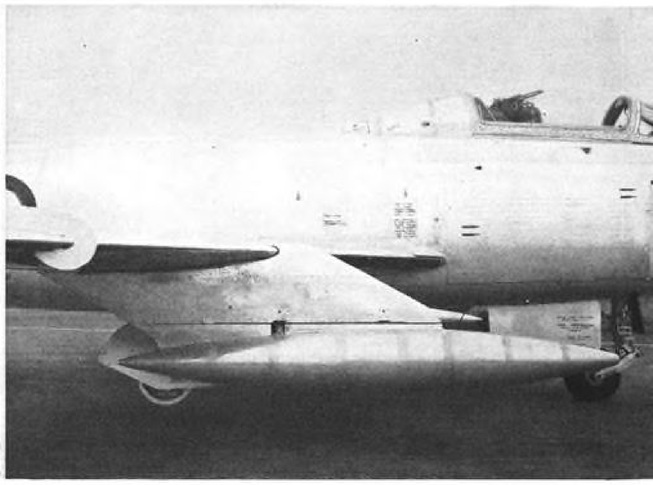
G.91 TAIL, like the rest of the airplane, carries duplicate markings in Italian and English. Drag chute housing is at base.



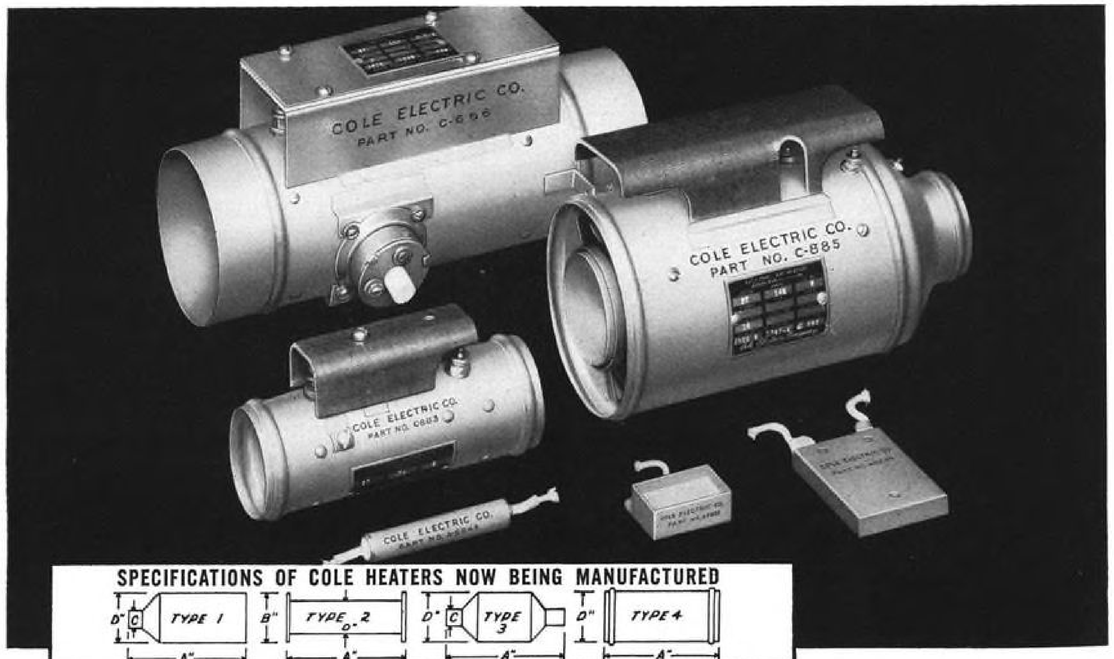
WING PYLONS for external stores show in this highspeed flypast of the G.91. Characteristic lines of the F-86 show in the rear fuselage and tail assembly.



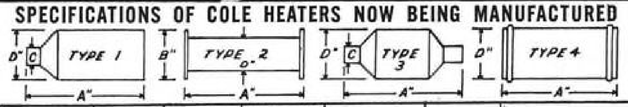
SPEED BRAKES of G.91 are symmetrical pair of surfaces beneath the fuselage. Brake actuators and other accessory system components are located in fuselage belly behind access doors.



ARMAMENT BAY of G.91 is rectangular area under canopy forming side panels of fuselage forward section. Two latches, opposite the bullet-shaped markings release for re-arming.



SPECIFICATIONS OF COLE HEATERS NOW BEING MANUFACTURED



CAT. NO.	CAPACITY K.W.	VOLTAGE	RATED AIRFLOW LBS/MIN.	TEMP. RISE AT RATED AIRFLOW °F.	THERMAL LIMITER	TYPE	DIMENSIONS A	B	C	D
C-970	.6	27	1.7	82	Thermo./Link	4	6			2
C-672	.75/.37	27	5	34/17	Thermostat	4	8½			3
C-1122	1	115	15	15	Fusible Link	Blower	1½			3¼
C-665	1./.67/.33	27	5	46/31/15	Thermostat	3	8⅝			3½
C-553	2	27	6	77	Thermostat	3	9		1	2
B-1246	2	27	10	47	Thermo./Link	4	6⅞			1½
C-667	2/1.3/.7	115	3	155/115/54	Fusible Link	2	6½			3
C-883	2	27	6	76	Thermo./Link	4	6			2
C-990	2	27	6	76	Thermo./Link	4	6			2
C-995	2	27	7.5	62	Fusible Link	2	2½	8		6-9/16
C-1258	2/4	27	2	230/460	Thermostat	2	10-3/16	6		5
C-660	2	115	11	42	Thermostat	4	7			3
C-726	2.1/1.05/.55	27	4	123/61/30	Thermostat	4	9½			3
C-1079	3	115/200	3	230	Thermostat	2	13	3⅜		3½
D-611	3	115/200	22	30	Thermostat	Misc.	25			7
C-561	3	115	3	235	Fusible Link	4	13			3½
C-666	3/2/1	27	10	70/47/23	Thermostat	4	10¼			3½
C-1329	3.5	115/200	40	20	Thermostat	2 (Blower)	13⅝	6-1/16		5
C-885	4	27	14	66	Thermo./Link	1	8½		2	4
C-980	4	27	6	155	Thermo./Link	4	9-15/16			2
D-312	4	27	10	94	Thermostat	1	8½		2	4
C-932	5/2.5	27	15	70/35	Fusible Link	4	9½			4
C-1082	5	115/200	15	70	Thermostat	4	15⅜			4
D-553	5/10/15	115/200	130	8/16/24	Thermostat	2 (Misc.)	20	6¾		6
C-562	5	115	15	70	Fusible Link	4	15⅜			4
C-602	6	27	10	140	Thermo./Link	4	11¼			4
B-1413	6	27	13	108	Fusible Link	2	5⅛			3
C-747	6/3	27	15	94/47	Fusible Link	2	6⅝			4
C-662	7	27	15	108	Fusible Link	4	9½			3
C-671	7/3.5	27	50	32/16	Fusible Link	4	9½			3½
C-787	7/3.5	27	8	205/102	Thermo./Link	4	9½			3½
C-1329	7.5	115/200	18	96	Thermostat	2 (Blower)	14½	8⅞		7¾
C-607	9	115	4	525	Fusible Link	4	15			4
C-648	9	115	8.33	255	Thermostat	4	15			4
							Length	**Width**		**Height**
A-7385	.05	27	Conduction	920°F	—	Flat	1½	1.7		⅝
A-6645	.058	27	Conduction	920°F (60W/IN²)	—	Tube	3			½
A-6649	.12	27	Conduction	1000°F	—	Flat	2¾	2		⅜
D-608	1.15	115	Conduction	170	Thermostat	Water	13½			
C-1319	3	115/200	22	30	Thermostat	Misc.	27	11⅞		6
C-1278	10	115/200	30	70	Thermostat	Misc.	10	8		7⅝
C-1320	27	115/200	170	36	Thermostat	Misc.	27	11⅞		6
C-1271	30	115/200	150	46	Thermostat	Misc.	25	16		4

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SIDE BY SIDE: Fiat G.91 and North American F-86K built by Fiat under license are non-identical aerodynamic twins. But G.91 is much smaller, and differs in component details such as the low-pressure tires, cantilevered landing gear and belly air speed brakes. Note proportionately larger size of the G.91 airscoop for the Bristol Orpheus engine.

different set of specifications than those that produced the Sabre series.

Gabrielli's job was to design a ground attack fighter that would also be suitable for air-to-air combat. It had to be rugged, simple to maintain, and capable of operating out of unprepared fields and off grass strips. Its armament had to pack a terrific wallop for strikes against a variety of ground targets: troops, bridges, armored vehicles.

Tough Requirements

The requirement had been dreamed up by technical teams of SHAPE during the winter of 1953. In addition to laying out the general requirements for the type, it specified some fairly tough performance requirements.

The planes had to be able to take off from grass and clear a 50-ft. obstacle within 3,000 ft. after releasing the brakes. They had to fly most of the mission at a cruise speed of 400 and then hold Mach 0.95 on the deck for the critical 30% of the strike. Maneuverability was to be excellent; rate of roll was specified at 100 deg. per second at Mach 0.9.

The cockpit was to be pressurized, and the pilot had to have these aids: UHF radio, IFF equipment, radar homing beacon, DME and a gyro gun-and-rocket sight.

The complete airplane had to weigh less than 5,000 lb. empty.

This was the specification framework within which Fiat engineers started work.

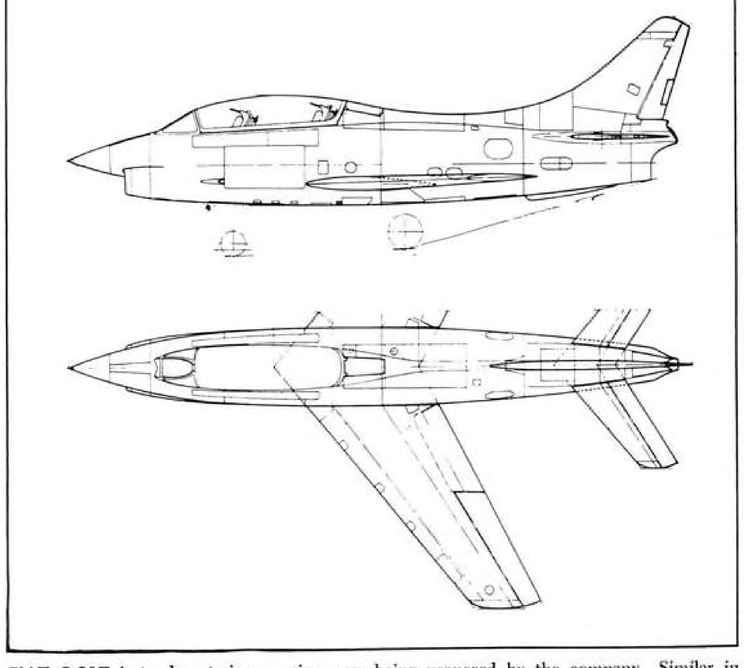
Design Evaluation

Eight different companies in Europe submitted designs to the SHAPE requirements. Work on many of them had been made easier by Bristol Aero-Engines Ltd. which saw the need for a small, light turbojet aimed at somewhere between 4,000 and 5,000 lb. thrust. The Bristol Orpheus was the direct result of that need, and was incorporated in the Fiat design, as well as in other light fighters to the same general formula.

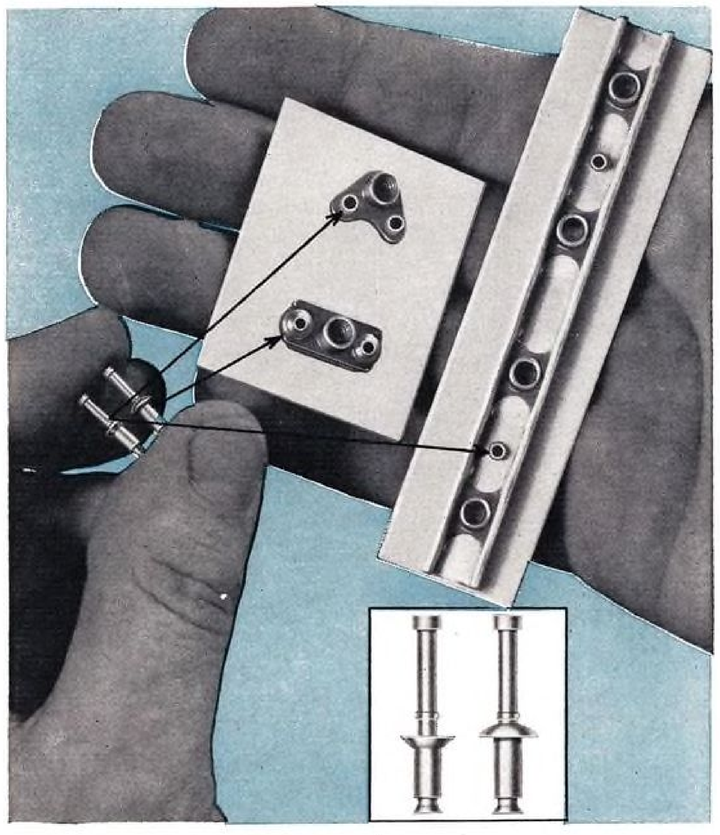
First examination of the designs was made by an AGARD commission, made up of engineers from the NATO countries. They investigated each design technically, and checked each submitting firm's potentiality from a production viewpoint. The complete evaluation of the eight proposals took several months for the engineers to handle.

Finally in June 1955 Fiat received the order to go ahead with the development of three pre-production and 27 production aircraft. Working against tight schedules, Fiat engineers developed the basic layouts of the proposals into engineering drawings and shop tools.

In a little more than one year's time, they had the first prototype ready to fly. It took off on Aug. 9, 1956 with Fiat test pilot Dott. Ricardo Bignam-



FIAT G.91T is tandem trainer version now being proposed by the company. Similar in line, the T version features changed forward and center fuselage sections. A photo-reconnaissance version, the G.91R, is also being studied.



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Available with either universal or 100° countersunk head, the Cherry 3/32" Monel Hollow Pull-Thru Rivet has a high shear strength particularly adapted to fastening nut plates, gang channel and honeycomb materials where extremely limited space makes use of solid rivets difficult. Damage to surrounding material in these difficult spots is eliminated with the pull-thru hollow rivet. Simplicity and speed of installation cut costs and save weight.

The new 3/32" Monel Hollow Pull-Thru Cherry Rivet can be installed with all existing Cherry Rivet guns, including the G-25 Hand Gun.

For technical information write to Townsend Company, Cherry Rivet Division, P. O. Box 2157-N, Santa Ana, Calif.

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SANTA ANA, CALIFORNIA

Townsend Company

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In Canada: *Parmenter & Bulloch Manufacturing Company, Ltd., Gananoque, Ontario*

Fiat G.91 T Trainer

Span	28.08 ft.
Length	36.44 ft.
Height	13.06 ft.
Gross weight	10,960 lb.
Max. static thrust	4,230 lb.
Max. speed at sea level	540 knots
Max. duration, training mission	1. hr. 40 min.
Max. Mach number, 30-deg. dive	1.03

ini at the controls. First flight duration was one-half hour.

The first flights were confirmations of the predicted performance. The airplane handled well and gave promise of growth when the final Mark of Orpheus engine would be installed.

Trouble Ahead

But there was trouble ahead. During a highspeed level run to determine the limits of the velocity-load envelope, the horizontal tail control system developed trouble and the plane began to buck uncontrollably. Structural failure followed and Bignamini was forced to eject, and was injured at touchdown.

Now the broken and charred pieces of the first prototype are set up on wooden frames in the spacious structures lab at Fiat's main plant while the engineers puzzle out all the last details of the accident. As guides they have the recovered wreckage and the flight test data taken during the trouble. They believe they have isolated the probable causes of the accident and have redesigned the tail system and parts of the structure to see that it doesn't happen again if they can help it.

Meantime the second prototype with the Mk. 3 Orpheus and complete armament bays is being groomed for its first flight.

G.91 Walk-around

First impression of the G.91 is one of small size. The wing is at waist height, the cockpit hood is just above the level of a tall man's head, and the plane sits close to the ground on short landing gear.

The wing has a single-slotted flap and a large-span aileron which measures approximately 60% of the semi-span. A single wing fence extends over the leading edge of the wing.

No fuel is carried within the wing itself, because there is sufficient room in the fuselage to carry the mission requirements. But there are wing pylons —one per side—for mounting external stores such as rocket, bombs or drop tanks.

The wing is a built-up structure, duplicating in rolled and extruded sections the integrally milled panels common to high-production aircraft. Fiat is equipped to do skin milling and has done it on its F-86K program, but the set-up and tooling cost is too great to be amortized economically over the relatively small production run now authorized.

Wing spars are heavy extruded sections, built up to the required form. Wing ribs, for the most part, are pressed pieces, but a few forged ribs are used in areas of concentrated loads. There are three such ribs at the pylon position, one outboard at the tip and another forged rib for attaching the aileron servo.

At the pylon location, there are many intercoastal members to distribute and transmit the load of the external stores over the wing section.

The entire leading edge of the wing is fastened with Elastic Stop Nuts to the front spar, so that access to the control pushrods, plumbing and wiring is provided by removal of the leading edge section. In addition, there are the usual screw-fastened inspection plates covering the joints of the controls, and removable for inspection.

The compass installation is in the left wing and the airspeed pitot head in the right.

Fuselage Construction

The wing-fuselage joint is a machined piece fastened with a large number of high-strength bolts.

The fuselage is constructed in a conventional manner with bulkheads and longerons or panels making a series of box and shell structures. The cockpit is placed above the engine intake duct; its sides form the inner panels of the armament bay.

The armament bay is formed by the cockpit sides, bulkheads fore and aft and horizontal bulkheads at top and bottom.

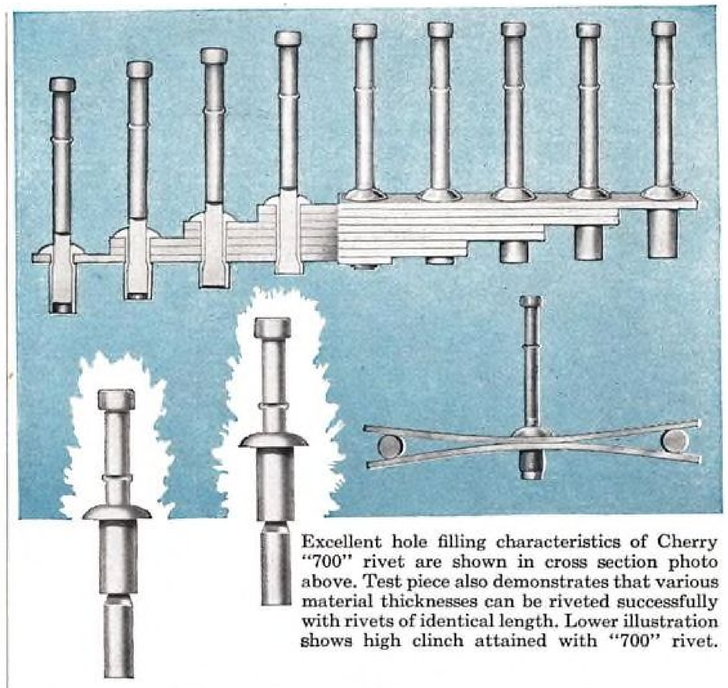
Paired .50-cal. machine guns, ammunition boxes and associated equipment are mounted on the outer panel doors of the gunbays. The complete armament installation is held in the plane by a series of pins actuated by two external flush levels, one on each side of each bay. After a strike, the plane's armament can be removed for re-arming by two men who pull down the levers freeing the pins, swing the panel down and lift it out of the bay.

Total weight of the loaded panel, complete with 600 rounds of ammunition, is about 400 lb.

Forward of the two gun ports, the fuselage side panels are made of steel for protection from gun blast.

The complete armament installation has been fired on the ground from a mockup of the forward fuselage and cockpit attached to a steel strongback.

The landing gear, designed for operation from unprepared fields, was developed for Fiat by Messier S. A., a



Excellent hole filling characteristics of Cherry "700" rivet are shown in cross section photo above. Test piece also demonstrates that various material thicknesses can be riveted successfully with rivets of identical length. Lower illustration shows high clinch attained with "700" rivet.

CHERRY "700"* Aircraft Rivet

Gives More Effective Fastening

The "700" rivet is versatile and in many cases one length of each diameter will cover all thicknesses of material. Also, the sheet hole size is not critical as with other rivets since the design provides positive hole fill even in oversize holes. The stem always adjusts to fill the hole which affords high stem retention independent of hole size.

The manner in which the "700" rivet is set provides high clinch by drawing the sheets together tightly and uniformly. When the "700" rivet is set, the stem shoulder protrudes above the rivet head and gives visual indication that the blind upset is properly formed, the sheet hole is filled and the rivet is properly set.

**Patents issued and pending*

The "700" rivet is available in countersunk and universal head styles in a wide range of diameters and lengths. It is installed with standard Cherry rivet guns with controlled-stroke pulling heads and accessories.

This fastener advancement is a typical example of how the Cherry Division has paced the industry with new and improved fasteners and the tools and accessories for applying them—all of which are designed, developed and produced in the Santa Ana plant.

For technical data on how the Cherry "700" rivet will give you a more uniform method of fastening, write to Townsend Company, Cherry Rivet Division, P.O. Box 2157-N, Santa Ana, California.

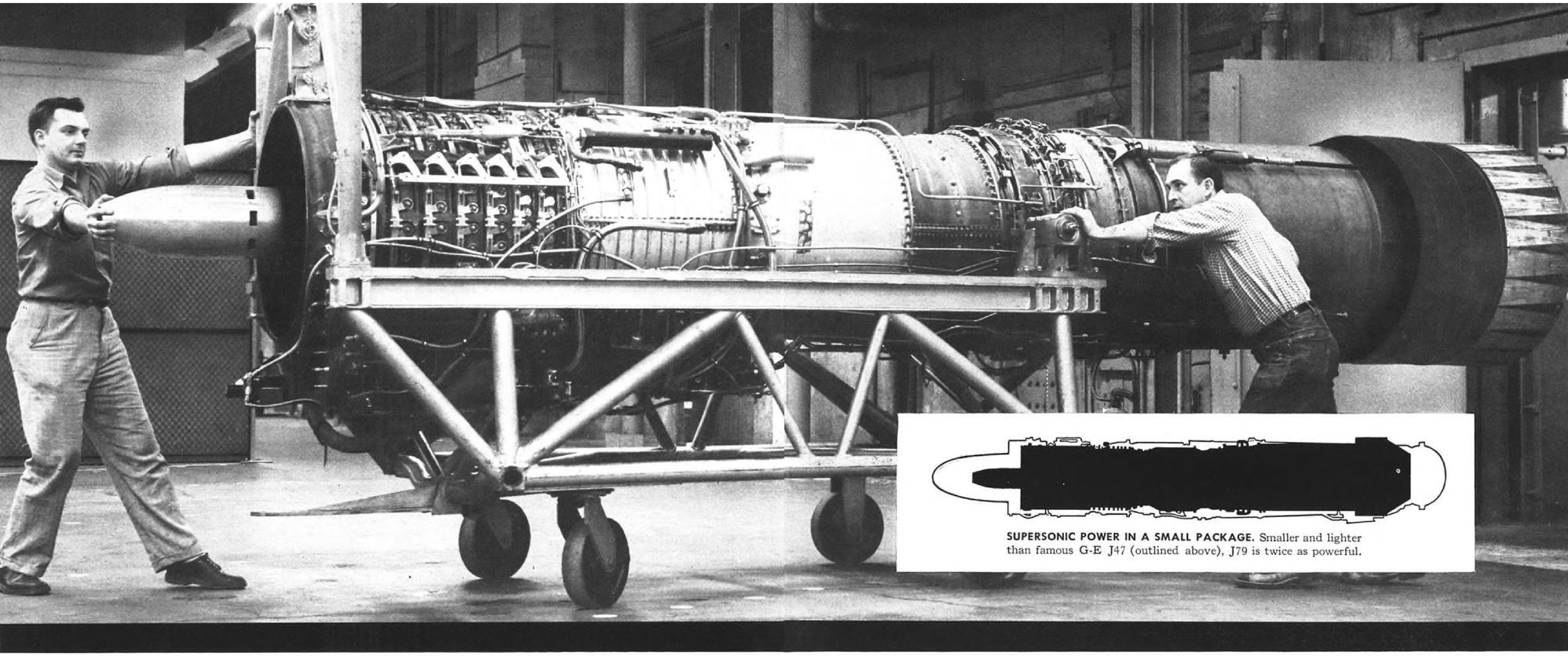
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SUPERSONIC POWER AND LIGHT WEIGHT

Washington, D.C., May 21—The General Electric J79—first U.S. jet engine capable of powering aircraft twice the speed of sound—was displayed publicly for the first time today. Rated in the 10,000 lb-thrust-class, the lightweight J79 has the lowest specific weight of any U.S. production turbojet.

Answering military demands for a mechanically-simple, high thrust-to-weight jet engine, J79 features include:

• **Variable stator**—To eliminate stall problems at "off-design" speeds and permit maximum compressor efficiency under all flight conditions, the first six stages of the 17-stage J79 compressor are variable.

• **Small frame size**—J79's diameter is less than three feet, its length about 17 feet.

• **Small hub diameter**—enables J79 to combine reduced-drag advantages of narrow frontal area with high airflow capacity.

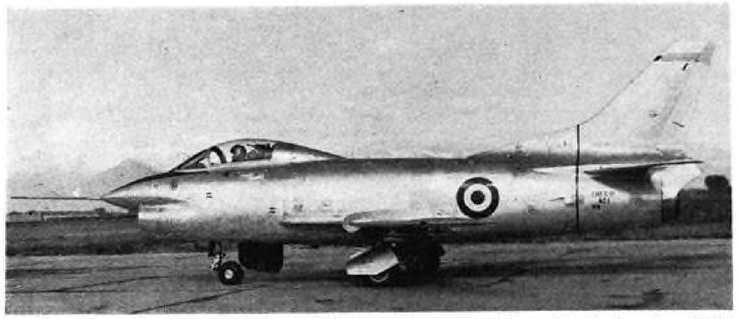
Today powering USAF's Lockheed F-104A, Convair B-58, and the Grumman F11F-1F, the J79 continues to set the pace for America's jet powerplants.

General Electric Company, Cincinnati 15, Ohio. 235-27

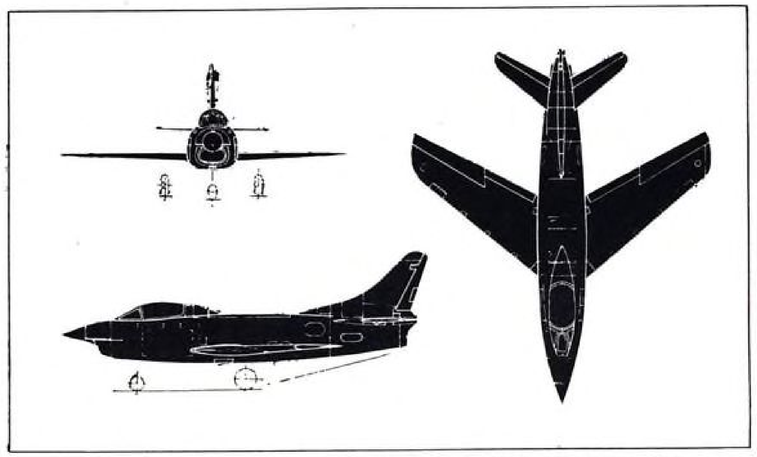
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FIAT G.91, shown taxiing out for takeoff, resembles a scaled-down North American F-86. Powerplant is a single Bristol Orpheus Mk. 3 turbojet for the pre-production and production airplane. First prototype shown here was powered by an Orpheus Mk. 1.



FIAT G.91, three-view drawing shows resemblance but not identicalness to F-86.

French firm specializing in landing gear work. Low-pressure tires are used; the nose-wheel pressure is 45 psi. and the main wheels only carry 64 psi.

Two variations of the G.91 are being studied. The first is the G.91 T, a two-seat tandem trainer for familiarization with the airplane and also for general jet transition work. The second is a photo-reconnaissance model.

The trainer is almost identical in wing and tail structure and form to the standard attack version. Fuselage changes have been incorporated to make the trainer body, and therefore the forward and center fuselage sections are extensively modified. Rear fuselage and tail are somewhat modified.

Orpheus Engine

Powerplant of the trainer is also the Bristol Orpheus. Performance is somewhat inferior to that of the ground-attack version.

So far this project has been a study only, and there are no indications that Fiat will either get an order or will build some with its own funds.

The photo-reconnaissance version has been studied through the mockup stage. Its nose has been modified and lengthened to make room for the cameras and the optically flat panels through which they photograph.

One armament bay has been converted to a camera-equipment bay and contains all the necessary power supplies and associated accessories needed with current types of cameras. The other armament bay remains as a standard unit with two machine guns.

Factory Capability

The observer of Fiat's aviation work generally is struck by two major thoughts. The first is that the quality of workmanship is very high. The second is that the morale of the technicians and engineers and workmen is equally high.

These two factors are interlocked, of course. But behind them both is a sense of pride in the renaissance of the once-great Italian aviation industry.

The tendency in many places is to forget the world records set by Italian aircraft and engines before the second World War, and to gloss over the fact that once Italian air units operated aircraft that were far and away the most advanced—from an engineering viewpoint—of any country's.

Any aerodynamicist will remind you that the first quality work in supersonic wind tunnels was done at the Italian experimental station at Guidonia, and that an Italian airplane was the world's second jet-propelled type to fly, even though it was a crude configuration of a ducted fan engine.

But pride is not enough to produce good quality. Fiat had of necessity adopted the North American system of quality control, including the exact duplication of the sign-off sheets for inspectors. This, incidentally, introduced a new word into the Italian language—"squawk"—which is prominent among the subject headings on the sign-off book.

Routine Pays Off

So it was natural for Fiat to continue with the NAA routine in its development of the light fighter. It has paid off many times, say Fiat engineers.

Behind the aviation division of Fiat is one of the largest industrial complexes in Europe, with overall facilities unequaled in Italy for development and production of aircraft and engines. Fiat employs overall about 75,000 people, or approximately as many as North American Aviation. Only a small proportion of that labor force is on aircraft work. The majority of them are employed in the automobile effort, which currently produces about 1,000 cars per day.

This factory was once a hotbed of Communist labor, but in mid-April, for the first time since the end of the war, the elections for shop stewards went overwhelmingly to the Catholic labor confederation and the Social Democratic Union. The Communist union polled about one-fifth of the votes; in its heyday, it had run up close to the four-fifths level.

But Fiat's total aviation picture is an uncertain one. Production of the F-86K is nearing the end of its run, and by December of this year should be about completely phased out. Fiat planners hope that the slackening of that work will be compensated for by one or both of two other prospects.

First is an increased production order for the G.91. Work on that airplane would naturally follow the Fiat style established and adapted for the F-86.

Second is the possibility of IRAN work on North American F-100s now in Europe. With no firm commitment, Fiat has gone ahead with its own funds and more than doubled its plant area at the North Caselle center where currently the company is performing its final assembly of the F-86Ks and IRAN work on the F-86Ds.

There's a lot riding on either of these

Engineering Careers at Curtiss-Wright

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Positions are available in plants located in several states, giving you a choice of geographical location. Work assignments range from pure research in specialized fields to production control of current manufacturing. Products range from plastics for the consumer market to new concepts in powerplants and propulsion systems. Especially interesting to the scientist or engineer are the opportunities offered in the following fields.

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prospects. Labor at the aviation division can not easily be shifted into the automobile plant because of the completely different skills required. The excellent facilities for research and development, the engine test cells, new hangars and flight test areas, plus the new avionic center could not be easily shifted to other work either.

At a higher level than this, though, is the intangible harm that could be done to the spirit of the labor core here. It has, by considerable effort pulled itself out of the disastrous years of the second World War. It has succeeded in producing a native airplane, designed by native engineers. Its contribution to the defense of Europe and the economy of Italy is an important one, the workers believe and they want to be able to continue standing on their own feet.

Orpheus 3 Finishes Official Type Test

London—Bristol's Orpheus 3 lightweight jet engine has completed its official type test at 4,850 lb. thrust, giving the 810-lb. engine a thrust/weight ratio of 5.99—probably the highest ever recorded for a standard jet engine.

Specific fuel consumption is given by the company as 1.06 lb./lb. thrust/hr.

Bristol Aero-Engines Ltd. says development of the Orpheus will proceed beyond original plans. A 5,760 lb. Orpheus 11 already has been announced. Now the company reveals it has under development an Orpheus 12, developing 6,810 lb. thrust. This can be boosted to nearly 8,000 lb. with afterburner.

Orpheus 12 is intended primarily for lightweight strike aircraft designed to SHAPE requirements. It is being developed under the Mutual Weapons Development Program.

The Orpheus powers the Folland Gnat, Fiat G.91, Dassault Etendard VI, and Breguet 1001 Taon. It also has been specified for the Aerfer Leone Fighter and Fuji T1F-1 trainer.

20 mm. Turret Replaces .50 Cal. Guns on P2V-7

Navy P2V-7 Neptunes are now coming off Lockheed assembly lines armed with turret-mounted 20 mm. cannons. Replacing .50 caliber machine guns, they increase Neptune firepower 70%.

Increased firepower system was introduced to provide greater defensive capacity as new electronic submarine detection equipment took over spaces previously devoted to armament. The 20 mm. cannon can pour 40 lb. of high-explosive shells on a target, compared with 23.2 lb. of incendiaries with the .50 cal. guns.

Production models of the high firepower turret, located atop the fuselage about halfway between the wings and the horizontal stabilizer, are built by Emerson Electric Co. in St. Louis, Mo.

P6M Debate

Washington—Congressional committees have turned down Navy requests for $8 million for a new base for the Martin P6M jet seaplane and funds for conversion of a ship as a tender for the SeaMaster.

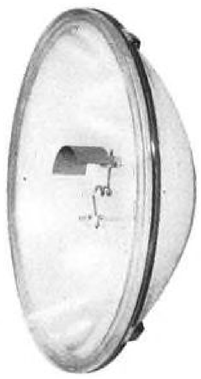
House Armed Services Committee refused to approve the new base despite the testimony of Rear Adm. Clifford S. Cooper, deputy chief of naval operations, that "the serious problems" in the development of the seaplane "are licked" and that Navy expects to have a successful version flying this fall. Both SeaMasters that have been test flown thus far have crashed.

The House Appropriations Committee said it will withhold for the tender "until the Navy has more basic data with reference to large seaplanes, especially the P6M."



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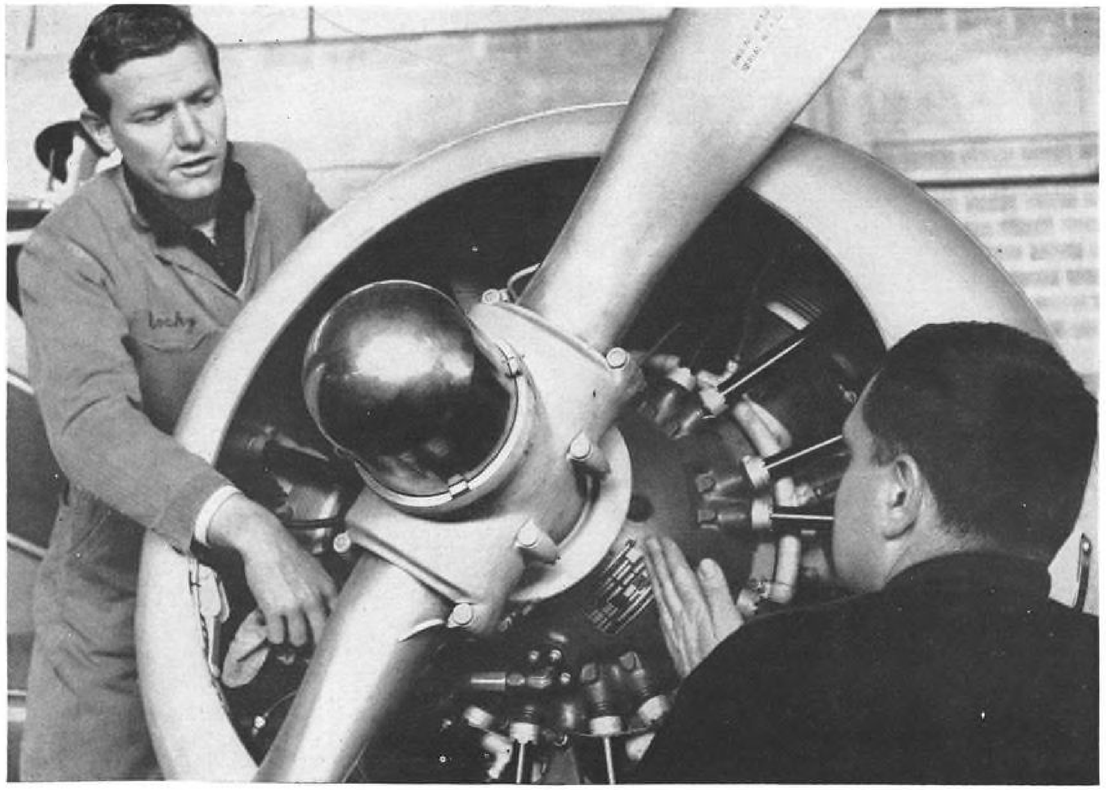
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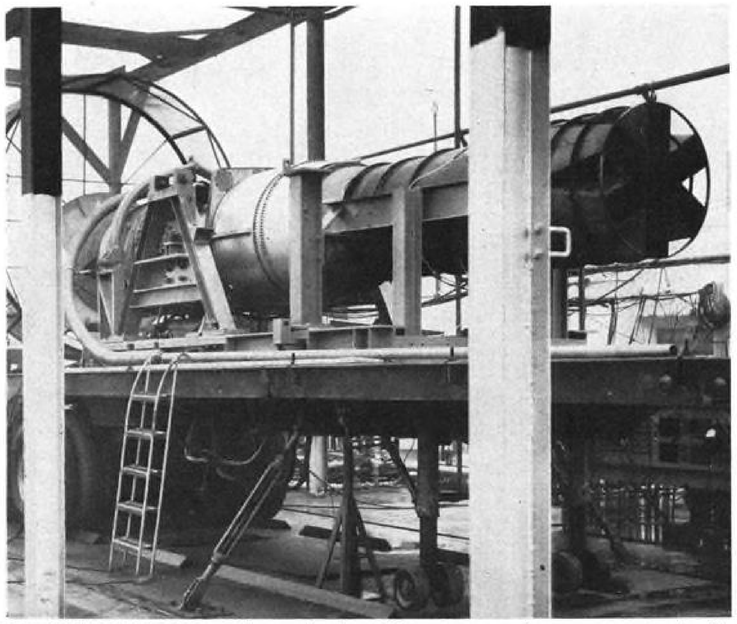
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CURTIS-WRIGHT TJ38 turbojet engine for civil transport use is run on test stand with saw tooth type noise suppressor. Thrust reverser also was demonstrated.

Curtiss-Wright, in Civil Jet, Finds Gain in Low Temperatures

By Robert Cushman

Quehanna, Pa.—High mass flow has been substituted for high turbine inlet temperature in Curtiss-Wright's new TJ38 commercial turbojet. This 12,500 lb. thrust engine was developed jointly by C-W's Wright Aeronautical Div., Wood-Ridge, N. J. and Bristol Aeroplane Co., Filton, England, from the latter's Olympus engine.

As against its competition for the commercial transport powerplant market, the TJ38 uses 40% more airflow and 360F degrees lower temperature on the theory this is better suited to the subsonic flight conditions typical for new airliners.

Development Progress

Curtiss-Wright claims it has developed the military J67 far beyond a Chinese copy of the original Bristol Olympus model it received 5 years ago. C-W is now developing the compatibility of the engine for high energy chemical fuels to extend its application in the dual cycle (turbojet-ramjet) Republic F-103 aircraft.

Olympus improvements from the J67 program have been fed back to Bristol and some, as the fir-tree attachments for the turbine blades, reappear in the TJ38, which is largely Bristol designed.

While the J57 and J79 use roughly 170 lb./sec. airflow with 1,700F temperature, the TJ38 swallows 238 lb./sec. airflow and only 1,340F turbine inlet temperatures. The biggest gains are lower noise level due to slower jet exhaust and significantly increased longevity of the hot parts of the engine. The Rolls-Royce Conway engine has a fairly high air flow rate, but because it is a by-pass engine has to operate with even higher turbine inlet temperatures. (However, Rolls-Royce engineers note, that because of blade cooling, actual blade temperatures in the Conway are lower than those on the turbine blades on the Dart turboprop engines now flying in the Viscount airliners.)

What Bristol and C-W have done is to parallel what NACA's Lewis Flight Propulsion Laboratory, Cleveland, has suggested to the industry. Abe Silverstein and Newell D. Sanders of Lewis in a paper given over a year ago before the Society of Automotive Engineers stressed the benefits in using lower turbine inlet temperatures in commercial jets.

High temperatures to pack a lot of power behind a small frontal area are not necessary in subsonic flight and greatly decrease the engine reliability, they pointed out. In addition, the high temperature military-type engine is inherently noisy for populated areas around commercial airfields.

In the TJ38, Bristol and C-W have taken an engine out of the Olympus family and expanded the first low pressure compressor stages from 40 to 41 in. to allow more flow. They have traded some compression ratio for flow in doing this but this is beneficial since they have also lowered the temperature. C-W said it retains the high temperature metals in the hot parts of the engine for safety margin. Since the TJ38 will weigh 3,600 lb. dry, according to Wright, some weight saving must have been accomplished.

Along with the engine, C-W intends to offer a package pod which will include a saw tooth type noise surpressor and the C-W developed clam shell thrust reverser. The noise surpressor will help the engine cut 25 db. off present jet engine noise levels and, according to C-W, permit quieter operation than many current piston transports.

The thrust reverser, which was demonstrated on a C-W J65 engine on one of the Quehanna outdoor static stands, could be thrown into 60% reverse or into full forward thrust in one second while the engine was at full power. There was no apparent effect on engine operation.

The TJ38 has passed a 150 hour test, but will not be ready for delivery until mid-1958.

Weight Class

The 3,600 lb. TJ38 weight falls between the single spool J79, which weighs less than 3,000 lb., and the dual-spool J57, which weighs more than 4,000 lb. C-W explains that the TJ38's lightness is because the bearing support framing and the engine housing did not have to be designed to withstand the high G-loads of military flight. Also the

TJ38 Specifications

Performance:	
Thrust, take-off	12,500 lb.
Thrust, maximum continuous @ s.l.	12,500 lb.
Specific fuel consumption, take-off	.718
Sfc., cruise	.88
Cycle characteristics:	
Compression ratio	10.5:1
Weight flow	230-238 lb./sec.
Turbine inlet temp.	1,340F
Dimensions:	
Length, intake to exhaust flange	121.0 in.
Diameter, across combustion chamber	41.0 in.
Weights:	
Weight, dry including standard equipment	3,600 lb.



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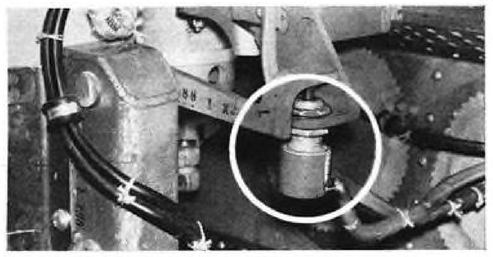
MICRO SWITCH can legitimately be said to be First in Precision Switching . . . First to apply actuating mechanisms to basic switches . . . First to use metal enclosures . . . First to furnish true hermetic sealing . . . First to design and build compact, lightweight, sensitive precision switches specifically for the aircraft industry.

Note the advertisement reproduced on the opposite page. It appeared in August 1941—sixteen years ago. MICRO SWITCH was first in aircraft even then.

Illustrated are twelve of the "EN" series switches. This series constitutes the outstanding aircraft switches today.

They are rugged, reliable, environment-proof and easy to mount. For details, which space prevents listing, ask for catalogs 77 and 78.

This advertisement appeared in August 1941. It showed wide use of MICRO SWITCH Precision Switches in aircraft at that time.



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MICRO SWITCH "EN" Series Switches

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2 SINGLE-POLE DOUBLE-THROW SM's 2 ISOLATED CIRCUITS	1EN1-6 MS24331-1	21EN9-6	41EN1-6 MS24420-1
2 SINGLE-POLE DOUBLE-THROW V3's 2 ISOLATED CIRCUITS	2EN1-6 MS24331-2	22EN9-6	42EN1-6 MS24420-2
1 TWIN BREAK TB, 4 WIRE	3EN1-6 MS24331-3	23EN9-6	43EN1-6 MS24420-3
1 DOUBLE TWIN BREAK TB, 8 WIRE	4EN1-6 MS24331-4	24EN9-6	44EN1-6 MS24420-4

AMPERE RATING AT 28 VDC

	SEA LEVEL	100,000 FEET*
INRUSH	24	24
RESISTIVE	4	4
INDUCTIVE	3	2
MOTOR	4	4

	SEA LEVEL	100,000 FEET*
INRUSH	36	36
RESISTIVE	10	10
INDUCTIVE	6	3
MOTOR	6	6

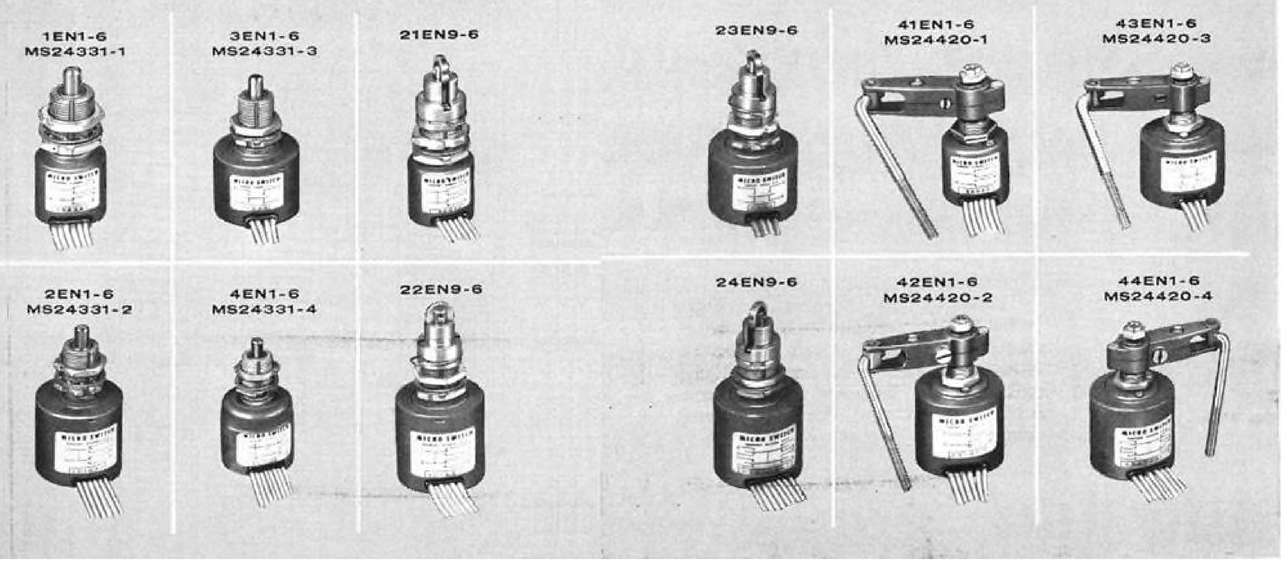
	SEA LEVEL	100,000 FEET*
INRUSH	30	30
RESISTIVE	15	15
INDUCTIVE	10	10
MOTOR	5	5

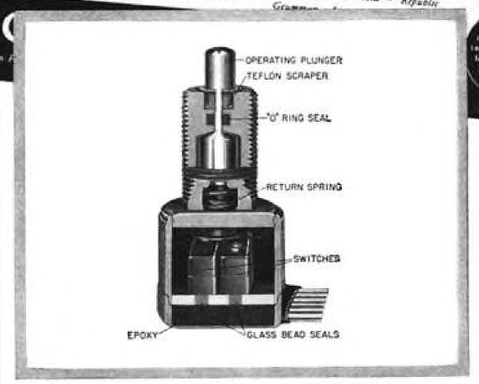
	SEA LEVEL	100,000 FEET*
INRUSH	30	30
RESISTIVE	15	15
INDUCTIVE	10	10
MOTOR	5	5

*Tests assume seal broken.

MECHANICAL CHARACTERISTICS

	Operating Force	Full Overtravel Force	Release Force	Pretravel	Differential Travel	Overtravel	Weight (without leads)	Operating Torque
1EN1-6	6-12 lbs.	30 lbs. Max.	4 lbs. Min.	.040 Max.	.020 Max.	.250 Min.	2¾ oz.	——
21EN9-6	6-12 lbs.	30 lbs. Max.	4 lbs. Min.	.040 Max.	.020 Max.	.250 Min.	4 oz.	——
41EN1-6	——	——	——	——	12° Max.	——	4¼ oz.	1 in. lb. Max.
2EN1-6	6-12 lbs.	30 lbs. Max.	5 lbs. Min.	.050 Max.	.035 Max.	.250 Min.	6½ oz.	——
22EN9-6	6-12 lbs.	30 lbs. Max.	5 lbs. Min.	.050 Max.	.035 Max.	.250 Min.	5½ oz.	——
42EN1-6	——	——	——	——	12° Max.	——	4¼ oz.	1 in. lb. Max.
3EN1-6	6-12 lbs.	30 lbs. Max.	5 lbs. Min.	.060 Max.	.035 Max.	.250 Min.	4 oz.	——
23EN9-6	6-12 lbs.	30 lbs. Max.	5 lbs. Min.	.060 Max.	.035 Max.	.250 Min.	5 oz.	——
43EN1-6	——	——	——	——	20° Max.	——	4¼ oz.	1 in. lb. Max.
4EN1-6	6-12 lbs.	30 lbs. Max.	5 lbs. Min.	.070 Max.	.045 Max.	.250 Min.	4¾ oz.	——
24EN9-6	6-12 lbs.	30 lbs. Max.	5 lbs. Min.	.070 Max.	.045 Max.	.250 Min.	5¼ oz.	——
44EN1-6	——	——	——	——	20° Max.	——	5¼ oz.	1 in. lb. Max.





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YH-32 Starts

Flames appear at tips of rotors of Hiller YH-32 helicopter in start for Armed Forces Day demonstration. Helicopter is powered by tip ramjets.

low pressure compressor casing did not have to be stressed to take the ram pressures built up in supersonic flight.

Specific fuel consumption for the TJ38 is "brochured" at .88 at cruise. C-W has compared this with the .94-.91 values of engines as the J79 and J57 with hotter cycles. Actual values for these engines may vary according to their component efficiencies. C-W pointed out that the dollar value of lower fuel consumption could amount to $\frac{1}{2}$ million annually for a fleet of 10 airplines.

Performance studies were based on a 230 lb. per sec. engine weight-flow at sea level on a standard temperature day. For a 100F day and for higher altitude airports, C-W plans to speed up the rotor rpm. slightly to swallow more airflow rather than boost the engine operating temperature. Unlike its competitors, the TJ38 will not have to carry water injection apparatus for hot day takeoffs. For a typical transcontinental flight, the total takeoff weight saving on a four engine transport would amount to 10,000 lb. The lower fuel consumption would mean that 3,000 lb. of fuel could be eliminated; lower engine weight would remove another 3,000 lb., and the omission of the water injection would save 4,000 lb.

C-W believes that the weight saved should be used for shorter takeoff runs and faster climbs out of airports to decrease further the noise nuisance to airport neighbors. Coupled with the low jet velocity and noise suppressor, it is expected that the flight pattern of a TJ38 equipped transport will make it less objectionable than a DC-6B piston transport.

Noise Level

Obviously C-W hopes that a lower noise level will give an edge over competition. The recent admission of the French Caravelle jet to Idlewild airport after the exclusion of the Boeing 707 has highlighted the problem. During its recent announcement of the TJ38 engine to the industry C-W went to pains to hold a special day for the benefit of airport authorities across the country.

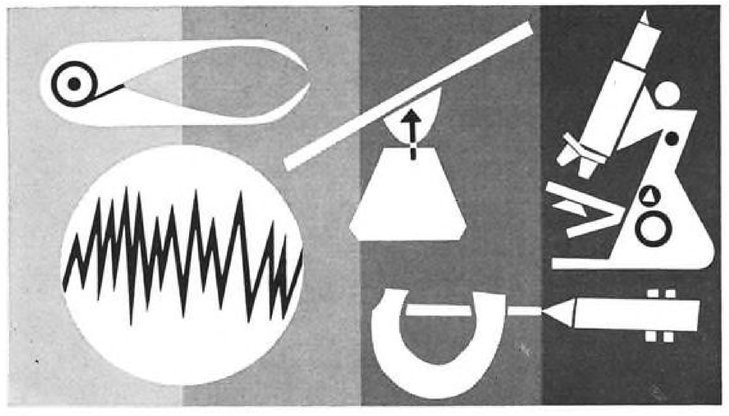
On the other hand a problem in TJ38 sales program may be its lack of flight hours. Roy Hurley, president of C-W said that the fact that this is a derated version lifted from the Olympus-J67 family should offset objections on this score. C-W feels that the flight time of the Bristol Olympus in the Avro Vulcan bomber should be counted in favor of the TJ38. The TJ38 is 97% similar to the rest of the Olympus family. About the only change is that the aerodynamic shape of the turbine blades has been altered for better matching at the lower temperature. Certain metal gages were lightened also for the lower commercial G-loads.

Much of the TJ38 designing was done by Bristol because C-W found Bristol could do it faster and cheaper. Because of the mutual interchange program, British have accustomed themselves to working to U.S. standards.

Swiss Order Twenty De Havilland Vampires

London—Swiss government has ordered 20 de Havilland Vampire trainers powered by the de Havilland Goblin jet engine.

This is the latest in a line of Swiss orders for de Havilland aircraft. Switzerland ordered 75 Vampire trainers in 1946. Since then it has been building under license Vampire and Venom fighters, as well as Goblin and Ghost engines.



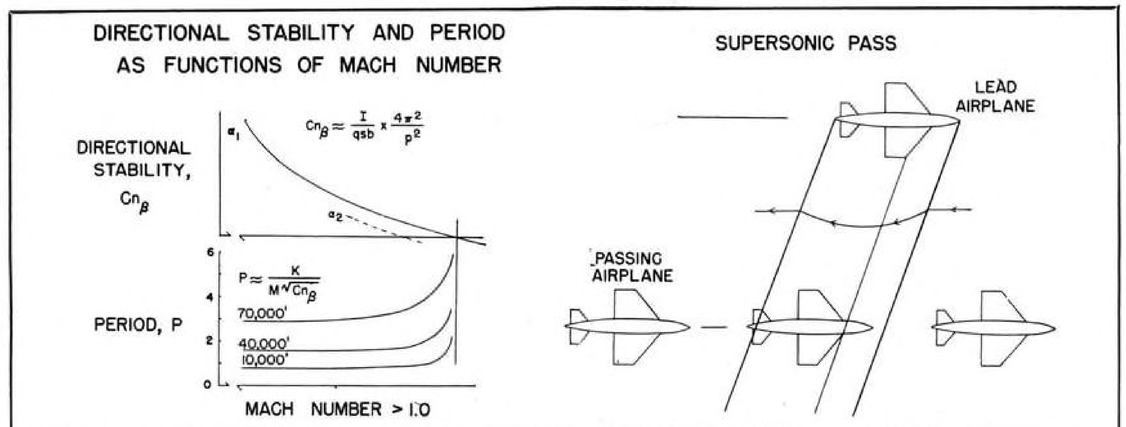
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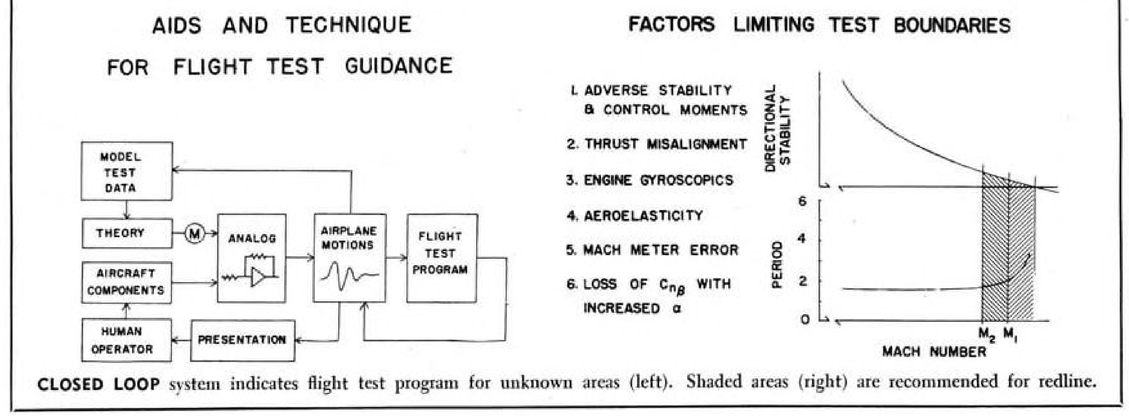
Solution: 1) use standardized components which have been tested and proven, *2)* a higher training level, *3)* use more detailed assembly instructions, and *4)* set up 100% inspection tests for any customer requirement.

Result: An overall customer rejection rate of less than 2% for Whittaker Gyros.

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STABILITY, judged by period concept, may be adequate (left) when it is in fact at vanishing point. Dotted line indicates passing into region of instability by increasing angle of attack. Possible supersonic pass damage might come from cumulative stabilizing oscillations (right) as tail passes through shock wave after jaw displacement and aerodynamic restoring moment takes place.



CLOSED LOOP system indicates flight test program for unknown areas (left). Shaded areas (right) are recommended for redline.

Redline Urged for Critical Test Areas

By Richard Sweeney

Lancaster, Calif.—Certain areas of critical stability in high speed flight where pilot and airplane are endangered, and which can be calculated in advance, are not proper subjects for flight test and are to be avoided, test pilots were told here.

This and other aspects of flight testing in areas of critical stability were detailed at a recent educational meeting of the Society of Experimental Test Pilots by Richard Day of National Advisory Committee for Aeronautics High Speed Flight Station, Edwards AFB, Calif.

Critical aspects discussed included the well-known problems of pitch up, roll coupling, loss of directional stability at high speeds and problems of high dynamic pressures.

Two highlights of the paper dealt with deterioration of directional stability at high speeds, and the supersonic pass and its possible effects on airplane structures.

No specific airplanes were discussed in the paper, which was concerned with typical airplanes and overall experiences in the field.

As to decay of directional stability at high Mach numbers, Day said:

"Since this Loss occurs in a region of high dynamic pressure and consequently is one of potential violence, it is necessary to detect the loss as it occurs. Unfortunately, the pilot's 'feel' for stability is not proportional to the decay itself. The main indication or feel that a pilot has for estimating directional stability is the period of oscillatory motion. Figure 1 (top left), showing directional stability and period of oscillation at three altitudes as functions of Mach number for a typical configuration, indicates how the period conception of stability can mask the true stability. The approximate equation for the stability coefficient, C_n is shown. Solving for the period indicates if C_{nb} were constant, the period would decrease as Mach number increased.

"However, since the stability coefficient is not constant, but decreases supersonically as shown in Figure 1, the period or apparent stability remains essentially constant until a dangerously low level of actual stability is reached. The period is shown as a family of curves for various altitudes, the lower the altitude, the nearer the approach to true instability at a constant period (of oscillation).

"This masking of true stability has often led pilots to report an airplane to be quite stable right up to the point where stability was non-existent, and for flight trajectories including a dive the pilot would even comment on the increase of stability. This false or apparent stability can lead to serious trouble in various ways.

"The point of zero or neutral stability cannot actually be approached

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X-2 Stability Loss

Fatal accident in which Capt. Milburn Apt died and the USAF X-2 research airplane was destroyed (AW Nov. 5, 1956, p. 26) undoubtedly was a result of loss of directional stability at very high Mach number.

At the time, USAF reported pictures taken during the plane's last moments showed the pilot being battered by violent divergence. Although the airplane was in a speed regime it had traversed in prior runs, the start of a turn by Capt. Apt that increased the angle of attack resulted in loss of directional stability and included extremely violent divergence.

Lt. Col. Frank K. (Pete) Everest, who had flown the airplane in these speed regimes obviously near the point of neutral stability, (AW Aug. 6, 1956, p. 454), apparently never induced an increased angle of attack or other disturbance in this critical area, thus never experienced the same divergence as Apt.

safely. There is a region near neutral stability which should be redlined as surely as any structural or engine limitation.

Flying in this region is literally balancing on a ball, where practically any disturbance can result in divergent motion.

"The solid line in Figure 1, labeled a_1 shows directional stability for trim lift. The dashed line labeled a_2 indicates the reduction in stability for some moderate increase in angle of attack.

"It is obvious that if a pilot is flying in a region of high apparent stability (as indicated by constant period), but low actual stability, and attempts any maneuver requiring increased lift, the airplane will suffer a loss of directional stability and possibly experience a directional-lateral divergence if sufficient lift is attained.

"This is probably the most important item to consider when flying in this redline region of low stability. The history of flight testing is well documented with serious incidents resulting from maneuvers of this type.

"In addition to increasing angle of attack, there are several other factors that increase the margin required below the neutral stability point and thereby limit the maximum safe performance of the airplane. Figure 2 (bottom right p. 67) shows these factors and helps define the boundaries for testing. The criteria of Figure 2 are based on the characteristics of a typical modern airplane. The first factor (1) in the figure is a limit set by the influence of adverse stability and control derivatives such as adverse aileron yawing moment combined with high positive dihedral. In



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(Advertisement)



Valve Talk

FOR WM. R. WHITTAKER CO., LTD.
BY MARVIN MILES

Everyone knows the explosive growth of aviation has almost hopelessly burdened our air traffic control system which is at least a decade behind the times, without the capacity or the flexibility to handle today's needs.

The problem shows up glaringly in CAB's near-collision report for the last four months of 1956—452 incidents involving 4,429 persons in the reporting aircraft alone—and in the untold hours of costly schedule delays caused by weather breakdowns in the antiquated system.

It shows, too, in CAA statistics of some 15 million take-offs and landings at major U.S. airports during 1956 under virtually the same air traffic system that existed in 1946 when there were only 4 million. Future growth estimates place the 1960 figure at 22 million!

Today the aviation industry and the Federal government are attacking the problem vigorously on two fronts: (1) a stop-gap program that will improve the system as quickly as possible to serve the interim until (2) an entirely new air traffic control system can be developed and placed in operation.

Underway is CAA's partial modernization program, already compressed from a five-year project to three years, which will bolster the system with increased radar installations that should total 83 en route units by 1961, with additional precision approach radar and instrument landing systems, with radar safety beacons and ground detectors for quick identification, with improved runway lighting, new approach lighting systems and surface radar detectors for ground traffic.

CAA also is pushing expansion of its navigational aid program toward achieving positive separation of high altitude traffic. Some 541 VOR units should be installed by the end of this year for directional guidance and CAA also hopes to have 267 VOR-TAC installations in service by mid-1959 so distance as well as directional information will be available through integrated facilities.

CAA has moved to take over control of all air space above 24,000 feet (in addition to its control of 90,000 miles of designated airways) with the floor of all air space control to be lowered to 15,000 feet by 1958. The Federal agency also is working on a simplified airways route structure to ease control problems wrought by today's acknowledged "crazyquilt."

The Air Coordinating Committee issued a voluminous report, replete with recommendations for accelerated modernization of the system, and the engineering group of the President's Aviation Facilities Planning Commission also publicized its recommendations. Among the latter were the early expansion of certain high-density routes by establishment of one-way airways separated according to aircraft speeds and the immediate control of all air traffic above 18,000 feet.

Experts say that by 1975 the air traffic control system will be revolutionary, leaving to the controller the exercise of judgment that no machine can make, but relieving him of the burdensome "clerical" duties he now must perform.

They say that most functions will be automatic, performed by advanced electronic gear, such as position reporting and position determining of aircraft.

Long range radar will provide full situation displays for given areas, giving controllers immediate, continuous and automatic information that will enable them to keep traffic moving smoothly and safely.

The future system will eliminate telephoning information from one control area to another and provide for electronic relays on a fast, accurate and fully automatic basis.

Today's system of radioed control instructions no doubt will be eliminated, too, except for special situations and stand-by use. Instead, instructions will be given and received automatically to avoid the waste of critical time that hampers the current system.

The great irony at present is that the potential hazards stem from past achievements. Planes are much faster, far safer; flying is increasing in popularity at an incredible rate. But when you mix in thousands of military planes with the transports, add thousands of light planes and additional thousands of business planes, there can be only one result in light of outmoded control: a staggering traffic problem that must be solved at any cost.

addition, adverse moments must be considered for possible thrust misalignment (2), this can be especially troublesome when dynamic motions result from changes in thrust or thrust termination. Other influences are (3) engine gyroscopic precession, (4) aerolasticity and (5) a possible Mach meter error. These five factors are additive in their effects and can limit the safe Mach number for trim lift to M_1, that is, some Mach number considerably below that for neutral stability. The sixth factor, loss of directional stability with increased angle of attack, further reduces maximum safe Mach number to M_2 when maneuvering at some desired lift coefficient.

Conception Threshold

"Since both these limits lie within the pilot's period conception threshold shown in the lower portion of Figure 2, it is particularly difficult for him to know he is in this region. Therefore, it is imperative that the pilot believe in and rely on the analyzed data along with computer studies to determine these limits."

Considering the supersonic pass, Day said:

"In order to give a physical picture of the problem, Figure 3 (top right p. 67) shows a maneuver in which appreciable airplane motions and loads can be encountered. The lead airplane generates a shock pattern illustrated by the heavy lines. The passing airplane is shown in three positions while traversing the flow field. The approximate path of a streamline is shown, greatly exaggerated.

"As the passing airplane traverses the flow field, it will experience a yawing-moment input due to this flow field and develop some kind of sideslip. The magnitude of the sideslip would be, as expected, a function of the time-to-pass. Experimental data and calculations have shown that a maneuver of this type is capable of imposing large motions and high stresses on the airplane. No known damage has resulted from a supersonic pass, but the possibility should be considered when two or more airplanes are maneuvering

Supersonic Pass

The problems of the supersonic pass are not clearly understood as yet. But possible danger areas can be seen in the form of results of a supersonic pass made in the area of another airplane at supersonic speed, test pilots were told at an experimental test pilots' meeting.

Also, the problem of the shock wave airflow inducing motions of the airplane being passed may need very close scrutiny leading to evolution of regulations concerning supersonic passes.

NEW! ultra-stable FM Telemetering Discriminator*



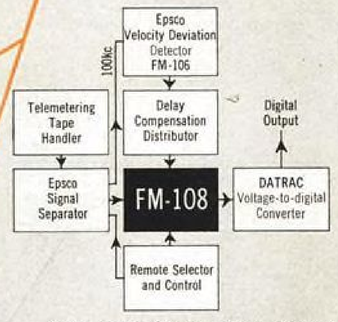
*Epsco Model FM-108 FM-to-Voltage Converter.



EPSCO'S MODEL FM-108 crystal-controlled ultra-stable, all-channel discriminator presents a new *standard of accuracy* . . . better than an order of magnitude more accurate and stable than any other commercially available equipment . . . and with absolutely *no* adjustments! This new standard of FM data processing features:

- **HIGH DYNAMIC ACCURACY:** Absolute accuracy is better than 0.05%, and the dynamic accuracy of the equipment from input to associated band-pass filter through the low-pass output filter is better than 0.2%.
- **LONG-TERM STABILITY:** 0.2% for life of equipment with no adjustments for zero drift, gain and line voltage variations, etc.
- **VERSATILITY:** Converter operates on any of 23 standard IRTWG telemetering sub-carrier frequencies from 400 cps to 70kc. Band switching may be accomplished remotely or by selector switch on front panel.
- **AUTOMATIC WOW and FLUTTER COMPENSATION:** With Epsco FM-106 Velocity Deviation Detector and Epsco CD-601 Velocity Deviation Compensation Distributor, errors from tape speed variations are reduced by a minimum of 35 db.
- **ZERO and 100% DATA CORRECTION:** Produces automatic compensation for variation of transmitting sub-carrier oscillator frequency and gain by a transistorized electro-mechanical servo feature.
- **DYNAMICALLY ACCURATE SELECTABLE LOW-PASS FILTERS:** A 5-pole filter utilizing precision wire-wound resistors and ultra-stable polystyrene capacitors in combination with chopper-stabilized d-c amplifiers provides:
  - Phase linearity deviation not exceeding 0.25 degrees over 90% of bandwidth.
  - Pass band flat within ±0.1% (0.01db) to F_c.
  - Minimum attenuation of 54 db of nearest beat frequency between sub-carrier channels.
  - A total of 62 different low-pass filter bandwidths selectable from 11 cps to 3490 cps.
- **PHYSICAL CHARACTERISTICS**
  SIZE: 10½" of space of standard 19" cabinet.
  WEIGHT: 29½ pounds.
  CONSTRUCTION: Constructed of 8 separate plug-in chassis assemblies containing electronic and magnetic components. All components are accessible on the standard layout forms.

Engineering data sheet available on request.



Epsco Model BF-601 Signal Separator units, each of which contains 23 band-pass filters, are available for separating the composite sub-carrier signal prior to input to FM Converter.

Complete FM telemetering receiving stations are available with or without wow and flutter compensation and zero and 100 percent correction features. Also available is the Epsco Model VCO-718 All-Channel Voltage-Controlled Oscillator for FM Discriminator calibration . . . which occupies only 3½ inches of panel space including power supply.

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near each other at supersonic speeds.

"Perhaps some test pilots have experienced motions from this source. If not, it should be pointed out that any pass at close range and high dynamic pressure should be approached with caution. Tests have indicated that such a maneuver is potentially dangerous from the standpoint of structural damage."

Regarding roll coupling, Day pointed out that its cause is thoroughly known and that practical fixes have been evolved (stability augmentation in the form of all axes dampers, aerodynamic design features such an anhedral).

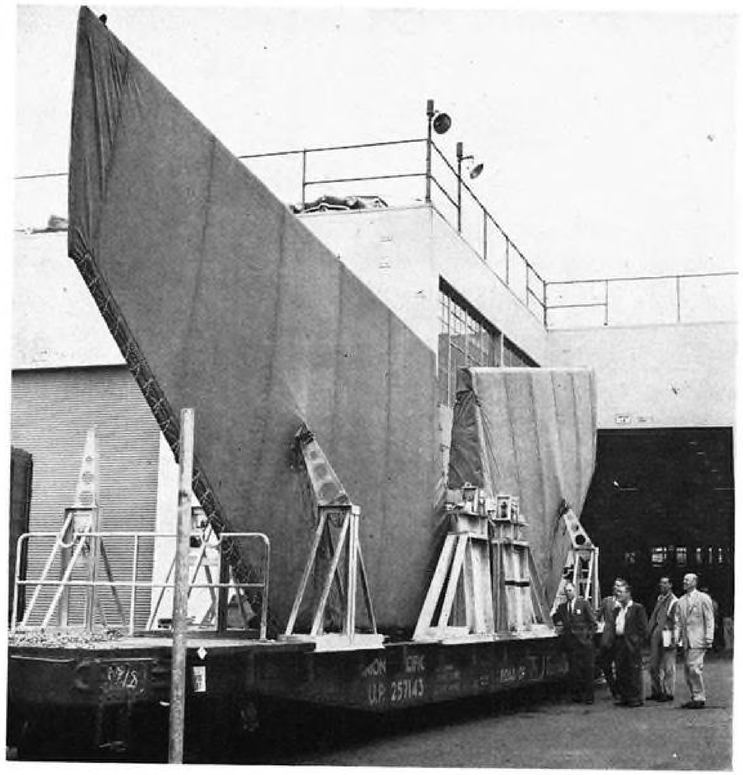
In addition, he outlined the aids available to flight test engineer and experimental test pilot, the closed loop system of model test data, theory, analog simulation, airplane motions and flight test program, with feedback from flight test program to airplane motions which in turn feeds back to model test data, a point where correlation between early indications of what may happen and actual in-flight results, can be made. Should wide discrepancies occur, they can be studied and determinations made of necessary changes and or fixes.

Although telemetering is a valuable aid to flight test in that it can provide the pilot with the services of a flight engineer, final authority should remain with the pilot regarding necessary action if telemetered data indicates malfunctions have occurred or other dangerous situations are developing, the paper said.

Investigations of severe pitchup, the paper said, are not proper areas for flight test due to inherent danger to airplane and pilot.

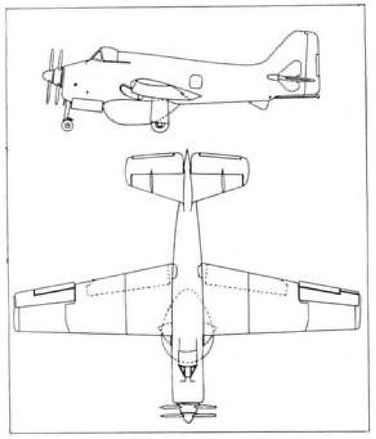
However, should they be required, the paper recommended initial investigations at high altitudes and 1G accelerations, progressing to higher accelerations in very small increments in turn maneuvers.

Day also recommended that both flight test engineer and test pilot visit the people who conduct model spin tests either in tunnel or by model drop, and carefully explore the ground already covered so as to be prepared for incipient spins which often follow pitchup.



Subcontracted B-52 Stabilizer

First horizontal stabilizer manufactured under subcontract by Cessna Aircraft Co. for Boeing B-52 rolls into Boeing warehouse at Seattle. The 19½-ft.-tall part was moved from Wichita in special freight car, routed via three railroads. Boeing says the shipment set a rail record for tall loads. B-52s are built at Seattle and Wichita.



FAIREY GANNET will do radar duty.

Gannet Developed As Early Warning Plane

London—Fairey Gannet AEW Mk. 3 aircraft has been developed as a flying radar center for the Royal Navy.

Prototype of the single-engined turboprop plane is under construction at Fairey's Middlesex factory. Production order has been placed by the Ministry of Supply.

Search radar is housed in a large dome under the fuselage. Fairey gave the range of the radar set as 30 mi. at 500 ft. and 200 mi. at 25,000 ft.

Grumman Net Lower, Research Called Factor

New York—Grumman Aircraft Engineering Corp.'s gross income totaled $39,546,493 for the first quarter of 1957, up from $38,921,580 for first-quarter 1956. Net income was $975,000 for the first three months of 1957, compared to $1,900,000 for the same period of 1956. The 1957 quarter's earnings equaled 41 cents per share, whereas the 1956 quarter's earnings equaled 80 cents a share.

The company called its 1957 results "disappointing" but not unexpected. Current sales, Grumman said, are related almost entirely to cost-plus-fixed-fee and fixed price incentive contracts, whereas contracts during the first quarter of 1956 were under fixed price contracts with a higher profit margin.

Another factor in the net income showing the company said, was a $2 million investment in research and design development related to military products. Grumman also noted that the first quarter results are not representative of the year as a whole.

The company is petitioning the Tax Court of the United States for a determination of 1953 excess profit status. Renegotiation Board has ordered a re-

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Missile Systems Division

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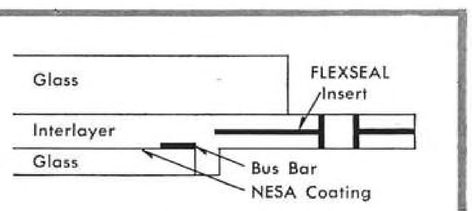
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Excellence in Electronics



"Ready-to-use" NESA® FLEXSEAL® windshields improve pilot visibility on the Convair 440





This is NESA FLEXSEAL

NESA is a transparent, electrically conductive coating applied to hot glass as it comes from the furnace. Fired-on bars are located on opposite edges of the glass. Sufficient voltage is applied between bus bars to provide heat dissipation of about 2,100 BTU/hr./sq. ft., usually enough to melt ice and prevent fogging.

FLEXSEAL edge contains a metal strip imbedded in the interlayer plastic. The protruding edge (see diagram) is bolted in the windshield frame, but the glass "floats." This is the secret of the strength and resiliency of FLEXSEAL installations.

Since it was introduced late in 1955, the Convair 440 has been chosen by 16 foreign airlines and five of this country's major air carriers to modernize their medium-range fleets.

The plane is equipped with NESA FLEXSEAL windshields to give the pilot maximum protection against icing and fogging. Windshields are delivered to Convair ready to drop into place, and are *directly interchangeable* between air-frames.

Holes are pre-drilled at the Pittsburgh Plate Glass factory and countersunk to very close tolerance. Windshields are shipped with retainers securely laminated into place, then bolted to prevent the slightest movement or variation in flushness. More than that, each unit is individually packed, and is protected with a special, tough cover. In other words, Pittsburgh windshields are designed to make the customer's job easier.

If you have a difficult aircraft glazing problem, our Technical Representative will be glad to help. Write Pittsburgh Plate Glass Company, Room 7301, 632 Fort Duquesne Boulevard, Pittsburgh 22, Pa.

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PITTSBURGH PLATE GLASS COMPANY

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Gun Measures Wind

Shooting Sphere Anemometer, built by Army Signal Corps Laboratories at Ft. Monmouth, N. J., has a gun which shoots small steel ball upward into the wind at an angle estimated to cause ball to fall back into aluminum overhead shield. Tilt angle of gun is accurate velocity measure.

fund from Grumman of $1,340,000. Most of the company's 1956 and 1957 sales also are subject to the Renegotiation Act of 1951, and while Grumman does not believe excess profits exist in either year, reserves have been provided in case the government decides otherwise.

Magnesium Process Developed by Avro

Toronto—Avro Aircraft Ltd. has devised a method of forming magnesium which makes use of existing autoclave equipment.

Magnesium, which is becoming increasingly important in the fabrication of high speed aircraft, can be formed by the same general methods used for other metals, but with one complication:

To achieve consistent good results an even heat is required.

For stretch wrap forming of magnesium skins, it is necessary that both the stretch form block and the magnesium part blank be heated. For small production runs this can be very uneconomical. Even with a heated blank and tool it is often difficult to produce a satisfactory part, Avro engineers point out.

Bearing in mind magnesium's need for both heat and pressure, Avro turned to its metal-to-metal bonding autoclave, and after some experimentation developed the following method:

• **One-eighth inch** thick 24SO aluminum skin is formed to the required contour, which is checked to a master model or lines template set-up. Special care is taken to insure that the surface of this aluminum skin is free from imperfections, since the magnesium will reproduce even minor faults.

• **Magnesium blank** is laid on the aluminum skin and secured with masking tape. Then the whole assembly is wrapped in felt and enclosed in a polyvinyl-alcohol bag, which has an outlet for vacuum attachment and thermocouples.

• **Magnesium is pressed** down by hand to conform to the contour of the heavier aluminum skin as the air is being exhausted from the vinyl bag. The holding of the magnesium in position as the bag is exhausted prevents the felt and the vinyl from being sucked between the two sheets of metal. The felt protects the metal from puncture on the edges and corners of the metals.

• **With air pressure** now holding the magnesium to the aluminum form, a thermocouple lead is attached to a temperature recorder to provide a record of temperature and time for the work load. The bag, with its contents and thermocouple and vacuum connections, travels into the autoclave with any normal bonding load and pressure and tem-



The Impatient Pilot With The Missing Part
or
So Long On The Runway

Once upon a time there was a flyer in a hurry to get flying. But he couldn't. His aircraft lacked a part (they often do!)

So he called *his* Parts Supplier, a nice warehouser.

"I need a flubub pin," he said plainly, and hung up firmly.

The flubub pin arrived the next day. But it wouldn't fit. He sent it back, in a huff and called another Parts Supplier.

"I need a flubub pin, he said plainly, accenting every syllable and hissing his consonants. He hung up firmly.

Same results. No fit (unless you count the flyer's).

Then he called Airwork. But—before he could hang up, *somebody started asking questions.*

So—the next day he received the *right* flubub pin.

MORAL: *When you need spare parts, call Airwork. They have technical know-how to get the right part (and the right information)—the first time!) Their 2 million dollar inventory helps, too.*



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How would you measure the bigness of a business?

By plant size — by net worth — by absorptions through mergers? Because obituaries are written for many small companies and few big ones, do you feel that "Little Business is on the rocks"?

Sometimes the contribution of a small manufacturer to the larger ones is an all-important success factor. For instance:

The last ten years have seen an important improvement in over-running clutches. A new type, using a sprag that grips better than the conventional roller or ratchet, was introduced by the then newly-formed Formsprag Company.

Acceptance came quickly; and much of what Formsprag designs, engineers and manufactures goes to large corporations. Only with their complete cooperation could Formsprag contribute the exact component required. The result: a power transmission device with improved accuracy and longer life.

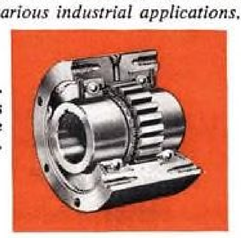
The important measurement, then, may not be bigness but "significant contribution". Where this exists, the success-potential of a smaller business may be as sound as that of the giant corporations.

FORMSPRAG COMPANY



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A3-6c

peratures are raised to normal bonding levels.

• **On completion** of the bonding cure cycle the assembly is removed from the autoclave and the now brittle vinyl bag is stripped off and the felt removed. The vinyl bag is only good for one operation, but the felt can be used several times.

This method is being used successfully for short batch production since it can be accomplished with any normal bonding load. Avro engineers feel that the process can be extended to the use of a heated fixture with provision for application of the vacuum and an air pressure bag to set the magnesium to shape.

Tank Bond Facility Constructed for 880

San Diego—Under construction here at Convair Division of General Dynamics Corp. is a $680,000 facility for adhesive bonding of integral wing fuel tanks for Convair 880 jet transports. Plant is scheduled for completion in November.

Wing spars and ribs will be bonded to the wing skins by the Scotchweld process, jointly developed by Convair and the Minnesota Mining and Mfg. Co., for use on the delta wings of the F-102A. Fatigue tests of adhesive-bonded joints indicate the bond will outlast the metal structure it binds together. No F-102A adhesive-bonded wing fuel tank has ever leaked, Convair reports.

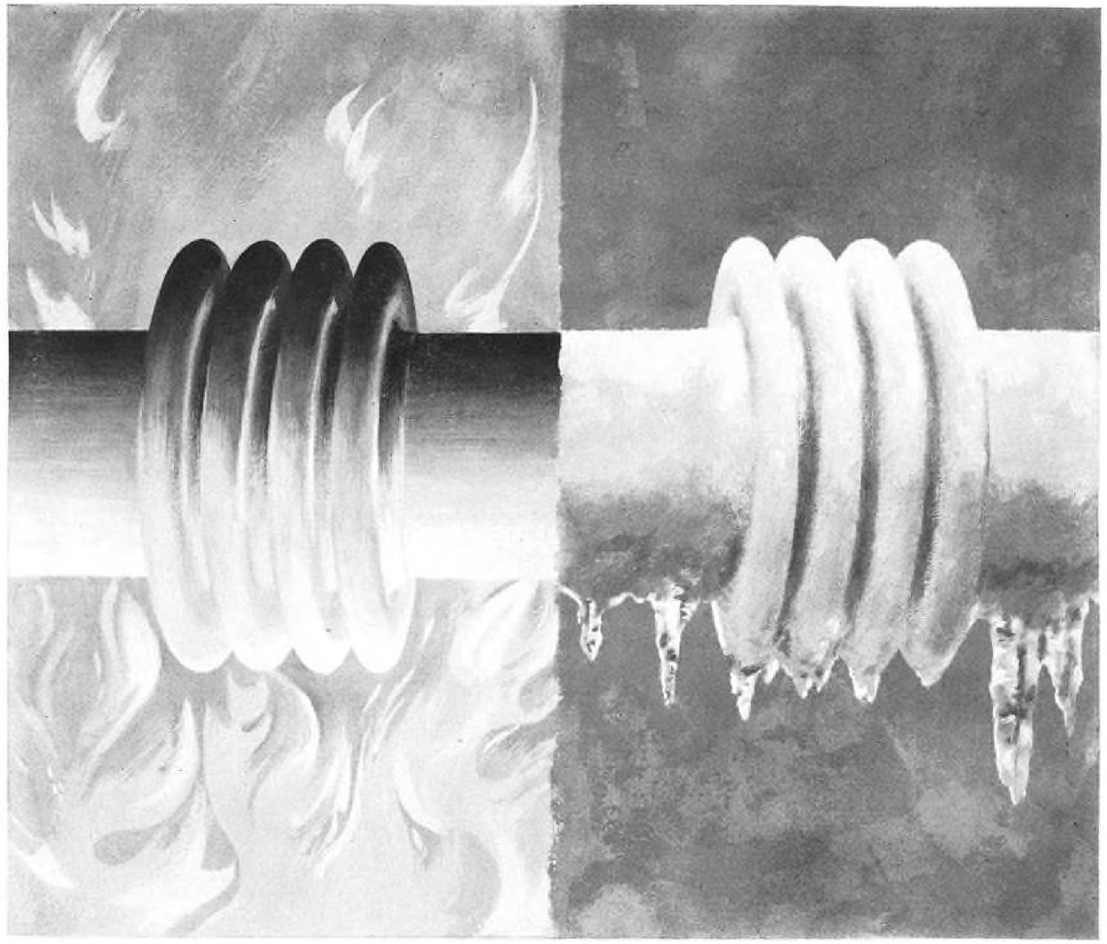
New facility will include a $178,000 electric oven, 80 ft. long, 20 ft. high and 10 ft. wide; six 4 x 10 x 35 ft. processing tanks; paint booth, and a three-compartment pre-curing oven, supplied by Despatch Oven Co., Los Angeles, to accommodate two 880 wing tank sections in one curing operation.

A Convair-developed rivet, similar to the Stravlor rivet employed in the F-102A, will be used to join 880 skins, ribs and spars, providing necessary clamping pressure on the Scotchweld tape during the curing process.

Gas-tight corners and lightweight self-sealing dome nuts, developed by Nutt-Shel Co. and Franklin C. Wolfe Co. for use with inspection covers, will complete the assembly of the wing tank areas.

Grand Central Acquires Large Propellant Mixer

Grand Central Rocket Co., Redlands, Calif., has acquired a large process mixer made by Bramley-Beken of New York which will increase solid propellant mixing capacity by 2,500 lb. per hour. New mixer will be installed in a two-story, part subterranean structure within the next two months.



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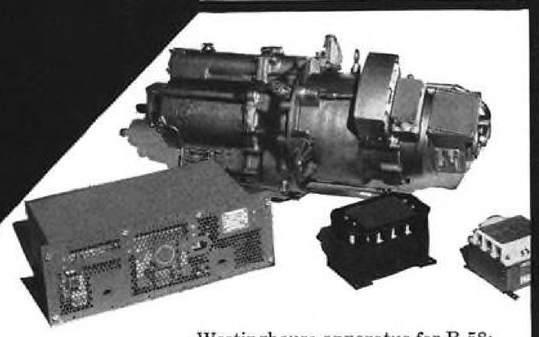
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USAF B-58 "Hustler", America's first supersonic bomber, Convair Division, General Dynamics Corp., Fort Worth, Tex.



Westinghouse apparatus for B-58:
(1) Sundstrand Constant-Speed Drive and Westinghouse 40-KVA Brushless Oil-cooled Generator, (2) Regulator-Control Panel, (3) Transfer-Contactor, (4) Current Transformer Assembly.



First airborne generator, shown on Billy Mitchell's Spad 16. Photo: Courtesy of The Smithsonian Institution, Washington, D.C.

Westinghouse is still the leader in airborne electrical power!

From the single-blade, wind-driven Westinghouse generator above, shown on Billy Mitchell's Spad 16, to the amazing electrical components of Convair's supersonic B-58 "Hustler", is an epoch in air power.

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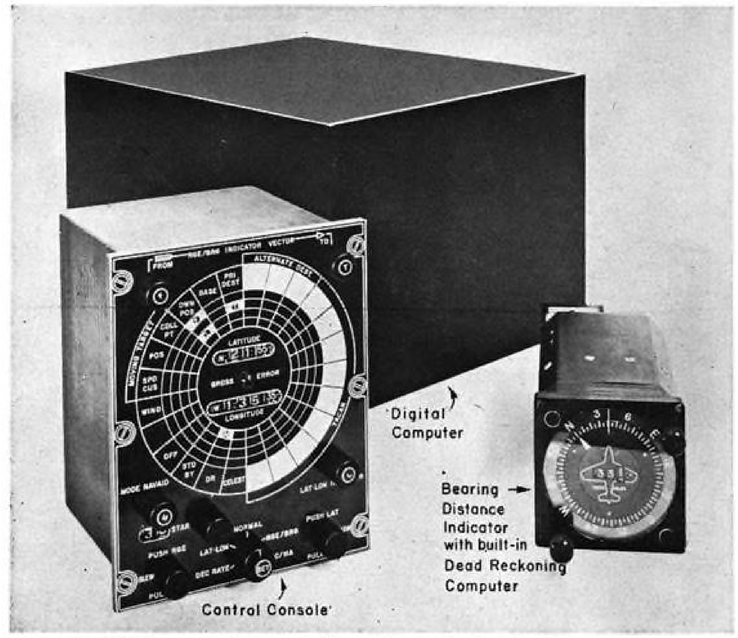
Light Digital Computer Auto-Navigates

By Philip J. Klass

Dayton—Lightweight, self-contained digital auto-navigator, designed to provide self-correcting dead reckoning and celestial navigation service, was revealed here at the recent National Conference on Aeronautical Electronics.

The versatile new auto-navigator could find application in airline and business aircraft in view of growing interest in self-contained navigators for Common System use.

At least one airline spokesman has publicly expressed interest in the potentialities of digital computers (AW Feb. 11, p. 97).



AIRBORNE digital auto-navigator provides self-correcting dead reckoning, celestial service, weighs only 32 lb. and occupies 0.6 cu. ft., including digital computer.

WADC Sponsorship

Librascope is developing the new auto-navigator under Wright Air Development Center sponsorship. A prototype model, weighing only 32 lb. and occupying 0.6 cu. ft. including digital computer and a standby analog dead reckoning computer, is expected to begin flight evaluation within a year.

One advantage of the digital approach is that the system can perform a number of different navigation computations simultaneously. John M. Mayer of WADC's Weapons Guidance Laboratory, who described the new system, said it will be able to provide the following services:

- **Present aircraft position,** in latitude and longitude, as determined by dead reckoning, celestial fix, ground-based navigation aids, or combination of these techniques.
- **Bearing and distance** (great-circle route) to destination, target, waypoints or alternate destinations.
- **Polar navigation.**
- **Automatic compensation** for magnetic variation. Known magnetic variation for different locations around the world can be stored in the computer memory and used to correct automatically magnetic heading input to true north coordinates.
- **Automatic wind computation,** both direction and velocity.
- **Automatic credibility testing.** The aircraft's position, as determined from celestial or ground-based reference, can be continuously checked against the airplane dead reckoned position. If this position, as determined from Vortac bearing and distance for example, coincides with the DR position within reasonable statistical limits, the DR position is automatically revised to agree; if not the Vortac information is disregarded momentarily and another reading is taken. The principles are similar to those of the Lear SCAN, previously described in Aviation Week (June 11, 1956, p. 71).

Like existing analog DR computers, the new Librascope system will work from inputs that include true airspeed, heading plus automatic sextant and doppler groundspeed, ground-based radio or radar when available.

Self-Checking

Computation errors of the digital computer (excluding input sensor inaccuracies) are expected to be less than 0.1%, compared to 1-2% for comparable analog computers. The digital computer portion of the system is expected to weigh only 18 lb., have a power consumption of only 100 watts, and use about 250 silicon transistors and 1,000 silicon diodes.

The digital computer will periodically subject itself to test problems designed to determine whether it is functioning properly.

If the digital computer fails to come up with the correct answer, a warning light will flash in the cockpit indicator and the system will automatically switch over to the simple analog type DR computer built into the panel bearing-distance indicator.

Librascope is developing a miniature star tracker for WADC, which will weigh about 5 lb., and which can provide automatic celestial fixes when used with the new digital auto-navigator. Information on the relative position of up to 57 major stars and planets will be stored in the computer memory.

When the pilot selects one of these stars or planets (by number on his control panel), the computer will position the small star tracker in the approximate azimuth position required to view the selected star and it will scan in elevation, establishing the azimuth and declination angle of the body. (The star must be selected so that there are no other first or second order magnitude stars nearby.)

Solving Triangle

Using star azimuth and declination angles, and stored and pre-set data, the computer can then solve the celestial triangle to obtain a line of position. Two lines of position will in turn establish a fix, which can then be used to correct automatically aircraft position established by dead reckoning.

Since celestial navigation can not be



POWER

for new aircraft in whatever form it takes—

from facilities keyed to the future

An important factor in the success of the J-57 turbojet, which has powered more aircraft at supersonic speeds than any other jet turbine in production, is the excellence of Pratt & Whitney Aircraft's research, engineering, and production facilities in thirteen towns in Connecticut, and in five locations in other states.

These facilities—keyed to the requirements of future power plant developments—are the homes of projects which can influence the whole course of aviation. They include the powerful J-75 turbojet entering volume production this summer . . . a number of advanced and still classified turbine projects . . . and entirely new engines of the future.

Before long these facilities will be supplemented by the test and development center near West Palm Beach, Florida, now being built on a 7,000-acre tract. And Pratt & Whitney Aircraft will develop nuclear power plants in the new multi-million dollar Air Force facility which is nearing completion at Middletown, Connecticut.

Within all these advanced facilities, nearly every branch of theoretical and applied science contributes to progress in aircraft propulsion. Whatever form the future takes . . . in new principles of propulsion, new materials, or new fuels . . . Pratt & Whitney Aircraft is prepared to offer continued advancement in power plant design and production.

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A frank statement about the future in Field Engineering

At first glance, Field Engineering may not seem to possess the potential and stature often associated with other engineering activities.

At *Hughes*, however, nothing could be further from the truth.

Men who undertake the responsible task of evaluating Hughes-produced military equipment in the field are in the enviable position of becoming thoroughly familiar with the complete design and operation of the advanced electronics systems involved.

Essentially, Field Engineering embraces all phases of support required to assure maximum field performance of Hughes armament control systems and guided missiles. E.E. and Physics graduates selected for this highly important and respected phase of our engineering activities work with the armed forces and airframe manufacturers at operational bases and plants in continental United States and overseas.

The knowledge, background and experience so gained assure unusual opportunities for more specialized development in other divisions of the Research and Development Laboratories at Hughes. In fact, few openings in engineering today offer the rewards and opportunities which are available to the Technical Liaison Engineers, Field Engineers, Technical Training School Engineers, Technical Manuals Engineers, and Field Modifications Engineers who comprise the Field Service and Support Division.

Engineers and physicists selected for this highly respected phase of our activities at Hughes enjoy a number of distinct advantages. These include moving and travel allowances between present location and Culver City, California. For three months before field assignments you will be training at full salary. During the entire time away on assignments from Culver City, you'll receive a per diem allowance, in addition to your moving and travel expenses. Also, there are company-paid group and health insurance, retirement plan, sick leave and paid vacations . . . and reimbursement for after-hours courses at UCLA, USC, and other local universities.

E.E. or Physics graduates who feel they are qualified to join the Field Engineering staff at Hughes are invited to write for additional information about this exciting and rewarding opportunity to establish a challenging career in electronics. Write to:

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Scientific Staff Relations • Hughes Aircraft Company, Culver City, California

Trend Spotting

Speaking of the trend toward airborne digital computers, John M. Mayer, Wright Air Development Center, told the recent National Conference on Aeronautical Electronics that it "was about 4½ years ago that we first started seriously considering the application of airborne digital computers to fire control and navigation." On Dec. 29, 1952, nearly 4½ years ago, Aviation Week was the first to report this new development with a story headlined: "Digital Computer Trend Seen."

used at low altitudes with a cloud cover, Robert R. Williamson, staff engineer at Librascope, suggests another interesting possibility. Celestial fixes might be used at the start of a mission to calibrate the amount and direction of steady-state drift in the airplane's gyro. This correction could then be applied to the gyro signal for the duration of the flight, using the DR mode of operation.

Flexible Aid

From the pilot's standpoint, the new computer should prove a versatile aid. At any time during a mission he can set in the longitude and latitude of any desired target or waypoint and the computer will give him the great circle distance and bearing to this point. Or, if he knows only the bearing and distance, he can set these in and the computer will then determine the target's latitude and longitude.

Williamson emphasizes that the control console to be provided with the prototype system is intended to facilitate system evaluation and has not been "human-engineered" for simplicity.

The digital computer itself will be a general purpose type, as opposed to the incremental or digital differential analyzer type of computer. It will operate in serial fashion, using 25-bit length words.

A magnetic drum memory, rotating at 6,000 rpm. will provide 32 memory channels, each with a 64-word capacity. The 2,048 word memory capacity will be divided into a 1,920 word permanent store and a "scratch pad" store of 128 words, according to Mayer.

The magnetic drum will also be used to provide recirculating registers and for timing and control. Analog-to-digital conversion will be accomplished within the computer so that synchro-type sensor input signals can be used directly.

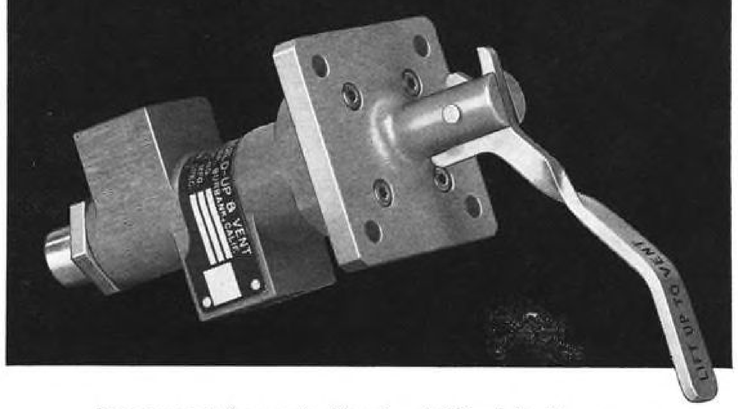
The standby analog DR computer built into the cockpit panel indicator is the miniature, transistorized AN/ASN-9 which Librascope developed earlier under WADC sponsorship.

Here's a

PRESSURE BUILD-UP and VENT VALVE

for aircraft liquid oxygen that gives

DOUBLE the performance at HALF the weight



Designed for use in 70 psi and 300 psi liquid oxygen systems, the ARDC Valve No. 7025 is entirely new in concept. It conserves the valuable oxygen supply by reducing gas-port and vent-port leakage to less than one-tenth of allowable specification limits. Weight is 0.5 lbs. (50% less than specification requirements).

Toggle handle action operates freely at liquid oxygen temperature (-297°F) and permits reduction of filler box dimensions by 50%. Removal of handle automatically places valve in build-up position. Guaranteed not to leak around handle shaft. After filling operations, the vent port seals leak-tight for quicker build-up of system pressure. Valve is interchangeable, no plumbing changes necessary.

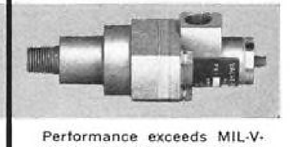
QUALIFIED—ARDC Valve No. 7025 was tested in accordance with Specification MIL-V-8057B and exceeded requirements. It also passed vibration test per MIL-E-5272 Procedure I and has been granted qualification approval by Wright Air Development Center, April 1957.

ARDC CHECK VALVE



For liquid oxygen, nitrogen, helium. No measurable leakage. Available in various sizes and pressure differentials.

ARDC RELIEF VALVE

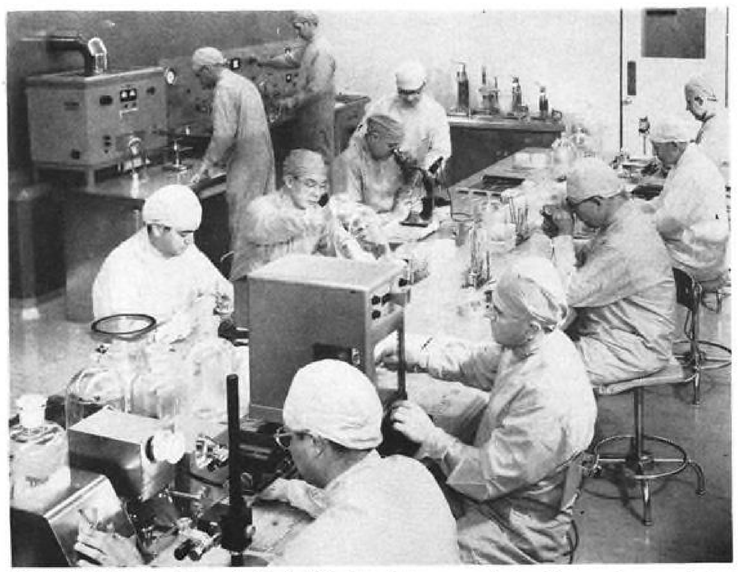


Performance exceeds MIL-V-9050 (Detail Specs. 25169 and 25302). Many sizes for liquid oxygen, hydrogen, helium, etc.

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ARDC

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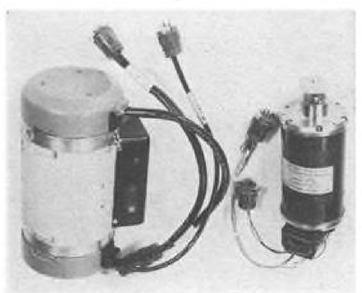
MULTI-MILLION dollar sterile facility has been opened by Sperry to manufacture gyroscopes and accelerometers for extremely accurate inertial navigation, guidance systems.

Dust Over .000012 In. Removed At Sperry Inertial System Plant

Lake Success, N. Y.—Multi-million dollar inertial guidance manufacturing facility, where parts can be machined to tolerances of less than 25 millionths of an inch and the air is filtered to remove dust particles larger than 12 millionths of an inch, has gone into operation here at Sperry Gyroscope Co.

A Sperry official calls the new facility "the finest in the world for manufacturing inertial guidance components and systems, to the best of our knowledge." Prior to designing the new facility, Sperry engineers visited a number of gyro manufacturers, pharmaceutical houses and hospitals to see the latest techniques for maintaining cleanliness.

The only Sperry inertial guidance project specifically identified is SINS (Ship's Inertial Navigation System) undergoing tests on the USS Compass Island.



INTEGRATING gyroscope (left) and integrating accelerometer built in new facility.

Such systems are required by nuclear submarines which can remain under water for long periods of time and for use by vessels that will launch the Navy's Polaris ballistic missile.

However, there is speculation that the Sperry bombing-navigation system for the B-58 Hustler will incorporate an inertial navigation-bombing system in addition to radar.

A visit to the new Sperry facility reveals the extreme pains that must be taken in the manufacture of inertial guidance components and systems to achieve the accuracy required for long-range aircraft and shipboard use. For example:

- **Temperature** in main assembly area is maintained to within one-half degree, humidity is maintained to within 5%.
- **Air is so pure** that if the atmosphere were as clean, it would be possible to see 900 mi. with the naked eye, according to C. D. D'Onofrio, production manager of the Air Armament division.
- **Every part,** whether purchased or manufactured, goes through preparation room where it is deburred using a 45-power microscope and dental tools, later electro-polished.
- **Every tool** is highly polished, cleaned daily by ultrasonics.

Sperry screened 800 employes, for both skills and health, to select the 40 used in the critical assembly areas. Any type of skin disease automatically disqualified a worker.

When a worker reports in the morning, he enters an outer sterile area, scrubs his hands and face (women workers cannot wear any cosmetics), then enters another air-lock room where shoes are scrubbed down. Following this the worker enters another air-lock where his street clothes are dusted off by a high-velocity air blast.

From here the worker enters another air-lock, takes off his street clothes, dons nylon pants and shirt, then gets into a nylon coverall, places nylon boots over his street shoes, and dons a nylon hat. (The nylon work clothes are cleaned and sterilized every night.) Following this, the worker enters air lock where he is again subjected to the high velocity air blast.

Then, after going through two more air locks, the assembler proceeds to the inner work area.

To eliminate any possible lint, no paper or pencils may be brought into the sterile area.

All blueprints are prepared on photosensitive plastic; all notes and test data are taken with ballpoint pens on vinyl plastic sheets. The walls of the individual work rooms are covered with vinyl plastic.

Despite all these efforts to keep foreign matter out of the assembly areas, components are kept in plastic bags or under bell jars when not in use as a further precaution.

When the integrating gyros are completely assembled, they are tested for accuracy and drift on a three-ton instrument mounted on seismic blocks below the ground to isolate it from extraneous disturbance. Although Sperry declines to quote accuracy figures for its gyros on security grounds, test equipment is capable of detecting gyro drift of less than 1/600 deg.



FINAL test on gyro is run on precision turntable mounted on seismic blocks.



WAITING FOR A CHANGE

Development of aircraft and aero engine design is a pattern of never ending changes and modifications. Improving engines and airframes demands more strength in more and better parts. Example: There are about 1,300 machined parts in the F-100A. In the F-100D, improvements have added 500 more. Higher power and speeds in the same size airframe call for improved elevated temperature performance in alloys for structures, forgings and fasteners.

The big problems have been the forgeability and machinability of the tough alloys used in the intermediate elevated temperature applications. But they're being licked. Carpenter is now producing uniform elevated temperature alloys of very high quality which consistently meet tough aircraft specifications. Their quality and cleanness also allow tightened forging tolerances, improve machinability and cold forming properties. Result: More accurate forgings with better finishes . . . fewer rejects . . . faster production.

Complete information on application, fabrication and engineering properties of these alloys is summarized in our new booklet, "Carpenter Alloys for Elevated Temperature Service". For your copy, drop us a line on your Company letterhead. The Carpenter Steel Company, 128 W. Bern Street, Reading, Pa.

Carpenter STEEL

Improved alloys for elevated temperature service

MORE ABOUT BRISTOL'S "WHISPERING GIANT"

No runway problems for the Britannia



The brilliant new Bristol Britannia is the world's largest, fastest turboprop airliner ... yet operates from existing runways throughout the world.

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The Britannia is powered by four 4,120 horsepower Bristol Proteus engines, cruises at 400 m.p.h., carries up to 133 passengers at amazingly low operating costs.

She is the world's most versatile airliner because she maintains her matchless standards of efficiency and economy on an extremely wide variety of stage-lengths ... from the longest trans-polar flight to short inter-city runs. On all counts, the Britannia is years ahead of any other passenger aircraft.

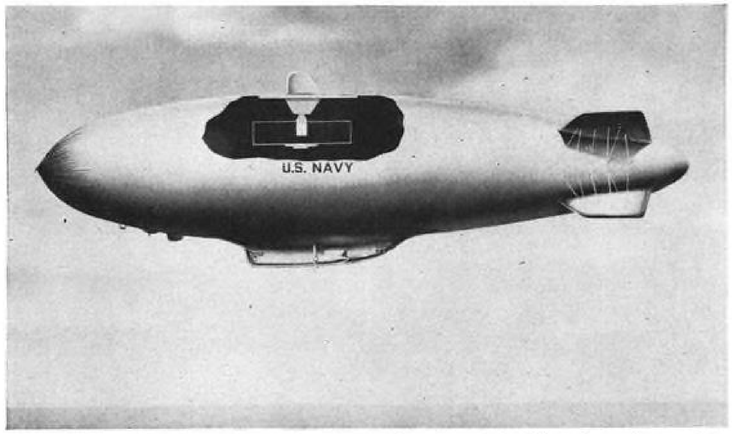
She is now in commercial service with British Overseas Airways Corporation. Britannias have also been ordered by Northeast Airlines, Canadian Pacific Airlines, El Al Israel Airlines, Hunting-Clan Air Transport, The Royal Air Force and The British Ministry of Supply.

BRISTOL

Britannia

BRISTOL AIRCRAFT LIMITED, ENGLAND





CUTAWAY drawing shows how radar antenna is mounted in blimp for early warning.

Radar-Carrying ZPG-2W Blimp May Play Air Warning Role

Akron, Ohio—Display here of Goodyear Aircraft Corp.'s modified ZPG-2W blimp with interior radar screen brought favorable response from high-ranking Continental Air Defense Command officers.

Growing part in the country's air defense warning system for such blimps with large radar antennas rotating inside their gas bags was foreseen by Rear Adm. Hugh Goodwin and Lt. Gen. Stanley Mickelsen, commanders of the Naval and Army components of tri-service CONAD, and Rear Adm. J. S. Russell, chief of the Navy's Bureau of Aeronautics. The officers agreed that the combination of large radar screens with low speed, long duration operation will make airships like the ZPG-2W suited for off-shore early warning missions.

All Weather

Because the blimps should keep the large radar scanning systems on station in all weathers, and because they will be able to maintain the radars at altitudes from sea level to 10,000 ft., they are expected to be superior to lower shipboard mounted radars, which are susceptible to sea-clutter interference from surface waves. Also, compared to the blimps, converted Lockheed Constellations (WV-2) are limited in the size of the radar they can carry as well as in their flight duration.

The approximately 1,000,000 cu. ft. volume, helium-filled ZPG-2W costs about $2½ million. It carries a bed-spring-type antenna suspended from a large plate riding on top of the gas bag. Height finding radar protrudes from the top of this plate. Also inside the bag is a series of electronic countermeasure devices for jamming enemy transmission frequencies.

The ZPG-2W carries a double deck car slung underneath. Lower deck houses the flight deck, radar scope room, internal engine room and fuel tanks. Upper deck houses the crew's quarters. Compared to the interior of a Constellation WV-2, there appears to be about the same amount and type of radar gear, but there is considerably more room for crew off-duty relaxation and rest.

Goodyear describes the operational advantages of a blimp in this sort of mission as follows:

- **Only vehicle** which can maintain a large radar antenna at optimum altitude on a sea station.
- **Low vibration level** means less failure and malfunction of electronic devices. For the crew, it means that much of the strain of extended airborne duty is eliminated.
- **Roominess** means engines and electronic gear can be dismantled for repair while under way.
- **Low speed** makes station keeping simple.
- **Fuel consumption** is only a few gallons per hour instead of hundreds of gallons per hour in a comparable heaver-than-air craft. Goodyear says it is a common practice to shut one of the blimp's engines down and cruise on the other.

Also on view in the Goodyear hangar was a 1,500,000-cu.-ft.-volume blimp under construction. At present the envelope is inflated but the car and tail surfaces have not yet been attached. Cost is expected to be $4 million.

A Goodyear spokesman said the firm had been considering a 4,000,000-cubic-ft. blimp but the project was dropped in favor of the intermediate step. But Goodyear officials emphasize that they do not know the limit to the possible size of a non-rigid airship. They have been discussing with Navy the possibility of building a nuclear propelled blimp for research purposes.

Nuclear Propulsion

Goodyear claims that a lighter-than-air ship is the only type of aircraft which is within the present state of the art for nuclear propulsion. Basically this is because a blimp, like a submarine, needs propulsion only for translational motion, since both of them displace sufficient volume to keep afloat in their respective mediums. A blimp has the additional advantage of permitting separation of its crew from the reactor. Shielding can be concentrated around the reactor, which would probably be placed in the stern, while the crew's car is shoved far forward. This would make ground handling easier.

There is no particular need for nuclear propulsion in blimps since their consumption or normal fuel is low. But blimps would provide one almost ready-made means of getting a nuclear propulsion system airborne, Goodyear says.

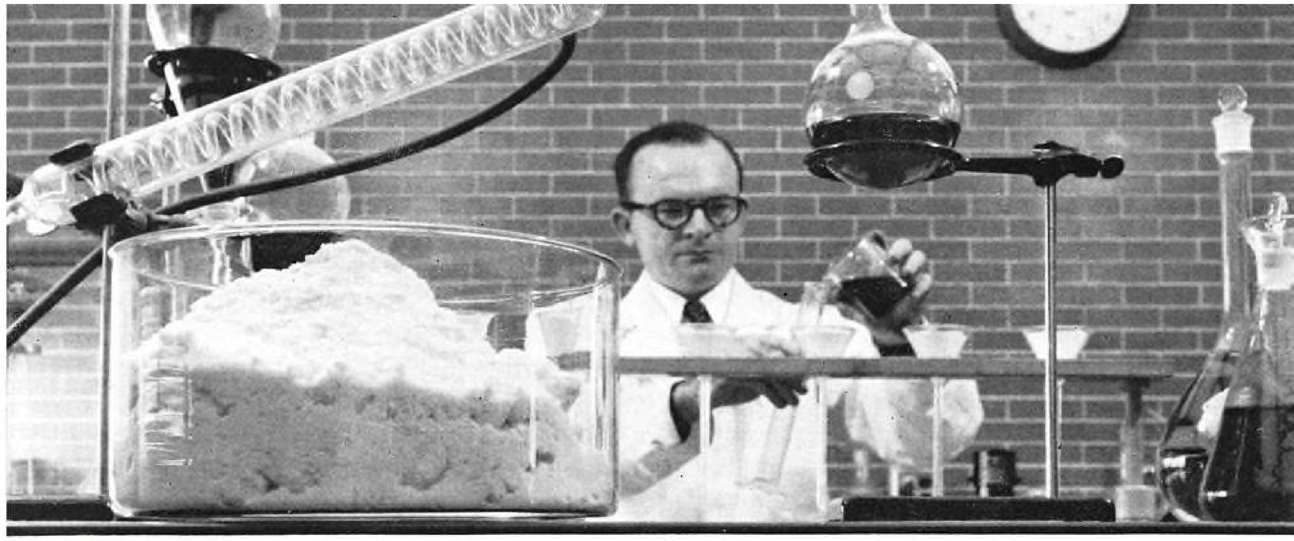
FILTER CENTER

(Following items are based on papers delivered at the recent National Conference on Aeronautical Electronics in Dayton—Ed.)

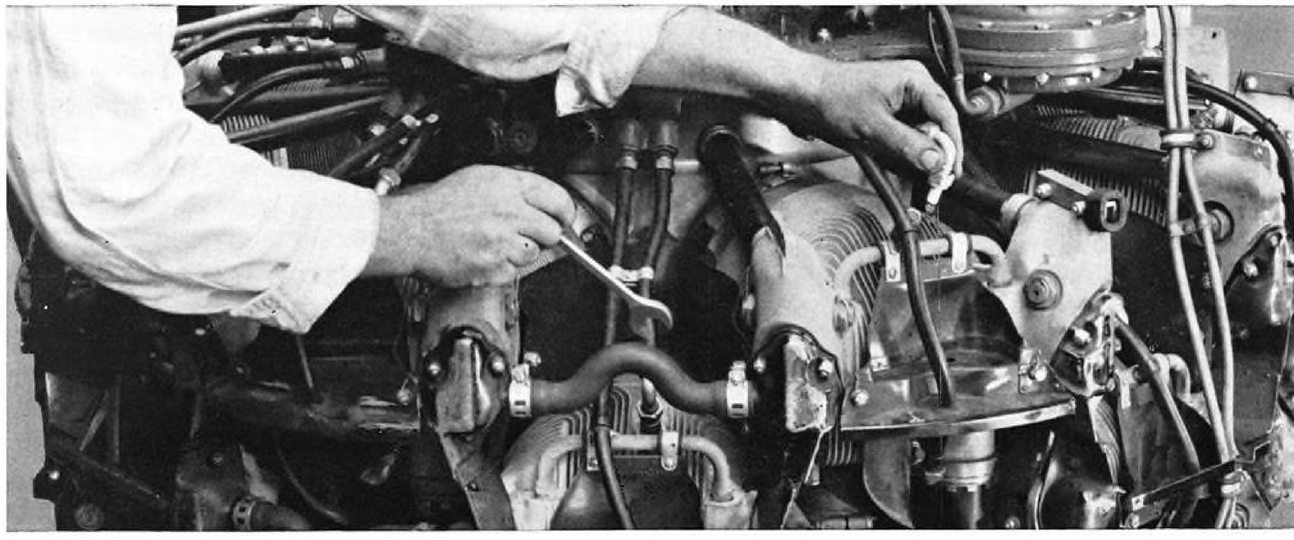
▶ **New Communication Horizons?**—Engineers were urged to take a fresh look at some of the basic communication techniques employed in nature in the hope of finding techniques other than electromagnetic radiation. George Scheer of Wright Air Development Center's Communication & Navigation Laboratory, pointing out that the male luna moth can detect and home in on infrared energy in the 7 to 13 micron region radiated by the female moth at distances of seven miles, called for closer liaison between biophysics and avionics.

▶ **High Temperature Tubes**—Bendix Aviation's Red Bank division has developed ceramic vacuum tube, under USAF sponsorship, which can be operated at ambient temperatures of 400C. Conventional glass envelope is replaced by a metal-ceramic envelope which also serves as the tube's anode.

▶ **Low-Frequency TWT Amplifier**—Traveling-wave tube capable of operat-



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HIGH-TENSION IGNITION CABLE / *tough, new high-performance aircraft cables!*

No silicone-insulated cables ever made equal the high-performance characteristics of Packard Electric's new, high-heat, high-tension cable, built to exceed the requirements of MIL-C-3162 for TYPE 1, GRADE B, CLASS 1 or 2 service—operating temperature range 450°F. to −65°F.

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combat flight characteristics
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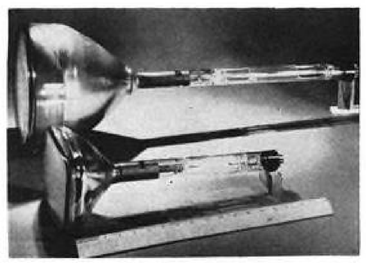
Cessna

ing at frequencies of 60 to 300 mc., measuring less than 36 inches long, has been developed by General Electric's Microwave Laboratory, Ward A. Harman reported. Previously available TWT amplifiers operated only in the microwave region. Maximum power output for the experimental Type Z-5092 is 240 watts at 220 mc., with half power points at 100 and 320 mc. Beam efficiency exceeds 40%.

► **Airborne Atomic Frequency Standard**—A miniature airborne version of the Atomichron, which weighs 65 lb. and occupies a volume of less than 2 cu. ft., excluding power supply, has been developed by National Co. The airborne atomichron has a stability of several parts in 10 billion. A modified version being developed for an undisclosed navigation system reportedly will have a stability of one part in 100 billion, according to J. J. Bagnall and J. H. Holloway.

► **Word Of Warning**—Cornell Aeronautical Laboratory studies indicate that the temperature of a vacuum tube's glass envelope is not always a reliable index of the temperature of its electrodes, CAL's J. P. Welsh reported. Tests to date indicate that bulb temperature is an accurate criterea only if it does not exceed 140C and the tube is operated at 70% or less of its maximum rating, Welsh said. Program was sponsored by Navy Bureau of Ships.

► **Short, Lightweight Wamoscope**—Sylvania has developed new model of its Wamoscope, combination traveling wave tube amplifier and cathode ray tube (AW Sept. 17, 1956, p. 75.) which is only 17 inches long and weighs only 4 lb. including solenoid, compared to 31 inch length and 24 lb. weight of



original model, D. E. George reported. (Paper was co-authored by Dr. R. G. E. Hutter.) The new Wamoscope (see photo) uses a 90-degree deflection system instead of previous 52-degree system, has rectangular instead of circular viewing area. Present model operates in S-band (2 to 4 kmc.), but George said Sylvania is developing an X-band Wamoscope for the Signal Corps. Another development effort is aimed at eliminating the solenoid which would cut the overall weight of the unit by 40%.

► **Delrac Timetable**—Delrac, long-range area-coverage ground-based system proposed by Britain for international adoption, could be put into trial operation a year after work was started, D. H. Toller-Bond estimated. However, because of the high cost of building the required 600-1,200 ft. antennas and high-power transmitters, the British Decca Co. has no immediate plans to put up an operating Delrac facility, Toller-Bond said.

► **New Name**—Sperry Cytac long-range navigation system (AW April 15, p. 101) has been re-named Loran-C. The cycle-matching Loran system was originally dubbed Cytac when it was being developed for tactical use.

► **Flat Tube Display Evaluation**—Navy's radically different cockpit instrument display, using flat TV-type tube developed by Kaiser, is slated to undergo flight test evaluation in a T2V later this year, according to Rear Adm. Rawson Bennett, Chief of Naval Research.

Expansions, Changes In Avionics Industry

Philco Corporation has opened new Western Development Laboratories in Redwood City, Calif. New facility, part of Philco's Government and Industrial Division, will be headed by Oscar T. Simpson, general manager, and Dr. Walter LaBerge as manager of systems engineering. The latter formerly headed the missile development division of the Naval Test Station at China Lake, Calif.

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

• **General Electric's Electronic Components Division** has established separate sales organizations for each of its five departments (cathode ray tube, power tube), receiving tube, semiconductor products and specialty electronic components) but all five will work out of same district sales offices, GE says.

• **Texas Instruments Inc.**, Dallas, has opened new semiconductor-components division marketing office in the Wilson Building, Camden 2, New Jersey. Company also has moved division headquarters office to new quarters in Dallas at 2929 Cedar Springs Road.

• **Waldale Research Co., Inc.**, has moved from Las Vegas to El Monte, Calif. New address: 11626 McBean Drive.

• **Federal Telecommunication Laboratories** has moved into its new 6,000 sq. ft. research and development facility

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CYLINDER COMPRESSION TESTER



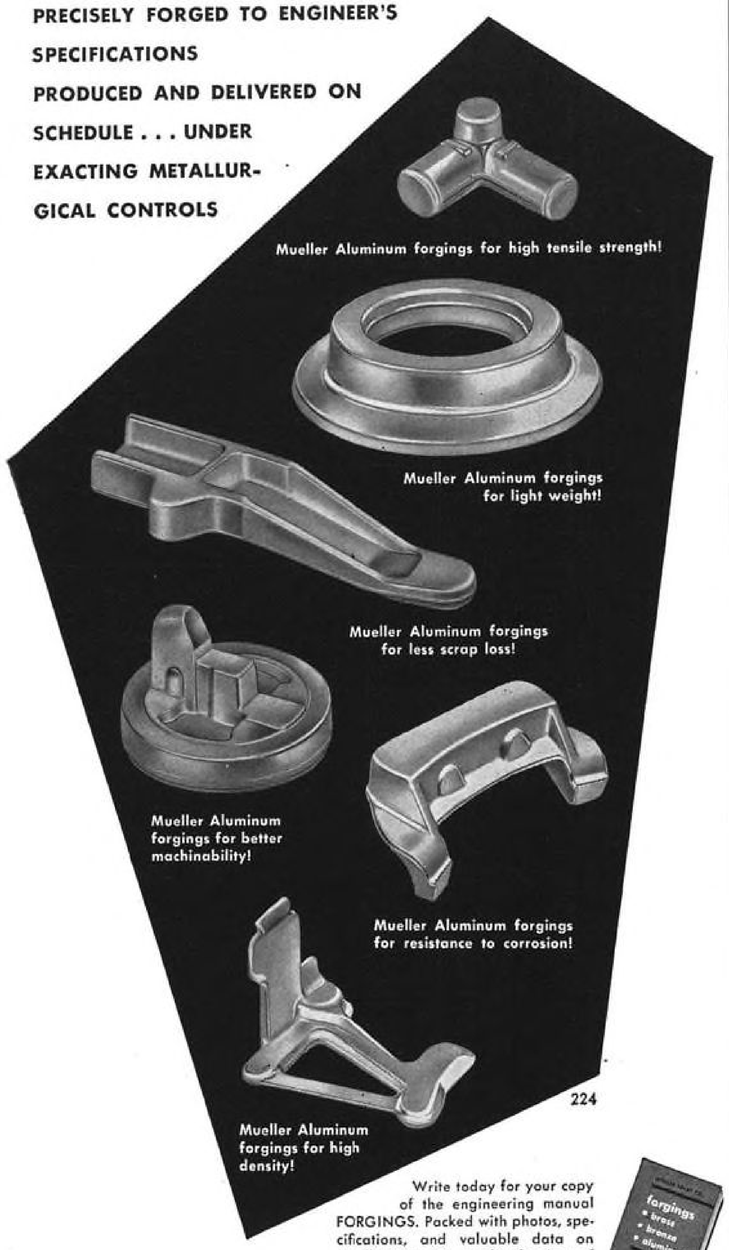
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One ACCRO-MATIC tester installed in each cylinder will register and retain the maximum pressure simultaneously, thereby indicating immediately any defective cylinders.
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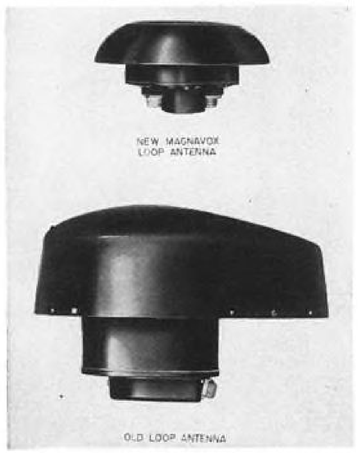
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Small ADF Antenna

Small, lightweight ADF loop antenna which weighs only 7½ lb., half as much as its predecessor, and occupies only one-third as much space, has been developed by The Magnavox Co., Ft. Wayne, Ind. The ferrite-core loop antenna, which protrudes only 2½ in. from the airplane skinline, operates between 190 and 1,760 kc., is rotated by a two-phase motor, and includes a synchro transmitter for bearing information.

at 937 Commercial St., Palo Alto, Calif.

• **Walter Kidde & Co., Inc.**, has transferred operations of its Thermalectric Engineering division from Van Nuys, Calif. to its Aviation Division at Belleville, N. J. The Thermalectric name is being dropped and its products, including thermal switches and heat detectors, will be produced and marketed in Belleville under the Kidde name.

• **Colorado Research Corp.**, Denver, will move to new 15,000 sq. ft. laboratory in Broomfield Heights, 15 miles northwest of Denver when new facility is completed late this year.

• **Philco Corp.** and **The Plessey Co., Ltd.** of England have formed new company, called Semiconductors Limited, to produce transistors under Philco patents. Initial production is scheduled to begin early in 1958. Plessey will own 51% interest, Philco the balance.

• **A. L. Livera & Associates, Inc.**, Madison, N. J., has been appointed sales representative for Clevite semiconductors in the New York City, Long Island and upper New Jersey region.

• **Components, Inc.**, Cleveland, will represent Rotron Manufacturing Co., maker of cooling equipment, in northern Ohio and western half of Pennsylvania.

• **MEL Sales**, Arnprior, Ontario, has been named to handle Canadian sales for The Reflectone Co., Stamford, Conn.

SPECIFICATIONS

208/120 Volts, 0.75 Power Factor, 3 Phase, 400 CPS

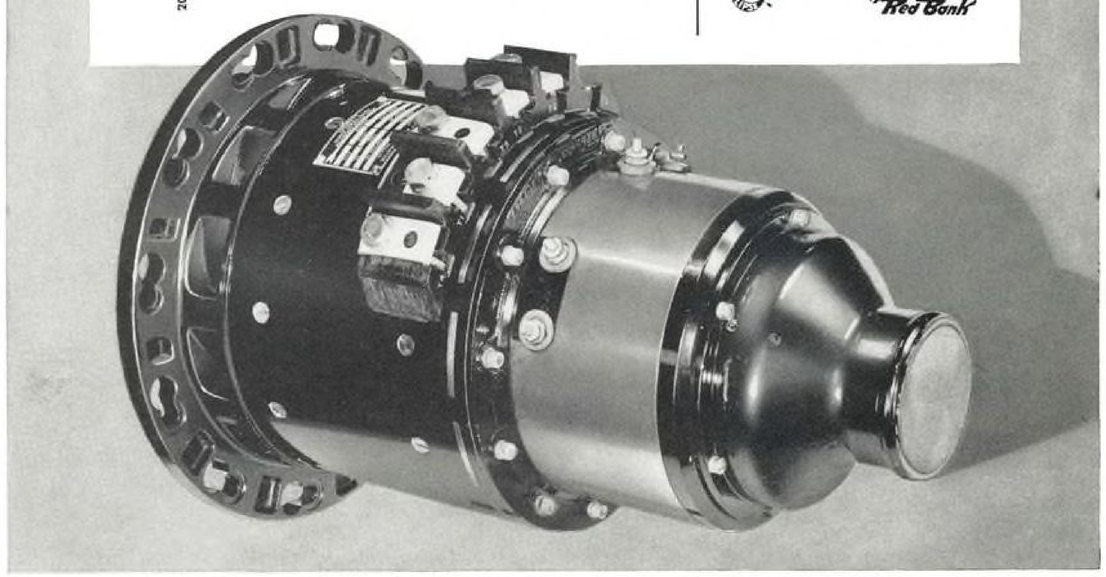
Type No.	Rating KVA	Rated Cooling Air Pressure in "H_2O"	Rated Cooling Air lb./min.	Diam. in.	Speed RPM	Approx. Weight lbs.	Flange and Drive Spline
*28E16-1	20	4	11	8.25	5700-6300	60	AND 10266 XVI-A
*28B23-1	20	4	11	8.25	4800-7200	65	AND 10262 XII-A
*28E17-1	30	8	14	8.25	5700-6300	69	AND 10266 XVI-A
*28E14-1	40	5	14.5	9.25	5700-6300	83	AND 10266 XVI-A
*28E15-1	60	6	16	9.25	5700-6300	103	AND 10266 XVI-A
28E19-1	10	4	7	6.5	7600-8400	30	AND 10262 XII-A
28E19-3	10	4	7	6.5	7600-8400	31	New 9" Flange
28E20-1	20	6	8.5	6.5	7600-8400	45	AND 10262 XII-A
28E20-3	20	6	8.5	6.5	7600-8400	46	New 9" Flange
28E21-1	30	10	12.4	6.5	7600-8400	60	AND 10262 XII-A
28E21-3	30	10	12.4	6.5	7600-8400	61	New 9" Flange
**28E10-1	9	6	8.6	6.5	7600-8400	39	AND 10262 XII-A

*These generators include integral fan permitting full load continuously up to 80°C. at sea level with no additional cooling.

**This generator incorporates a DC output of 30 volts, 50 amps capacity in addition to the AC output.

All generators have been designed to MIL-G-6099 and MS-33542, which specifies cooling air of 120°C. at sea level, 40°C. at 50,000 ft., and −12°C. at 65,000 ft., and will deliver full-rated load under these conditions.

Bendix Red Bank



HOT GENERATOR PROBLEM? HERE'S THE ANSWER: BENDIX RED BANK HIGH-TEMPERATURE AC GENERATORS

If you have an AC Generator cooling problem, here's the solution. Bendix Red Bank High-Temperature AC Generators meet military class C air-cooled specifications and combine a minimum of size and weight with a maximum of performance. Ranging from 9 KVA to 60 KVA, they are designed as part of complete Red Bank high-temperature AC generating systems. These also include magnetic amplifier voltage regulators and system protection components. For details, write Red Bank Division, Bendix Aviation Corporation, Eatontown, New Jersey.

ATTENTION ENGINEERS—We have unusual opportunities for experienced design engineers to work on aircraft type AC and DC rotary power supplies and associated control equipment and distribution systems. Write today: Attention of Personnel Dept. L.

West Coast Sales and Service: 117 E. Providencia Ave., Burbank, Calif.
Canadian Distributor: Aviation Electric, Ltd., P. O. Box 6102, Montreal, P. Q.
Export Sales and Service: Bendix International Division, 205 E. 42nd St., New York 17, N. Y.

Red Bank Division

Bendix AVIATION CORPORATION

EDISON'S SIZE 11 GEARHEAD MOTOR

1000 TO 1
GEAR RATIO UNIT
USED IN
BOEING'S BOMARC

Typical of the specialized servo motor work done by the Edison Instrument Division is a size 11 gearhead motor with 1000 to 1 gear ratio. This unit is currently being supplied to Boeing for use in its newest missile project, the Bomarc.

This gearhead motor offers minimum size and weight for systems designers, and extremely fast delivery schedules on units of this type make its use mandatory wherever applicable.

Edison's capabilities in servo motors, servo instrumentation, and associated precision equipments and systems are the result of years of cumulative engineering experience and the best in modern machine shop and quality control facilities. When critical requirements are necessary for servo motors or allied components, or if you'd like to know more about Edison's Systems work, write for *The Systems of the Instrument Division.*



McGRAW EDISON

Thomas A. Edison
INDUSTRIES
INSTRUMENT DIVISION
WEST ORANGE, NEW JERSEY

NEW AVIATION PRODUCTS

Tachometer Calibrator

Electronic decade type counter used for tachometer calibration has an electronically adjustable-speed drive, instrument under test being driven at speeds ranging from 0-5,000 rpm., definitely adjustable by means of a 10-turn potentiometer. For rapid production testing, a push-button switch will select any of five pre-determined test speeds.

Driving speed is continuously displayed with an accuracy of ±1 rpm. plus line frequency error. Counter may also be used for checking inverter frequency, telemetering switch counts and the like. Electronic pickup accessory permits checking rotation or lineal speed of motors, gear trains, etc.



Servo-Tek Products Co., 1086 Goffle Rd., Hawthorne, N. J.

Miniature Rate Gyro

Miniature rate gyroscope, called Golden Gnat rate gyro, Type GN, is suited for autopilot damping, radar antenna stabilization and fire control applications.

It measures one inch in diameter, is 2¼-in. long, weight is 3.8 oz. Range of full scale rates is up to 600 deg./sec. Threshold and resolution is stated to be 0.01 deg./sec. Inertia ratio is 0.00045 sec.

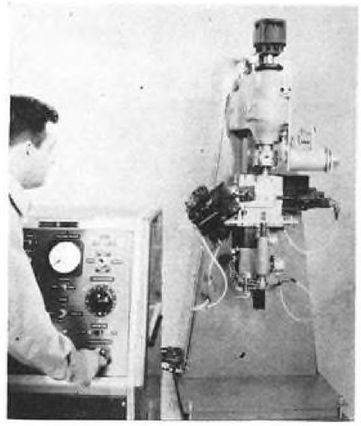
Boston Division, Minneapolis-Honeywell, 1400 Soldiers Field Rd., Boston 35, Mass.

Pilot Valve Weighs .375 Lb.

Three-way normally opened magnetically operated miniature pilot valve weighs 0.375 lb. and is rated for 4,500 psi.

Designated Model MV-137-G, unit has a hermetically sealed solenoid operating within a 14-32-v. range to control flow through what is equivalent to a sharp-edge orifice diameter: 0.030 in. Unit has an ambient temperature of −100F to 250F and a fluid temperature range of −65 to 250f.

Marotta Valve Corp., 330-10 Boonton Ave., Boonton, N. J.



Remote Positioner

Electrolink is a closed loop servomechanism system for precision tolerance positioning of tools machining radioactive materials. All normal hand operations can be carried out from a remote station with operator shielded by lead or concrete walls.

Quick positive stops of the load motion are possible by magnetic powder clutches. Oscillation and hunting are prevented by transmitting a voltage, proportional to servo-drive velocity, from an integral velocity generator to the control.

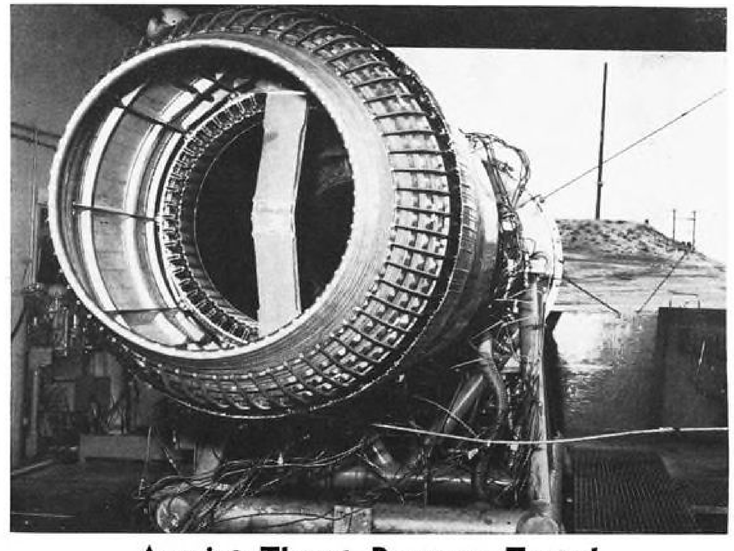
Units are used by a major manufacturer on a Hardinge lathe on both the compound and cross-feed motions, with a third on a milling attachment. Entire system occupies less than one cubic foot and weighs less than 11 lb. Models are available for either 60-cycle or 400-cycle input.

Lear, Inc., 110 Ionia Ave., N.W., Grand Rapids, Mich.

Vibration Monitor System

Non-electric vibration monitor system is stated to be sensitive to increases in vibration yet ignores both that incurred in starting and transient shocks due to normal operation.

Applications include protection of pumps, motors, blowers, compressors, centrifuges, engines, turbines and other equipment. Unit includes Robertshaw Model 65 malfunction detector and Model 651 a.c. control unit wired to



Aerojet Thrust Reverser Tested

"Aerobrake" jet engine thrust reverser has been tested successfully on an Allison J71 turbojet. Program involved 170 hr. of testing, of which 30 hr. were under various engine operating conditions. Device was developed by Aerojet-General under license from the French firm, Snecma. Aerojet engineers say Aerobrake proved capable of satisfactory thrust reversal without adverse effects on the performance of the engine. Aerojet pronounced it fail-safe and effective in flight as well as on the ground. Maximum reverse thrust can be obtained in about 3½ sec., tests showed. Aerojet says that, with modifications, the reverser can be made to perform satisfactorily with other jet engines in use today. Aerobrake is shown in the reverse thrust position. Structure in center of the tail pipe is reverser's exhaust deflector.

What Research Means to American Business

American industry plans to invest $150 billion in new plant and equipment during the next four years—more than in the five years 1952-1956. It plans to carry out this record investment even though manufacturing capacity has nearly doubled since World War II. These facts are reported in McGraw-Hill's tenth annual survey of Business' Plans for New Plants and Equipment. They contradict many long-established theories about investment in capital goods.

According to the textbooks, a high and rising level of capital investment is generally followed by a decline. The bigger the rise—so the old theory goes—the bigger the decline will be. But, after a decade of high-level investment and an especially strong rise in the past two years, industry now has plans to keep right on with near-record outlays for plant and equipment. Does this mean some new factor has been added, to change the investment cycle?

The New Factor—Research

The latest McGraw-Hill survey points out one new factor which, more than any other, is changing the nature of the investment process. This is the record outlay planned by U.S. corporations for **scientific research and development**—to create new products and develop new industrial processes. The rapid growth of research in industry, and plans for even more remarkable growth in the years ahead, are shown by the accompanying table.

This year industry plans to spend $7 billion on research and development — up 20% from 1956. By 1960 it will spend $9 billion—enough to create a major new industry.

By 1960 manufacturing industry expects sales to be up 26% —with half the increase in products that were not made in 1956.

Growth of Research and Development Expenditures

(Millions of Dollars)

	1955	1956	PLANNED 1957	PLANNED 1960
Machinery	408	506	577	704
Electrical Equipment	950	1,149	1,310	1,637
Aircraft and Parts	1,038	1,558	2,274	3,161
Fabricated Metal Products and Ordnance	134	165	174	210
Professional and Scientific Instruments	185	252	300	453
Chemicals	440	498	528	617
Paper, Rubber, Stone, Clay and Glass Products	149	174	196	233
Petroleum Products	171	205	225	277
Other Manufacturing	1,038	1,279	1,388	1,557
Non-manufacturing industries	254	310	347	419
ALL INDUSTRIES	4,767	6,096	7,319	9,269

What Research Is Doing

Here are some examples of how industrial research is opening up new markets, or compelling the modernization of old facilities:

New automatic controls in petroleum refining will raise the quality of gasoline and reduce the time required for production. A new process for recovering oil from depleted wells promises to multiply our potential reserves.

A new process for treating iron ore will permit the ore to be fed directly into steel furnaces—without the need for blast furnaces or coke ovens.

New turbine engines—made possible by the development of heat-resistant alloys for turbine parts—offer greatly increased power for aircraft, ships and automobiles.

Altogether, industry plans to introduce more new products in 1957-1960 than in any previous four-year period. It also plans new processes on a scale that will make much of our present capacity obsolete. These new products and new processes are the secret behind continuing plans for high investment.

One-third of all manufacturing firms are building new plants this year to produce new products, and by 1960 this may account for 10% to 20% of all capital expenditures. At the same time, manufacturing companies report that over half their capital expenditures in the next four years will be for modernization of equipment and introduction of new processes. Thus the preponderant share of new investment will be based on developments growing out of research.

A New Kind of Prosperity

The keen interest of U.S. business firms in scientific research points the way to a new kind of prosperity for our economy —a prosperity based on deliberate creativeness. As long as we can create new products that will offer better value to consumers or cut costs to manufacturing firms, business will continue at a high level—not at fever pitch, perhaps, and it is to be hoped not at an inflationary pitch. But based on a steady stream of new products and processes, we can have a high level of general prosperity that defies the old laws of boom and bust.

It's Not Automatic

Of course, there is no guarantee. New products do not spring up by magic as the medieval alchemists hoped they would. They are found as the result of long and expensive effort in laboratories and pilot plants. This effort requires an increasing number of trained scientists and engineers. In 1957 alone, manufacturing companies report they will need 7% more of these highly trained people in research and development. And by 1960, they will need an additional 15% to carry out planned research programs.

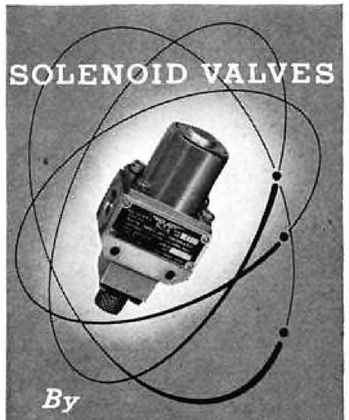
The effort to maintain prosperity — as well as the national defense effort — will depend increasingly on this supply of scientific and technical personnel. But if we can supply the people, industry now has the plans for a research effort that will put an end to the spectre of idle plants and idle workers.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nation-wide developments. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw
PRESIDENT

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SOLENOID VALVES



By

M.C. MFG. CO.

The one shown is:

MC 2644-1 VALVE—SHUT OFF SOLENOID OPERATED

fulfilling the following aircraft specifications:

FLUID: Air or Nitrogen
PRESSURE RANGE: 0 to 1500 psi
TEMPERATURE RANGE: —65°F to +160°F
FLOW FACTOR: F=.05
INTERNAL LEAKAGE: 10 cc/min. max. at 18 to 30 volt DC, 200 to 1500 psi inlet pressure
EXTERNAL LEAKAGE: Zero
SOLENOID: Continuous duty Voltage range 18 to 30 volt DC 1.5 amps max. at 27 volt DC
PORT CONNECTIONS: Per AND 10050-4
WEIGHT: .9 lbs.
MILITARY SPECIFICATION: Applicable paragraphs of MIL-P-5518 and MIL-P-8564

Hydraulic and Pneumatic Components for the Aircraft Industry

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

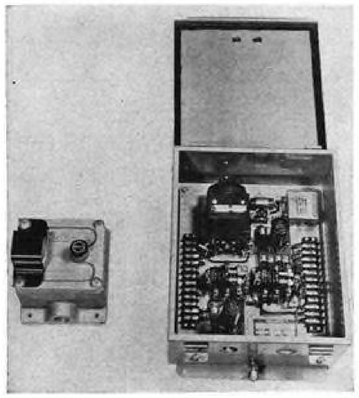
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M.C. MANUFACTURING CO.
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West Coast Office: 716 Wilshire Blvd. Santa Monica, Calif.

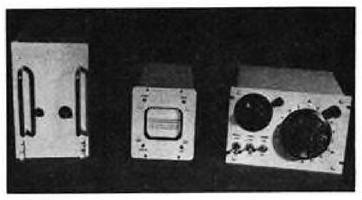
Representatives:
D. & O. ENGINEERING CO.
P.O. Box 3107, Wichita, Kansas

F. C. MINCH
1132 Donson Drive, Dayton 10, Ohio



the detector through three-quarter inch conduit. Malfunction detector trips if vibration exceeds the preset level.

Fielden Instrument Division, Robertshaw-Fulton Controls Co., 2920 N. Fourth St., Philadelphia 33, Pa.



Vibration-Ignition Analyzer

Airborne ignition analyzer for 7, 9, 14, 18 and 28-cylinder engines is built in three separate packages having a total weight of 27 lb., the switching package incorporating the normally separated vibration selector switch.

Total volume of the Inflite 136 is 0.7 cu. ft.; power consumption is 250 watts.

Land-Air, Inc., subsidiary of California Eastern Aviation, Inc., 7444 W. Wilson Ave., Chicago 31, Ill.



Gas Compressor for Missiles

Gas booster compressor supplies high-pressure, dry helium or nitrogen for missile and test applications using a variable inlet pressure source operating without lubrication to ensure material is not contaminated by oil.

Gas pressures may vary from 6,000 psi to 10,000 psi, with average capacities from 10 to 20 scfpm., compression being handled by an integral two-stage hydraulic-driven single-acting gas pump. Either an electric motor or gasoline engine prime mover can be provided as a part of the equipment.

Haskel Engineering & Supply Co., Glendale, Calif.

Function Programmer

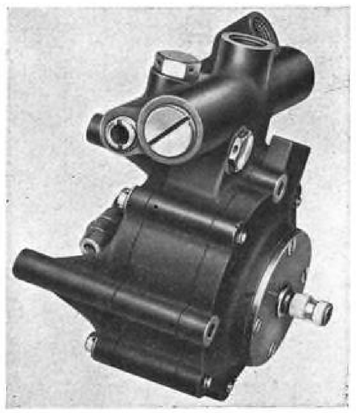
An electro-mechanical function programmer for use in missiles, aircraft and automatic control of machinery has eight switching elements which can be sequenced in multiples to handle up to 32 switching functions. Units can be provided with linear or non-linear potentiometer elements used in lieu of or combined with switching elements.

Hubbard Scientific Laboratories, Inc., 1292 E. Third St., Pomona, Calif.

Rotary Torque Booster

Type 141F12 rotary torque booster is designed as fail-proof unit providing hydraulic amplification at an 8:1 ratio. A dirt-insensitive servo valve, combined with protection against torque feedback to throttle input, are key features.

In event of hydraulic power failure, a direct mechanical link allows no-boost

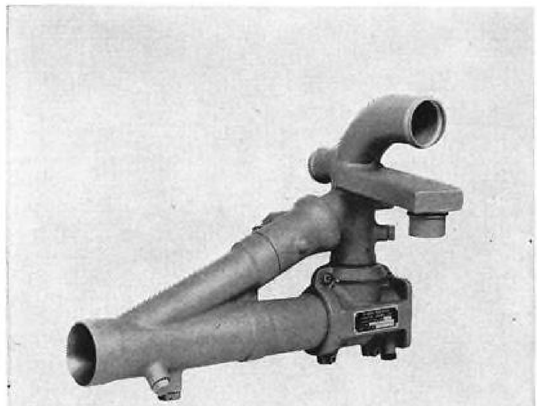


operation of the engine control. Design permits input overloads of 600 in.-lb. without damage. Either fuel or oil can be used as the operating medium.

Aircraft Products Division, Manning, Maxwell & Moore, Danbury, Conn.

Correction

Recently developed visual fire detection system, developed by Pyrotector, Hingham, Mass., signals alarm in less than 15 milliseconds, not 15 min., as inadvertently reported here (AW Apr. 22, p. 131). Unit, which offers complete discrimination against sunlight and all forms of interior lighting, is designed for aircraft and rocket applications. Standby current is 100 microamps at 28 v. d. c.



MODEL 111 BLOWER
High speed, lightweight, small size. For missile applications.



MODEL 119
ALTERNATOR COOLER
Shut-off Valve. Pneumatically-actuated, open-closed, butterfly type.



MODEL 100 BLOWER
For aircraft applications. High speed, high pressure rise.

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Successful engineering demands the highest order of creative thinking, tempered by a finely-tuned sense of responsibility. At Propulsion Research Corporation you'll find such engineering to an exceptional degree, always balanced by a deep understanding and appreciation of your problems. This blending of skill, purpose and understanding enables PRC to create accessories which set new standards of performance and efficiency for both aircraft and missiles. And in addition to providing a fully-engineered accessory to your specific needs, PRC has the integrated production facilities to produce your accessory efficiently, accurately and economically. You're invited to utilize the exceptional talent and experience of PRC — you need only call in our accessories engineers. They'll be glad to work with you.

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Navy Contracts

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

BUREAU OF AERONAUTICS, Wash. 25, D. C.

Loral Electronics Corp., 794 E. 140th St., N. Y., N. Y., pilot's dead reckoning indicators, NOas 57-550-f (PD-42-1236-57), $179,121.

Specialties, Inc., Skunks Misery Rd., Syosset, L. I., N. Y., angle of attack and sideslip system, NOas 57-508-f (AE-71-1939-57), $30,478.

Syracuse University (Syracuse University Research Institute), Syracuse 10, N. Y., investigation of effects of stress concentrations on mechanical properties and performance of heat-treated titanium-alloy sheet., NOas 57-483-d, $37,225.

Bendix Aviation Corp., (Eclipse Pioneer Div.,) Teterboro, N. J., azimuth and range indicators, NOas 57-602-r (PD-32-880-57), $10,757,182.

McDonnell Aircraft Corp., P. O. Box 516, St. Louis 3, Mo., materials and services to replace the Government-owned machine tools and other capital equipment, NOas 56-034-c (IP-12-6039-56), $234037.

The Emerison Electric Mfg. Co., 8100 Florissant Ave., St. Louis 21, Mo., instructions to naval and marine corps personnel in the operation, maintenance and servicing of Aero series turrets, NOas 57-136-s, (MA-30-3696-57), $26,794.

Sylvania Electric Products, Inc., (Electronic Systems Div.,) 175 Great Arrow Ave., Buffalo 7, N. Y., radar sets, NOas 57-363-f (AV-45-2664-57), $63,645.

Westinghouse Electric Corp., 1625 K St., N.W., Washington 6, D. C., product improvement on the J34 engine, NOas 57-627C (PD-41-1087-57), $2,099,572.

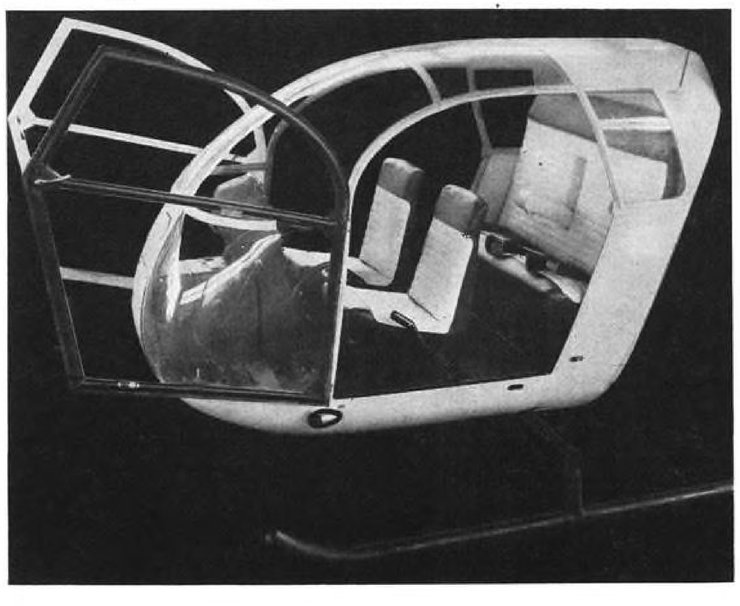
Thompson Products, Inc., 23555 Euclid Ave., Cleveland 17, Ohio, acquisition, rehabilitation and installation of machine tools, NOas 56-049-c (IP-33-3430-52), $45,868.

Raytheon Mfg. Co., 138 River St., Waltham 54, Mass., technical assistance and instruction in the maintenance, repair and operation of aircraft, electrical and electronic equipment, NOas 57-245-s (MA-30-3739-57), $107,654.

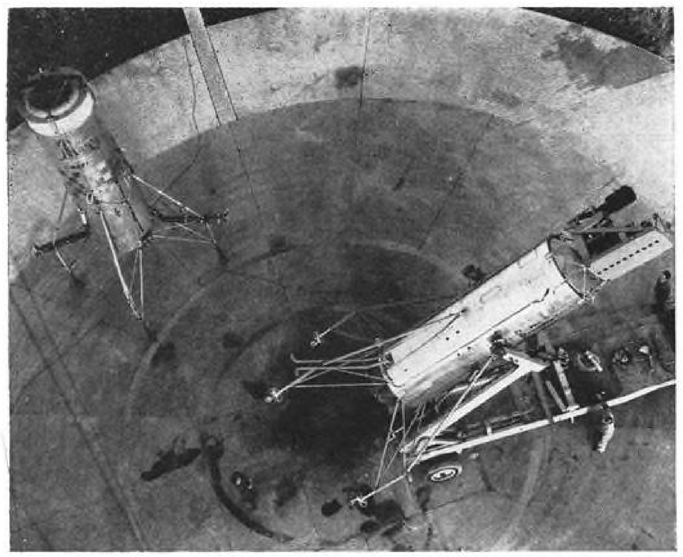
Groll-Beach & Associates, 3528 14th St., N. W., Washington 10, D. C., evaluation program of aviation shore facilities, NOas 57-453-f (SE 43-1606-57), $658,000.

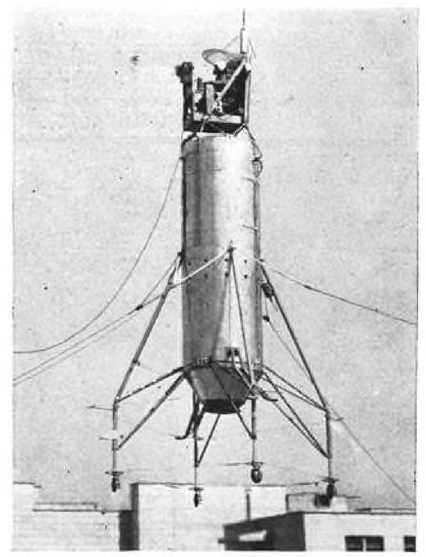


Loewy Designed Civil Alouette Introduced



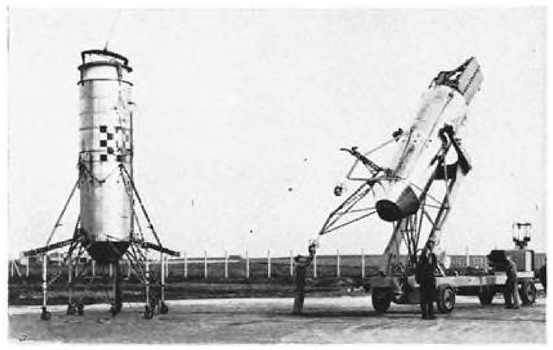
Civil version of Sud Aviation's Alouette II turbine powered helicopter has fuselage shell and interior designed by U. S. firm of Raymond Loewy Associates. Designated the Gouverneur, the civil version is identical to the Alouette II in powerplant, using the Turbomeca Artouste II, and in basic structure. The Gouverneur's maximum speed of 125 mph. is 15 mph. faster than the military version, but its payload of 1,155 lb. is about 300 lb. less. The Loewy interior uses horsehair for chair construction with vinyl covering for cushions and backs. Two seats are forward, one for the pilot, and a banquette at the rear seats three persons or alternately two persons with the middle section folded down as an arm rest. Storage compartments are in seat backs and in banquette head rests. Floor is grey wool carpet of uncut pile and double layer ceiling, finished in pale blue vinyl, allows for storage of a nylon sun shade for the pilot. Landing gear was untouched by Loewy, but the metal tube tail protector was changed for appearance. Two tone color schemes are in powder blue and light beige.

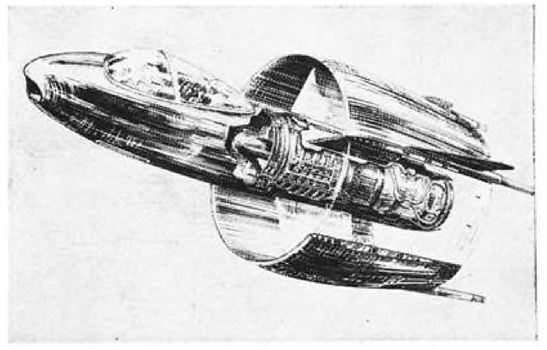




Flying Atar Development

First two versions of Snecma's Flying Atar VTOL flying turbojets are photographed together (top and bottom, left), from above and from side. Second version, the C-400 P.2 (right), is equipped with ejection seat which the first, the C-400 P.1, does not have. A third version, C-400 P.3, will have an enclosed cabin and an ejectable, tip-up seat arrangement. It is now under construction. Possible evolution of the design is a coleopter (lower right). Snecma holds European rights on the von Zborowski patents.





Army Contracts

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

REDSTONE ARSENAL, Huntsville, Ala.

Philco Corp., Technical Rep. Div., 22nd St., and Lehigh Ave., Philadelphia 32, Pa., Item 1—Unit demonstration voltage, regulator, lecture, special devices, #MK-314/GSQ-Ta Philco #463-2528, 3 ea., chassis analysis, voltage regulator laboratory circuit, special devices #MK-315/GSQ-T4 Philco #463-2350, 40 ea., unit demonstrational units sonic & synchro lecture, including motors, special devices #MK-322/GSQ-T4, Philco #463-3665, 3 ea., unit, demonstration frequency modulation lecture, special devices #MK-317/GSQ-T4 Philco #463-2532 ea., unit frequency modulation laboratory circuit analysis, special devices #MK-318/GSQ-T4, Philco #463-2534, 20 ea., unit, radar and micro wave systems lecture demonstration. Special devices #MK-319/GSQ-T4, Philco #463-2356, 3 ea., unit radar microwave system laboratory circuit analysis. Special devices #Mk-320/GSQ-T4, Philco #463-2540, 20 ea., trainer radar & microwave systems, test equipment special devices #OA-1174/GSQ-T4 Philco #463-2543, 20 ea., locker storage & chassis, special devices #CY-1982/GSQ-T4, Philco #463-2581, 3 ea., storage drawer, special devices #CY-1983/GSQ-T4 Philco #463-2579, 6 ea., (purchase request OGMS-382-57 and OGMS383-57), $34584.

Douglas Aircraft, Inc., 3000 Ocean Park Blvd., Santa Monica, Calif., item 1 emergency of blue streak requirements for repair parts for Nike missile & missile systems. Contract will be utilized for the procurement of repair or rebuild Nike systems or missiles which are deadlined or about to go on deadline, 1 job (purchase request Z-699-7), $25000.

Western Electric Co., Burlington, N. C. item 1 emergency or blue streak requirements for repair for Nike missile and missile systems, contract will be utilized for the procurement of repair parts required for Nike systems or missiles which are deadlined or about to go on deadline. 1 job (purchase request: Z-699-7) $25000.

Huck Mfg. Co., 2480 Bellevue Ave., Detroit 7, Mich., Item 1. Huckbolt aircraft, close tolerance, AN 509 C-Sunk Head 102400 ea., Huckbolt, aircraft, Pan Head ALPP 75S-T6, 90100 ea., Huckbolt aircraft close tolerance, An509 S-Sunk heat, 27800 ea., Huckbolt, aircraft, collar, LC, 130, 000 ea., Huckbolt, panhead, aircraft, ALPP-steel ALPPN-T8-28, 1000ea., Purchase request ME-11806-57) $38810.

Gilfillan Bros., Inc., 3815 Venice Blvd., Los Angeles, Calif., generator, YO56-8130035, Ord Part No. 8130035, (Line item 1-1-1235), 8 ea., f.o.b. La Carne, Ohio, 4 ea., f.o.b. Avondale Colo., (Purchase request: RSP-271-57), $30,984.

Arnolt Corp., Warsaw, Ind., coupling, Y-018-8170738, Ord Part No. 8170739 (Line item 2-1-1196, 195 ea., f.o.b. LaCarne, Ohio, 105 ea., Avondale, Colo., (Purchase request: RSP-274-57), $26,295.

Clark Cable Corp. 3184 W. 32nd St., Cleveland, Ohio, capacitor, various types, various quantities, (Purchase request: RSP-124-57), $49,238.

CORPS OF ENGINEERS, New England Div., 150 Causeway St., Boston 15, Mass.

J. Slotnik Co., 99 Chauncy St., Boston 11, Mass., construction of Geo-Physics Laboratory (Lot III), Laurence G. Hanscom Field, Bedford, Mass., (IFB ENG-19-016-110B), job, $106,677.

CORPS OF ENGINEERS, Tullahoma District, P. O. Box 2091, Tullahoma, Tenn.

H. E. Collins Contracting Co., 793 E. 9th St., Chattanooga, Tenn., construction of cart stand & extension of transfer car tracks for the propulsion wind tunnel, Arnold Engineering Development Center, Tullahoma, Tenn., (IFB ENG-40-126-57-13), job, contract No. DA-40-126-ENG-268, no subcontracts open, $101,804.



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FOR almost ANY MISSILE, ANYWHERE ...CREATIVE ENGINEERING BY CLEVELAND PNEUMATIC

Our Special Products Division designs and builds launching stands, test towers, ground-movement vehicles, and storage devices for *almost* any size missile, anywhere.

What do we know about ground-support devices for missiles?

Since 1924, Cleveland Pneumatic has been developing and building cushioning devices. Impact absorbers . . . structural units . . for large and cumbersome loads.

Our ideas on ground-support vehicles and structures for missiles are firmly based on 33 years of experience.

May we call on you soon to discuss your missile and its ground-support requirements?

Your missile project ...and creative engineering

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Check the proper box and enclose with your name and address if you want more information on the complete line of aircraft instruments offered to military, commercial, and business aviation by General Electric's Instrument Department at West Lynn, Mass. Return to Section 586-13, General Electric Company, Schenectady 5, N. Y.

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

AIR FORCE OFFICE OF SCIENTIFIC RESEARCH, ARDC, Washington 25, D. C.

New York University, Washington Square, N. Y., N. Y., research and reports in the field of elasticity, (AF 49(638)-161), job, $46,895.

Wayne State Univ., Detroit 2, Mich., continuation of research on "Study of surface phenomena in semiconductors and the growth of semiconductor crystals", (AF49-(638)-158), job, $62,300.

Univ. of S. Calif., 3418 University Ave., Los Angeles 7, Calif., continuation of research on: "Two-phase wind tunnel", (AF18(603)-95), job, $68,791.

Philips Laboratories, Div. of North American Philips Co., Inc., Irvington, N. Y., continuation of research on "The study of noise phenomena in high power klystron oscillators," (AF18(603)-33, job, $27,507.

The Regents of the Univ. of Calif., Berkeley, Calif., continuation of research on "Gaseous Radiation" (AF18(600)-1570), job, $29,300.

Univ. of Washington, Seattle, Wash., continuation of research: "Boron and silicon chemistry" reports, (AF18(600)-1541), job, $2,800.

Polytechnic Institute of Bklyn, 99 Livingston St., Bklyn, N. Y., continuation of research on interference of shock drag in supersonic flight, (AF19(600)-694), job, $95,000.

Technical Operations, Inc., Arlington 74, Mass., research and reports concerning "Mechanism and Kinetics of Photographic Development" (AF18(600)-371), job, $74,-790.

AIR FORCE MISSILE TEST CENTER, ARDC, USAF, Patrick, AFB, Fla.

The Ralph M. Parsons Co., Electronics Div., 151 S. DeLacey Ave., Pasadena, Calif., conversion system, (P. R. 57-1169), job, $25,385.

Consolidated Electrodynamics Corp., 300 N. Sierra Madre Villa, Pasadena, Calif., reproducers, (P. R. 55-1195), job, $500,000.

Electronic Engineering Co. of Calif., 180 S. Alvarado St., Los Angeles, Calif., subcentral time units and modification to central timing equipment, (P. R. 57-1090, 57-1095), job, $151,870.

Minneapolis-Honeywell Regulator Co., Ordnance Div., 600 Second St., N. Hopkins, Minn., power supplies, model 35502, (P. R. 57-1061), job, $35,424.

Houton Fearless Div., Color Corp. of America, 11801 W. Olympic Blvd., Los Angeles 64, Calif., coils, elevator assys., reducer, spacer, spindle, spring, squegee, tank, thermometer, tip, transmission, fan assy., rods, roller, tracks, compressors, pump, spray, roller, glass bearings, roller, valve assys., drive assy., washer, etc., (P. R. 10D-11-25745, 10D-11-57-25700, 10D-11-57-25287, 10D-11-57-25813, 10D-11-57-24837), $41,040.

AIR FORCE CAMBRIDGE RESEARCH CENTER, ARDC, USAF, Hanscom Field, Bedford, Mass.

The Warner and Swasey Research Corp., 34 W. 33rd St., New York, N. Y., research directed toward the experimental study of the infrared radiation from hot gases, job, AF19(604)-2223, $30,000.

The University of Texas, Austin Tex., studies in tropospheric propagation, job, AF19(604)-2249, $30,000.

International Telephone and Telegraph Corp., Federal Telecommunication Laboratories Div., 500 Washington Ave., Nutley, N. J., research on growing single crystals of ceramic materials with ferrimagnetic properties AF19(604)-2261, job, $48,751.

SAN ANTONIO AIR MATERIEL AREA, USAF, Kelly AFB, Tex.

Airborne Accessories Corp., 1414 Chestnut Ave., Hillside 5, N. J., actuator, electromach-rotary 1050 hp., S/N 4238-R294-2F, PR: SA-639680 and SA-639680-1, 235 ea.

Spray Engineering Co., 114 Central St., Somerville, Mass., nozzle, fluid injection, steel, S/N 4324-1388; PR SA-715273, 34,15* ea., $44,053.

Grimes Mfg. Co., 515 N. Russell St., Urbana, Ohio, aircraft accessory spare parts, PR: SA-729302, 12 items, $101,473.

General Dynamics Corp., Convair Div., Fort Worth, Tex., accomplishment of inspection, repair, modification and flight test of F-102 type aircraft, PRs: SA-721742, SA-721742-1, SA-721742-2, SA-721742-3, SA-721742-4, and SA-01B-2048, $3,349,258.

SHELBY AIR FORCE DEPOT, Wilkins Air Force Station, Shelby, Ohio.

Ronan & Kunzi Inc., 502 S. Kalamazoo Ave., Marshall, Mich., repair and reconditioning of tank, liquid oxygen, no fund call contract (MH-606766/756).

The Cal-Tev Co. of Tyler, P. O. Box 1211, Tyler, Tex., net, snow and ice removal, wing and tail, 69 sets, AF drawings, 16 sets, installation instruction sheet, 69 ea., (IFB-33-57-1 44),$192,292.

Harvick Mfg. Co., 10727 S. Garfield, South Gate, Calif., jack, hand, hydraulic, axle, 50 ton capacity, 226 ea., spare parts and maintenance data (IFB33-602-57-96), $97,550.

O. E. Szekely and Associates, Inc., Box 269, Commerce, Ga., trailer-lift bomb hyd type, (IFB-33-602-57-67), 150 ea., $178,800.

Bristol Mfg. Corp., Bristol, R. I., overshoes, flying: man's type MC-1, (IFB 33-602-57-154), 7,183 pair, $47,910.

Lockley Machine Co., 310 Grove St., New Castle, Pa., towbar, acft NW type, 94 ea., reproducibles, 1 set, total, $182,446.

AIR FORCE SPECIAL WEAPONS CENTER, ARDC, Kirtland AFB, N. Mex.

C. R. Davis Contracting Co., 1000 Manuel S. E., Albuquerque, N. Mex., modification of facilities for WS102A systems program, (IFB 29-601-57-102), job, $27,975.

USAF ACADEMY CONSTRUCTION AGENCY, P. O. Box 1670, Colorado Springs.

Wade Lahar Construction Co., 5560 W. 56th St., Denver 4, Colo., construction of utilities, general distribution, Phase II, (IFB 05-613-57-19), job, $2,322,470.

WARNER ROBINS AMA, Robins AFB, Ga.

Curtiss-Wright Corp., Caldwell, N. J., modification kits and spare parts for CT 7355-B108 propeller assys., $83,125.

Servomechanisms, Inc., Post & Stewart Aves., Westbury, N. Y., positioning mechanism, range servo (RFP-1106), 225 ea., $104,990.

Clark Equipment Co., Pyson St., Plant, Jackson, Mich., complete upright assys and drive axle assys., $97,035.

DAYTON AF DEPOT, Gentile AF Station, Dayton 10, Ohio.

General Electric Co., French Rd., Utica, N. Y., components of AN/ALT-6B transmitter system, spares, spare parts and data, (MD-7-16K1-60021), $20,000,000.

Artisan Electronics Corp., 171 Ridgedale Ave., Morristown, N. J., dummy load, electric DA-90/U in a/w mil spec MIL-D-4739 (USAF) dtd 29 Jan 54 tnd amend no. 1 dtd 14 April 55, 112 ea., photographs for above, 3 sets, (RFP 33-604-57-1950), $32,138.

Gabb Special Products, Inc., Windsor Locks, Conn., indicator-piston position, GABB special products 1600.1, 500 ea., (RFP 33-604-57-1952), $25,990.

Hewlett-Packard Co., 275 Page Mill Rd., Palo Alto, Calif., signal generator contractor's model No. 608D and including the following accessories: fuseholder (1) ea contractor's P/N 608A-95A, one (1) ea output cable contractor's P/N AC-16K, one (1) UG-201A/U adapter contractor's P/N 125, 310 ea., (PR: MD-609054), $278,829.

Thordarson Meissner Mfg. Div., Maguire Industries, Inc., 7th and Bellmont, Mt. Carmal, Ill., filter, thordarson T48351, 1000 ea., (RFP 33-604-57-1525), $33,750.

Radio Corp. of America, Tube Div., 415 S. Fifth St., Harrison, N. J., tube-electron JAN type 12SK7Y pentode general purpose glass envelope 1.320" dia 3.320" H O/A a/w spec MIL-E-1C dtd 3 Oct 55, supplement 1G dtd 17 Sept 56 and individual spec sheet MIL-E-1/61A dtd Sept 56 and individual spec sheet MIL-E-1/61A dtd 14 Jan 54, 55000 ea., (IFB 33-604-57-257), $37,400.

F P 6-4-57 VJ

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CAB Accident Investigation Report:

Both Pilots Fail Sighting in Collision

At 1432,[1] Sept. 9, 1956, a Continental Air Lines Douglas DC-3A, N 33315, and a Cessna 170B, N 8143A, collided in flight approximately two miles southeast of the Phillips Airport, Bartlesville, Okla. Both aircraft, substantially damaged, were landed safely at that airport. There were no injuries to the passengers or crew of either aircraft.

HISTORY OF THE FLIGHT

On Sept. 9, 1956, Continental Air Lines Flight 190 was scheduled between El Paso, Tex., and Kansas City, Mo., with planned intermediate stops, among which were Tulsa and Bartlesville, Okla.

The crew consisted of Capt. Bennes M. Richards, First Officer John R. Deshurley, and Hostess Jonette Weist. Departure from El Paso was at 0718 and the flight was routine to Tulsa. At Tulsa the aircraft was serviced and it departed there at 1418.

The flight to Bartlesville was planned and operated in accordance with visual flight rules at an altitude of 2,000 ft. and the elapsed time was estimated to be 16 min. The gross takeoff weight of the aircraft from Tulsa was within approved limits, the load was properly distributed, and there were 14 passengers.

Ten minutes after leaving Tulsa and in the vicinity of Ochelata, Okla., the captain advised his company that the aircraft was in range of Bartlesville. He was then given the altimeter setting, 30.29, and advised to change to Bartlesville Radio frequency. During a call to Bartlesville Radio he was advised that the active runway was 17 and the wind from the south at 10 kt.

Some time after the captain initiated his first radio call the first officer began the "in-range" cockpit check. This check took approximately 30 sec. and just as it was completed the collision occurred. At the time of collision the DC-3 was continuing north and about to enter the downwind leg of the airport traffic pattern on a reciprocal heading to the intended landing on runway 17.

James L. Folk, owner and pilot of Cessna N 8143A, took off from Dewey, Okla., Hi-Way Airport at approximately 1417. The flight was a sightseeing trip for Mr. Folk's four passengers whose ages were between eight and sixteen years. Pilot Folk flew from Dewey to Bartlesville and from an altitude of about 1,000 ft. above the ground pointed out the homes of some of his passengers.

As the Cessna completed a 45-deg. right turn to the northwest the two aircraft collided. Both aircraft were landed safely at the Bartlesville Airport.

Weather at time of accident was clear, visibility 15 mi., wind south 10 kt.

INVESTIGATION

• DC-3 damage.

The right aileron lower fabric covering was cut a distance of 13 in. by the propeller of the Cessna. This cut began one-half inch in from the leading edge and extended diagonally inboard toward the trailing edge at an angle of 45 deg. from the lateral axis of the aircraft. Cut also damaged the seventh aileron rib and the spar lower cap.

A second cut paralleled the first approximately 1½ in. outboard from it. This cut began about two inches rearward from the inboard end of the first cut and extended in the same direction through the trailing edge cutting both lower and upper surfaces. The fracture of the trailing edge metal strip tore the fabric both top and bottom adjacent to the cut.

The right horizontal stabilizer and elevator were severed diagonally at an angle of 43 deg. with the fore and aft axis, inboard and rearward from the stabilizer tip through the elevator trailing edge. Both surfaces were cut upward and the lower surface of the tip contained red paint similar to that on the propeller hub spinner of the Cessna. The outboard elevator hinge bracket was broken and the lead counterweight was severed upward. The elevator torque tube and four ribs were cut and broken upward. All severed parts were recovered.

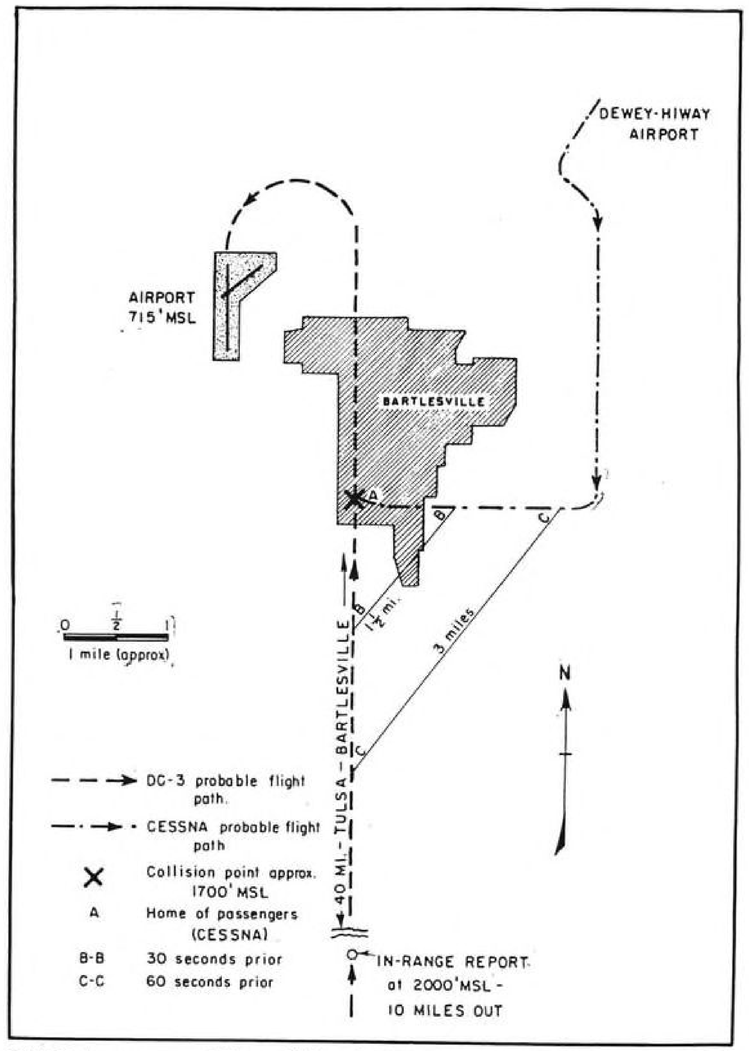


CHART shows courses of Cessna 170B and DC-3 which led to collision.

• Cessna damage.

The leading edges of both metal propeller blades were scarred, nicked, and abraded and one tip was curled forward. The propeller hub spinner was crushed and torn and the upper left nose cowl was crushed rearward. The upper left engine cowling was torn free along the center hinge line and the upper engine baffling on that side was crushed. Sparkplugs from cylinders Nos. 4 and 6 were torn from the cylinders and broken.

The right side of the windshield was scuffed and cracked as if struck by the cowling when it left the aircraft. At a point about eight feet outboard from the root, the leading edge of the left wing was flattened somewhat for a distance of 10 in. and there were abrasion marks and scratches sloping inward at an angle of 25 deg. There was no evidence of fire having occurred in either aircraft.

• Collision.

The impact between the two aircraft occurred about 1,000 ft. over the southwest section of Bartlesville. Relatively small severed pieces (right elevator and stabilizer tip from the DC-3 and engine cowling from the Cessna, etc.) fell to the ground but caused no injury to persons or damage to property.

A group of witnesses on the ground, several with aeronautical experience, observed both aircraft prior to and at the time of collision. The consensus of their observations was that the Cessna was proceeding westward and then turned to the northwest just before the impact, and that the DC-3 was proceeding level laterally and longitudinally almost due north. The statements of the Cessna pilot and the DC-3 crew are in substantial agreement with regard to the headings of both aircraft when the collision occurred. Both pilots gave accurate estimates of their airspeeds.

Computations, using the angles of the propeller cuts on the DC-3 aileron and tail surfaces, the Cessna propeller rpm. and diameter, and the furnished airspeeds, produce the following results: Angle of convergence of the two aircraft—44 deg.; rate of closure—98 mph. (144 fps.); viewing angle of Cessna from DC-3—52 deg. to the right; viewing angle of DC-3 from Cessna—84 deg. to the left.

At 1430, Sept. 9, 1956, the altitude of the sun (angular elevation above the horizon) at Phillips Airport was 48 deg. The azimuth of the sun (measured eastward from zero north) was 229.3 deg. This placed the sun in front of the Cessna while it was on its westward heading.

The pilot of the Cessna had been visiting friends living in the southwest portion of Bartlesville. The purpose of the flight from Hi-Way Airport, Dewey, Okla., three miles north of Bartlesville, was to take four children for a short trip over Bartlesville.

After taking off, the Cessna proceeded about four miles due south and then turned westward at an altitude above the ground of 1,000-1,100 ft. According to the pilot, who was in the left front seat, after reaching a point where the home he had been visiting was seen to the right by occupants of the Cessna, a 45-deg. turn was made to the northwest. While coming out of this turn, the collision occurred.

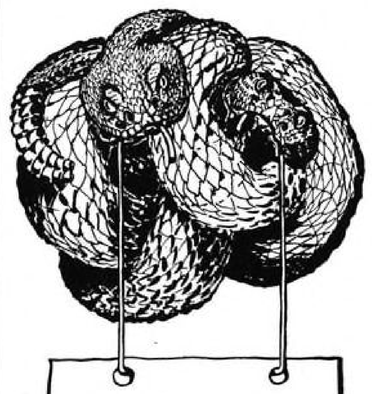
The Cessna pilot stated that he did not intend to land at Phillips Airport and was not aware that he was nearing the airport traffic pattern. His two-way radio was not turned on. The pilot also stated that the visibility was unlimited and that the sun did not interfere with his vision when on a west heading.

Testimony of the DC-3 flight crew disclosed that shortly after making the in-range report approximately ten miles south of Bartlesville, the copilot, seated on the right side, started the in-range cockpit check. This portion of the cockpit checklist consists of seven items, the last being a check of hydraulic fluid which requires that the copilot turn left towards the rear of the cockpit in order to see the fluid quantity indicator. The collision occurred at this time.

The captain's scope of vision, from his seat on the left, is hampered by the compass and radio installation located over the center of the instrument panel and at the bottom center of the windshield. The in-range checklist usually takes about 30 sec. to accomplish. The DC-3 crew also testified that, although the bright sun did not

[1] All times referred to herein are central standard and based on the 24-hour clock. All altitudes are mean sea level unless otherwise stated.

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hamper their vision, the form of haze present at low altitudes, coupled with the variegated background of the populated area of Bartlesville over which they were flying, would make it difficult to spot the small, aluminum-colored aircraft. They were at the correct altitude to enter the downwind leg of the airport traffic pattern.

The airport at Bartlesville is operated by the Phillips Petroleum Company. Local traffic rules stipulate left-hand turns on two patterns—a larger, circular pattern for large aircraft to be flown at 1,000 ft., and a smaller, rectangular pattern for small aircraft to be flown at 500 ft., for all aircraft in flight below 1,500 ft. above the surface (2,215 feet msl.) within three-mile radius of the airport. Straight-in approaches may be made, providing Bartlesville Radio is in operation. This airport is classified as uncontrolled, i. e., there is no control tower.

Bartlesville Radio (BVO) is owned and operated by the Phillips Petroleum Company, and is in operation between 0600 and 1800.

The radio operator is not licensed by the CAA as an airport traffic control operator—nor is he required to be—and only limited advisory service, to be used at the pilot's discretion, is furnished to flights operating into the airport. The radio room is located on the second floor of the Administration Building and its windows provide visibility on the west, north, and south sides only. It does not serve as a control tower.

ANALYSIS

The sole purpose of the Cessna flight over Bartlesville was a sightseeing trip for the young passengers. It is apparent that the attention of the Cessna pilot was largely directed to his right as he approached over the area of his hosts' and passengers' homes.

While the Cessna was proceeding westward, 60 sec. before the collision, the DC-3 was three miles away and about 45 deg. to the left of the forward view from the Cessna. Thirty seconds before the collision the DC-3 was 1½ mi. away at the same bearing.

The altitudes of both aircraft could not have differed more than 100-200 ft. during this time.

Regardless of the sun's position and the reported haze, it seems that regular scanning of the horizon by the Cessna pilot during the last minute or so before the collision would have revealed the DC-3.

This applies equally to the copilot of the DC-3 seated in the right-side pilot seat. If 30 sec., ending at the time of collision, was required to complete the in-range cockpit checklist, there was at least a prior minute when the Cessna would have been visible on a bearing of about 45 deg. to the right and near the altitude of the DC-3.

The compass at the bottom center of the windshield would restrict the captain's field of vision to the right but a small movement of his body to either side would again place this area in his view. It is possible that the Cessna was in this sector during the minute or so before the collision. Other than the cockpit check there were no duties requiring attention inside the aircraft at that time, according to crew testimony.

Although the 1420 Bartlesville weather report of Sept. 9, 1956, gave 15 miles visibility, the kind of haze mentioned by the DC-3 crew may have contributed, in a small degree, to the failure of all three pilots to see the other aircraft.

The Board is of the opinion that the DC-3 flight crew were aware of all restrictions to cockpit visibility and the necessity for continual outside scanning. Such a scanning is necessary even though it requires a break or interruption in cockpit duties. Both aircraft were flying VFR under weather conditions far better than VFR minimums. Consequently, the Board believes that the entire responsibility for observing and avoiding other aircraft rested on the pilots of the two aircraft involved in the accident.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The carrier, the aircraft, and the pilots were properly certificated.
2. Both aircraft were in airworthy condition and operating without mechanical difficulty prior to the collision.
3. At the time of the accident, the weather was clear and the visibility was 15 miles.
4. The DC-3 was maintaining a straight course in a slight descent, preparatory to entering the downwind leg of the airport traffic pattern.
5. The Cessna pilot was not aware of being near the airport traffic pattern, and



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made a 45-deg. right turn just prior to the collision.

6. The pilots of both aircraft had ample opportunity to see and avoid the other aircraft for at least a min. before collision.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was the failure of the pilots of both aircraft to observe and avoid the other aircraft.

By the Civil Aeronautics Board:

/s/ JAMES R. DURFEE
/s/ CHAN GURNEY
/s/ HARMAR D. DENNY
/s/ G. JOSEPH MINETTI

Member Louis J. Hector did not take part in the adoption of this report.

SUPPLEMENTAL DATA

The Civil Aeronautics Board was notified of the accident at approximately 1645, Sept. 9, 1956. An investigation was immediately initiated in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. Depositions, ordered by the Board, were taken at Kansas City, Mo., on Sept. 28, 1956; at Bartlesville, Okla., on Sept. 30 and Oct. 1; at El Paso, Tex., on Oct. 25.

AIR CARRIER

Continental Air Lines, Inc., a Nevada corporation, is a scheduled air carrier with its principal offices at Denver, Colo. The company possesses a currently effective certificate of public convenience and necessity issued by the Civil Aeronautics Board and an air carrier operating certificate issued by the Civil Aeronautics Administration which authorize the carriage of persons, property, and mail over the route described herein.

FLIGHT PERSONNEL

Capt. Bennes M. Richards, age 35, was employed by Continental Air Lines on Jan. 4, 1946. He held a valid airman certificate with an airline transport rating and type rating for DC-3 aircraft. Captain Richards had, according to company records, a total of 11,235 flight hours, of which 5,445 were acquired in DC-3 equipment. His last first-class physical examination was passed on July 25, 1956. The date of his last route check was Nov. 4, 1955.

First Officer John R. Deshurley, age 28, was employed by Continental Air Lines on Aug. 13, 1951. He held a valid airman certificate with an airline transport rating and type rating for DC-3 aircraft. Pilot Deshurley had, according to company records, a total of 3,856 flight hours, of which 3,024 were acquired in DC-3 equipment. His last first-class physical examination was passed on Feb. 17, 1956. The date of his last route check was Sept. 7, 1956.

Stewardess Jonette Weist was employed by Continental Air Lines on June 4, 1956. Her training was completed June 16, 1956, and assignment to flight duty was June 26.

James L. Folk, age 48, Carthage, Tex., was the owner of Cessna N 8143A. He held a valid airman certificate with a private pilot rating. According to his statement, he had a total of 3,200 flight hours, of which 50 were acquired in Cessna 170B.

AIRCRAFT

Douglas DC-3, serial No. 4978, N 33315, was manufactured on Oct. 13, 1942, and converted to a DC-3A on May 10, 1946. Total time on the airframe was 35,501 hours, with 10,169 hours since last major overhaul. The aircraft was equipped with two Pratt and Whitney R1830-92, SIC3G engines, and Hamilton Standard model 23E50 propellers with 6353A blades. Total time on the left and right engines was 17,037 and 15,462 hours, respectively. Time since overhaul on the left and right engines was 190 and 465 hours, respectively.

Cessna 170B, serial No. 20995, N 8143A, was manufactured August 18, 1952. Total flying time of the aircraft, per the recording tachometer, was 514 hours. The aircraft was equipped with a Continental model C-145-2, 145 hp. engine with a McCauley propeller, serial No. 55401, design 1A170.

Portable Muffler Cuts Jet Noise Via Hoops

Martin Co. reports that its low cost portable jet engine muffler (AW April 8, p. 74) is designed to reduce noise within a radius of 500 ft. to what it normally would be within a five-mile radius. Chief component of the muffler is a cone-like framework formed by a number of steel hoops of decreasing diameter. As the exhaust wake passes through the tapering row of hoops, it is broken and dispersed. Martin says the units will vary in price from $500 to $10,000, depending upon the aircraft for which it is designed.

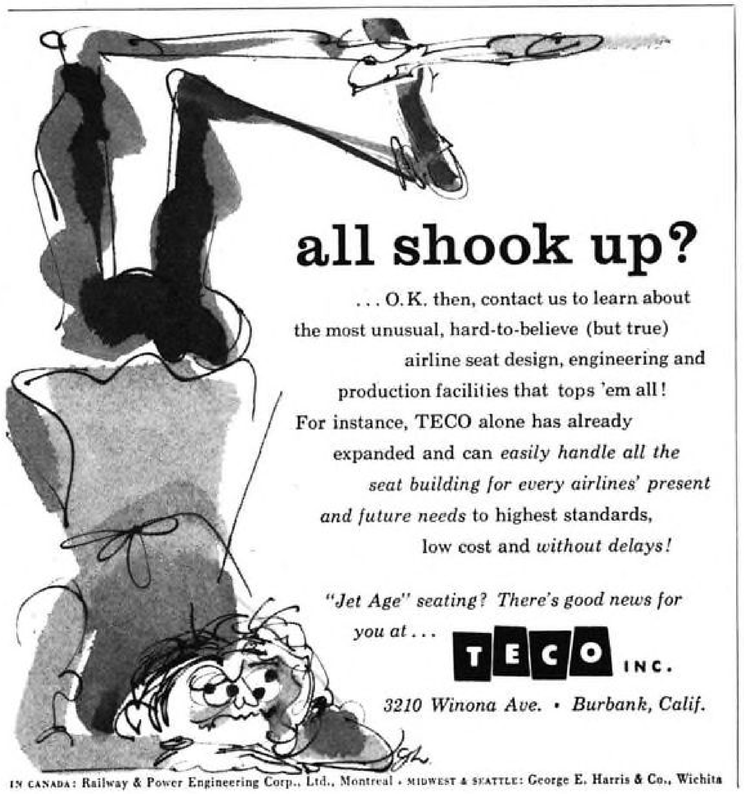
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20th
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A special anniversary issue of The Royal Gazette (founded in 1828) will be published for this occasion. Advance orders for this unique edition, which will be mailed in a postal commemorative cachet, are now being solicited. Price: 20 cents (in coins, not stamps) including postage. Address orders to: Aviation Edition, The Royal Gazette, Bermuda.

The Royal Gazette



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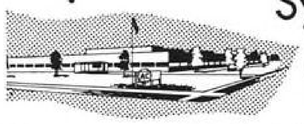
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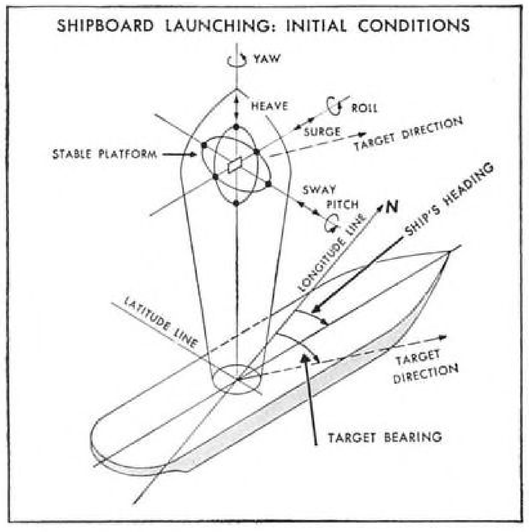
ENGINEERS—SCIENTISTS

GENERAL ELECTRIC SELECTED TO DEVELOP GUIDANCE AND FIRE CONTROL SYSTEMS FOR NEW NAVY MISSILE, POLARIS

New Group Forming as Missile & Ordnance Systems Department of G.E. Adds Navy Project to Nose Cone Development Program.

POLARIS is the most challenging development undertaken by industry for the Navy since the nuclear propulsion program. It is an Intermediate Range Ballistic Missile, whose specifications call for launching capability from both surface vessels and submarines.

PROBLEMS UNIQUE IN MISSILE TECHNOLOGY



The diagram above presents the primary parameters involved in shipboard launching of a ballistic missile in its simplest form.

For Polaris, MOSD must not only surmount these initial conditions but solve fire control problems more complex than heretofore encountered. Pinpoint accuracy in missile guidance is an impressive accomplishment under the most favorable conditions. But how do you achieve it with a missile hurled from a moving platform and aimed at an object approximately 1,500 nautical miles away?

In addition, the Polaris guidance and fire control systems must also operate effectively under the difficult conditions created by submarine launching.

HOW IS MOSD EQUIPPED TO SOLVE THESE PROBLEMS?

As prime contractor for IRBM and ICBM Nose Cone Development, MOSD can draw on a reservoir of top level experience and skill. This G-E department also has a backlog of significant experience in the development and manufacture of Naval Fire Control Equipment, such as range-finders, computers and radar antennas.

NEW OPPORTUNITIES FOR ENGINEERS WITH EXPERIENCE IN THE DEVELOPMENT OF GUIDANCE & FIRE CONTROL SYSTEMS

A new group is now being formed to work on Polaris Missile Sub-Systems at MOSD. It will be located at Pittsfield, Mass. in the heart of the Berkshire resort and vacation area. Openings are at all levels for men with experience in:

GUIDANCE & ELECTRO-MECHANICAL COMPONENTS

Design, evaluation of guidance and fire control equipment
Design, development of electro-mechanical components and servomechanisms
Design, development, evaluation of inertial components, synchros, pick-offs, accelerometers, stable platforms, platform gimbals, verticals, etc.
Design, development, fabrication of analog computers for guidance and fire control systems

GUIDANCE & CONTROL SYSTEMS

Mathematical analysis, feasibility study of control systems and techniques
Synthesis, design, evaluation of guidance and fire control systems
Laboratory development, testing, modification of control systems

ELECTRICAL & ELECTRONIC COMPONENTS

Development of amplifiers and associated circuitry
Development, packing of electronic, magnetic, transistor servo type circuits and components
Reliability, evaluation, analysis of electronic circuits and components
Design, development of fire control consoles
Systems integration, design of electrical and electronic components
Development of electronic and solid state devices, semi-conductors, new transistor applications

OPPORTUNITIES OPEN ON OTHER MISSILE PROGRAMS

Engineers and Scientists with experience in other areas of Electrical Engineering, Aeronautical Engineering. Aerodynamics, Mechanical Engineering, Physics or Mathematics should inquire about positions on other missile programs at Missile and Ordnance Systems Department.

AN INVITATION

If you would like to contribute to any of the advanced missile development programs at MOSD, you are invited to send a resume of your education and experience. Or write us for a convenient application form. All resumes will be carefully reviewed by the MANAGERS *of our various technical components. You will be invited to visit our offices and discuss work we are doing directly with the Manager with whom you will be working. Communications will be entirely confidential.*

Please send resume to Mr. John Watt, Room 595-4

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Perform basic development on transducer for use in precision electronic computer field.

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Establish engineering requirements and investigate design approaches. Plan and direct the preparation of specifications for special in-plant test and evaluation facilities on centrifuges, scorsbys, complex wave simulators, sidereal tables and digital computers. Liaison between subcontractors and company.

DESIGN ENGINEER — GROUND EQUIPMENT
Design and development of production test and field test equipment where specific objectives and general requirements are known in the electrical and mechanical engineering fields. Must have experience on design or development of electromechanical instruments.

DATA PROCESSING AND REDUCTION ENGINEER
Responsible for establishing overall data reduction procedures. Direct the activities in specifying and procuring all components of standard automatic digital and analog data handling and processing equipment. Responsible for design or procurement of special data processing equipment.

FUNCTIONAL ENGINEERS — MISSILE SYSTEMS
Develop inertial guidance systems including gyro, accelerometers, integrators, servo systems and computers. Analyze functional problems arising during development and evaluation of said system.

ELECTRO-MECHANICAL ENGINEER
Conduct investigation on special electromagnetic and electromechanical devices including evaluation and/or design of transducers, servo systems and related devices.

GROUND EQUIPMENT ENGINEER
Plans and performs engineering studies, basic electrical and mechanical design, development and evaluation of production test and field test equipment where specific objectives and general requirements are known. Must be familiar with electromechanical instrumentation.

TRANSISTOR CIRCUIT ENGINEER
Pulse application of high speed transistors used in airborne digital computers. Circuit design applications requiring knowledge of latest transistors such as tetrodes and surface barriers.

DIGITAL COMPUTER ENGINEER
Basic research and development including logical design, dynamic analysis, component development, hardware and packaging, system and component reliability, and laboratory and field evaluation of complex computers for fire control and guidance systems.

FIELD EVALUATION ENGINEER
Perform overall planning functions for field evaluation of missile guidance systems. Direct activities in scheduling the field operations. Liaison with field test site agencies and formulating overall operating procedures at test site on missile project.

PROJECT ENGINEER — AIRBORNE EQUIPMENT
Project engineering of computers, pro and anti submarine fire control equipment, airborne navigation plotting equipment and similar equipment. Preparation and proposals on equipment of such types.

PRODUCT ENGINEER
Initiate, compile and maintain design standards on electrical, electronic and mechanical design subjects pertinent to fire control equipment and inertial guidance components. Must have considerable responsible experience on product design standards covering areas indicated in job studies.

DEVELOPMENT ENGINEER — RADAR
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DYNAMICS TEST ENGINEER
To conduct vibration, shock and acceleration tests on electromechanical components and systems. Analyze results and develop equipment to conform with specification requirements.

ENVIRONMENTAL TEST ENGINEER
To plan, conduct and report on environmental tests of electromechanical and electronic components.

ENVIRONMENTAL ENGINEER
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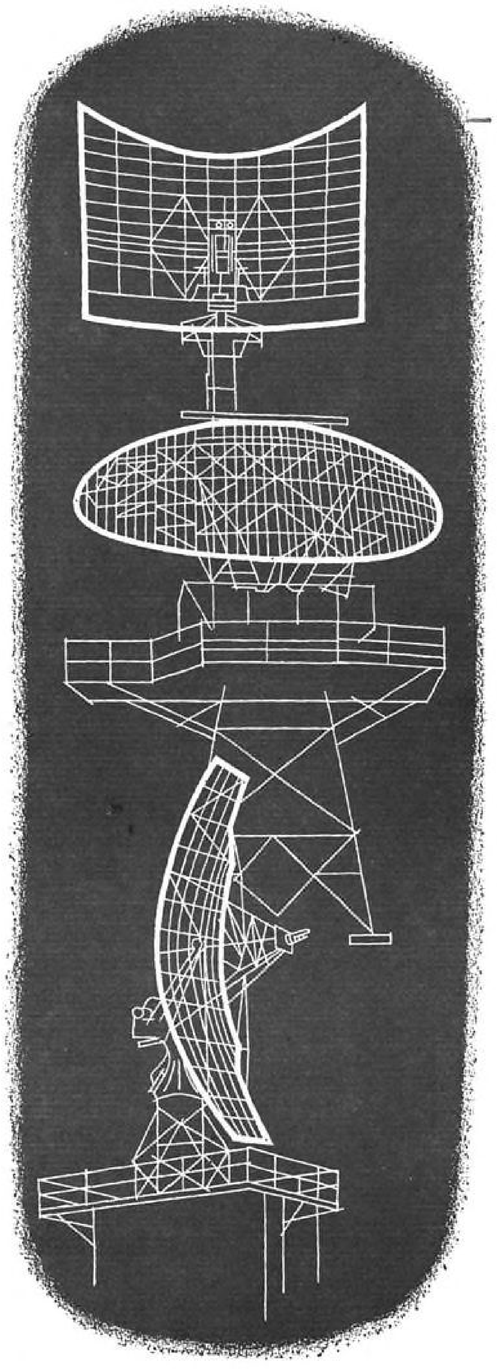
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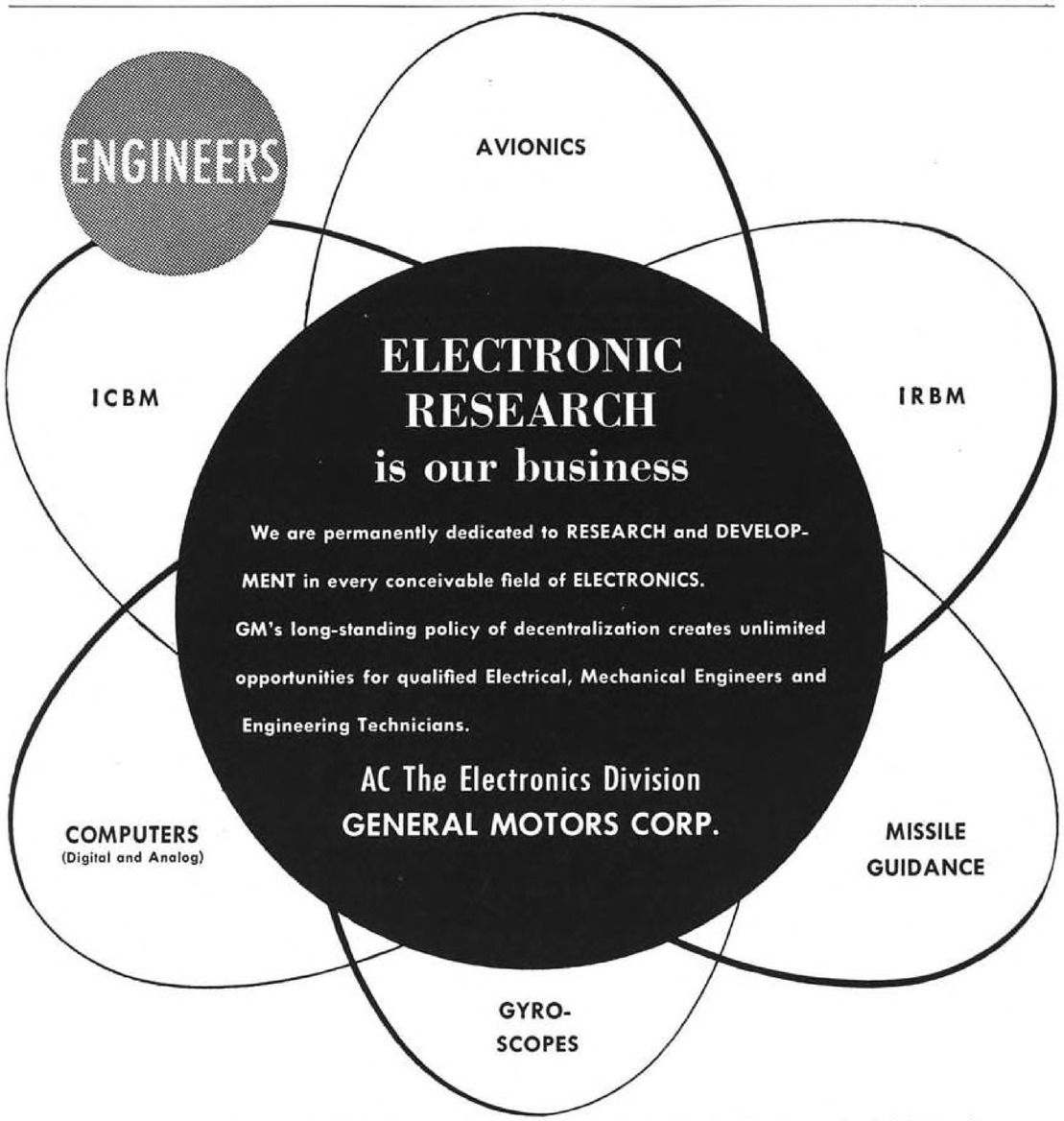
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TITLE_____
(or job interest)
STREET_____
CITY_____
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LETTERS

Ad Man Retorts

The letter from "A (Happy) Jobshopper" in the May 20 issue (p. 158) disturbs me for a number of reasons.

First, his reference to "Madison Avenue Knuckleheads" and "Characters" prompts me to think that he has heard someone refer to someone scornfully as a "Madison Avenue Type" without his realizing what the tag entails. What advertising people have to do with red tape or engineering personnel men is beyond me. This wholesale use of a New York street to depict the despicable must stop.

Second, his obvious lack of experience in engineering prompts him to assume that he can see all the faults of the profession and has an uncanny knack of correcting them. He hasn't.

Also, I see no reason why engineers can't be gentlemen.

Third, if all engineers knew anything about engineering they wouldn't exist long in our society, nor would they be very good engineers.

Engineers are, after all, human beings and just because they took Humanities and Greek in college makes them no less engineering minded.

Fourth, the secret of good sound engineering as it applies today is not individuality, but cooperative effort. No effective engineer can closet himself away in his ivory tower and think esoteric thoughts unless he is pure research, and pure research doesn't get planes and missiles in the air.

Fifth, while high school students are capable of a great deal they cannot compare, educationally, to the college man and in an engineering profession college courses in math and science are absolute. Picture, if you can, the average high school student solving a problem in aerodynamic heating at high altitudes.

Sixth, while I admit a lot of people go to college who shouldn't, I don't feel this is especially bad since the overall intelligence of the human race must be uplifted. Furthermore, lawyers, personnel men and English majors all have a place in this world, even in industry.

Seventh, from his discourse I must only assume that his pseudonym should be "Jobs Hopper" instead of "Jobshopper."

BARRY J. HAWKINS
Advertising Manager
General Precision Equipment Corp.
New York, N. Y.

Weight Penalty

In your issue of Jan. 7, p. 112 and 113, you ran a story on "Preloading Aids Cargo Operations," in which my company's name is mentioned.

I wish to correct a very serious error. Our payload on our Bristol Freighter aircraft on the Cook Strait crossing between Paraparaumu in the North Ireland and Woodbourne in the South Island—distance of 72 mi.—is 13,250 lb. using our Cargon removable floors. Previous to introducing

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

the Cargon removable floors the Bristols could carry on the same route 13,800 lb. Therefore, the weight penalty is only of the order of 550 lb. and not 2,000 lb. as reported. In actual fact, we daily handle aircraft where combined in and out payload is of the order of 26,000 lb. in 10 min. only.

Our removable floors are now being preloaded at warehouses and being interchangeable with road transport, rail, and aircraft they are quickly and easily transferred from one vehicle to another with no individual handling at any stage from consignor to consignee.

THOMAS M. A. O'CONNELL
Managing Director
Straits Air Freight Express Ltd.
Wellington, New Zealand

Clarifies Merger

I have read with great interest the article on Italian Airlines appearing in AVIATION WEEK, May 20, p. 41.

The information contained therein is a pretty accurate analysis of the present situation in our country and will surely help to improve the knowledge and the beliefs of the world industry on the aspects of the proposed merger.

I feel, however, compelled to clarify two points:

(1) The name Alitalia was not established during the Fascist regime, as pointed out in the article, but dates back only to the postwar foundation of our company in 1947. During the Fascist period the names of the two Italian air carriers were Ala-Littoria and Lati (Linee Aeree Transcontinentali Italiane).

(2) When you say that Alitalia flew "the good weather, fog free routes to South America and Africa," you somewhat minimize the value of previous statements on our sound operational record. Whereas it is true that the North Atlantic run involves varied and often critical weather conditions, you will agree that routes affecting London, Paris, Frankfurt, Geneva, destinations which we fly with very high frequency, offer as many meteorological difficulties as those encountered on other sectors. Moreover, most of our domestic services and 65% of our international runs touch down at Milan in addition to our daily services to Torino, Catania and Naples. I, therefore, think our company has had and has as much, if not more, bad weather operational experience as any other carrier and this should only stress more the satisfaction and the pride we take in our operations.

Let me add that it is well known that the Central and South Atlantic, being less equipped with navigational aids than the North Atlantic (radio beacons, Loran stations, ground to air communications, etc.) provide usually severe navigational difficulties which should not be overlooked.

I thank you for your kind attention and take the liberty to express to you my personal admiration and that of my company for the wonderful work you perform with your magazine of which I am a regular reader.

FABRIZIO SERENA DI LAPIGIO
Representative for the U.S.A.
Alitalia
Aerolinee Italiana Internazionali
New York, N. Y.

Cockpit History

In your issue of April 29 under the heading "New Cockpit Layout Proposed by CAB" (p. 40), I was very much surprised at the expression of the 'newness' of this layout.

As far back as 1943 Col. Duckworth at Bryant, Tex., Air Force Instrument Training School, stressed the attitude system of instrument flying. This called for the airspeed, horizon, and altimeter instruments, which show pitch and attitude, to be installed in one line, and the turn indicator and direction indicator, which indicate banking attitude, in another line just below. By cross checking his horizon with his airspeed and altimeter (all located in one line), the pilot may determine the cause for changes in pitch and attitude of the airplane.

Installed in the line below are the direction and the turn indicator, both of which show banking attitude of the airplane.

After completing this course I was assigned as Training Officer for the Air Transport Command in Little Rock, Ark. At that time we converted all of our training ships to the now proposed 'new' system of instrument installation. Since 1947 I have been an executive pilot and in every airplane to which I have been assigned we have installed the instruments in this proposed layout.

If we want to go back still further, in the late 1930s, American Airlines built panels for DC-3s in exactly the same configuration.

Has the aviation business gotten into such a rut that we are just now 'officially' approving something that happened years ago?

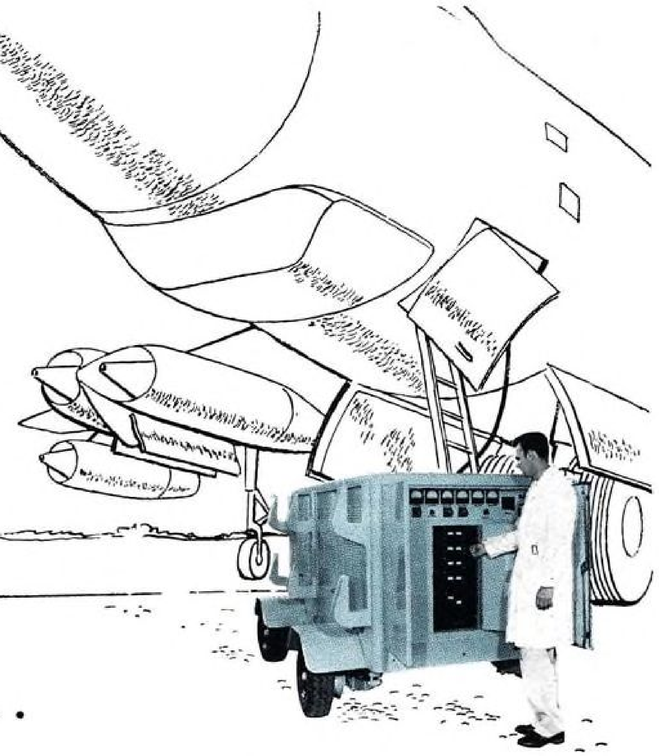
In the past few months I have applied for a patent for an instrument on which I have been working for six years that will give a pilot a three-dimensional indication of his attitude and will also give him heading and all necessary navigational information including glide path in clearly legible figures.

So far the only objection that has been raised to it is that it would not fit in a 3⅛ in. hole in the panel!

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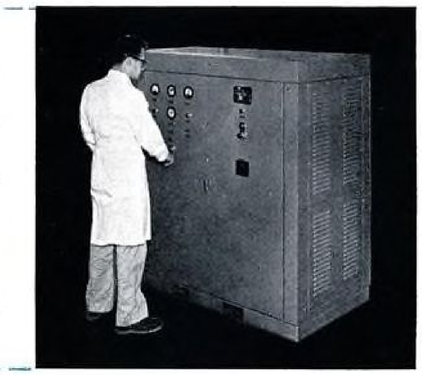
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