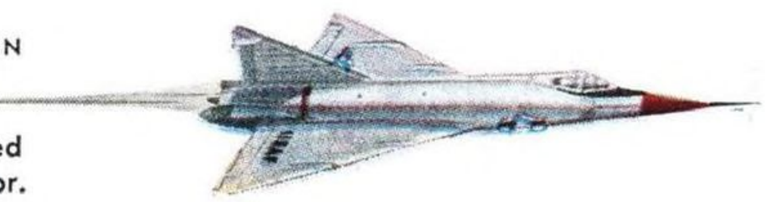
AVIATION WEEK
A McGRAW-HILL PUBLICATION
SEPT. 26, 1955
50 CENTS



Another town is safer tonight because these trained civilian members of the Ground Observer Corps are scanning the skies to warn against possible enemy attack. But all over America there are many areas, perhaps your own, that do not have this protection because the G.O.C. is seriously understaffed.

In extending its vital work to all 48 states the Ground Observer Corps needs many thousands of new observers. You'll find the G.O.C. both interesting and exciting! A few hours a week of your spare time will help keep your home and country safe. Volunteer today...contact Civil Defense!

CONVAIR A DIVISION OF GENERAL DYNAMICS CORPORATION



Through the assistance of the Ground Observer Corps, the U.S.A.F. Air Defense Command is prepared for any alert with aircraft such as the Convair-built F-102A all-weather supersonic interceptor.



Douglas YC-124B powered by four 5550 h.p. Pratt & Whitney T-34 turboprop engines.

How the Holley "hidden co-pilot" does two jobs with one handle control



Throughout the entire operational range of the new Douglas YC-124B, engine power and propeller governor setting must be precisely coordinated. This has always been a "two-handle" job but in this new airplane the job is done with a single control lever and the help of a Holley Power Control which functions like a "hidden co-pilot".

One of these controls installed on each 5550 horsepower Pratt & Whitney Aircraft T-34 engines automatically senses altitude, air temperature and speed and feeds the information to its nerve center —a series of precision manufactured 3-dimensional cams. These cams continuously interpret this information in terms of engine power which is automatically adjusted through precise metering of fuel by the control.

The Holley Power Control not only coordinates the engine and propeller for all forward thrust conditions but also controls the vital reversing of thrust necessary to reduce the aircraft's landing roll.

Designed, developed and manufactured by Holley, the "hidden co-pilot" is dependable, easy to service, compact and lightweight—four qualities that always distinguish Holley aviation equipment.

HOLLEY Carburetor Co.

11955 E. NINE MILE ROAD
VAN DYKE, MICHIGAN

LEADER IN THE DESIGN, DEVELOPMENT, AND MANUFACTURE OF AVIATION FUEL METERING DEVICES

A-22



Need to save weight and space? Insure reliability? Guarantee fast action? Then consider the talents of pneumatics!

Weight-saving pneumatic systems use smaller lines, require *no* return lines whatsoever. Even the heart of a pneumatic system – the compressor – aids in the task of conserving weight and space. You *store* air until it's needed, building up *high-horsepower* delivery from a lightweight, *low-horsepower* source!

Pneumatic systems give fast, efficient performance through an extremely broad temperature range. Because the viscosity of the air they use remains essentially the same from −65° to +250°, pneumatic systems are *never* sluggish!

Pneumatic systems are dependable – face no serious leakage problem. The compressor itself automatically compensates for any minor leakage which might occur. Furthermore, since the air used in the system cannot burn, pneumatics frees you from the danger of fire!

We here at Kidde have a complete line of pneumatic system components, including high-output compressors, as well as the facilities for engineering complete pneumatic systems. If *you* have a problem in pneumatics, please write us.

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Phillips 66
PRESENTS

MILESTONES IN AVIATION

25th Anniversary of the "Sky Girls"

This year marks the 25th Anniversary of airplane stewardess service, which started back in 1930 when eight nurses first started flying for Boeing Air Transport, a direct ancestor of United Air Lines. Today, United employs more than 900 stewardesses, chosen from thousands of applicants and trained at United's school in Cheyenne, Wyoming. Approximately 10,000 stewardesses are now flying for air lines throughout the world.



First air stewardesses: In 1930, eight San Francisco nurses were assigned to tri-motored Boeing 80-A's which carried 14 passengers at cruising speed of 120 miles an hour.



Stewardess service, pioneered by United Air Lines 25 years ago, now ranks high among favored careers for women.



W. A. Patterson, President of United Air Lines, with Ellen Church (left), the world's first stewardess, and Libby Doyle Decker, national President of United's Stewardess Alumnae.

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Phillips 66

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SEPTEMBER 26, 1955

AVIATION WEEK

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FACTS

about

NEW DEPARTURE

BALL BEARINGS



New Departure split inner ring bearings are separable, facilitating cleaning, inspection and assembly into the engine. They carry heavy thrust loads from either direction and will also support major radial loads.

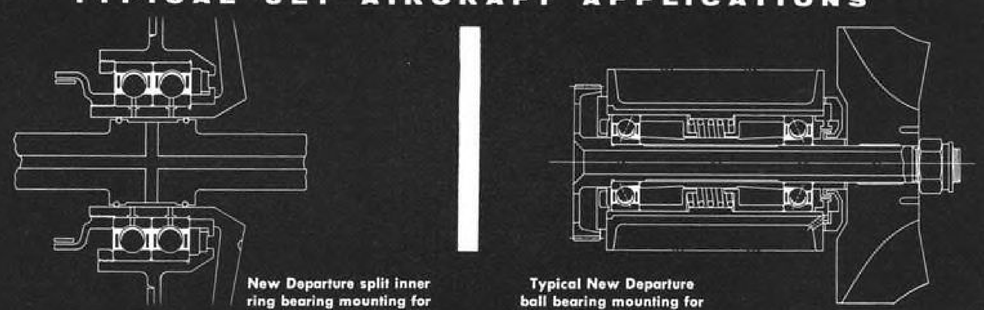
Research develops aircraft bearings for extreme speeds and temperatures

With jet aircraft flying higher and faster than ever before, ball bearings are being called on to meet increasingly severe conditions. For example, bearings that support the turbine wheels are subjected currently to temperatures up to 500° F. at high speeds and heavy thrust loads.

Anticipating still greater demands in the future, New Departure's Aircraft Research Program is already developing bearings for operational speeds of over 100,000 rpm and temperatures moving up towards 1000° F.

Typical of the bearings used in jet engines are New Departure's split inner ring types. These bearings are giving satisfactory performance in production engines today at extremely high speeds and heavy thrust loads. Write for full details.

TYPICAL JET AIRCRAFT APPLICATIONS



New Departure split inner ring bearing mounting for jet engine mainshaft

Typical New Departure ball bearing mounting for alternator drive power turbine

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NEWS DIGEST

Domestic

Eastern Air Lines plans to announce this week an overall re-equipment program for turbine-powered airliners after a company meeting in New York. Eastern will place large orders for Lockheed's turbo-prop Electra and for the Douglas turbojet DC-8. Lockheed spokesmen anticipate that Eastern's Electra order will be larger than the 35-plane order placed by American Airlines. Eastern will buy the Allison Model 501 turboprop engine for the Electra, following American's lead in placing a $12,500,000 order last week for the Allison powerplant. National Airlines also is planning an Electra-DC-8 fleet (AW July 11, p. 108) but has not yet placed firm orders.

Seaboard & Western Airlines and BOAC have entered into an interline air cargo agreement to expedite air-freight deliveries over both carrier's routes through the use of one airway bill. S&WA recently made a similar agreement with American Airlines for trans-Atlantic cargo service (AW Sept. 19, p. 142).

Lockheed Electra turboprop transport ailerons and wing flaps will be made by Temco Aircraft Corp., Dallas, Tex., with first deliveries scheduled for late 1956. Temco will handle design tooling and fabrication of the components. Electra work represents Temco's first commercial subcontract.

Ryan Aeronautical Co., San Diego, Calif., will build structural components for Convair B-58 supersonic bomber under a contract totalling more than $500,000.

Prototype Douglas SC-54 air-rescue conversion by Convair-Ft. Worth has made its initial flight as a prelude to 25-hr. flight check of electronic and special search and rescue equipment. Convair has a USAF contract calling for conversion of 36 C-54s to air-rescue duties.

Fairchild C-123 assault transport has completed accelerated service test by personnel of 309th Troop Carrier Group Assault (Fixed Wing) at Ardmore AFB, Okla., during which the plane was flown 500 hr. in less than two months. Purpose of trial was to compile C-123 operational data, supply requirements and train flight and ground crews.

Radar training for 1,785 United Air Lines pilots begins next month. Course in C-band weather mapping equipment includes home-study and classroom work. UAL began installation of $2.5 million in RCA radar this past summer.



Grumman Produces New Navy Trainer-Transport

Deeper, roomier fuselage keynotes the new TF-1, trainer-transport version of Grumman S2F combination sub hunter-killer. This new airplane does not carry the retractable belly radome, magnetic airborne detection (MAD) boom and underwing searchlight of its combat counterpart. A number of TF-1s already are in service with Navy. Plane pictured above carries arresting hook, indicating that it is intended to work from carriers as well as Navy shore bases.

Supercarrier U. S. S. Saratoga is scheduled to be christened Oct. 8 at the N. Y. Naval Shipyard, Brooklyn. A 60,000-ton sistership to the U. S. S. Forrestal, Saratoga is slated to be commissioned early next year. Her construction began in December 1952.

Navy and Marine Corps officials recently made a 49-min. flight in Lockheed C-130 Hercules turboprop-powered transport at Marietta, Ga., where the plane is in production for USAF. Visitors were: James Pyle, assistant to the Navy's Assistant Secretary (Air), Lt. Cmdr. G. E. Lambert, BuAer and Maj. W. H. Rodenberger, USMC, BuAer.

Cmdr. Harold T. Bartlett, (USN, ret.), who made an unsuccessful attempt to fly nonstop from Norfolk, Va., to Panama Canal Zone in a PN-10 flying boat in 1926, died in San Francisco. He was 68.

Avionics & Missile Systems Laboratories has been dedicated by Sylvania Electric Products, Inc. at Waltham, Mass. New 120,000-square-foot laboratory will utilize 700 technicians for research and development in radar, countermeasures, communications and missiles. The latter function previously had been performed at Sylvania's Whitestone N. Y., facility.

Colonial C-1 Skimmer three-place amphibian has been granted Type Certificate 1A1 by Civil Aeronautics Administration. Powered by a 150-hp. Lycoming 0320 pusher engine turning a constant speed Hartzell propeller, the C-1 has a top speed of approximately 125 mph. It will sell for about $16,000 with VHF radio and standard flight panel. Builder is Colonial Aircraft Corp., Deer Park, L. I., N. Y.

Financial

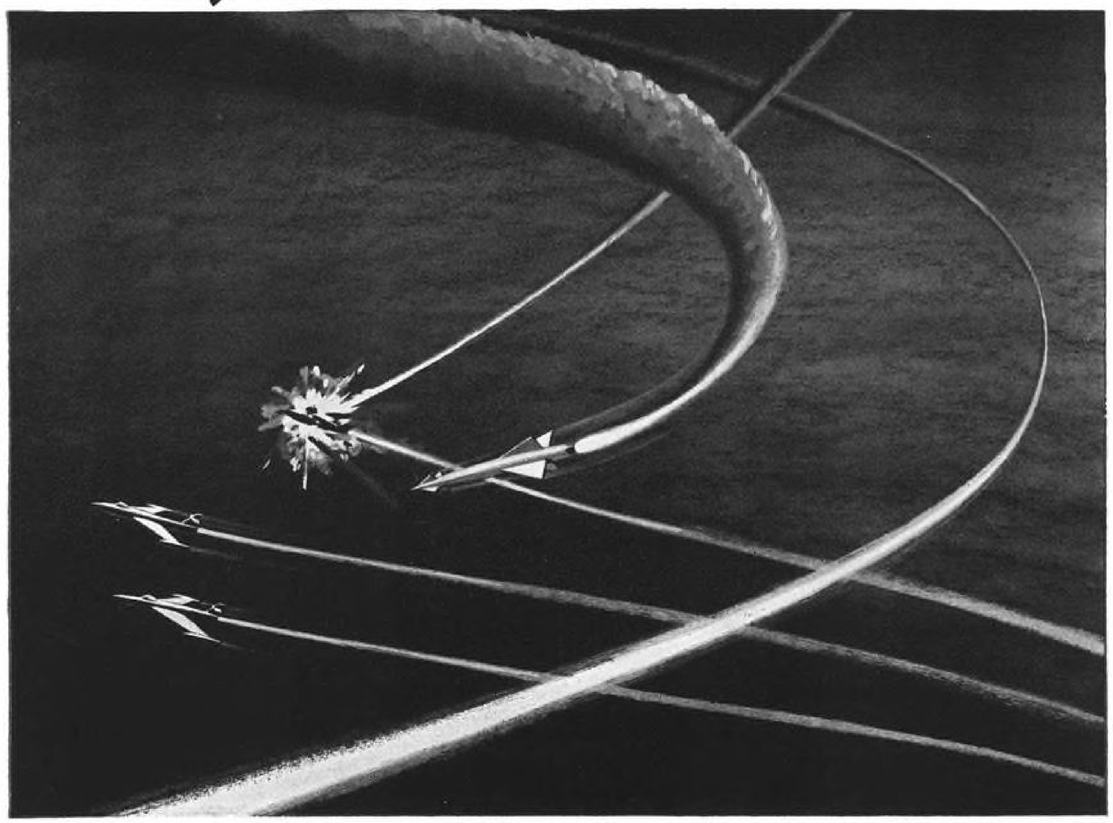
Capital Airlines reports a July net profit of $112,986 and operating profit of $310,896. Total operating revenues for the month: $4,579,404. Passenger revenues totaled $4,201,472. Capital flew 237,008 passengers 73,853,595 passenger-miles in July compared with 223,672 passengers flown 70,016,692 passenger-miles in July 1954.

International

New airfreight carrier, Midland Air Line, has been formed in Zurich, Switzerland, using Curtiss C-46s and Lockheed Constellations. The C-46s will fly airfreight from various European points to Basle where loads will be transferred to Constellations for air shipment abroad.

Irish-Belgian air agreement has been signed permitting Aer Lingus to fly from Dublin to Brussels and beyond in exchange for Belgian trans-Atlantic rights at Shannon Airport. Airlines of both countries also are allowed to open direct services between their capitals.

Today and Tomorrow...



CANADAIR COUNTS — *in Guided Missiles*

Grim herald of the push-button war, the guided missile's development has become an urgent matter for all world powers. The missile itself is not enough . . . the race is now for sharper control, greater speed, higher altitudes, more sensitive response.

In the interests of national security, this program is naturally classified but we can say this much: we are working closely with Canadian government research agencies, in the advanced technological fields of design, development and construction of guided missiles. We have produced missile airframes and control equipment . . . have seen them through actual firing tests.

This is a challenging field, where Canadair engineers face and overcome new problems every day. In missile development, as in other fields of aeronautical achievement, people who know say, "you can count on Canadair."

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AVIATION CALENDAR

Sept. 29-30—Radio Technical Commission for Aeronautics, fall assembly, Hotel Statler, Washington, D. C.

Oct. 3-5—Eleventh National Electronics Conference, Hotel Sherman, Chicago.

Oct. 4-6—Eleventh annual Aircraft Spark Plug and Ignition Conference, sponsored by Champion Spark Plug Co., Secor Hotel, Toledo, Ohio.

Oct. 5-7—National Business Aircraft Assn., eighth annual Meeting and Forum, Sheraton-Cadillac Hotel, Detroit.

Oct. 5-7—1955 National Airport Conference, sponsored by American Association of Airport Executives and University of Oklahoma, Norman, Okla.

Oct. 5-9—World Plastics Fair & Exposition, National Guard Armory, Los Angeles.

Oct. 7—Escape from High Performance Aircraft Symposium, sponsored by Institute of Transportation & Traffic Engineering Ext. at U.C.L.A., Aeronautical-Engineering Assn., Institute of the Aeronautical Sciences, IAS Building, Los Angeles.

Oct. 11-14—National Association of State Aviation Officials, annual convention, Dallas.

Oct. 11-15—Society of Automotive Engineers, Golden Anniversary Aeronautic Meeting, Aircraft Production Forum and Aircraft Engineering Display, Hotel Statler, Los Angeles.

Oct. 18-19—Seventh annual Aerial Dusting and Spraying Conference, sponsored by the Washington State Aeronautics Commission and the State College of Washington, Wenatchee, Wash.

Oct. 17-21—National Safety Council, 43rd National Congress and Exposition, La Salle and Conrad Hilton Hotels, Chicago.

Oct. 17-21—International Air Transport Assn., 11th annual general meeting, Waldorf-Astoria Hotel, New York.

Oct. 20-21—Sixth annual National Noise Abatement Symposium, Armour Research Foundation, Chicago.

Oct. 24-25—Institute of Radio Engineers' Professional Group on Electronic Devices, first annual Technical Meeting, Shoreham Hotel, Washington, D. C.

Oct. 25-27—Technical Conference on Aircraft Electrical Applications, American Institute of Electrical Engineers, Hollywood-Roosevelt Hotel, Los Angeles.

Oct. 26-28—Southwestern Airport Managers' Assn., annual meeting, Greenville, S. C.

Oct. 27-28—Aircraft Electrical Society, 12th annual display, Pan Pacific Auditorium, Los Angeles.

Oct. 30—Second annual Topeka Aviation Day, Topeka, Kans.

Oct. 31-Nov. 1—Institute of Radio Engineers, 1955 East Coast Conference on Aeronautical and Navigational Electronics, Lord Baltimore Hotel, Baltimore.

Nov. 3-4—Institute of the Aeronautical Sciences and Canadian Aeronautical Institute, second annual joint meeting, Chateau Laurier, Ottawa, Ont., Canada.

Nov. 8-10—National Aviation Trades Assn., annual convention, Hotel Westward Ho, Phoenix, Ariz.

Nov. 9-11—Industrial Management Society, 19th annual time, motion study, management clinics, Hotel Sherman, Chicago.

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INDUSTRY OBSERVER

(Editor's note: This column was written by Aviation Week's staff attending the SBAC flying display at Farnborough and visiting the British aircraft industry.)

► Avro and Saunders-Roe interceptors, powered by combined turbojet-rocket powerplants, are scheduled for first flight within next few months. Saunders-Roe design will use high test peroxide in a decomposition cycle for its rocket motor; layout of the plane features a delta wing.

► Gyron Junior, new turbojet developed by de Havilland as a half-thrust model of its massive Gyron (AW Sept. 19, p. 13) appears to be a prospective powerplant for production versions of some of the projects now nearing flight or on the drawing boards. Suggested airframes for the 8,000-lb. thrust Gyron Junior include the Saunders-Roe and Avro interceptors.

► Performance of Avro Vulcan has exceeded requirements of contract by substantial margin, approaching sonic speeds in level flight at extremely high altitudes. But Avro designers, who had hoped to push plane into the supersonic speed range, are disappointed. Design is limited by aerodynamics of thick wing. To thin the wing would (for the delta form) mean a complete redesign of the major portion of the airframe. Current maximum performance at altitude is apparently limited by availability of elevator control.

► Recent Olympus-Canberra altitude record of 65,876 ft. set by Bristol's Walter Gibb (AW Sept. 12, p. 17) did not show absolute limit of the design. Gibb had a margin of ten knots left between stall and compressibility when he stopped climbing. He landed with approximately 50 gallons of fuel in the tanks.

► Vickers Viscount replacement design is still not finalized. Argument now centers around wing location. Some factions in BEA prefer high wing because of passenger acceptance of the Elizabethan. Others favor low wing layout. Vickers doesn't care but urgently needs an immediate decision from BEA.

► Fairey FD 2 delta research craft is pointed toward understanding of problems of maneuverability at high altitude and speed. Specific parts of its flight research program will be devoted to study of intercepting supersonic bombers.

► Gross weight of DH 110 in present pre-production configuration is 36,000 lb. Armament now is a gun pack of four 30-mm. cannon. Like the Hawker Hunter's, the pack can be winched out of the airplane as a unit for fast service and turn-around. Eventual development of plane will be as a missile launcher.

► English Electric P.1, designated as a long range interceptor, is limited by fuel capacity to the job of target area defense. Development of the aircraft is expected to progress from current powerplant of twin Sapphires through twin Avons ultimately to a single Gyron.

► Hunter two-seater development is aimed at an all-weather fighter with performance superior—although not by a big enough margin—to the Gloster Javelin. Hawker and official sources act coyly about the design, hope it will be taken for a trainer. But the plane that was demonstrated at Farnborough had a large painted stencil on left-hand side of nose, labeling the radar cooling connection.

► Rolls-Royce vertical takeoff projects, not to be confused with the company's "flying bedstead" which is simply a control test rig, are joint Anglo-American efforts. Rolls philosophy is believed to be based on the use of clustered Soar turbojets.

► Rolls-Royce RB 109 turboprop is now in its third major design modification, and some feeling is that the engine as finally built will have little resemblance to the designs that were presented to the aircraft industry about one year ago.

WHO'S WHERE

In the Front Office

Everett M. Goulard, vice president-industrial relations, Pan American World Airways.

John H. Sidebottam, vice president, Flight Refueling, Inc., Baltimore.

David Dettinger, vice president and chief engineer, Wheeler Laboratories, Inc., Great Neck, N. Y. **Frank H. Williams,** assistant chief engineer.

Rear Adm. Harry B. Temple (USN Ret.), assistant vice president of Robertshaw-Fulton Controls Co.

Harry B. Horne, Jr., assistant to the vice president of Piasecki Helicopter Corp., Morton, Pa.

Jack C. Tobin, vice president of Hawaiian Airlines.

Honors and Elections

Walter L. Rice, president of Reynolds Mining Corp. and vice president of Reynolds Metals Co., appointed by Secy. of the Interior Douglas McKay to serve on the Industry Advisory Committee on Aluminum.

Roger Waindle of Wai-Met Engineering Co. appointed chairman of the Investment Casting Institute's Metal Specifications Committee; **V. S. Lazzara** of Casting Engineers, Inc. appointed chairman of the Program Planning Committee; **George Cannon, Jr.,** Educational Program Committee.

Changes

Vincent J. Cushing, manager of the propulsion and structural research dept. at Armour Foundation of Illinois Institute of Technology.

William M. Burr, chief of aircraft and missile section, Control Engineering Co., Detroit.

John F. Nycum, manager of flight equipment development, Delta C&S Air Lines.

James R. Gage, military relations manager for Douglas Aircraft Company's Long Beach Division.

A. S. Bowser, Jr., chief of operations services at Northrop Aircraft's Palmdale Airport installation. **Col. Willard W. Millikan,** assistant Washington representative. **Ray D. Gardner,** project engineer on new Northrop long range interceptor.

Ralph E. Pettit, technical advisor-metal industries department of Diversey Corp., Chicago.

DeLoy Monroe, manager-engineering services, Spartan Electronics Div., Sparks-Withington Co., Jackson, Mich. **Bert Aaron,** engineering staff.

Neil A. Baer, application engineering specialist, Vickers Inc., Detroit.

John Attinello, assistant chief of research in preliminary design at Fairchild Aircraft.

John T. Hickey, general manager, Motorola Inc. transistor manufacturing facility in Phoenix, Ariz. Also appointed: **Dr. Virgil E. Bottom,** director of research and development; **Edmund G. Shower,** product production manager.

Americo J. Focacci, New York City district sales manager of Slick Airways.



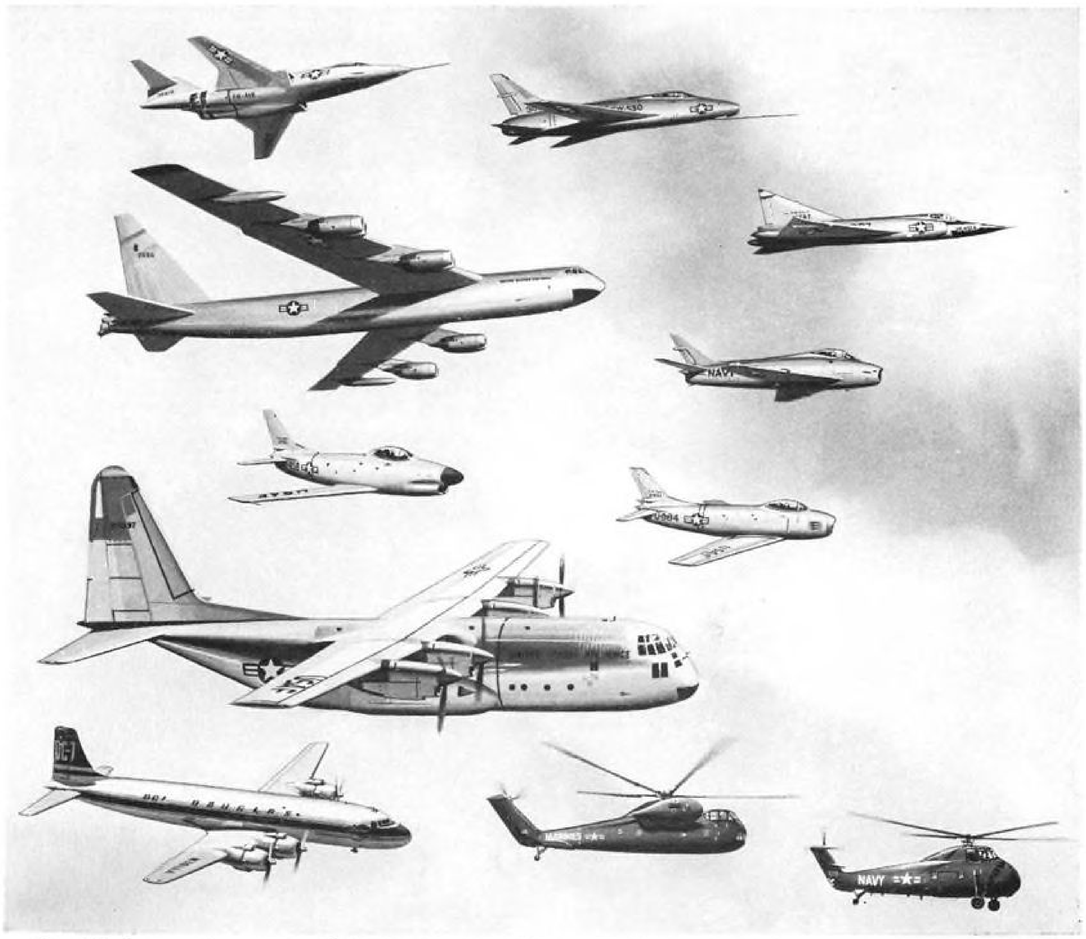
SPECIAL Hamilton Standard reversing Hydromatic propellers are being furnished for the new Douglas DC-7C "Seven Seas" airliners. Years of aviation experience, the highest engineering skills and unsurpassed modern facilities lie behind these propellers, and other *basic lines* * of equipment which Hamilton Standard is producing for jet and piston-engined aircraft.

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Left to right, from top to bottom: McDonnell F-101; North American F-100; Convair F-102A; Boeing B-52; North American FJ-4, F-86D, and F-86H; Lockheed C-130; Douglas DC-7; Sikorsky S-56 and S-58.

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Washington Roundup

Airline Hiring Conference

The Eisenhower Administration is getting set to extend its policy of barring discrimination in hiring for government contract work to the nation's airlines.

The President's Committee on Government Contracts—headed by Vice President Richard Nixon—is preparing a conference with airline officials to explain federal rules which ban discrimination against minority groups by contractors dealing with the federal government. The federal-industry-labor committee favors placing such a clause in government-airline contracts.

Before the committee recommends such action, however, it wants to advise the industry's executives of its determination to eliminate hiring bias in airline positions. In the meeting, which has not yet been fully worked out, the committee will emphasize that it has no powers to penalize violators of the anti-discrimination clause and that it seeks voluntary support.

The contract committee approved the idea of a conference after receiving complaints from the Urban League in New York that Negroes were barred from jobs as pilots, flight engineers and stewardesses. At present, a committee aide says, a "handful" of Negroes have been hired as ticket sellers and in maintenance work but that, in general, Negroes do not hold airline jobs that are in contact with the public.

The airline conferences are part of a series of future committee sessions on hiring discrimination in the entire transportation industry. Initial plans are to meet separately with industry and union leaders to explain the committee's purpose, prior to action that will extend anti-discrimination clause to transportation contracts.

All government contracts of $10,000 and over include an anti-discrimination hiring clause, with the federal contracting agency authorized to cancel the contract with violators. However, this enforcement power has not been used by the Eisenhower Administration.

Purpose of the Nixon committee is to ride herd on these agencies pinpointing complaints of violations and to seek compliance through the agency and the contractors by persuasive methods. But, before extending the clause to transportation industries, the group wants to explain why the Administration is doing so and the results it hopes to achieve.

All Flights IFR?

All-weather positive air traffic control or 100% Instrument Flight Rules in major metropolitan areas is getting increasing attention from air line pilot groups. Observers predict that air line managements will soon be faced with pilot demands to make it a matter of company policy to fly only under IFR in high-density areas.

The Pilot's Master Executive Council of one of the major trunk airlines has gone on record with a resolution in favor of implementing 100% IFR air traffic control at New York, Chicago and Washington, D. C. Conditions listed as necessitating such action included:

- **The visibility factor** in today's air carrier aircraft is about 5%.
- **The cockpit-to-cockpit** closure rate of some of today's aircraft is now greater than the speed of a .45 cal. Colt automatic bullet.
- **The conjection of air traffic** has reached the proportions where the New York center alone, in one 24 hour period last spring, cleared 4,000 individual IFR aircraft.
- **The aviation industry** will never be strong enough not to be scarred by the blow it would receive from the public's reaction to a needless mid-air collision over some major city.

Air Power Debate

The air supremacy issue still is being tossed back and forth in Washington and seems certain to stay alive long enough for what Sen. Stuart Symington (D.-Mo.) former USAF Secretary, predicts will be a "searching inquiry." Most recent flurry was caused by a columnist's claim that the Killian Committee report, now in the hands of the White House and the National Security Council, warns Russia is winning the air-atomic weapons race and will be in the front before 1965. The report brought a prompt statement from President Eisenhower's press secretary that it was "inaccurate," adding that the President alone will decide what parts of the report, if any, will be released to the public. Symington's reaction was to demand that the Defense Department tell the people the truth, indicating he would press next year to find out "why there is a current effort to further heavily reduce our defense expenditures while the Congress is not in session."

Progress Payments

Defense Department's proposed revision of the progress payments clause in government contracts will get close attention in Washington this week from Accounting and Controllers Committee of Aircraft Industries Assn.

Purpose of the revision is to limit progress payments to 75% of total costs and 90% of the value of direct labor and materials. In addition, it is designed to insure that the government has title to all parts, materials, inventories, work in progress, tools, etc. This is included to help aircraft manufacturers fight local efforts to tax capital equipment and inventory that do not represent company investment.

The limit on payments has been in effect for several months. The proposed revision, circulated to industry by the Defense Department for comment, will standardize the clause. The Pentagon has asked for comments not later than Oct. 10.

$80 to Seattle?

Sen. Warren Magnuson (D.-Wash.), from his key position as chairman of the Senate Commerce Committee, is campaigning for the same low air coach fares to the Pacific Northwest as apply to transcontinental service to California—$160 round trip. His committee has scheduled hearings on the matter for mid-October, in Seattle. In addition to Magnuson, Sen. John Bricker (R.-Ohio) and Sen. Charles Potter (R.-Mich.) are expected to attend.

Northwest Airlines is considering expanding, and possibly reducing fares, for coach services to the Pacific Northwest, but flatly writes off any chance of the $160 fare. "Let's not kid ourselves," a Northwest Airlines spokesman said, "the traffic to the Pacific Northwest is only about 9% of that to California". Civil Aeronautics Board members have had meetings with Northwest and United Air Lines officials about reducing coach fares to Seattle and Portland, but there were no concrete developments. —Washington staff

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Gardner Defends Greater R&D Spending

Pushes request for $200-million more now to keep pace with Russian guided-missile gains.

By William Coughlin

Los Angeles—Trevor Gardner, USAF Assistant Secretary for Research and Development, last week vigorously defended the additional $200-million he wants from Congress despite administration pressure for a balanced budget.

Gardner also warned that "hundreds of millions of dollars" more will be needed if the U. S. is to keep pace with the Soviet Union in the guided-missile field.

Speaking before the fall meeting of the American Rocket Society and plainly irked at the recent talk of reduction in defense appropriations, Gardner admitted that R&D requirements are "in combat" with the budget. Then he warned:

". . . The most complex and baffling technological mystery today is not the Russian capability in aircraft and nuclear weapons but rather what the Soviet progress has been in the field of guided missiles.

"This causes people a great deal of concern, and it makes me say we have to have large sums of money for guided missiles."

The double-edged warning was one of the most significant made against defense cuts by administration officials since the beginning of Russia's "open-door" policy. And he went one step further by telling the delegates to the meeting:

"As a responsible official of your government—in charge of your Air Force research and development program—I wish to assure you that it is not the intention of this administration to lose our technological lead over Russia in order to neatly balance the budget.

"We all know," he added, "that it is necessary to keep a balance, but we need $200-million more now to work on the problems I have just been talking about. (The problems he had just been talking about were those of guided missile complexity and reliability.) He continued:

Willingness to Expend

"We must be willing to expend increasingly larger amounts of our natural resources—both in dollars and technological effort—in our efforts in the development of guided missiles.

"This means, in addition to other things, additional hundreds of millions of dollars for research and development."

Gardner thus renewed a plea for increased R&D spending which he made less than a month ago at the Air Force Assn. meeting in San Francisco.

It is not generally known but Gardner tempered his San Francisco speech considerably only a few hours before it was to be delivered after he learned that Donald A. Quarles had been appointed Secretary of the Air Force by the administration.

Insiders said at the time that Gardner had planned a harsh indictment of present R&D efforts but changed his speech at the last moment when Quarles, a Defense Dept. research and development expert, was named to the top Air Force post.

In his talk last week, Gardner declared:

"They made an excellent choice in selecting an outstanding man in Secretary of the Air Force Quarles."

Quarles' Stand

And his speech echoed in more dramatic and dogmatic terms a policy already enunciated by Secretary Quarles (AW Sept. 19, p. 150) who told a panel of newsmen on the Columbia Broadcasting System network television show that, "We should not slow down our program to build up a most modern and effective air force."

Quarles indicated that defense spending might be cut in non-critical areas to help administration officials balance the budget but emphasized he would oppose any cuts that might hamper the military's present accelerated aircraft program.

Asst. Secretary Gardner left little doubt that attempts to cut defense spending would also draw heavy fire from his office, but he also touched upon one of the greatest difficulties in such a fight when he emphatically declared:

"Those of us who are charged with the management of the national investment in guided missiles are constantly caught in the dilemma of attempting, on the one hand, to report to you on the progress we are making while investing your tax dollars and, on the other hand, of avoiding the aid such reporting might give to our potential enemies. It is like looking for a gas leak with a match."

Kimball and the Pentagon

Los Angeles—Dan Kimball, president of Aerojet-General Corp. and former Secretary of the Navy, in his address to the American Rocket Society fall meeting last week outlined some of the difficulties of doing business with the Pentagon:

- "You take as much or more abuse than you get from commercial customers."
- "The time to get a contract is ten times as long."
- "You make one-half the profit."
- "You get redetermined, renegotiated and re-twisted around until you wish you had never seen the place."

Douglas Weapons System Policy

Los Angeles—The philosophy of Douglas Aircraft Co. in regard to the guided missile field was outlined last week before the American Rocket Society by Donald Douglas, Jr., vice president of the company.

He said the Douglas Co. believes the role of the aircraft manufacturer should be that of "architect" of the weapon systems and builder of the airframe.

"I am well aware that some of the leading aircraft companies have moved into the guidance and propulsion fields," Douglas said. "They believe, naturally, that there are advantages to be gained by this." We happen to believe it is better to leave such work to companies whose experience and facilities best qualify them to do the job."

The Douglas executive said that competition with suppliers or potential suppliers cuts off the free flow of information that is essential in working out the best possible choice of the various elements involved.

"In the first place," he said, "the work of the guidance system specialists is absolutely basic. We at Douglas believe that best results are obtained by working with them, instead of moving into their field. Airplane engines are basic to an airplane, also, but we have never been in the business of manufacturing them.

"As in the production of airplanes, we believe that in manufacturing missiles it is best to let others do whatever phase of the job they are best qualified to do."

Adm. Radford Warns: Red Air Gains Startling

The speed with which Soviet Russia has developed long range jet bomber forces and atomic weapons "is one of the most startling, fundamental military facts of our time," in the opinion of Admiral Arthur Radford, chairman of the Joint Chiefs of Staff.

Addressing an Atlantic City meeting of the National Petroleum Assn., Admiral Radford declared that Soviet scientific, technological and production skills in the military field have removed the country from the position of a second-rate power that it held during World War II.

After the war, he said, the United States disarmed while the Russians "began a new kind of arms race—primarily a technological race to perfect superior weapons systems. Then, as rapidly as possible, they began turning out these systems in impressive quantity.

These developments, Admiral Radford said, have resulted in a vital contest for the United States and "our whole future depends on winning it."

The top military advisor to the White House attributed Russian progress to "a very heavy investment of their available scientific and technical skills." He said they have been ruthless in squeezing their resources to achieve military power.

Of major significance, he said, is the stress placed on forcing young Communists into technological careers, turning out well-trained scientists twice as fast as the United States.

"Our technological leadership in these major fields is being seriously challenged," Admiral Radford said. "We have held the lead in scientific and technological manpower, but our lead inevitably will be whittled away unless we correct these recent trends."

The United States still is ahead of Russia, he said, but this conclusion is tempered by the knowledge that the trend is the other way.

"There is always the grave possibility," he added, "that the Soviets could develop radically advanced weapons. They might be able to do this, even though not as advanced technologically as we are, through a tremendous concentration of their efforts."

At Helicopter Forum

Gas Turbine Monopoly Predicted

Los Angeles—New gas turbine engines now under intensive development may achieve a near-monopoly of the helicopter field within a few years, military and industry experts predicted last week.

Reports on these new engines highlighted the two-day Western Forum of the American Helicopter Society.

Disclosure that Lycoming is developing an XT55 gas turbine for helicopter use came in a Navy paper. This followed release only a few days earlier of information on the Lycoming XT53, rated at 825 hp. (AW Sept. 19, p. 17).

The Lycoming XT55, developed for the Air Force and Army, is rated at 1,650 hp. twice that of the XT53. Presumably, like the XT53, it will be adaptable to helicopter use and as a turboprop for fixed wing aircraft.

Cmdr. R. R. Thoe of the U. S. Navy Helicopter Section said the Navy believes future helicopter requirements demand the use of gas turbine engines almost exclusively.

"No reciprocating engine development of major importance is planned to meet these installations," he said. "The free power turbine type of engine obviously offers many advantages when applied to helicopters and will be used in all cases except those involving an engine developed for both fixed and rotary wing applications."

Thoe reported that the Navy's development plans center around the General Electric XT58 engine.

Geared Turbine Drives

Navy interest is centered in geared gas turbines. "Various configurations of test drives such as the Allison T56-A-2 load compressor engine are being pursued on a research and development basis only, without extensive thought being given to a production program," he said.

The Navy is pushing gas turbine engine development for helicopters on a class approach, independent of specific application to a given model.

In other words, Thoe said, rather than determine the requirements of a given type of helicopter and then develop an engine to meet the need, effort should be devoted to developing an engine to conform to a particular segment of the propulsive power spectrum. This spectrum for the helicopter gas turbine should extend from 3,000 to 4,000 shaft horsepower, he declared.

"Comparing this power spectrum with the gas turbine engines presently under development, namely, the T53, T55 and the T58, it is noted that a considerable gap occurs between 300 horsepower and T53 engine, and between the T55 and 3,000 horsepower," Thoe said. "We believe that these gaps should and will be filled."

D. D. Weidhuner of the Army Transportation Section said it appears that for the majority of helicopter applications the free turbine type turboprop engine offers the greatest potential. But, he added, the Army believes that as long as the general requirement of long life with a minimum of maintenance and supply support is met, "it does not make any difference as to the type of engine, whether it is a reciprocating engine, gas turbine, rotor tip burner or any other type."

Weidhuner said a major part of the Army power plant development program is devoted to improvement of in-service engines. He listed projects to alleviate spark plug fouling, increase valve life, improve filtration of induction air and improve piston ring configurations.

Among new developments, he mentioned investigation of the principles of exhaust ejector cooling, hot fuel priming development for cold starts, fuel injection, automatic carburetor heat, automatic mixture controls for the carburetor and new air filter media.

Trial Installations

D. C. Berkey of General Electric said gas turbines offer these advantages: light weight, fuel consumption comparable to reciprocating engines, lower fuel cost, reduced vibration, lower maintenance and improved reliability.

Charles H. Zimmerman of National Advisory Committee for Aeronautics reported on experiments indicating that jet engines in vertical takeoff aircraft produce gyroscopic problems.

"Certain configurations of the jet tail sitter could not be flown through transition satisfactorily even with the aid of rate damping because of lateral-directional instability," he said.

The rotating parts of turbojets or turbofans tend to produce large gyroscopic couples "which cannot be ignored either in theory or in practice." Helicopters generally avoid the direct effects of gyroscopic couples by use of hinged rotors, he noted, while some VTOL's eliminate their external effects by using counterrotating propellers.

"It becomes difficult, however, to avoid gyroscopic couples with designs utilizing turbofan and turbojet engines because engine manufacturers do not ordinarily produce both left- and right-hand rotation engines," he said.

Congress Threatens Investigation Of AF Communications Contract

Washington—House Appropriations Committee investigators last week started spade work on a threatened full-scale probe of an Air Force program to spend $2.4 billion with private industry to improve the air defense system.

The money would be paid out over ten years to Western Electric Co., and American Telephone & Telegraph Co., to provide a communications network known as SAGE to link remote radar stations with control centers to direct planes and missiles against enemy raiders.

Some Democrats clearly were looking for a scandal involving the Defense Department and big business, charging that USAF had been devious and secretive in making arrangements for the circuits. The Air Force replied that necessary congressional groups had been informed of the project and details discussed at hearings before appropriate committees.

USAF lost the first round, with the announcement by Rep. John W. McCormack (D.-Mass.) that Comptroller General Joseph Campbell had blocked the deal on the grounds that Congress had given no authority for a long-term commitment. The Air Force immediately prepared to appeal and said that the Comptroller General's office had agreed to reconsider. Campbell's decision, dated Aug. 15, means no money can be spent on the SAGE project at this time.

It was pointed out that the communications network had been approved by the National Security Council, headed by the President, as vital to the security of the nation.

McCormack said he was not questioning the need for the system, but the propriety of leasing it from private companies instead of having it built by the government.

He further said the contract would be a bonanza for big business because the two firms would still own the circuits after collecting $2.4 billion over the ten-year period.

In his decision Comptroller General Campbell acknowledged that the question had been discussed at hearings before Congress, but this "cannot reasonably be regarded as establishing congressional approval or authorization for undertaking and financing the extensive new communications program . . ."

USAF replied that Congress already has appropriated substantial funds for acquisition of sites, construction of facilities and procurement and installation of equipment.

The extensive new telephone net is needed to mechanize communications, substituting complex equipment for human beings to report warnings from radar stations.

Royal Gull Certificated

Civil Aeronautics Administration issued the first type certificate for a foreign aircraft built to U. S. standards for an Italian twin-engine amphibian built by Piaggio.

Piaggio officials were presented the certificate by Henry W. Weeks, CAA engineering director, who was in Italy on an official tour (AW Sept. 5, p. 99).

The amphibian will be marketed in the U. S. by the Royal Aircraft Corp. of Milwaukee, Wisc., as the Royal Gull.

AMC to Take Over Far East Logistics

Command of the Far East Air Logistic Force will be shifted from Far East Air Forces to Air Materiel Command Oct. 1. The change will give AMC responsibility for USAF depots at Tachikawa, Japan, and Manila, as well as procurement, supply and maintenance centers in the Pacific and Far East.

Next step in the growing world-wide sphere of AMC activity will be transfer of materiel responsibility in the European theater. Details will be worked out later this month by a team scheduled to visit headquarters of USAF in Europe at Wiesbaden, Germany.

The new operational plan increases the logistical responsibilities of AMC. They already include direct materiel support to the Alaskan, Northeast, Spanish and Caribbean Air Commands.



Airlines Personnel Get 707 Check Flight

With representatives from four U. S. airlines aboard, the Boeing 707 jet tanker-transport prototype takes off from Boeing Field, Seattle, on a two-hour demonstration flight. The airline personnel, all members of the Society for Automotive Engineers' committee on cockpit standardization, included: Carl M. Christenson and W. E. Larned, United Air Lines; M. G. (Dan) Beard, American Airlines; Capt. M. Blake Cahill, Northwest Airlines, who flew co-pilot with A. M. (Tex) Johnston, Boeing's chief of flight test; and Capt. Scott Flower, Pan American World Airways. Beard stated that the 707's cockpit agrees with SAE standards. Plane is carrying streamlined Boeing flying boom for air-to-air refueling tests.

Convair B-58 Contract to be First To Include Profit-Penalty Clause

Los Angeles—First U. S. Air Force contract to include profit penalties for failure to meet performance specifications will be that for the Convair B-58 supersonic bomber.

This was revealed last week as industry comment on the new Air Materiel Command policy ranged from a cynical "grandstand play" to cautious approval.

USAF and Convair now are negotiating a test contract with the new AMC provisions for penalties on performance and delivery schedules (AW Sept. 19, p. 12). The new B-58 contract will be the first weapon systems contract to incorporate these as fixed provisions.

Question in the current USAF negotiations with the San Diego manufacturer is whose specifications to use in establishing performance standards. Air force specialists previously had questioned Convair's performance figures for the new delta-wing bomber as being too optimistic and produced their own figures to prove their point.

Convair believes the Air Force calculations should be used in setting up the required performance parameters while USAF wants to use the more optimistic Convair figures.

North American Position

Meanwhile, another manufacturer, who did not wish to be quoted, denounced the AMC policy statement as a "propaganda stunt" to gain favorable publicity. USAF, he asserted, has always had the ability to penalize contractors who failed to live up to performance specifications and delivery schedules.

North American Aviation declined official comment on the new policy, but it is known that top NAA officials have felt for some time that USAF should take sterner measures to punish those who fail to live up to promises made in design competitions.

More than two years ago, J. L. Atwood, NAA president, recommended financial penalties for firms whose planes fail to meet specifications.

Atwood said at the time that there is a need for "maximum realism" in procurement and no longer "a disproportionate premium attached to winning a design competition."

Increases Competition

He called for action by both the Air Force and Navy, adding, "If the imposition of financial penalties for nonattainment of performance guarantees is the only workable answer, then I believe such penalties should be invoked."

Lockheed Aircraft Corp. and Northrop Aircraft likewise declined to comment officially on the policy outlined by Maj. Gen. David H. Baker, AMC Director of Procurement and Production.

A Northrop spokesman pointed out that company president, Whitley Collins, has stated many times that he "is well aware of the competitive nature of our business, and we hope to make Northrop as competitive as possible and keep it competitive."

Others Hailed

Others also hailed the Baker statement as a move to increase competition and incentive.

"Anything that increases incentive is good," declared a high Convair official.

"The idea has fundamental merit." He pointed out that there will be difficulty in administering such a policy in regard to such unknown fields as new powerplants and aerodynamic heating.

"In such unknowns as guided missiles, where do the performance parameters come from?" he asked. "Will a company be willing to gamble a half-billion dollars knowing that 5% off the desired performance over several thousand miles will wipe out all profit?"

Donald Douglas Jr. said the Douglas Co. favors the idea of more severe performance penalties and believes it will result in more realistic design competitions.

Production Policy

It must be limited to production items, however, the Douglas vice president said. "You cannot apply this to research and development or it will kill interest in R & D type projects," he warned.

Component manufacturers pointed out that in most cases a simple but effective penalty procedure already is in effect for failure to meet component specifications and delivery dates: "Next time the aircraft manufacturer takes his subcontract elsewhere."

Small defense firms greeted enthusiastically the news from AMC that government-furnished tools and buildings are a thing of the past. This has been one of the bitter issues at the subcontracting level.

SDIA Applauds Move

The Small Defense Industries Assn. issued a statement applauding the AMC move.

"We have few differences with the major contractors," Paul Omohundro, SDIA director and president of Omohundro Co., told AVIATION WEEK, "but the government facility question has been a sore point with many of us for a long time. In the past, many government facilities have been installed and turned over to large company operation even though identical equipment and capacity was already available in private hands.

"We feel that national security demands a strong aircraft industry but the top management of major companies is often unaware of the situation created by this condition," he said.

Omohundro pointed out that SDIA members have long expressed the hope that no new facilities would be created unless a thorough and unbiased survey showed clearly that similar capable facilities did not exist in private hands.

"We think the Air Force has made a major forward step toward maintaining competitive economy through its new policy," he concluded.

Eastern Reaction To Policy Mixed

Washington—Reaction of East Coast industry representatives to USAF's new stern attitude toward performance and delivery promises was mixed.

One major engine manufacturer hailed the decision as "what we have been advocating for years."

Said a spokesman for an important airframe company: "If the industry is forced to assume more responsibility it must be compensated with more profit and then left alone and not hampered by continuing changes.

"Poor performance," this executive said, "can be the result of many things besides a company's own mistakes. There are developments beyond a company's control that come about between the time a design is bought and production can be started."

Another engine firm representative said, "We agree on punitive action if they can make it stick." This spokesman said there is a constant danger that the exceptions will outnumber the enforcements and that the results will be unfair.

It was also pointed out that penalties have been imposed in the past, but the rule was not enforced across the board.

Among airframe makers, the question was raised of the standards used to judge how well a new weapons system lives up to its scheduled performance.

The case was cited of the Convair F-102, designed according to the state of the art before development of the area rule concept by the National Advisory Committee for Aeronautics (AW Sept. 12, p. 12). Modification of the design to the F-102A with an area rule



TWELVE SUPER SABRES of the 479th Fighter Day Wing, first USAF Tactical Air Command unit to receive the supersonic fighter, stage fly-by over George AFB, Calif. F-100Cs now rolling off production lines can carry atomic bombloads.

fuselage following the NACA development made it possible for the plane to achieve supersonic performance.

Would performance in this case, it was asked, be judged before or after the area rule improvement was incorporated in the design.

Another airframe manufacturer pointed out that delivery schedules, upon which USAF will place greater emphasis, can be upset by such vagaries as the failure of GFAE items (government furnished aircraft equipment) to arrive on schedule. During these delays, USAF itself sometimes decides on changes due conditions that have been experienced in the field.

The case has been cited of a plane now in production where the engine is furnished by the government. After the aircraft was on the factory line, USAF changed engines, supplying a power unit that weighs 800 lb. more than the one that was called for in the original design.

This company also feels that the new USAF policy of eliminating design studies and awarding contracts that go through Phase I to a small number of proven firms, is too restrictive.

Other industry representatives expressed themselves in favor of stricter demands from USAF but were skeptical of statements that competition will be enhanced by recent procurement policy changes.

The Aircraft Industries Assn. declined comment.

Defense to Limit Contractor Payments

Defense Department on Oct. 1 will forbid payment of more than 105% of the costs incurred on incentive-type and price-revision-type contracts, prior to negotiation of a final price.

Defense directive (4105.7) says the purpose is to "eliminate the need for substantial refunds by contractors after retroactive final determination of prices."

Actually, the purpose is viewed by Pentagon observers as twofold:

- **To stop the practice** of companies that collect more than their product is worth and invest the extra money pending the government's price redetermination.
- **To help balance the budget,** as part of the Defense Department's effort to save more than $750 million from estimated 1956 expenditures.

There also was a report that the Pentagon is working on a program to speed up price redeterminations.

The new Defense directive calls for a 105% limitation clause to be written into all new contracts. In addition, contracting officers are to control the payments within that amount in administering existing contracts.

Russia Views X-1A

Russia's popular press has finally recognized the existence of high-speed American experimental aircraft but, to their way of explaining, the planes are nothing to cause Soviet designers alarm. As an example, Znanie-Sila (Knowledge is Strength), a monthly scientific and mechanics' magazine for young Soviet industrial workers, recently published a picture of the Bell X-1A with the following caption:

"The experimental Bell X-1A rocket plane has achieved a speed of 2,656 kilometers per hour in a dive. This is more than twice the speed of sound. The craft has attained a maximum altitude of 27 kilometers.

"However, the Bell X-1A is unable to take off from the ground by itself. It is carried to a great height by a special airplane. There the rocket plane is launched and flies by itself, burning up its entire fuel supply in several minutes.

"It should be noted that the records set under such conditions aren't recognized by anybody."

(Editor's note: The Bell X-1A actually achieved the speed of 2,656 kilometers—1,650 mph.—in a climb, not a dive as reported by Znanie-Sila.)

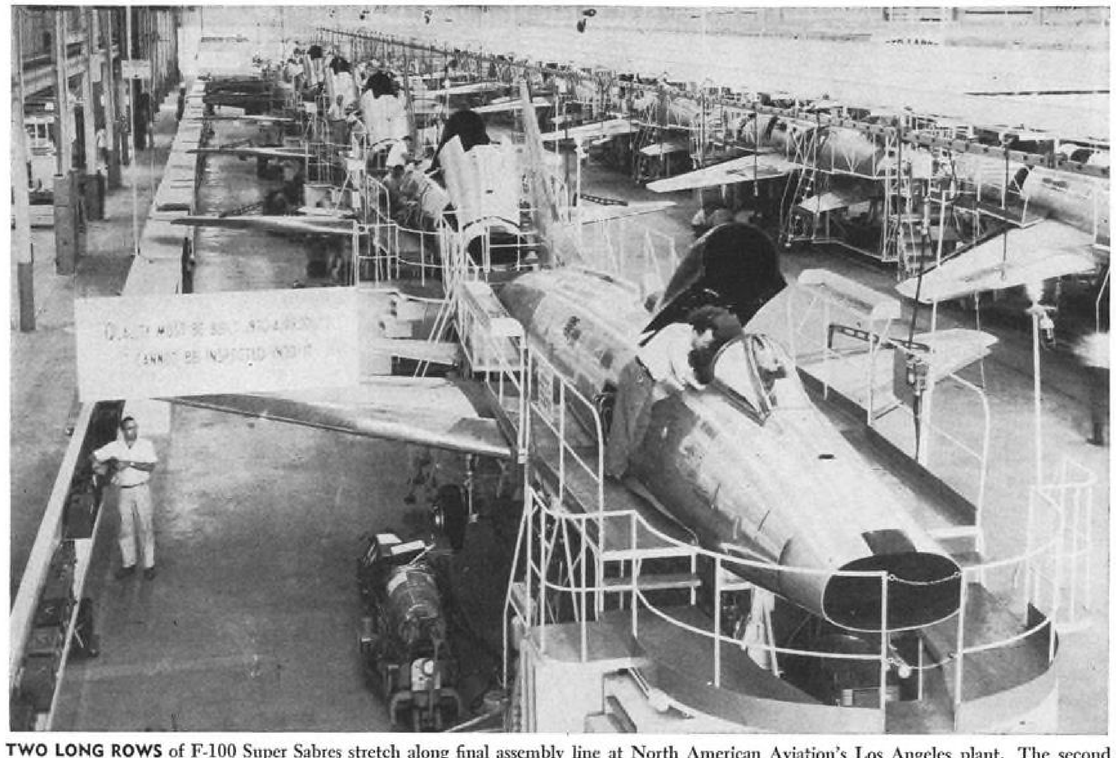


NORTH AMERICAN F-100 bends into steep climb (above) . . .



WHILE FOUR others hit supersonic speeds over desert.

TAC Flexes New Super Sabre Muscle



TWO LONG ROWS of F-100 Super Sabres stretch along final assembly line at North American Aviation's Los Angeles plant. The second TAC unit to receive the planes is the 450th Fighter Day Wing, of Foster AFB, Texas.

'No Show' Penalty Fee Dropped For Domestic Coach Passengers

Washington—The domestic scheduled airlines have killed the "no show" penalty fee on air coach services. It was a unanimous action by the Air Traffic Conference but made with reluctance for "competitive reasons" on the part of a minority group of carriers.

Abandoning the air coach no show penalty is seen as a direct contradiction of the efforts to develop a "no show" penalty system for first class air services (AW Aug. 22, p. 11).

The decision to drop the fee plan for air coach passengers holding reservations who either fail to show or cancel too late to resell the space was first carried by a majority of the carrier members of the Air Traffic Conference, and later made unanimous. The action is formally effective Oct. 2 but the necessary tariff changes filed with the Civil Aeronautics Board do not take effect until Oct. 15.

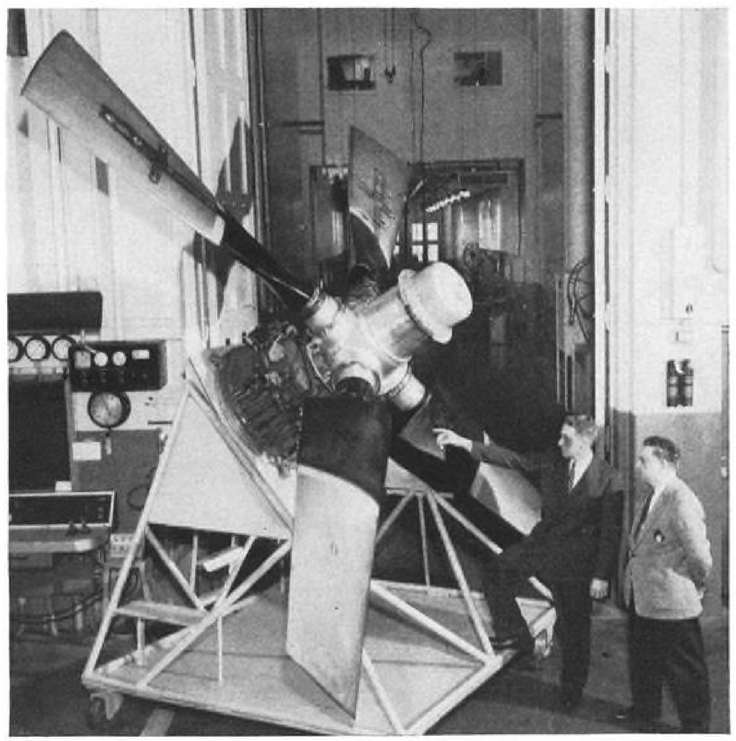
The "no show" penalty presently in effect imposes a charge of 20% of the one-way coach fare with a minimum charge of $5. It was designed as a corrective measure for the continued abuse of the airlines reservations system. A proposal for extending a comparable system to first class flights has long been under consideration. Inability of the carriers to agree on a single, uniform plan for assessing penalties has precluded implementation of an industry program.

C. R. Smith, American Airline's president, summed up the situation with the statement: "Experience clearly indicates that no single carrier or minority group of carriers can effectively operate a system designed to discourage abuse of the reservations system if all other carriers refuse to do so."

American has been a vigorous proponent of the use of penalty charges as a means for reducing the traffic problem of "no shows" and late cancellations. Once the ATC voted to cancel penalties in coach service, Smith criticized the decision in a letter to CAB stating that American's concurrence "is due to competitive forces."

Smith observed that "the continuing abuse of the reservation system by the public is primarily the fault and responsibility of the air lines . . . for the existing system, which permits, and at least indirectly encourages, abuse of the reservations system is one devised by the air carriers and continued with their approval." He said that a penalty system to discourage abuse of the space reservations procedure is an essential element of the public service the airlines are expected to provide.

Smith told the Board he felt that there should be no distinction in general reservations policy as between the air coach passenger and the first class passenger. He accused those who advocated abolishing the penalty system for air coach of acting against the public interest. Rather, it would be in the public interest to impose a like system on first class services, Smith said.



New Propeller For Supersonic Flight

Hamilton Standard's new nose-mounted, four-bladed turbo-hydromatic propeller, designed to operate through the subsonic and supersonic speed ranges, will be used on the Pratt & Whitney T57 turboprop engine which will power the Douglas C-132 transport.

The propeller derives its efficiency in the different high speed flight ranges through the use of different blade designs.

Principal feature of the new propeller is the method of mounting. Advantages include:

- **Relieves engine** of all propeller induced bending moments. The engine shaft transmits torque only, does not support the propeller.
- **Affords substantial reduction** in overall engine-propeller weight.
- **Propeller pitch change** and control systems are integrated within the propeller assembly.
- **Propeller balance** is improved by permitting more accurate centering of propeller on its own shaft.
- **Propeller and mounting system** are ready for installation as a unit.

Douglas Shifts

George B. Gelly, Douglas Aircraft Washington representative for the past eight years and assistant secretary, is returning to the general offices in Santa Monica, Calif., where he is scheduled to be elected secretary of the company.

L. E. Tollefson, now corporate secretary and director of contracts, has been appointed as the Washington representative.

Edward Curtis, former assistant director of contracts, has been named director of contracts.

H. E. Hjorth, of the Douglas Washington office, has been assigned assistant project engineer on the DC-8 jet transport. His replacement is S. W. Cebuhar, who was formerly with the military relations staff located at the Santa Monica headquarters.



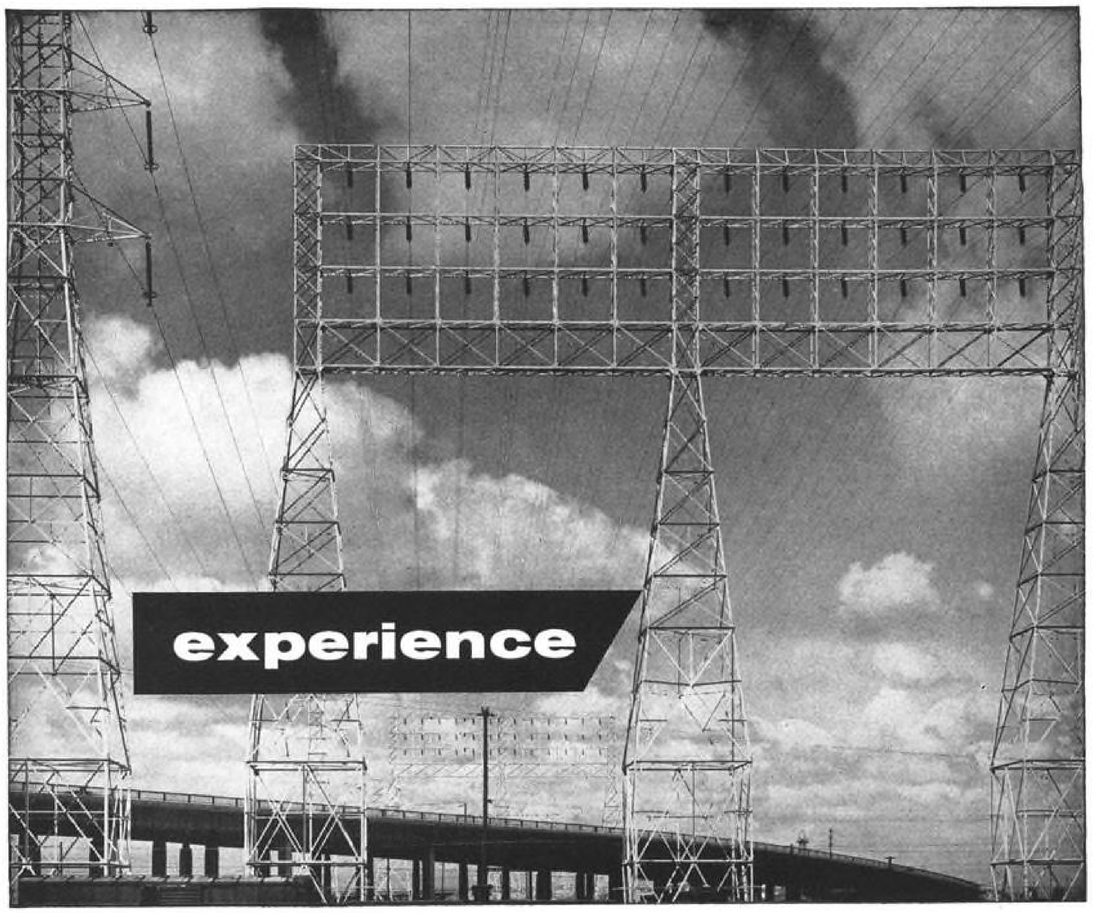
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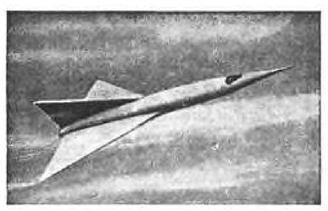
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'Satelloid' Debut, Soviet Delegates Highlight Astronautical Congress

Two significant concepts emerged from the recent Sixth Congress of the International Astronautical Federation in Copenhagen. One—the proposal for a new vehicle known as a "satelloid"—stemmed from mechanical design. The other—the friendliness of the Russian delegates and their interest in a cooperative satellite project—was simply by design.

In the following article, three American delegates to the Congress—Frederick I. Ordway III, Heyward E. Canney, Jr., and Norman V. Petersen—discuss the Congress in both its technical and practicable aspects. Mr. Ordway, with the Guided Missiles Division of Republican Aviation Corp., is a director of the American Astronautical Society and editor of the Journal of Astronautics. Mr. Canney, a member of the Engineering Division of Bell Aircraft Corp., is also a director of the AAS and associate editor of the Journal of Astronautics. Mr. Petersen, with Sperry Gyroscope Co., is president of the AAS and a member of its editorial board.

Delegates from 20 nations, including Soviet Russia, gathered in Copenhagen for the Sixth International Astronautical Congress almost immediately after President Eisenhower's announcement of U. S. plans to place small, unmanned satellites in orbit during the coming International Geophysical Year (July 1957-December 1958).

The announcement helped set the tone of the meetings, which produced two new—and significant—concepts: A new vehicle called a "satelloid" and sudden Russian gestures of lively interest in the general satellite undertaking.

The satelloid, proposed by Mr. Krafft Ehricke of Convair, is a hybrid and manned vehicle—half airplane, half satellite. Small rocket motors boost to a matter of days the orbit lifetimes which in a true (unpowered) satellite would last only hours at the low 80-mile altitude proposed. Unlike the first true satellites, the satelloid is to be manned, powered, reusable and able to glide safely back to Earth with its occupant(s) when the propellants are exhausted. Resembling a motorless (perhaps delta-winged) airplane, it would rely on a mere 3,400 lbs. of propellants used in small bursts to maintain an average speed of 17,400 mph for about six days.

The higher orbit (200-300 miles) required for unpowered satellites of the same lifetime demands very large rocket stages. The money otherwise used for these could be very advantageously spent on expensive ground stations without which the establishment of the satellite is of largely academic importance.

With a crew, observation capabilities of vastly greater range and complexity would be provided and a large step would be made in the direction of manned space flight.

A moot point arises as to whether the Eisenhower announcement was a cause or a result.

Officially, it was somewhat "routine" in connection with preparations for the International Geophysical Year.

Conceivably, the United States wished to "steal the march" on Russia, believed to have been prepared to make a similar announcement of her own.

Conversely, it is possible that the long astronautically-minded Russians opportunely grasped the occasion as a means of indicating peaceful intentions while Big Four talks were in progress in Geneva.

Russian Research

Some reports at the Congress speculated on the possibility that "flying saucers" may be Russian satellite vehicles. Although this is highly unlikely, it is certain that the Soviet Union is seriously working on the satellite vehicle proposition. The first official post-war Soviet organization interested in space flight was the Astronautics Section of the Chkalov Aero Club.

Meetings were held early last year to discuss the concept, to orient it to peaceful objectives and to form five technical committees. The fields of responsibility were: Astronomical and physical aspects, rocket technology, interplanetary navigation, human biology and automatic and radio control of interplanetary flight.

A symposium on the artificial satellite was scheduled for the fall of 1954, but it is not known whether it took place. Late last year the Soviet Academy of Sciences (which directs all scientific research in the USSR) took over and formed a "Permanent Interdepartmental Commission on Interplanetary Communications."

Head of the Commission was Prof. Peter L. Kapsitza, atomic scientist and radiation expert. Other key men included V. A. Ambartsumyan, astronomer and chairman of the Armenian Academy of Science; P. P. Parenago, astronomer, and B. V. Kukarkin, astrophysicist. Announcement of the commission's existence was made last April.

Russian satellite vehicle plans appear more ambitious than those announced so far in the United States. They have been described as automatic cosmic laboratories. There have even been poker-faced announcements by responsible Russian scientists hinting at unmanned flights to the moon.

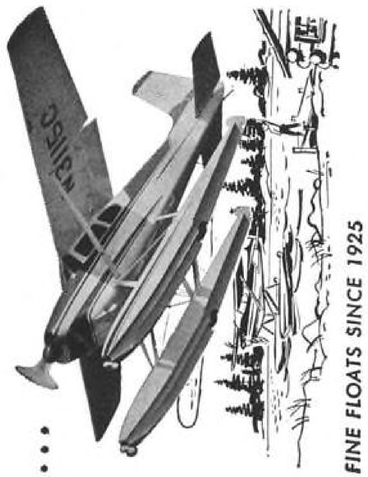
Soviets at Copenhagen

Three Soviet observers showed up at the Copenhagen Congress: Leonid Ivanovich Sedov, member of the Moscow Academy of Sciences and president of the Permanent Interdepartmental Commission on Interplanetary Communications; Kyrill Feodorovich Ogorodnikov, professor of physics and astronomy at the University of Leningrad, and Nikita Sannikov, interpreter.

Sedov thought the International Astronautical Federation (IAF) was a fine medium for international cooperation but said the final decision as to Russian participation would be up to Moscow. He seemed to feel, however, that Russia would cooperate with the American satellite program. Similar thoughts were echoed elsewhere by Communist party chief Nikita Krushchev, suggesting that the "Geneva spirit" has entered into the realm of astronautics with a flurry.

After the administrative matters of the Congress had been ironed out, scientific sessions began with Mr. Ehricke's highly technical paper on the satelloid. Other papers on the classical satellite vehicles included:

- **Prof. Alessandro Boni** (Italy) spoke on an "Artificial Satellite Orbit Synchronizing System," a technique for constraining a satellite in a circular orbit around the earth. This involves a pattern of transversal synchronizing forces whose direction is perpendicular to the line joining the earth's center of gravity to that of the satellite. The intensity of the force is proportional to the difference between the actual value of the angular velocity of the satellite and that of the orbit.
- **Methods** of determining the approximate lifetimes of simple satellite configurations, as influenced by the gravitational field and rarified atmosphere of the earth, were discussed by Norman Petersen (USA). In his paper, he estimated lifetimes of satellites from near-



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circularity, assuming spherical and conical body shapes. Petersen gave an approximate solution of the differential equations for the special case of diffuse reflection of free molecular flow. From an examination of several mass-area ratios he demonstrated that lifetimes increase markedly with altitude and mass-area ratio.

• **R. Tousey** (USA) approached the general problem of ground observation of artificial satellites. A white, 21-inch spherical body—taking into account known values of sky brightness, solar illumination and the visual threshold of the eye—enjoys optimum visibility at a zenith angle of 70 degree in an azimuth opposite the sun, Tousey said. "If one knows exactly where to look, the satellite, when nearly directly overhead at 200 miles altitude, will first be visible to 7x50 binoculars when the sun is 2 degrees below the horizon." For solar depression angles greater than 9 degrees, naked eye visibility will obtain as long as the satellite is sunlit. For easy detection, the sun should be 5 or more degrees below the horizon.

• **Capt. Glauco Partel** (Italy), discussing problems of rocket and satellite development, considered some optimum launching sites—six equatorial, high-altitude ground areas well-served by railroads. Advantages would be less air friction in thinner atmosphere and maximum earth-spin effect. He also thought it possible that the satellite could be established by launching a V-2-sized missile from a Bristol Britannia airplane at altitudes up to 60,000 feet.

• **Fred Ordway III** and Heyward Canney Jr (USA) presented the results of an extensive 120-page survey on the utility of the satellite vehicle. They concluded that the satellite vehicle is essential for more-fundamental study of nearly every major field of scientific inquiry but notably in astrophysics, geophysics, communications, chemistry, biology and medicine. With the exception of reconnaissance, the military value of the satellite was regarded as dubious: as a springboard to actual deep-space flight, its use was considered unavoidable unless some fundamental improvement appears in propellants.

Space Biology and Physics

As might be expected, the papers in this field revolved more or less around the biological effects of cosmic radiations. Switzerland's Prof. J. Eugster reported on the present status of such research. He showed that cosmic rays have produced definite effects on unicellular bacilli, plant seeds, mice and eggs of crustaceans. Definite genetic effects were noted in all but the mice where only skin burns were observed. Transplants of human skin exhibited granulae —which later changed to pigmented spots—after about six months.

Prof. S. F. Singer (USA) on a treatment of cosmic ray effects on matter at high altitude, showed that the physical effects on both inanimate and biological matter can be separated into atomic and nuclear effects. While the biological effects have been the subject of intensive study (except in the case of heavy primaries), this was the first mention of nuclear effects. Singer showed that while they are small, they are cumulative. He gave numerical values and described a method by which biological effects could be properly gauged.

Singer emphasized the nuclear transmutations which are produced by cosmic rays and looked into their nature and frequency. He showed that, unlike atomic effects, nuclear effects are permanent.

He speculated whether cosmic ray bombardment would cause the moon's unprotected surface (no atmosphere) to become radioactive making surface exploration dangerous to human beings (he does not think so). He discussed the shielding problem against heavy primaries and said that hydrogenous material is the most efficient on a weight basis, especially as a fragmentation shield.

Dr. F. A. Hitchcock (USA) explored the physiology of space flight. He showed that physiological and pathological effects at 63,000 feet are equivalent to those encountered in a complete vacuum. From there on up sealed environments would be necessary.

Manned Flight

He reported that people at Ohio State University were studying this problem. While simple air-conditioning systems for sealed cabins have already been investigated, Mr. Hitchcock felt that biological methods (man versus leafy plants) needed more study. He discussed tests made on animals at near-vacuum conditions:

At about 30 mm of mercury, two body-swelling effects occur. The first is due to simple expansion of intestinal gases. The second is apparently due to the boiling of blood and other body fluids. An exposure of two minutes or more is almost certainly fatal.

Hitchcock noted the chief problems of manned flight into space as acceleration, zero gravity, aerodynamic heating, noise and vibration, illumination and visibility. These are serious but they can be solved.

Two other papers on this general subject were presented: One, by Simons and Steinmetz (USA) on the effects of primary particles on balloon-borne specimens; the other on corpuscular rays from the Sun by Mr. C. E. Andersen (Denmark).

Three papers by Italian delegates, Prof. Antonio Eula, Renato Pennacchi

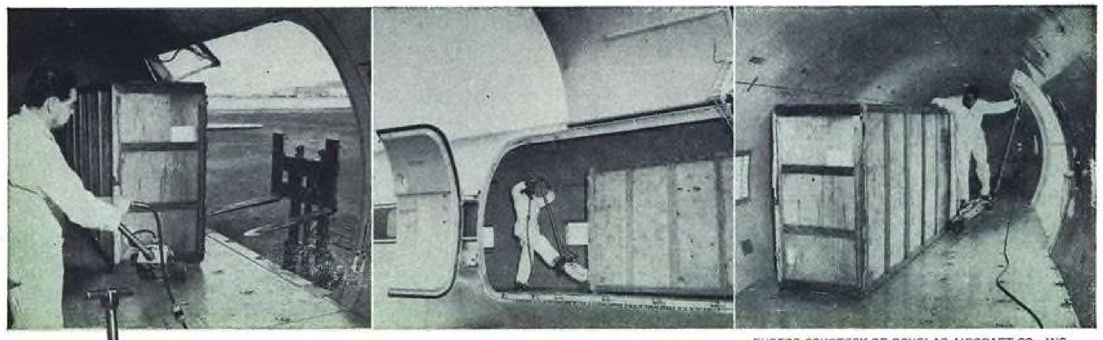
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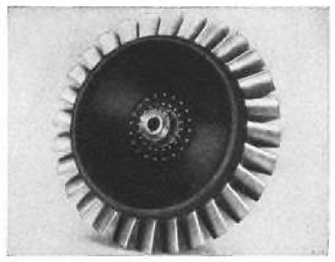
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NRL	Aerobee	17	Churchill, Canada
NRL	Aerobee	5	New Mexico
NRL	Rockoon	40	Pacific, off San Diego
SCEL	Aerobee	8	Churchill, Canada
SUI	Rockoon	40	Arctic
SUI	Rockoon	40	Antarctic

AGENCY CODE:

AFCRC Air Force Cambridge Research Center, Boston, Mass.
NRL Naval Research Laboratory, Washington 25, D. C.
SCEL Signal Corps Engineering Laboratories, Ft. Monmouth, N. J.
SUI State University of Iowa, Iowa City, Iowa

NOTE:

The firings scheduled for Churchill will, of course, be subject to the approval of the Canadian Government.

and Prof. Cesare Cremona, treated various aspects of missile dynamics. Dr. J. M. Kooy of Holland presented some calculations on a long range rocket. Vertically launched, the rocket discussed would incline to the horizontal aspect of flight, its axis maintained parallel to the orbital plane by the supervision of an automatic pilot.

Derek Lawden (England) considered the optimum launching of a few-pound payload into a 200-300 mile orbit. From the standpoint of propellants, the most economical trajectory stood between a tower on the equator and the point of assuming an equatorial orbit. The object of the study was to arrive at a compromise between the demands of fuel consumption and air resistance. The optimum ascent velocity appears to be very high.

Definite Plans

The United States and France already have announced definite plans to use rockets in connection with the International Geophysical Year. England and Australia are considering rocket programs, but it is not known whether they will actually participate.

Dr. Homer Newell (USA) discussed the role of rockets in the IGY and listed many observations which could not be made from the surface of the Earth:

- Measurement of solar ultraviolet and X-rays which do not reach the Earth.
- Measurement of low-energy cosmic rays.
- Measurement of the chemical and ion composition of the upper atmosphere.
- Detection and measurement of auroral particles.
- Measurement of ionospheric current flows.
- Measurement of the earth's magnetic field at high altitudes.

Other uses noted were measurements of temperature, pressure and density distributions in the atmosphere; winds, ionospheric charge densities, heights and intensities of airglow and of auroral radiations. He outlined the tentative American plans for the IGY which employ rocket vehicles.

Space Flight Problems

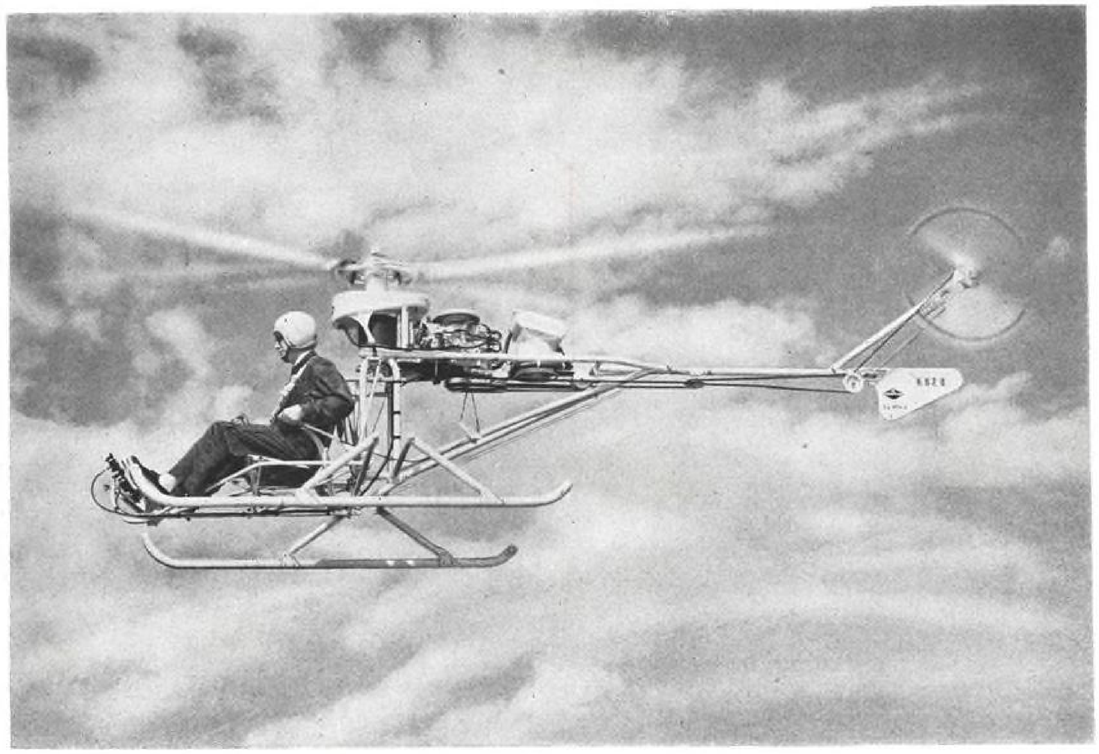
H. H. Koelle (Germany) discussed a thirty-year space-travel program consisting of five phases 4 to 7 years each in length. The program breaks down, approximately, as follows:

- 1956-1960 Unmanned satellites.
- 1961-1965 Cargo and passenger satellites.
- 1966-1970 Experimental space stations.
- 1971-1977 Full-fledged space station.
- 1978-1985 Expedition to Mars.

This could be accomplished for about $11½ billion a year, Koelle said.

Along the same general line of space-flight planning, Darrell Romick (USA) suggested an organization of the various sciences which go to make up the over-all body of astronautical science. The form would be analogous to that for the over-all body of aeronautical science.

Parallel with aerodynamics, for example, he suggested "astrodynamics," covering the general behavior of vehicles in interplanetary space. This science of astrodynamics would form a "hub" for integrating the efforts of various other astronautical engineers and scientists, to develop truly spaceworthy vehicles and suitable performance.



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It performs every maneuver of helicopter-magic, including rolling pull-outs, hovering and pattern flight.

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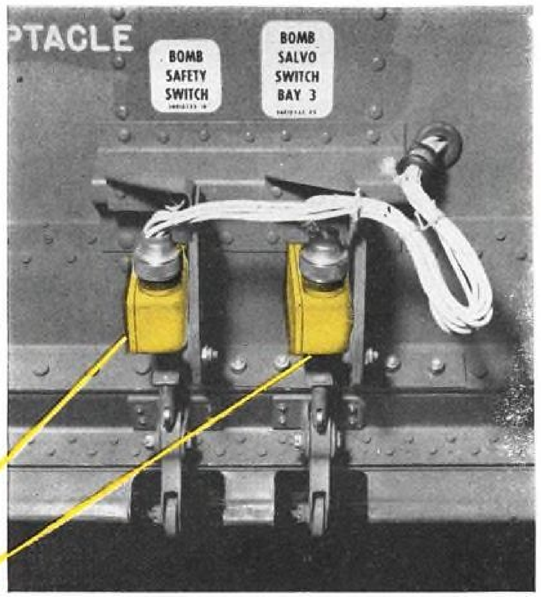
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Civil Charter Pacts To be Studied by CAB

Washington—The Civil Aeronautics Board this week is scheduled to begin hearings that could help American air charter operators bolster their bid for world-wide recognition as fast, economical carriers of passenger groups and cargo.

The future of the charter business in the United States is directly tied to the final hearings on requests for civil charter exchanges by the ambitious Aircoach Transport Association and the Independent Military Air Transportation Association. ACTA and IMATA already operate exchanges for military charters.

In the 12-month period ending Sept. 30, 1954, the 46 member lines of ACTA and IMATA flew some 118.8 million ton-miles in military and civilian passenger flights and 57.6 million ton-miles of cargo. Military charters were arranged through the Associations' exchanges. Civilian traffic was booked through the facilities of the individual airlines.

Military charter service negotiated through the ACTA exchange has increased from a 1954 dollar volume of $12,207,000 to $40 million thus far in 1955.

ACTA's hoped-for civilian exchange would be run on a "multiple charter" basis, i.e., several groups of passengers or cargo consignments constituting one planeload. IMATA, however, intends to use only single charters (one group of passengers or one consignment of cargo to the planeload) because of the administrative difficulties of the multiple charter system.

Both exchanges would serve only bona fide organizations requesting transportation. Charter clearing houses would be prohibited from dealing with ticket agents, although they could secure contracts from freight forwarders.

Officials of both organizations are optimistic concerning CAB approval, basing their hopes on these five factors:

- **Board's favorable preliminary decision.** Examiner Paul Pfeiffer favored the exchanges for a three-year trial period (AW July 4, p. 79).
- **Promised cuts in Defense Department costs.** Co-ordination of civil and military charter traffic would eliminate many deadhead return trips, lowering the price for each customer.
- **More economically sound industry.** A solvent charter system would give the airlines industry a firmer economic foundation.
- **Rivaly of two exchanges** would further lower charter costs.
- **Senate Recommendation.** In 1953,

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Addition of Narco DME in the Mohawk fleet marks the first use by a scheduled airline of this latest navigation aid which gives the pilot exact distance information from a VOR or ILS site.

The Narco DME gives this information on two scales — 0 to 20 miles for close-in approach work and 0-200 miles for en route navigation.

Use of DME by Mohawk is expected to effect considerable economies by permitting expedited IFR approaches.



DME Network in Wide Operation

DME coverage on all major airways plus installation at key ILS sites is in current everyday operation. CAA appropriations cover continued operation of the system throughout the nation. CAA has recently announced new procedures using DME which eliminate much of the time-consuming procedures now necessary.

Executive Pilot Praises DME



E. R. Morris, Executive Pilot for G. T. Pew (left), Board Chairman for Aero Design and Engineering Co., manufacturers of the Aero Commander, has flown 700 hours with Narco DME during the past year and a quarter.

"I wouldn't want to be without it," is Mr. Morris' summation of DME. "For instance, when you're flying a holding pattern, DME makes it so much easier.

"Expedited approaches on instruments are another big advantage of DME. Because we can tell the tower exactly where we are anytime, we often get straight-in clearance almost as if VFR.

"DME also lets us make instrument approaches to many out of the way airports, just as though they had ILS.

"There's nothing finer than DME for night flying in strange country, in marginal, semi-instrument weather or around thunder storms. You know exactly where you are."

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In the Design Development Department of the Owens-Illinois Glass Company, Toledo, Ohio, no time is lost in tedious redrafting. A simple short cut involving the use of Kodagraph Autopositive Paper and Kodalith Film *gives customers fast service . . . saves dollars every day.* Chances are you can adapt this technique to your own routines.



Big head start. Kodalith Film prints of elements which are repeated from time to time are kept on file. When a new design calls for any of these elements, the draftsman merely tapes the right films on clear acetate *and orders an Autopositive.* No redrafting!



A positive photographic intermediate is produced *directly* by exposing the "paste-up" in contact with Kodagraph Autopositive Paper, then processing the print in standard photographic solutions. No negative step . . . *easy room light operation.*



New design is added to the Autopositive, which has dense photographic black lines on a clean white translucent base. Required number of shop prints—each crisp and uniform—are produced from this master, which can also be used later on for minor revisions.

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Kodak TRADE-MARK

a Senate Small Business Committee approved a civilian charter exchange.

A recent nationwide survey of charter users by IMATA reported that establishment of a civilian air exchange would increase traffic 100% and provide an opportunity for exploiting the potential charter market (AW Feb. 7, p. 94).

The market is made up of these principal groups:

- **Convention travellers.** Organization delegates would rather charter "fraction of a plane" for 10 to 15 members than to buy individual airline tickets.
- **Exhibitors for trade shows.** Transportation of a company's machinery is often postponed until the last minute when only a chartered plane can get it to its destination on time.
- **Production managers.** Emergency flights are often necessary to carry replacement parts for vital production machinery in order to avoid plant shut-downs.
- **Flower growers.** Availability of fast transportation on short notice determines profit and loss for such groups.
- **College and professional athletic teams,** theatrical groups and officials on inspection tours occasionally require flights on short notice.

The foreign charter market has successfully employed a civilian exchange for the last eight years. London's Baltic Air Exchange handles the great majority of international civilian charter flights. There also are trade associations in France and Germany with interests similar to the Baltic's.

Some 50 principal United Kingdom and foreign operators are represented on the Exchange, which is worldwide in its scope. Foreign charters are handled principally by carriers in the category equivalent to our certified airlines. British Overseas Aircraft Corp., British European Airways, Sabena Belgian Airlines, KLM Royal Dutch Airlines, Air France and Air India carry much of the charter traffic.

Early success of the exchange was limited only by the shortage of suitable long-distance, high-capacity freighters (AW Dec. 7, '53, p. 21). With the increased availability of these aircraft, costs of charter flights have dropped appreciably.

Lower cost, however, is but one of the advantages afforded shippers and organizers of passenger parties. Speed of operation, global service and new routes also have attracted business to the exchange.

Recent exchange bulletins have indicated that passenger flights constitute a greater percentage of foreign charter traffic than ever before. During a recent week, it ran higher than 90% of the total charter service on the exchange.



design predictability



Trying to firm up new fuel pump specs? Well, stop staring at your slide-rule...call Hydro-Aire right now. The performance of our HY-V/L* Fuel Booster Pump is as predictable as ants at a picnic. We'll show you a simple chart method that'll pull the clouds out of that crystal ball.

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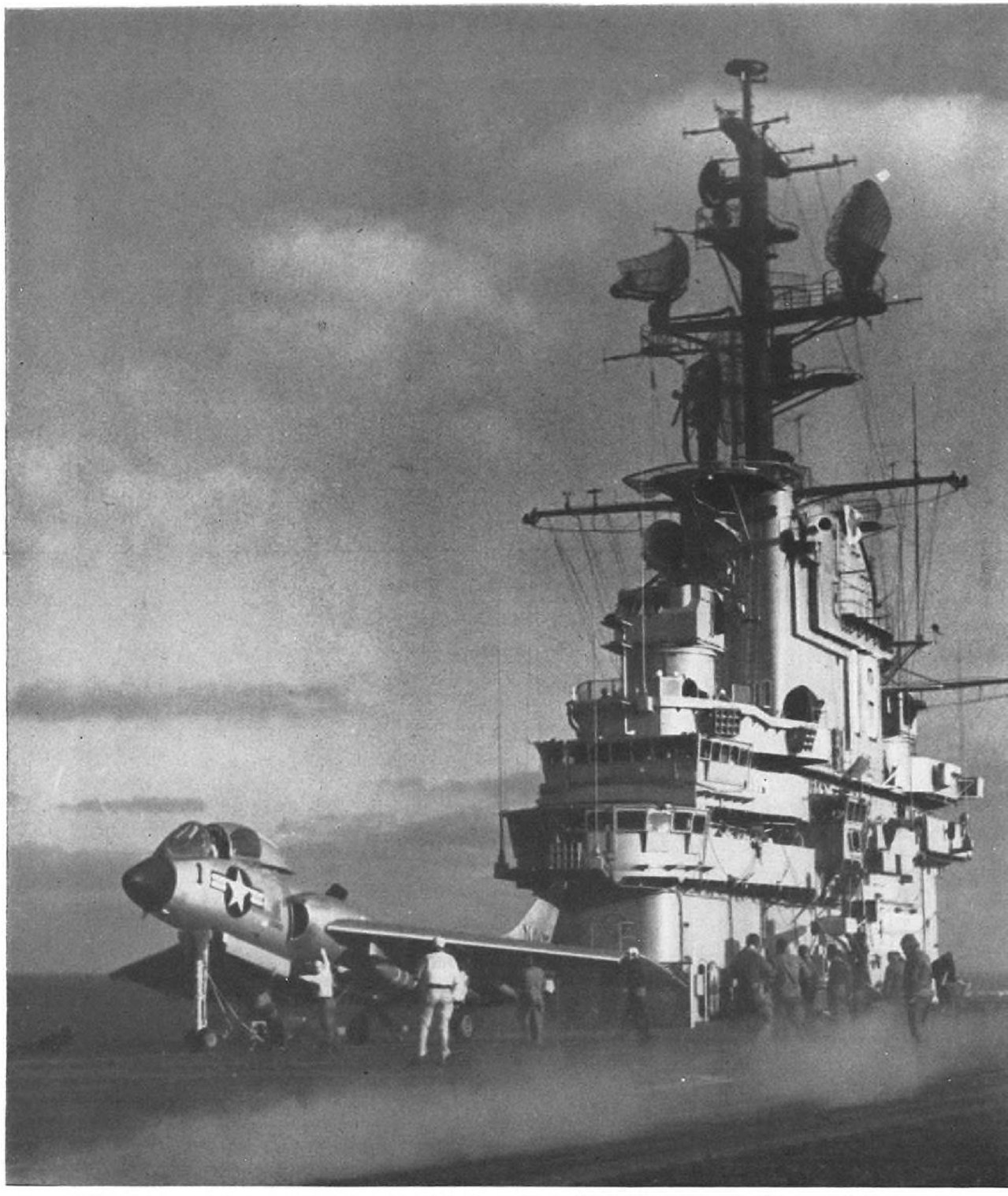
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Cutlass Joins Fleet

. . . Delayed But Not Stayed





SEVEN YEARS after the production of its prototype, the Chance Vought Cutlass recently joined the Navy on an operational basis. Squadron VF-124, equipped with 14 F7U-3s, boarded the carrier USS Hancock (above and left) for eventual duty in the Far East. The F7Us were slow in reaching the fleet because of delays in engine development.

FLY WEATHER-WISE

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

TERRAIN



THE VARIOUS TYPES of terrain surfaces have a significant effect on the air masses flowing over them—with a consequent effect on the weather and plane performance.

One of the most spectacular effects of terrain on air currents is the Mountain Wave—a high-reaching deflection of the winds when a range of hills blocks a strong flow of air. This sets up a "wave" which may reach high altitudes and extend in a chain of waves for several hundred miles downstream. The Lenticular-Type Standing Wave Cloud identifies these large waves. Even small ridges may cause air waves and produce dangerous downdrafts on the lee side (see diagram at right).

Care should be taken in approaching a ridge into the wind, because in a low-powered plane the downdraft may make it impossible to maintain enough altitude to clear the top. Also, when taking off on a runway towards a hill, be prepared for a decreased rate of climb if the wind is coming over the hill.

When flying in the vicinity of mountain tops, the possibility of altimeter error is important. Two primary factors can cause altimeters to indicate *higher altitudes than actual*: Lowered pressures created by disturbed flow on the lee side and abnormally cold temperatures. Combined, they can produce errors in excess of 1000 feet.

Best Pair to Get You There!

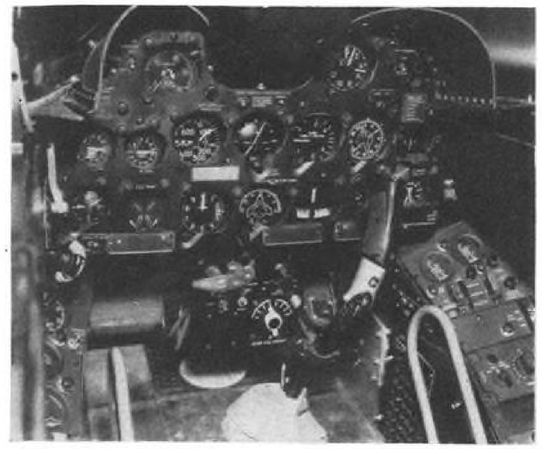
Mobiloil AERO

Mobilgas AIRCRAFT

Flying over rough terrain, shifty air currents and sudden downdrafts can call for extra-quick engine response. Here's where insisting on the right fuels and lubricants can pay off.

Mobilgas Aircraft and Mobiloil Aero meet aviation's toughest tests . . . exceed rigid Army and Navy specifications . . . assure you full power and performance when you need it most. *Good reason it pays to fly with the Flying Red Horse!*

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OPERATIONAL FLIGHT TRAINER for the McDonnell F2H-2 fighter. Student's cockpit is at left; instructor's station at right.

Navy's Special Devices Center; Better Training, Less Expense

By Henry Lefer

Sands Point, L. I., N. Y.—The Special Devices Center of the Office of Naval Research here is one of the Navy's key weapons in the struggle to cope with the increasing complexity of modern aircraft.

The attack goes on along many fronts, but for the most part SDC's approach is to develop training equipment to permit pilots and crews to learn a good part of their jobs on the ground without tying up expensive aircraft, and without being hampered by limiting factors such as weather. Special Devices Center is also responsible for the provision and control of logistic and material support for training equipment.

The center's projects include operational flight trainers (Air Force calls them flight simulators), procedure trainers, tactical trainers and animated panel systems. It has worked out simplified cockpit instrument presentations. SDC psychologists are delving into human engineering aspects of flight, crew training and maintenance. SDC engineers have developed various types of highspeed computers.

Special Devices Center is under the office of Naval Research. Its more than 600 personnel, under Capt. C. H S. Murphy, are mainly civilian. The military complement includes about 40 from Navy, an Army Participation Group and Air Force liaison officer. SDC is the designated agency for appropriate Army research, eliminating the need for a separate Army organization of this type. One recent development for Army is the Nike simulator, which permits the operational training of Nike batteries without use of actual missles or target aircraft.

The Air Force representative monitors proposed projects to avoid duplication of work by Wright Air Development Center and Special Devices Center.

The Research and Development Department, one of the three major groupings at SDC (the others are Training Requirements and Field Operations, and Administration and Services), is under the command of the center's technical director, Cmdr. Edward W. Hribar.

It is comprised of three divisions: engineering development, human engineering, and equipment research (to be activated in the future). The various divisions are made up of a number of branches.

Of special aviation significance are many of the projects of Engineering Development's Aviation division, to which the remainder of this article is devoted.

The Aviation division consists of:

- **Operational flight trainers.**
- **Aviation trainers.**
- **Air applications.**
- **Computers.**

In charge of these four branches is John Hickey, reporting to Cmdr. Hribar.

Operational Flight Trainers

This branch produces OFTs and generalized trainers.

• **Operational flight trainers** are designed to reproduce all flight problems, from takeoff to landing, including simulated malfunctions and other difficulties. Noise and vibration of the



2-FH-2 CONTACT FLIGHT SIMULATOR utilizes intense point source of light and transparencies to create terrain and horizon illusion for helicopter students.

NOW... from a foremost manufacturer of Aviation Metal Hose—

Lightweight Titeflex flexible hose... made from Du Pont Teflon*



Chief Characteristics

- **Has high resistance to synthetic lubricants, hydraulic fluids**
- **Withstands extremely low temperatures**
- **Operates at extremely high temperatures and pressures**
- **Virtually chemically inert**
- **Will not crack, chip; will not cause lines to clog**
- **Has indefinite shelf life**
- **Available in ¼" to 1¼" sizes with standard fittings**

Titeflex knows the aviation hose business . . . has been making flexible aircraft metal hose for over 20 years. And now . . . to keep pace with the requirements of the jet engine industry, Titeflex has developed a *new* type of flexible hose with an inner core made from Du Pont Teflon tetrafluoroethylene resin.

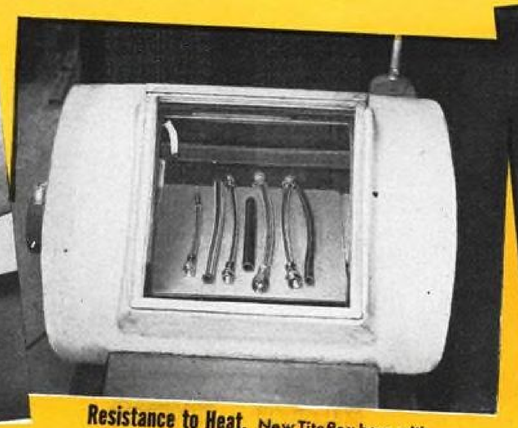
Our Engineering and Research departments with their specialized experience in hose manufacture, working with all types of metals, now adding special resins, have designed, developed and tested a new product to complement our complete line of metal hose. This is not just a Teflon inner core with wire braid covering, but a completely engineered product from fittings to carefully selected braid and materials.

Working with the designers and engineers of leading jet engine manufacturers, we have developed a flexible hose that meets all practical requirements of MIL-H-5511 specifications under independent testing by a leading research laboratory.

For any conveying application where increasing high pressure and high temperature requirements combine to make most other hose assemblies either uneconomical, too bulky, inefficient or obsolete . . . this latest addition to the Titeflex line of flexible hose offers a practical solution to one of the aviation industry's serious design problems. Use the coupon at right to obtain additional information or request one of our sales engineers to discuss your specific application.



Resistance to Chemicals. New Titeflex hose is impervious to the corrosive action of synthetic lubricants, hydraulic fluids, salt spray; is unaffected by fungus.

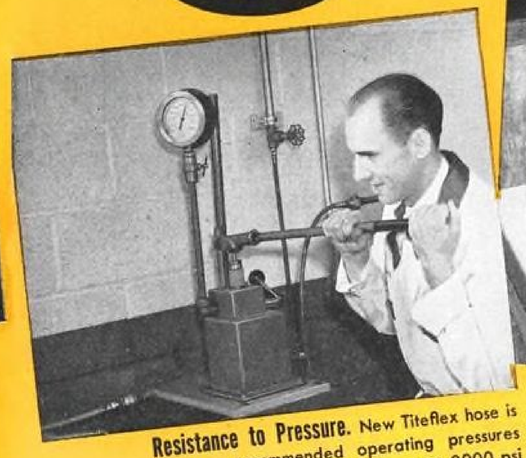


Resistance to Heat. New Titeflex hose withstands temperatures up to 500°F. Does not soften, deteriorate or change in any way under high heat torture.

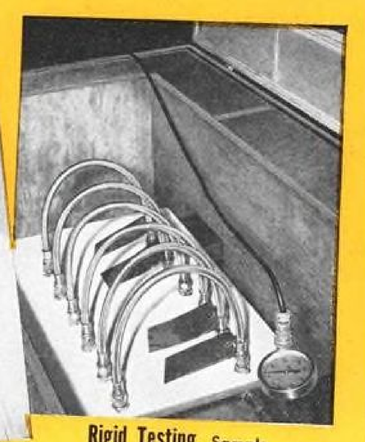


Resistance to Cold. New Titeflex hose retains its flexibility even at —100°F. Super-cohesive—will not crack, chip or cause fuel or oil lines to clog.

Titeflex



Resistance to Pressure. New Titeflex hose is tough — recommended operating pressures range from 600 psi for 1¼" hose to 3000 psi for ¼" hose. Shows no visible effects from aging, and has unlimited shelf life.

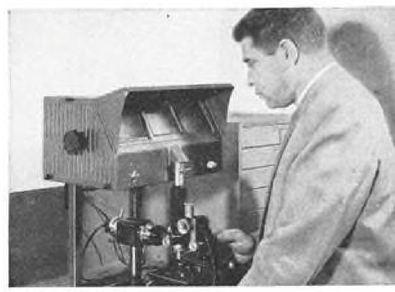


Rigid Testing. Sample Titeflex hose lines set up for impulse-test cycling from 75—2500 lbs. psi. MIL-H-5511 test.

*Du Pont trademark for its tetrafluoroethylene resin



Customer Service. Titeflex sales engineers are competent, trained specialists. They work directly with you to help you find the *right* answers to your aviation hose problems. Call on them, without obligation, at any time.



Quality Control. This is a view of the Titeflex quality control laboratory where raw materials and other components are inspected for uniformity. Nothing is left to chance in maintaining Titeflex standards.



Engineering Service. If you are looking for design ideas, product developments and adaptation of Titeflex aviation hose to your own specifications, call on our highly skilled engineering department. No obligation.

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Please send new literature on Titeflex flexible hose made of Teflon. Will be used for

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This traveler finds relief in the desert sun, thanks to an expedient "desert icebox" . . . towels draped around bottles in a shallow pan of water. Capillary action keeps the towels moist and a few degrees cooler than the ambient temperature. *Here's adiabatic cooling in its simplest form.*

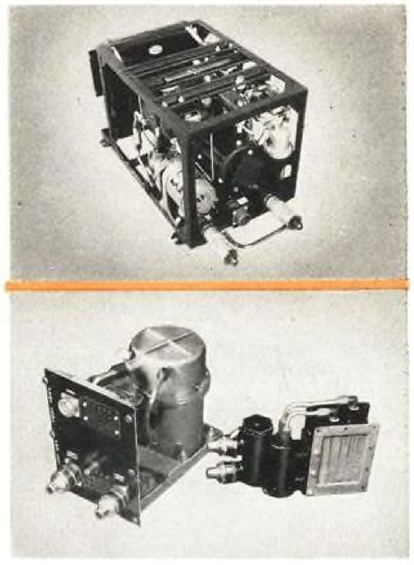
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The temperature of electronic equipment must be bracketed and firmly controlled. Miniaturization of modern electronic equipment has made it impossible to maintain operating temperatures by natural convection and radiation. UAP engineers have designed complete cooling packages which maintain the proper temperature ranges of electronic equipment while in operation. These packages can be installed remote from the equipment, or the electronic components can be intimately mounted within the cooling package envelope. They are designed for shipboard, ground equipment and airframe installations. UAP cooling packages employ liquid-to-liquid, air-to-liquid and air-to-air Hi-D heat exchangers and meet MIL-E-5400 and MIL-E-5272A specs.

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actual aircraft are also duplicated. About the only feature of flying that is missing is the effect of G, which has proven difficult to duplicate.

• **Generalized trainers** are used to give instruction in navigation, tactics and instrument procedures but do not simulate landing or takeoff conditions.

There are about 30 OFTs in the field, with another 25 or 30 in the works.

Size of an OFT varies, anywhere from a simulator for a fighter like the McDonnell F2H-2 to a unit for Martin's anti-sub weapon, the P5M, with stations for the entire crew of six. The P5M trainer consists of two trailers, one containing the flight simulator and the other the tactics simulator, to provide training in the plane's anti-submarine warfare mission.

SDC designs all of its OFTs to fit inside 40-ft. trailers, making for easy transportation from coast to coast as squadrons are shifted. The trailers are equipped with cargo hooks so that they can be slung aboard aircraft carriers if the Navy decides to make such a move. This would permit carrier crews to maintain flight proficiency around the clock regardless of weather. "Trailerization" would also make it feasible to install or remove the simulators as a carrier switched from one type aircraft to another.

The trainers are self-contained, except for the power supply. A typical trailer includes capacity for 10 tons of air conditioning, for comfort of personnel and to keep equipment temperature within suitable operating limits.

Development of an operational flight trainer is no easy matter. A typical fighter simulator may require 80-100,000 engineering man-hours and perhaps 40-50,000 production man-hours, A. A. Blanck of the OFT branch told Aviation Week. The OFT for the P5M required between 150,000 and 175,000 engineering man-hours, with an additional 75,000 man-hours for its associated tactics trainer.

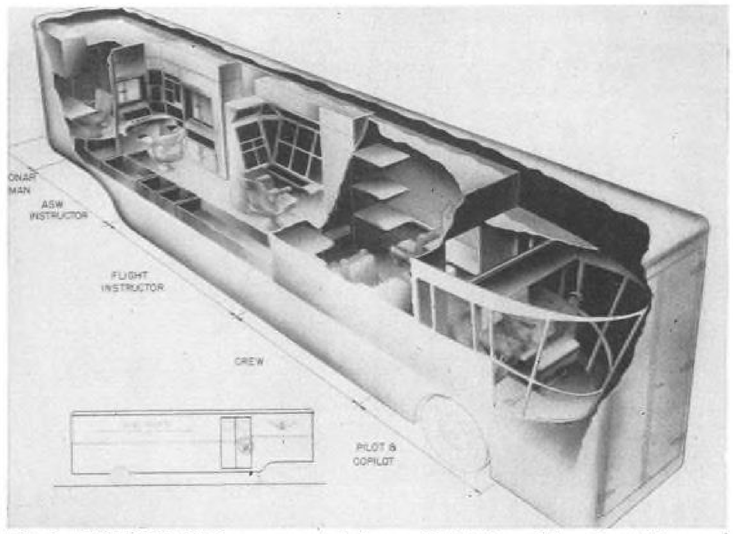
As with its other projects, the center either builds the first prototype or lays out the requirements, then asks bids from private industry for building production units.

An OFT is designed for a specific type of plane (F2H, for instance) and generally for a specific model (F2H-2). Because of the complexity and high cost of a typical trainer ($1 million), SDC has embarked on a number of programs. For example, new OFTs are being built so the cockpit can be removed and backed up to a tactical trainer. In this way, a single tactical trainer can be used in conjunction with a number of different types of operational flight trainers.

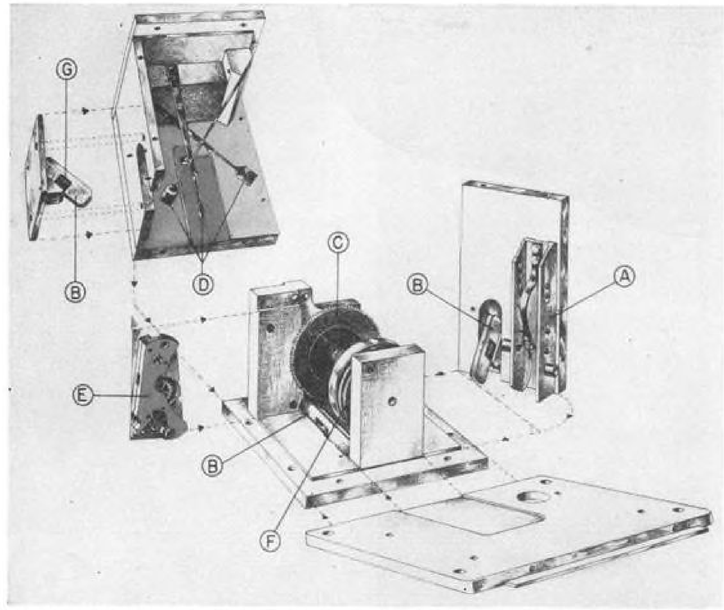
The OFT branch is also pushing a program to standardize components and designs used by the various contractors building simulators, to simplify maintenance, reduce the number of spares required, and cut weight size and expense. SDC is utilizing transistors and magnetic amplifiers in this approach.

A typical electronic unit had its weight cut to 13 oz. from 53 oz. when tranisistors were used in place of tubes. Its volume was cut to 61 cu. in. from 208 cu. in. An associated part which was redesigned for magnetic amplifiers weighed 103 oz. before and 51 oz. after. Size was cut from 216 to 98 cu. in. Power requirements were reduced from 10 watts to 5 watts.

Another problem the OFT branch is studying involves simulator instrument activation. Contractors' engineers are now free to design their own circuits



ZSG-4 AIRSHIP TRAINER was converted from a Link trainer. Like other trainers and simulators developed by Special Devices Center, it is fitted in a trailer.



OMNI-DIRECTIONAL ACCELEROMETER developed by Special Devices Center is used in aircraft safety research. It is triggered by a 10G shock and will record up to 250G. The parts are (a) trigger assembly, (b) dash pots, (c) drum assembly, (d) reed elements, (e) escapement, (f) main spring and (g) bimetal compensator.

Leading Aircraft *Manufacturers* use RED METALS CO. SEAL aluminum tooling plate

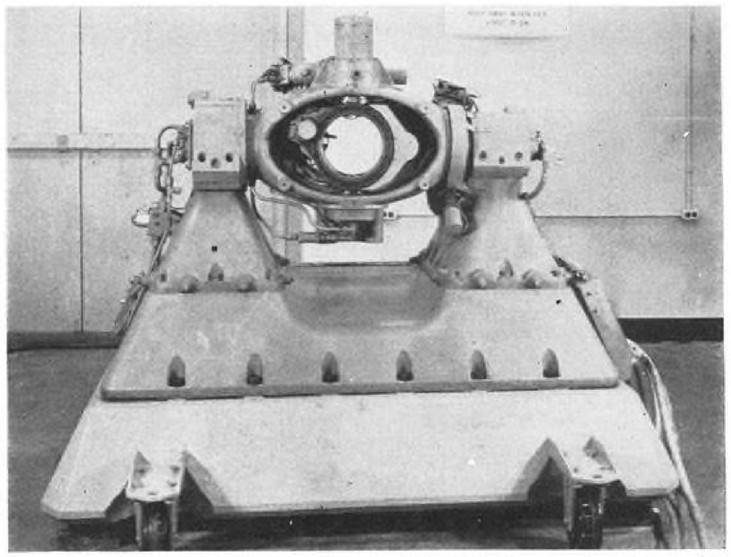
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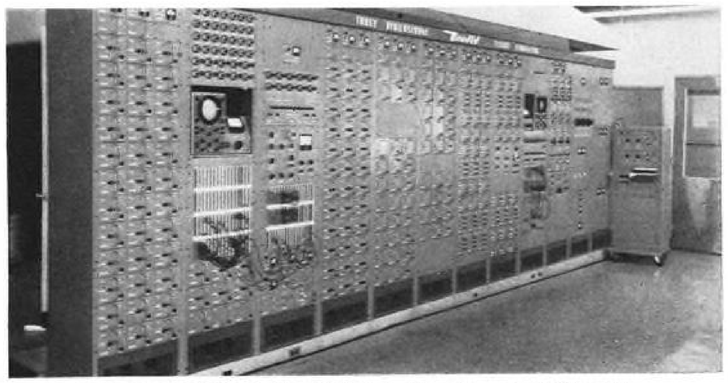


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THREE-DIMENSIONAL FLIGHT TABLE developed by SDC's Computer branch is used to test behavior of missile seeker systems. It will take a 50-lb. seeker element.



LARGE ANALOG COMPUTER feeds variables into three-dimensional flight table.

and techniques for activating instruments as long as the final results meet SDC requirements. By developing standardized techniques, OFT personnel hope to reduce maintenance and spares requirements. The OFT has converted a number of simulators for obsolete planes to newer ships—cheaper than building a new simulator but still an expensive job, involving a redesign of computer circuitry. A typical conversion may take from 14 to 18 months.

Generalized trainers are also converted to new missions as an economy measure. Recent units include trainers for the ZSG-4 airship and for helicopters.

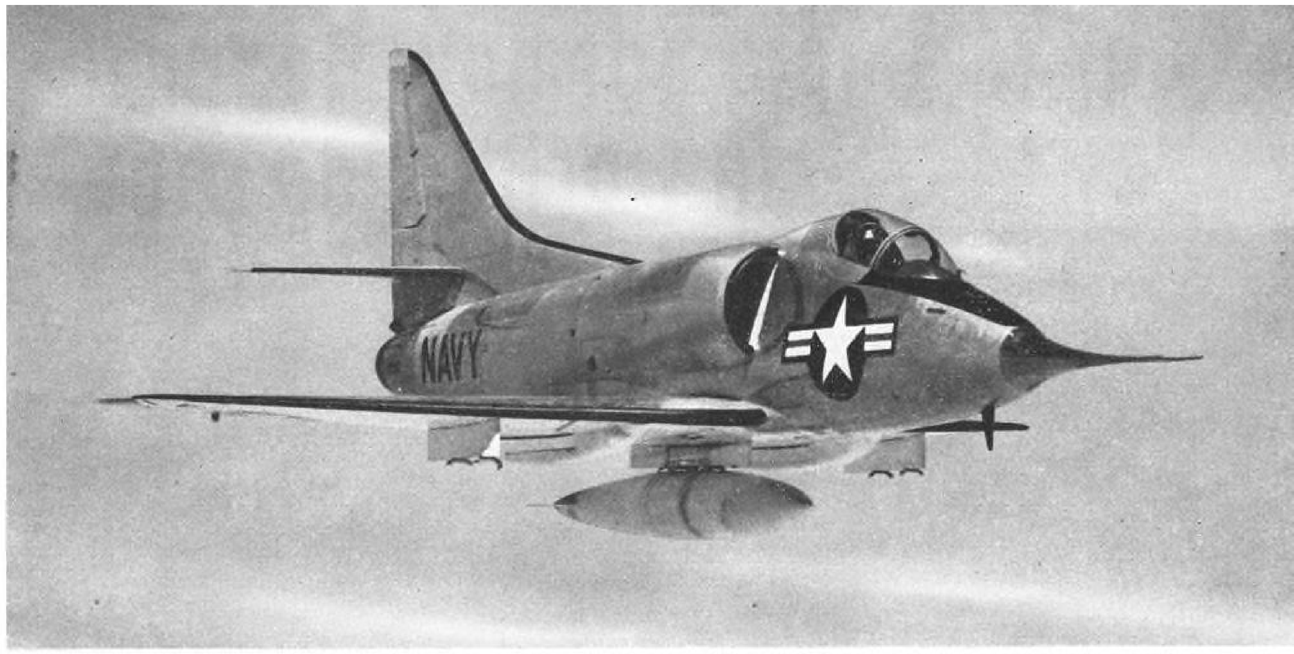
These are basically Link trainers, with cockpits changed to represent new functions and circuits "slowed down" to the proper speeds.

The Aviation Trainers branch is responsible generally for all training devices which do not come under the OFT branch. Mainly these include procedure trainers and animated panel training aids.

• **Procedure trainers** are comparatively inexpensive devices designed for specific procedures, such as cockpit familiarization, navigation, fire, emergency, etc. Although the cockpit is an exact replica of a specific plane, as it is in the operational flight trainers, many of the instruments are dummies. Only those involved in the actual procedure to be taught are operative.

A recent trainer, the 2-FH-2 helicopter contact flight simulator, developed for SDC by Bell Aircraft Corp. (AW Aug. 29, p. 9) is expected to give the equivalent of four hours of primary flight instruction. It will be installed at the Navy Flight School, Pensacola, Fla.

The student sits in the 2-FH-2 cock-

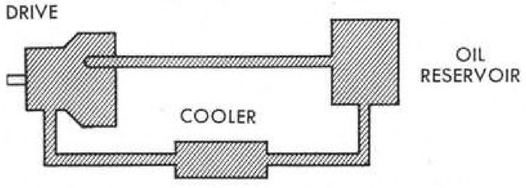


DOUGLAS A4D SKYHAWK USES LIGHTWEIGHT GENERAL ELECTRIC CONSTANT SPEED DRIVE.

How G-E constant speed drive's unique design improves Bantam A-bomber performance

The unique ball piston design of the General Electric 9 KVA hydraulic constant speed drive improves the performance of the Douglas A4D Skyhawk by providing a more reliable drive of reduced weight and size. The simplicity and symmetry of the few moving parts also permit the drive to run "full of oil" in a completely oil-filled system.

OIL-FILLED SYSTEM



ADVANTAGES OF G-E OIL-FILLED DESIGN

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VERSATILE 9 KVA DRIVE allowed addition of starting gears on A4D application

The General Electric hydraulic constant speed drive is currently being built in 9 and 20 KVA sizes. Drives can be built up to 60 KVA covering a wide range of speeds and many design variations.

FOR SPECIFIC INFORMATION on how a G-E constant speed drive can be designed to suit your particular application, contact your General Electric Apparatus Sales Office. For further technical information on these G-E drives, write for bulletins GEA-5979 and GET-2480. Address request to: General Electric Co., Section 221-5, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

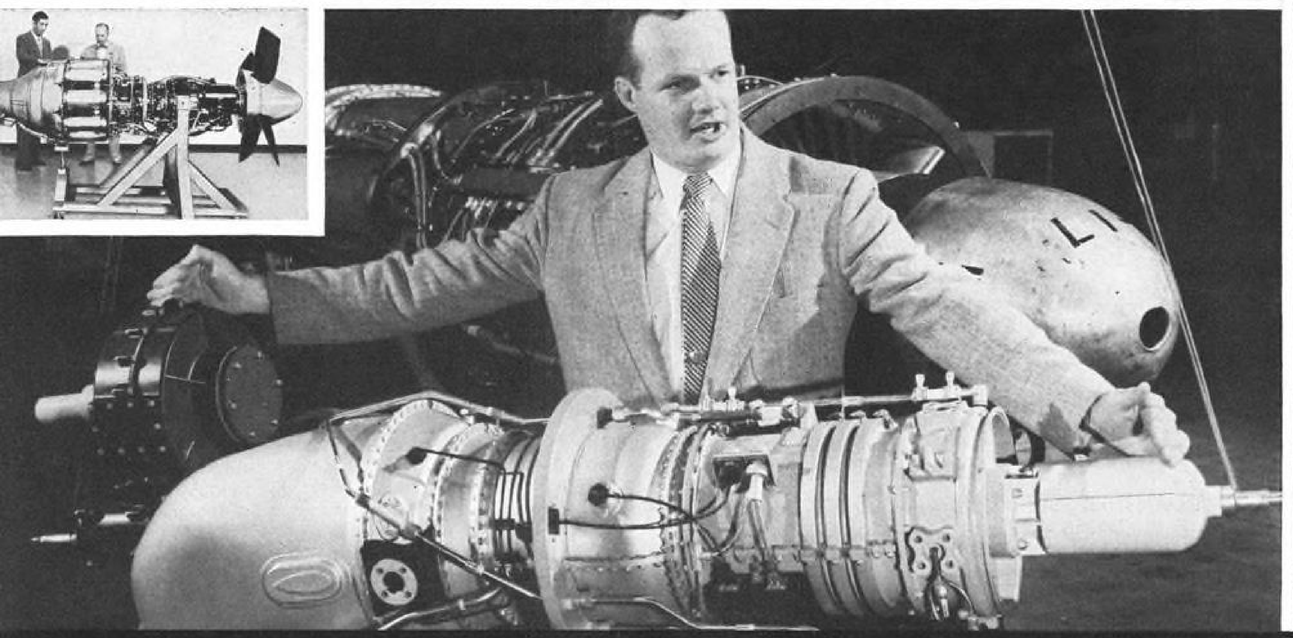
Four examples of how General Electric helps U.S. progress in world-wide race



In 1942, G-E jet engines powered America's first jet aircraft, the Bell P-59A. Today, more G-E jets power Air Force planes than all other jet engines combined. The sleek Boeing B-47 bomber uses six G-E J47's. In addition, J47's power the nation's jet fighter mainstay, the North American Aviation F-86 Sabre Jet.

Progress Is Our Most Important Product

GENERAL ELECTRIC

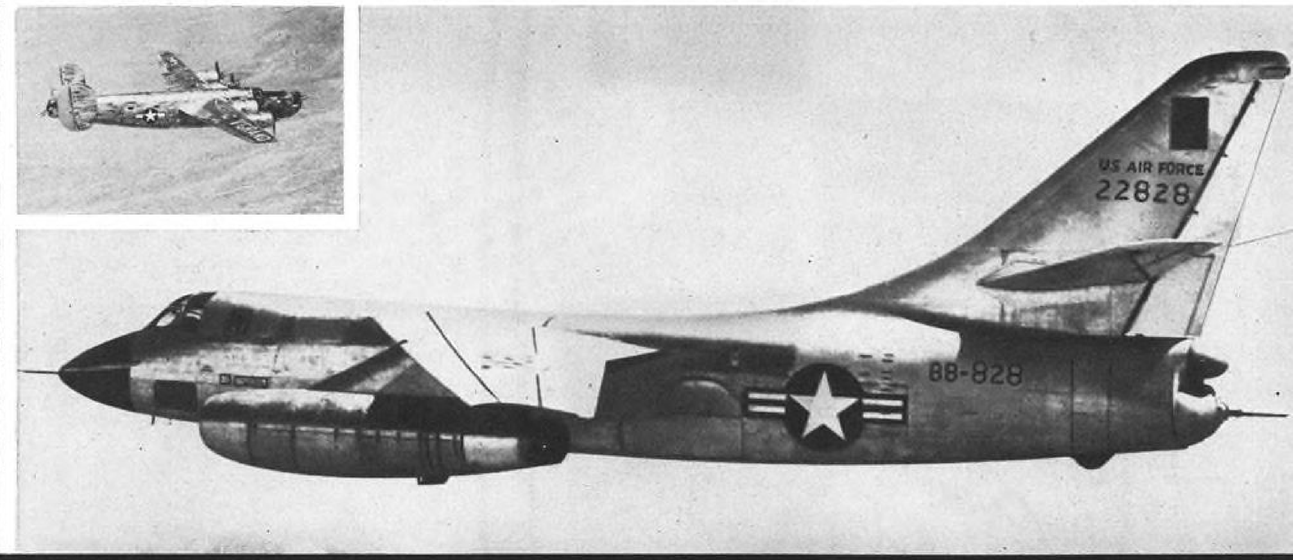


First American turboprop engine built by G.E. had 2150 hp. Today, smaller, more efficient gas turbines promise better, power-to-weight ratio for helicopter and other aircraft applications.

Progress Is Our Most Important Product

GENERAL ELECTRIC

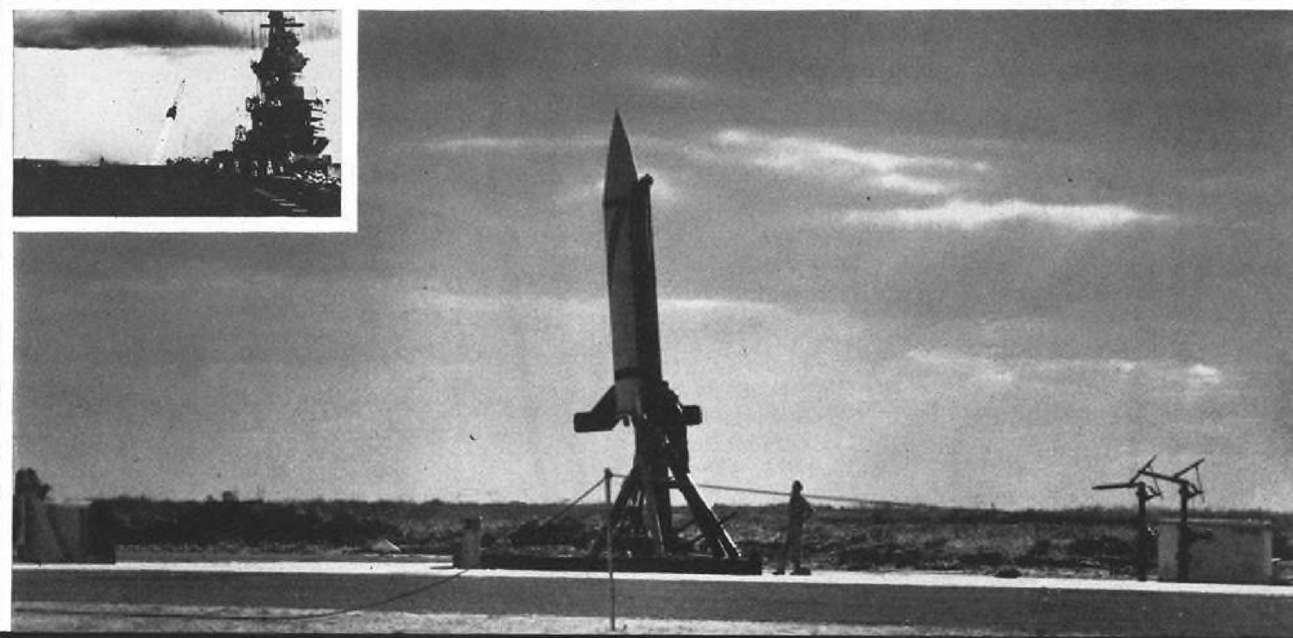
Electric helps U.S. progress for air superiority



World War II "Liberator" had gun turrets powered with G-E amplidyne drives, directed and fired manually. Today, newest TAC bomber B-66 has G-E fire control system which is radar directed by remote control.

Progress Is Our Most Important Product

GENERAL ELECTRIC



G.E. supervised test development of V-2 rocket, shown above in first launching from U.S. aircraft carrier. Today, advanced G-E design rockets like the RV-A-10 provide new data on large solid propellant rocket motors for use on guided missiles.

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pit, which is a replica of the Bell HTL copter compartment, while a perspective image of the terrain is projected on a hemispherical screen before him. Actually the images from two projectors—a horizon unit showing sky and horizon conditions and a basic terrain unit— utilizing an intense point source of light and colored terrain transparencies are blended to produce a realistic composite image for the trainee.

Pick-off potentiometers mounted on the standard HTL controls provide basic inputs to a special-purpose a.c. analog computer which solves the dynamic equations of motion in real time and sends output commands to six servo drives associated with the projector and the various instruments, vibration devices and noise generators in the cockpit.

The projector light and transparency are suspended together by a gimbal system for pitch, roll and yaw of the whole picture, simulating for the pilot the actual appearance of the terrain and horizon as he moves various controls in the 2-FH-2 trainer.

While the 2-FH-2 may prove useful in training copter pilots, a primary reason for its development was to test the realism achieved through use of transparencies and the point source of light.

Work is under way on a similar trainer for fixed-wing aircraft.

Another approach to the problem of helicopter flight simulation is being studied by SDC's Air Applications branch. Here a contour model of the terrain is built and viewed by a television camera connected through appropriate circuitry to the trainer cockpit. An enlarged TV image of the terrain is projected on a hemisperical surface in front of the cockpit. As the pilot "files," the projection is varied so the image he sees corresponds to the real thing.

Special Devices Center is also working on helicopter ground procedure trainers for the Piasecki H-21 and Sikorsky H-34 for Army.

A recently completed project is the procedure trainer built by Carmody Corp. for the Grumman F11F-1 Tiger Navy fighter.

When first revealed by AVIATION WEEK (Mar. 28, p. 58), the unit was known as the F9F-9 procedure trainer, but the designation of the plane has been since changed. A later development is the award of a contract to Link Aviation for a Tiger operational flight trainer.

H. R. Florea, project engineer on the Tiger procedure trainer, says the cooperation of Grumman and the instrument manufacturers during design and construction of the unit, helped

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keep development time to a minimum. Florea says a typical procedure trainer may cost only $50,000, compared to approximately 20 times that figure for a simulator.

It is hoped eventually to supply squadrons with procedure trainers well ahead of the delivery of new-model aircraft and considerably before the long-lead-time OFTs become available.

• **Animated panels**, or Naval air mobile trainers as SDC calls them, take the place of cutaways or actual working systems, and are designed to instruct personnel in the operation of various systems.

The NAMT panels, pioneered by SDC, consist of large, legible working schematics of various plane systems. Some newer ones use colored lights to indicate fire or sequence of operations when a system is activated. The panels fold up into individual portable carry cases, so they can be transported from base to base and set up quickly, in a tent if necessary.

The sets vary in complexity with the aircraft. Arthur Braun, who worked on the R7V Super Constellation set, says it contains 14 presentations, including two of the flight control systems, two electrical (one a.c., one d.c.), flap control, fuel, fuel injection, oil, de-icing, heating and ventilating, and pressurization.

One R7V set is going to Patuxent Naval Air Station, another to USAF at Hickman AFB, Hawaii.

Among the contractors building NAMTs for Special Devices Center are Technical Training Aids, Lockheed Aircraft Service, Jam Handy and Grand Central Aircraft. Technical Training Aids recently delivered to Navy the first plastic-lighted animated trainers.

These were for the Douglas R6D-1 (DC-6) and are now in service with Military Air Transport Service in California, Florida and Massachusetts. An earlier TTA animated panel set—for the Convair 340—was described in AVIATION WEEK Nov. 16, 1953, p. 85.

Air Applications

The Air Applications branch has developed practically all of Navy's survival training devices. Personnel of this branch have been working on simplified instrument displays for some years now.

As long ago as 1949, Moses Aronson told AVIATION WEEK, SDC had worked out a pictorial cockpit display similar to the one installed last year in the F9F-6 (AW June 28, 1954, p. 69). Thus far, the F9F-6 display is the only one carried through to completion. Its lower half shows a ground landscape and heading indicator which rotates as the airplane itself turns. The miniature

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Aviation Week Buyers' Guide



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PUBLISHING DATE **NOVEMBER 28, 1955**

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- **KEY** to the Major Buying Influences in the Multi-Billion Dollar Aviation Market

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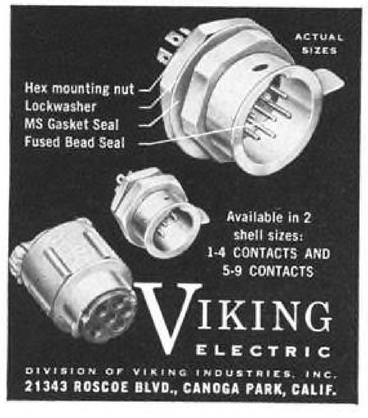
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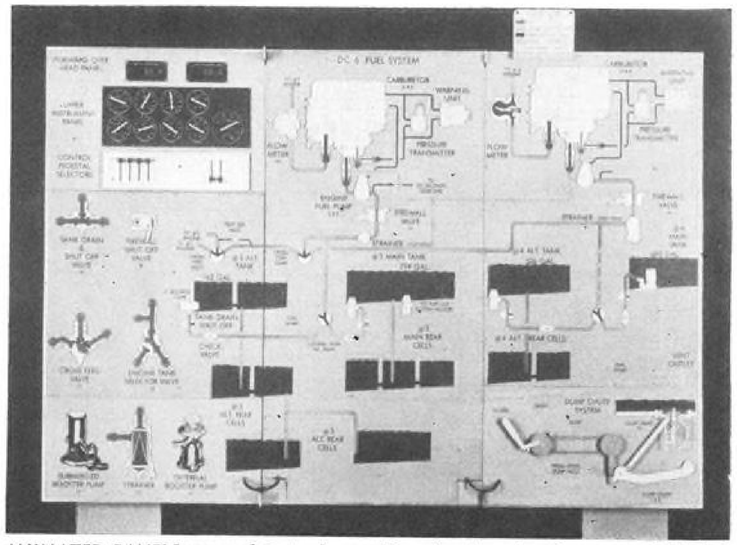
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ANIMATED PANELS are used to teach operation of various aircraft systems. This fuel system panel is one of a set prepared for the R6D-1 transport (DC-6).

plane on the upper part of the instrument duplicates the F9F-6's maneuvers, showing actual airplane attitude.

Air Applications has developed a recording accelerometer which records Gs and their duration in all three axes when the aircraft is involved in an accident. The recorder is triggered by a 10G impulse, ignoring forces below that level and will show accelerations up to 250G. Several Navy squadrons, flying jets and piston aircraft, are equipped with the device. Others have been provided to USAF, NACA, Flight Safety Foundation, Air Force's School of Aviation Medicine, and civilian organizations for safety studies.

Knowledge of G forces and their duration provides aircraft and equipment designers with valuable information for decreasing injury to personnel.

SDC develops ejection seat trainers for both the Navy and Air Force. Hundreds of military pilots have received operational training in use of escape devices on SDC units.

The Air Application branch is developing various research tools to investigate physiological problems of flight. A recent project is the human disorientation device for aeromedical research in pilot vertigo and loss of balance in flight.

Many of this group's projects are the result of a team effort among pilots, human engineers and engineers. The pilot says what is desirable, the human engineer works out the theoretical solution, and the engineer translates it into practicality. The team's decisions lead to construction of mockups, for evaluation and screening, and final recommendation to BuAer or Air Force.

The heart and brain of any operational flight trainer is its computer. Here are stored the operating and flight characteristics of the plane. As the instructor feeds problems into the simulator and the pilot and crew react, the computer analyzes the situation instantaneously with respect to the plane's operating parameters and duplicates the conditions of the flight.

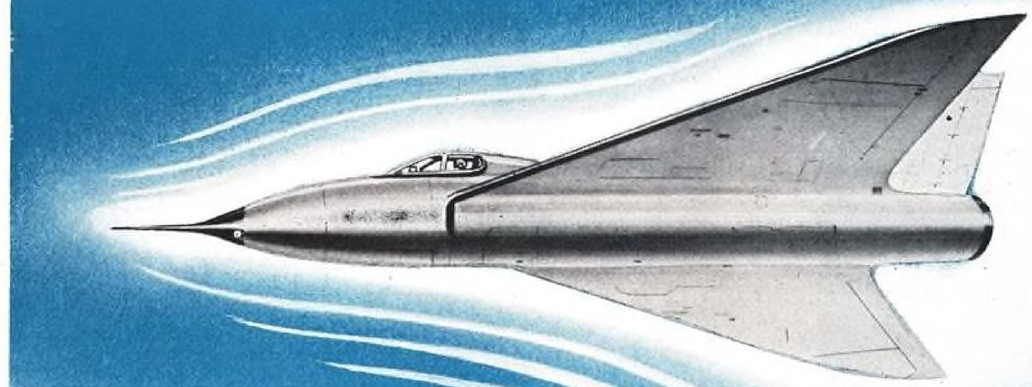
The center's Computer branch, under Francis J. Dellamano, is responsible for the design of these computers. This branch is also responsible for the development of a number of industrial computers, several of which have been built by private contractors. Among these are the Cyclone analog computer, built and operated by Reeves; the Typhoon analog computer built by RCA and now at Navy's Johnsville, Pa., station; the Hurricane digital computer, an integrated data system which can be used for missile guidance and control, built by Raytheon and in operation at Pt. Mugu, Calif.; and the digital Whirlwind, located at Massachusetts Institute of Technology, which built it. The Whirlwind is being used for development of aviation components.

These computers are available to private industry for problem solving. A typical problem may take from two to eight months to work out, so the computers are kept on a fairly busy schedule.

An important new development of the computer branch is an ultra-high-speed digital computer, believed to be the fastest of its type in the world. Design work is nearly completed and actual construction should begin early next year. The new computer could bring great economies in time and money.

A drawback of digital computers in

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the past has been their comparative slowness. Whereas analog computers have been able to show an instantaneous picture of conditions, permitting their use in "real time" problems, digitals generally must perform a step-by-step summing process, so their output lags the input by an appreciable time. (Univac, the electronic "brain" which was used by one of the radio-TV networks to analyze trends during the last Presidential election, is a digital unit.)

However, by ingenious redesign, the Computer branch's new digital computer will be instantaneous for all practical purposes. Programming an airplane's characteristics is much simpler in a digital than an analog computer.

William Zimmer of the Computer branch believes that with the new digital computer, production of new OFTs could be considerably speeded. At present, a computer for a particular aircraft cannot be built until the plane has flown and its characteristics learned. Lag between delivery of the aircraft and the first OFT usually runs well over a year.

With the new unit, analog computers could be built on a semi-production basis and kept on the shelf until needed. After the new airplane flies, programming work for the computer can be done in a few months. The same computer design could be used for many different planes and variations, with only the programming and cockpit installations changed in the various simulators.

Also a particular OFT could be changed from one type of aircraft to another in a matter of hours instead of the months now required. This feature, together with the practice of designing flight simulators so the cockpit installation is easily removable, would greatly increase OFT flexibility.

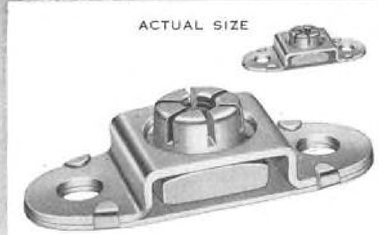
A three-dimensional flight table developed by the Computer branch is being used to test guided missile seeker systems and other components. Bendix has been operating the unit for about a year at Detroit for BuAer. Another unit is being built for USAF, to be installed at Holloman AFB.

At present the table's use is limited to problems where rotation around the axis is less than a single turn. However, with installation of slip rings, the table will permit unlimited rotation.

The flight table is designed to be used in conjunction with a large computer, such as the Typhoon or Cyclone, solving complete missile equations.

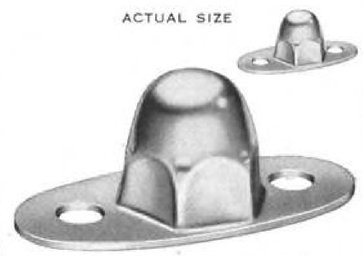
The missile seeker element is mounted in a special holder on the table and desired aerodynamic conditions are programmed into the computer. These are then fed to the table and behavior of the seeker element studied. The table will accommodate elements up to

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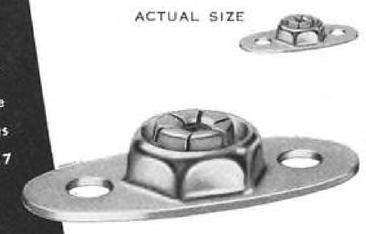


No. 4605. FIXED, TWO LUG, LOW DOME ANCHOR NUT, with restricted rivet spacing. Designed to eliminate wire chafing on screw threads and to provide for sealing areas. Available in cadmium plated steel for 550° F temperature.

These New MINIATURE NUTS weigh less and require less space

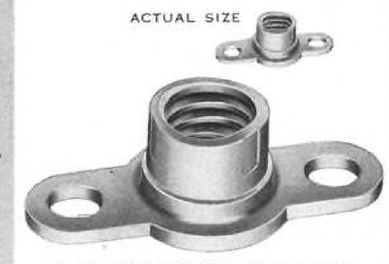
These nuts are especially useful wherever space is restricted and weight must be reduced. They meet applicable requirements of Spec. AN-N-10 and are designed for requirements of Spec. MIL-N-25027 (A.S.G.).

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50 lb. in weight and 8 in. in diameter.

Performance parameters designed into the table far exceed any anticipated missile performance, according to Jack R. Bennett, project engineer. Velocity capabilities are: roll, 50 radians/ second, with 50-lb. load; yaw, 15 rad./sec., unloaded; pitch, 12 rad./sec., unloaded. Acceleration capabilities are: roll, 2,500 rad./sec./sec., with representative load; yaw, 900 rad./sec./sec., unloaded; pitch, 500 rad./sec./sec., unloaded.

Dynamic response in roll is 125 cycles/second; in yaw, 51 cps.; in pitch, 51 cps. Positional accuracy is within 0.2 degrees.

PRODUCTION BRIEFING

► **Huck Manufacturing Co.,** 2480 Bellevue Ave., Detroit 7, Mich., announced the expansion of their West Coast facilities through their exclusive West Coast representative, Milton A. Miner and Associates. The new building containing 7,000 sq. ft. of floor space will provide facilities for sales staff, order department, warehouse and tool maintenance. New address will be 1237 Arbor Vitae, Inglewood, Calif.

► **Investment Casting Institute** announced the completion of a Sales and Net Profit Survey by the certified public accounting firm of Seely and Evans. The survey shows that average 1954 sales for the companies reporting amounted to $957,953; 1955 volume is expected to reach $125,000,000. Copies of the completed sales and profit reports are available from the Investment Casting Institute, 27 E. Monroe St., Chicago, at a cost of $50 per copy.

► **The Bill Jack Scientific Instrument Co.,** Solana Beach, Calif., has created a research and development laboratory at an initial cost of $100,000. New director of research will be Dr. Charles G. McIlwraith, aided by Dr. John B. Breazeale.

► **Long Reach, W. Va. silicone plant** of Linde Air Products Co., a division of Union Carbide and Carbon Corp., is scheduled to start production this fall. Several buildings have already been completed and about 200 people will be employed by the end of 1955.

► **Hexcel Products, Inc.,** has installed a new production line to produce aluminum honeycomb sheets up to four-feet wide. To accommodate the fast-growing production schedule, Hexcel's home plant in Oakland, Calif., moved into additional floor space giving a total of 100,000 sq. ft. A new branch plant is also being installed in Baltimore, Md.



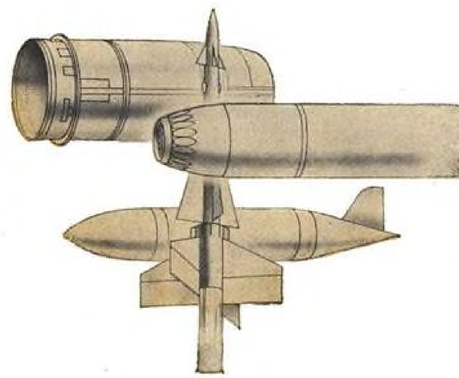
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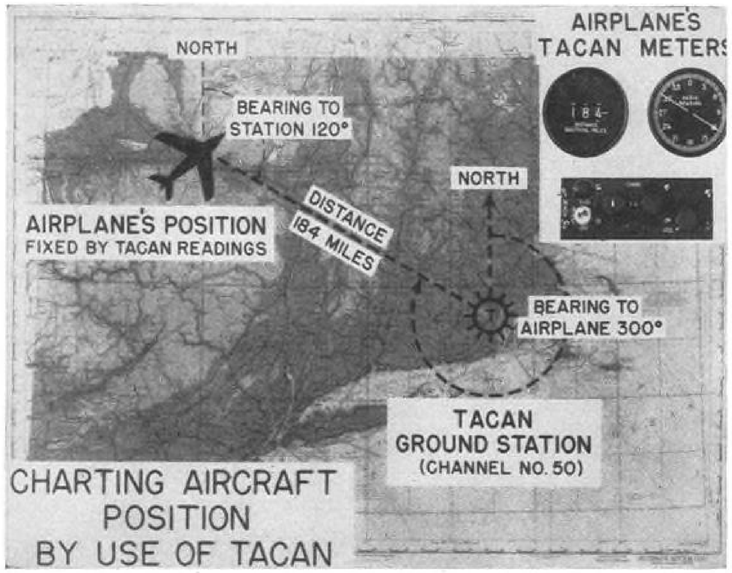
Tacan Makes Public Bow, Passes Test

By Philip J. Klass

Nutley, N. J.—The first public in-flight showing of Tacan by International Telephone & Telegraph Co., whose Federal Telecommunications Laboratory developed the controversial navigation aid, demonstrated some of the advantages which promoted the military to develop the system.

Flying in an IT&T DC-3 over known landmarks whose bearings and distances to the Nutley Tacan ground station were precalculated to permit speedy checks, the military Tacan set appeared to be accurate to within one degree in bearing and within 0.2 mile at distances up to 20 miles from the Nutley station. The private flyer set performed nearly as accurately.

So far as the pilot is concerned, the operation of Tacan and its cockpit presentation of bearing-distance information might have been coming from a VOR-DME except that Tacan's bearing indication was unaffected by terrain which occasionally caused the plane's VOR needle to jump several degrees.

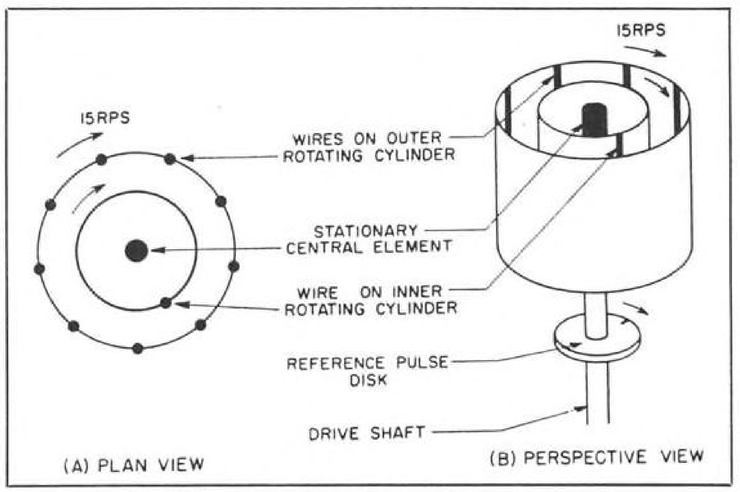


TACAN, like present VOR-DME, provides pilot with bearing and distance to ground station.

Similarities and Differences

The bitter DME-Tacan controversy has tended to obscure the many basic similarities between Tacan and present civil VOR-DME. There are differences, however – differences which IT&T claims give Tacan its superiority and growth potential. These include:

- **Clear-channel DME,** in which individual channels are provided solely by frequency separation between stations in place of the pulse-coding (multiplexing) required by civil DME to provide sufficient channels. This Tacan characteristic makes multiplexing available for additional functions, such as bearing, instrument landing, data link and, possibly at some future date, voice communication via pulse-code modulation.
- **UHF-band (1,000 mc.) operation** of both bearing and distance functions makes Tacan's omnirange bearing service much less effected by terrain and obstructions near the antenna than is VOR, which operates in the lower-frequency VHF band (112-118 mc.). For the same reason, Tacan can use a much smaller ground-station antenna, an important consideration for Navy shipboard and various USAF mobile installations.
- **Combined "coarse" and "fine"** bearing indicating system employed in Tacan enables it to provide greater accuracy than VOR.

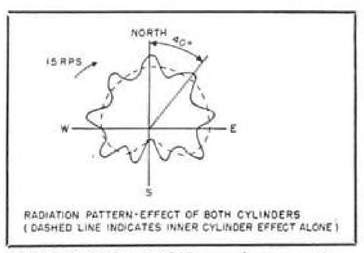


GROUND ANTENNA, consists of center DME element and two rotating cylinders which produce . . .

Civil and Tacan DMEs operate on the same basic principle: an airborne set transmits an interrogation pulse which is received by the ground station causing it to transmit back a pulsed reply.

The airborne equipment measures the time interval between the interrogation and reply. The interval is proportional to the airplane's distance from the station.

Both types of DME transmit pairs of pulses for interrogation and reply to



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These twins complement each other ideally. Thunderflash, the photo reconnaissance twin in the foreground, locates the targets. Thunderstreak, the A-bomb carrying fighter-bomber, smashes same. Designated RF-84F and F-84F, these combat twins are two of the Air Force's most versatile planes. In addition to their regular missions, the Thunderflash has a special assignment. It has been equipped to be carried kangaroo fashion in the belly of a B-36 and launched or retrieved in the air. Thus, fighter speed over the target is coupled with bomber range — a formidable combination. Republic keeps production schedules smooth on these planes by subcontracting several assemblies, including rear fuselage sections of both, to TEMCO. Work on these vital planes is reinforcing TEMCO's well established reputation for producing a quality product, on schedule, at one of the lowest costs in the industry.



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Dotted line shows how airplane passed between storm cells in its flight path.



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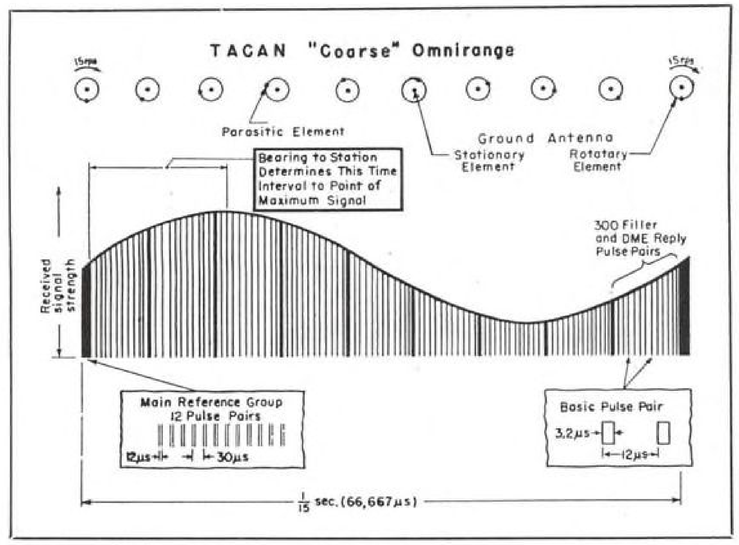
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"COARSE" omnirange signal is produced by 15 cps rotation of ground antenna cylinder.

distinguish them from spurious noise, or other DME pulses in the case of civil DME.

In civil DME, pulses 2.5 microseconds wide are given one of 10 different possible spacings, 14 to 77 Ms apart, to provide 10 discrete channels at one operating frequency. In Tacan, the DME pulses are 3.2 Ms wide and always spaced 12 Ms apart, since each channel operates at a different frequency. Both the ground and airborne DME receivers contain twin-pulse decoders set to pass only pulse pairs having the prescribed spacing and to reject all others.

During the initial "search" mode of operation, when either type of DME is looking for ground station replies, it transmits pulse-pairs at the rate of approximately 150 per second. When contact has been established with the ground station, this rate is lowered to approximately 30 pulse-pairs per second.

In order to prevent an airborne receiver from mistaking ground replies intended for other aircraft for an answer to its own interrogation, the repetition rate of each airborne transmitter is "wobbled" or varied slightly to give it an instantaneous repetition rate which differs from that of other aircraft in the area.

Tacan ILS

An experimental Tacan system which provides the equivalent of ILS instrument approach service, has been flight tested, according to IT&T officials. Lack of ILS has been one of the criticisms leveled at Tacan by some opponents.

During the search mode, which may take up to 20 seconds, the Tacan receiver looks for ground station replies which are effectively synchronized with its own "wobbled" repetition rate. Any other ground station replies are either intended for other aircraft or are part of the Tacan omnirange service. When a synchronized reply is found, range-gate circuits lock onto it, and the set goes into its normal operating ("track") mode. If the Tacan DME signal is momentarily lost when the plane banks so that the fuselage screens the signal, the range servo maintains its distance indication for a period of 10 seconds. If the DME signal returns within this interval, the airborne receiver returns to its track mode; otherwise the equipment automatically starts a new search cycle.

Tacan Omnirange

To understand the operation of the omnirange (bearing) portion of Tacan, it is necessary to examine the ground station antenna. This consists of a conventional DME antenna (a stack of vertical biconical radiators) to which all Tacan RF energy is supplied.

Surrounding the center element is a five-inch diameter Fiberglas cylinder in which an insulated metal rod is imbedded. (See sketch, p. 56). The rod acts as a parasitic antenna, intercepting some of the RF energy radiated from the center element and re-radiating it. The result is a cardioid pattern in which the signal strength of the pulses emitted by the central element are strengthened in one direction (North, in the sketch, p. 56), and weakened in the opposite direction.

The parasitic antenna is motor driven

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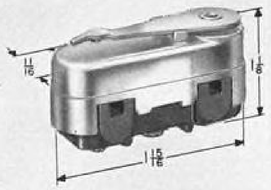
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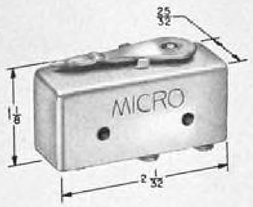
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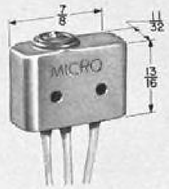
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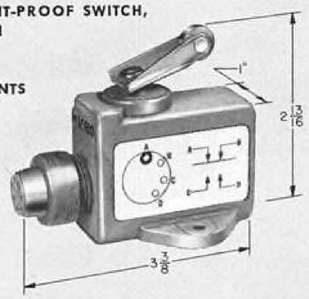
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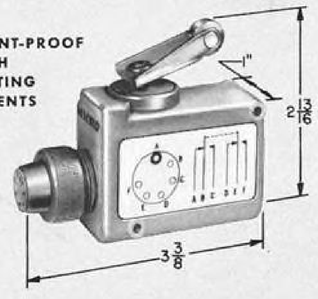
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at 15 revolutions per second, causing the cardioid pattern to rotate at the same speed. The effect on an aircraft's Tacan receiver is a 15 cps (amplitude) modulation of the signal strength of DME pulses received from the central element. Maximum signal strength will be received when the peak of the cardioid pattern, rotating in space, is pointed at the aircraft.

If the center element is caused to emit a special pulse code at the instant the cardioid peak sweeps past North, then the time interval between this reference code and the instant of maximum received signal will vary according to the airplane's "coarse" bearing to the Tacan ground station. Stated another way, a comparison of the electrical phase of the 15 cps modulation appearing on the DME pulses relative to that of the North reference code establishes the approximate aircraft bearing to the station. (See sketch, p. 61.) The North reference code consists of a group of 12 pulse-pairs, each pair spaced 30 microseconds apart.

Whereas VOR provides a 30 cps. modulation of its continuous-wave carrier, the Tacan "coarse" omnirange gives a 15 cps modulation of a group of DME pulses. If there is a sufficient number of DME pulses being emitted, the use of a peak-riding detector in the Tacan receiver enables it to extract the 15 cps modulation envelope as effectively as if the system employed a continuous-wave transmission. Tacan's omnirange modulation purposely is kept down somewhere between 12% and 30% to be sure that the DME pulses are not weakened sufficiently to prevent their use for distance measurement.

If, however, there are few aircraft in the area, DME reply pulses would be too infrequent to permit the Tacan receiver to extract a faithful reproduction of the 15 cps. modulation. To take care of this situation, the Tacan ground station supplements DME reply pulses with "filler" pulses, randomly spaced, so that a total of approximately 2,700 pulse-pairs are transmitted every second (plus an additional 900 main reference and auxiliary reference pulse-pairs, to be described shortly.)

(This "constant duty cycle" type of operation plays another important role in maintaining an essentially constant load on the ground station power supply to prevent fluctuations which might introduce spurious signal level modulation or affect operating frequency.)

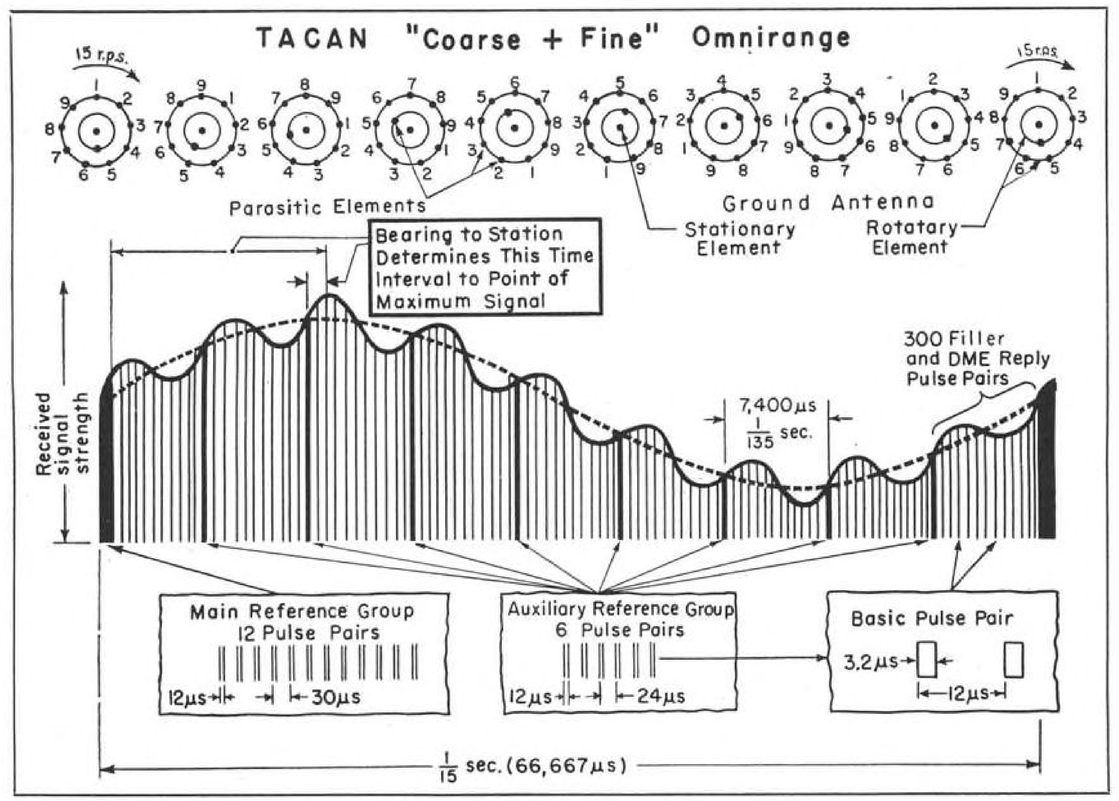
As more aircraft interrogate the ground station and the DME replies increase in number, the Tacan ground station automatically reduces the number of "filler" pulses.

Co-Channel Spacing

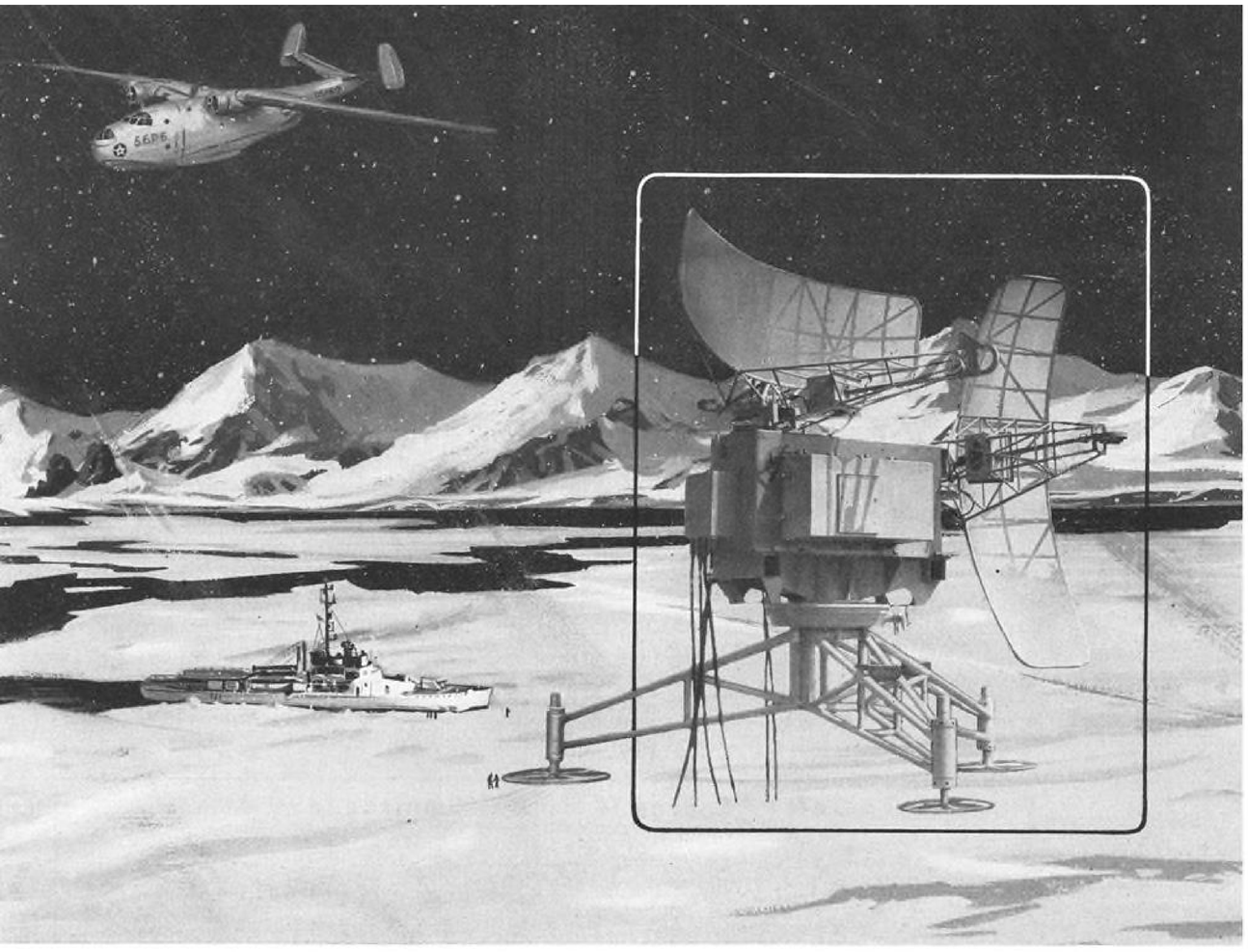
Unlike continuous-wave nav-aids like VOR, two Tacan stations can be operated at the same frequency within line-of-sight distance of one another without interference, according to an IT&T spokesman. Flight tests conducted with both the Nutley and Atlantic City Tacan ground stations operating at the same frequency, indicate that the airborne receiver remains synchronized to the closest ground station until the signal strength of the other becomes stronger. However, in practice Tacan stations operating on the same frequency will be located 500 miles apart wherever feasible.

Precision Omnirange

Tacan owes its superior bearing accuracy to the addition of a "fine" or vernier system which is superimposed upon the "coarse" one already described. This is done by adding another Fiberglas cylinder, 33 inches in diame-



PRECISION OMNIRANGE bearing accuracy results from rotation of inner and outer antenna cylinders which produce 135 cps modulation superimposed on the 15 cps "coarse" signal (shown dotted.) Phase relationship shown is for an aircraft due East of the station.



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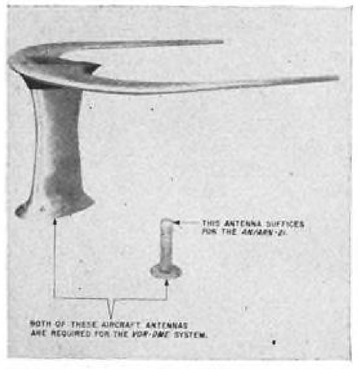


TACAN ground station antenna atop Federal Telecommunications Lab tower.

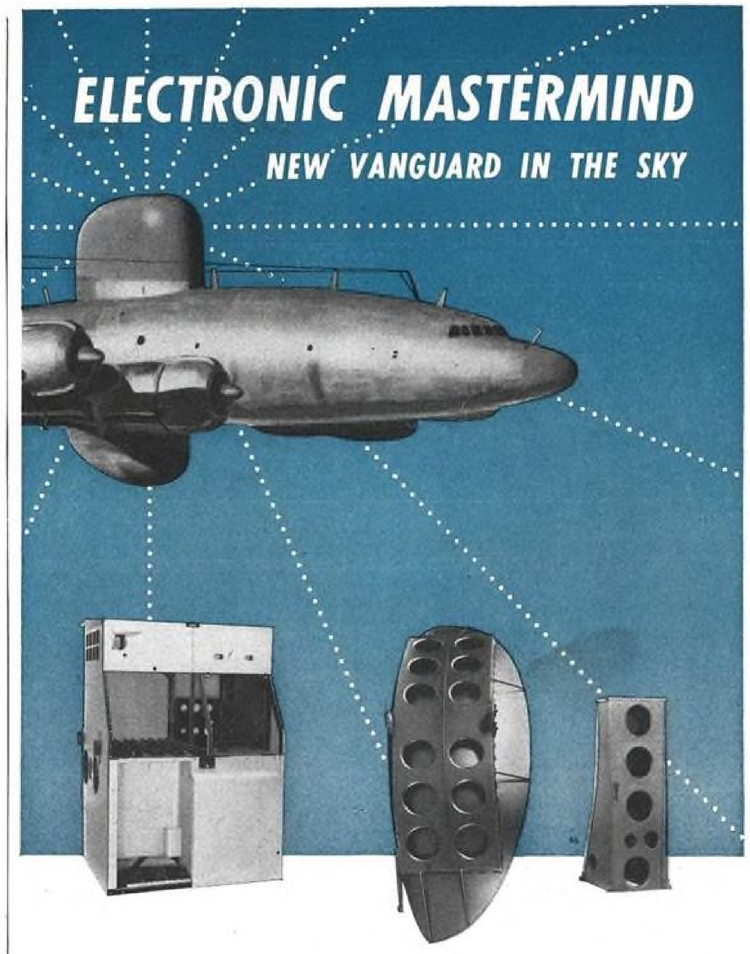
ter, containing nine parasitic (non-fed) antenna rods to the Tacan ground station antenna. The larger cylinder surrounds the one with a single parasitic element, and both rotate at 15 cps.

Each of the nine rods in the outer cylinder produces an intentional distortion of the signal pattern radiated by the center DME element. This produces a scalloped or nine-lobe cardioid which is superimposed on the basic cardioid pattern. (See sketch, p. 56.) The overall result is to produce a 135 cps. amplitude modulation (9 x 15) on the DME pulses radiated from the center element, in addition to the 15 cps. modulation.

The phase of this 135 cps. envelope cannot be directly compared with the main (North) reference signal used in the "coarse" system because there are nine lobes, or cycles, between successive reference signals which would give nine possible points, 40 degrees apart, each



SINGLE airborne stub antenna (r.) suffices for Tacan, whereas VOR-DME requires use of both antennas.



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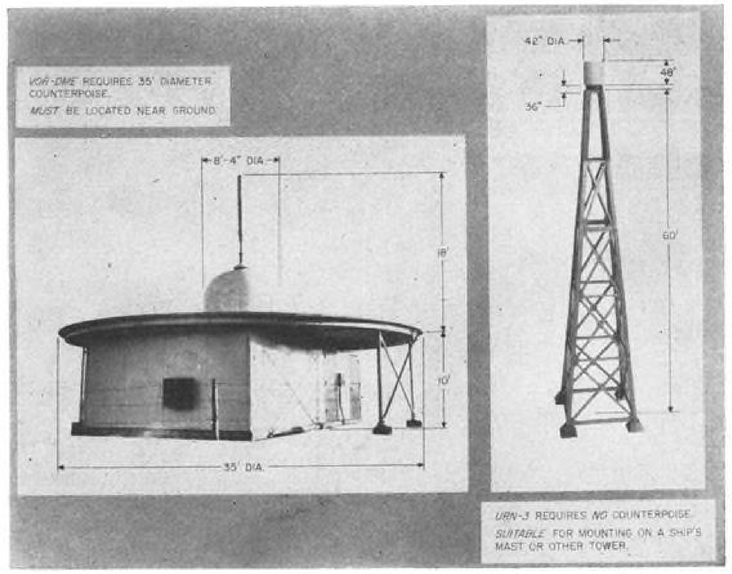
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with the same phase relationship.

Resolving Ambiguity

To resolve this ambiguity, the central DME element transmits eight auxiliary reference codes, emitting one for every 40 degrees of antenna rotation. (See sketch, p. 63.) The main reference signal completes the cycle. (Each auxiliary reference group consists of six pulse-pairs, spaced 24 microseconds apart.)

This enables the Tacan receiver to compare the phase of the 15 cps. modulation relative to the main reference signal to establish which 40 degree sector the airplane is in; then to compare the phase of the 135 cps. signal with the nearest auxiliary reference signal to resolve aircraft bearing down to less than one degree.

The airborne receiver has two rotary phase shifters, one geared up to turn at nine times the rate of the other, driven from a small servo motor. During the initial search mode, the slow-speed shifter varies the phase of the 15 cps. signal, which controls the opening of gating circuitry, until the main (North) reference pulse group occurs at the instant of the gate. When this happens, the Tacan omnirange goes into its track mode. This switches control of the servo motor to the output of the auxiliary reference group channel which operates to keep the 135 cps. gate centered around the auxiliary reference pulse group. When the gate is so centered, the airplane's station bearing is proportional to the position of an output shaft from the phase-shifter gear train.

If the Tacan omnirange signal is momentarily lost during the track mode, the equipment will maintain its last bearing for three seconds. If the signal does not return within this period, the unit automatically returns to its search mode.

Performance Details

The airborne Tacan interrogator transmits on any one of 126 channels, spaced 1 mc. apart, in the 1,025 to 1,150 mc. band. The ground transmitter replies on one of 126 channels in the bands of 962 to 1,024, and 1,151 to 1,213 mc.

For the first 63 channels, the airborne transmitter operates at a frequency which is 63 mc. higher than the ground transmitter. For channels 64 to 126, the airborne transmitter fre-

Collins, Bendix Hold Back

While current producers of military Tacan receivers (IT&T, Stromberg-Carlson, and Hoffman Electronics) are hopefully eyeing the possible civil market, two major suppliers of airline and business aircraft navigation aids, Collins and Bendix Radio, are sitting tight. Spokesmen for the two firms told Aviation Week that if and when Tacan gets a firm go-ahead for civil aviation, they intend to add Tacan receivers to their present line.

Neither of the firms, however, yet see signs of a clear-cut Tacan victory over civil DME. Under Navy sponsorship, Collins is developing a pressurized, ruggedized version of the military Tacan receiver.

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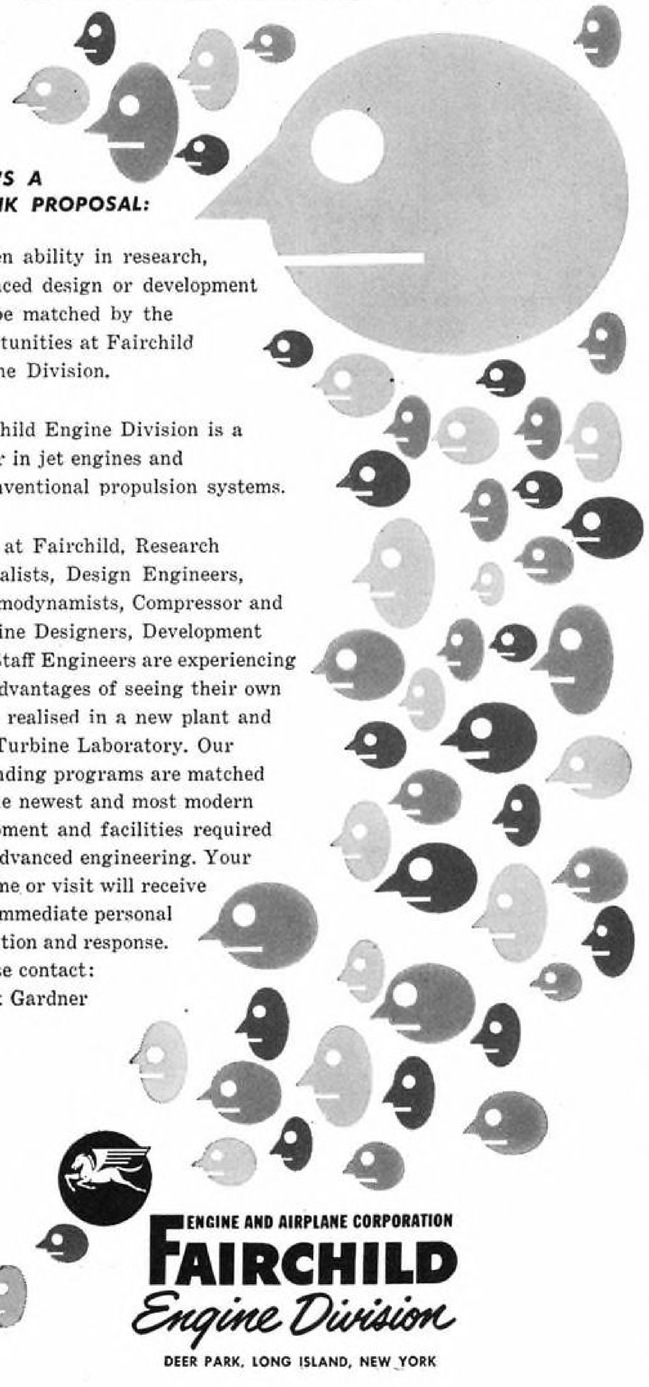
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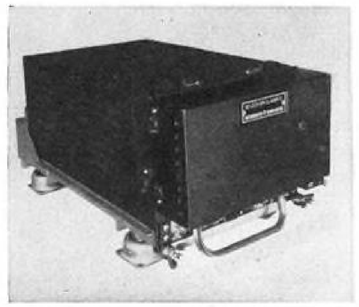
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DEER PARK, LONG ISLAND, NEW YORK



TACAN receiver measures 8 x 10 x 15 in., weighs 56 lb., uses 74 tubes.

quency is 63 mc. lower than the ground transmitter. For example, when operating on Channel No. 1, the airborne interrogator transmits at 1,025 mc., while the ground transmitter operates at 962 mc. When operating on Channel No. 64, the airborne interrogator transmits at 1,088 mc., while the ground transmitter operates at 1,151 mc.

Peak power of the transmitted pulses is 2 kv., and receiver sensitivity is quoted at 120 db. below one watt. A Ferris discriminator is used in the airborne receiver to achieve one megacycle selectivity. Signals more than 1 mc. off the selected frequency are attenuated more than 70 db.

The local oscillator operates on the transmitter frequency so the resulting intermediate frequency is 63 mc. (separation of transmit and receive frequencies.) According to figures released by the Air Navigation Development Board, the worst spurious response is 70 db. below the true response and occurs at 42 mc. above receiver frequency in channels 1 to 42, and 42 mc. below receiver frequency in channels 84 to 126. Response at the image frequency reportedly is 30 db. down.

NEW AVIONIC PRODUCTS

Components & Devices

● High temperature 400 cycle servo motor size 15, rated for operation at 150C ambient. New Series 2287 has minimum stall torque of 1.45 in. oz., no-load speed of 4,800 rpm, and stalled-power input of 12.2 watts. Fixed phase operates from 115 v., and control phase may be connected for 57.5 or 115 v. Motor also is available for 60 cps. operation. **John Oster Manufacturing Co., 1 Main St., Racine, Wisc.**

● Midget toroid coil, measuring only $\frac{3}{16}$ in. square x $\frac{3}{8}$ in., is available in any inductance up to 1 Henry, with a useful frequency range of 1,500 cps. to



Here is America's first commercial jet airliner

Above is the Boeing Jet Stratoliner 707 as it will look when it takes to the air. Its prototype—America's first jet transport—has been flying for more than a year. It has completed more than 200 hours of flight test—has repeatedly flown well above 40,000 feet and at speeds above 600 miles per hour.

Boeing has indicated to the commercial airlines that it could deliver jet transports so that flight operations could start early in 1959. Such early delivery is possible because Boeing has the prototype flying now—is already building a military jet tanker-transport generally similar to the 707 Stratoliner—and has accumulated vast experience in producing well over 1,000 B-47 and B-52 multi-jet bombers.

The 707 Stratoliner—a sleek, four-jet swept-wing beauty—will cruise in the 550-mile-per-hour range. It will make possible transcontinental flights in less than five hours; transatlantic in less than seven hours!

Incorporated in the Stratoliner are Boeing's specialized knowledge gained in 20 years of building multi-engine pressurized aircraft, and the full 39 years of the company's experience in the aircraft business.

It is typical of Boeing leadership that the company has designed and built America's first jet transport.

It was this leadership which gave commercial aviation the twin-engine 247, the 314 flying boat, the original pressurized transport Stratoliner 307, and the Stratocruiser; and gave the military the B-17 Flying Fortress, the B-29, the six-jet B-47 and the eight-jet B-52.

BOEING

Rolls-Royce built the first propeller turbine aero engine to fly.

★

A Rolls-Royce propeller turbine engine was the first to be officially approved for civil aviation.

★

The only propeller turbine engined airliners in service in the world are powered by Rolls-Royce.

★

Eighteen airlines have ordered Rolls-Royce propeller turbine aero engines.

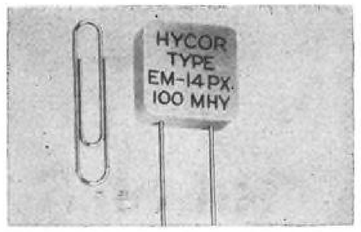
★

Capital Airlines have bought Rolls-Royce propeller turbine aero engines.

★

ROLLS-ROYCE

AERO ENGINES LEAD THE WORLD

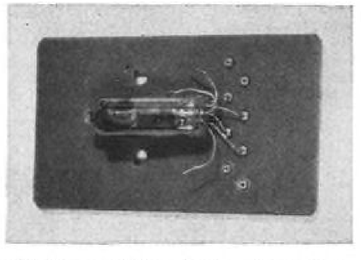


150 kc., depending upon inductance value. Unit withstands temperature of −55C to125C. Unit has wire leads specially designed for printed circuit use. Toroid core is molybdenum permalloy. **Hycor Co., Inc., 11423 Vanowen St., North Hollywood, Calif.**

● Magnetic pulse generator, Type MP 414-A, to trigger rydrogen thyratrons, can replace four vacuum tubes. Device is a line-type pulser whose repetition rate is equal to line frequency. Input voltage is 12.5 v. at 400 cps. Pulse rise time is 1μs, with a pulse width of 4μs at 50% amplitude. Unit weighs 14 oz. Bulletin EB-204 gives application data. **Magnetic Research Corp., 200-202 Center St., El Segundo, Calif.**

● Speedy relay, Type 100-MS, operates in Milliseconds, but has built-in contact wiping action to eliminate chatter and bounce. Contacts can handle 1.5 amp. inductive or 5 amps resistive load. Coil resistances up to 30,000 ohms are available and drop out can be adjusted to 65% of pick-up voltage value. Relay comes in hermetically sealed container with octal plug-in base or with dust cover, and is available in a variety of contact arrangements, from SPST to DPDT. Unit measures 1¼ in. dia x 3⅜ in. **Hedin Tele-Technical Corp., 87 Dorsa Ave., Livingston, N. J.**

● Solderless connectors for printed circuit boards, called "Micro-Pin Socket", into which diode, transistor, and other component leads can be connected without soldering. The socket's spring action holds component leads rigidly, yet



permits repetitive plug-in, removal operations. Sockets to fit 0.016 in. dia. leads are now available and soon will be available for 0.175 in. and 0.022 in. diameters. **Techron, Inc., 254 Friend St., Boston, Mass.**

(Advertisement)

Valve Talk

for WM. R. WHITTAKER CO., Ltd.

by Marvin Miles,
Senior Member, Aviation Writers Assn.



Like many another up-to-the-minute company, Whittaker protects itself and its customers with microfilm.

The operation started some years back when a neighboring factory was razed by fire in the early morning darkness. The plant was totally destroyed, including every record, every piece of correspondence.

The blackened, water-soaked chaos, the ruined machinery, represented not the big loss, for building, equipment and furnishings were covered by insurance. But the nearby company was left in serious trouble without one scrap of paper covering its designs, agreements, inventory, orders, personnel and historical records, etc.

The tragedy brought home to Whittaker the urgent need for records protection, and immediate steps were taken to nullify the danger. A battery of microfilm cameras and readers was purchased, and the necessary people immediately assigned to the task of photographing every available document – back to the company's inception.

If fire or bombs should wreck any one of the valve concern's plants today, any record, drawing or letter filed in Whittaker history – up to within two or three weeks – could be reproduced through the magic of microfilm almost overnight.

Biggest job in the beginning of the program was to photograph the huge pile of past records accumulated over the years and packed away in a company warehouse section.

It took some three months of intensive work to bring the program up-to-date – with the vast paperwork of the accounting department representing the largest single effort – then the 16 mm negatives were stored in a Salt Lake City bank vault for safe keeping.

Today they are stored in a special vault with temperature and humidity control in the desert resort city of Palm Springs, 120 miles distant, where an ordinary-sized cabinet holds the accumulation that once almost filled a warehouse.

After the day-by-day story of the past was safely on film, the mass of stored papers was destroyed, and Whittaker embarked on a continuing program of microfilming covering every division of the company.

For immediate protection it was decided to photograph every document, drawing, letter, even payroll files and time cards, as quickly as possible. Each department was made responsible for running its own papers under the lenses of the typewriter-sized cameras, and the time lag has since varied from one to three weeks, depending on the type of work of each department and the extent of microfilming involved.

Initially, there is no effort made to keep the exposed negatives in any special order. The various papers, properly labeled but as yet unfiled, are simply photographed in small accumulations week after week and placed in the vault for safety.

Then, once each year, the original records of the prior twelve months – now carefully indexed and filed – are again photographed in sequence, each document going under the camera for two exposures so one complete set of negatives can be preserved in the Palm Springs vault while another is retained for use at the plant after the original papers are destroyed following two years of storage.

Microfilming of records is not required by the military services although in the past the USAF has asked for reproducible (Van Dyke) blueprints of certain drawings, but now, accepts 35 mm microfilm negatives used to cover the larger sheets.

Whittaker has found that microfilming, conducted on a systematic basis, takes little time and requires negligible expense once the camera equipment and necessary "readers" (enlargers for reading negatives without actual reproduction) are purchased.

While protection for both the company and Whittaker customers was the main objective, amazing savings in space were realized as an unexpected additional benefit of the film recording process.

The "Hercules" of hoses flies with the Lockheed Hercules



Powerful is the word for Lockheed's C-130 Hercules . . . with its long range and capacity for tough assignments.

"Herculean" strength and endurance also characterize the Fluoroflex-T hose assemblies that convey fuel and oil on this plane and on its four turboprop engines.

Fluoroflex-T R3800 hose assemblies represent the latest word in aircraft hose progress. They're 500°F lines. These are the only assemblies using a tube compounded from Teflon that have A-N approval for synthetic fuels, oils and nitric acid.

Get the facts—send for Bulletin FH-2.

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Airwork, Pratt & Whitney Push Hi-Per DC-3 As Executive Plane

By George L. Christian

Millville, N. J.—The Airwork Corporation and Pratt & Whitney Aircraft, encouraged by the performance of the Hi-Per DC-3, are pushing the R2000-powered transport as a faster, more economical executive plane. The aircraft will cruise at well over 200 mph. and have greatly improved single engine and high altitude take off performance over standard DC-3s.

At Airwork's Engine Operation and Maintenance Forum held in cooperation with P&WA, a Hi-Per DC-3 pilot produced the plane's actual performance figures to back up the companies' claims of how much better an aircraft a Hi-Per is as compared with the conventional old work horse. His figures carried authority because he also flies an R1830-92-powered DC-3, giving him an accurate yard stick for performance comparison.

While R. E. Sheriff, chief pilot of Thompson Products, Inc., listed the Hi-Per DC-3's performance figures, the plane itself was parked on the apron of Airwork's airport for all to inspect closely.

Apart from the R2000-7M2 powerplants, light-weight Hamilton Standard propellers and other improvements inherent in the Hi-Per DC-3 configuration, the Thompson plane also incorporates wheel well doors and short exhaust stacks. Sheriff estimated that the doors add about 5 mph. to the plane's speed, while the short stacks knock 60 lb. per engine off its weight. They also do much to reduce vibration since the engine is no longer attached to the airframe except by dynafocal mounts. Previously, a connection between tail pipe and nacelle transmitted engine vibration to the plane's structure.

Conversion Cost

Sheriff told AVIATION WEEK that his company was so satisfied with the Hi-Per's performance that it had authorized the modification of a second DC-3 to the the R2000 configuration as soon as it comes up for engine change.

The engines are bought from Airwork, while the actual modification is performed by Pan American World Airways in Miami. Total cost of the conversion is between $90,000 and $100,000.

The Thompson pilot stressed the fact that, after over 400 hr. of operation, the engines had functioned perfectly without a single squawk. Other Hi-Per features stressed by Sheriff:

• **Modifications have** boosted cruise speeds from 175-180 mph. to 210-215 mph.

• **Extra power in case of engine failure** during take off at maximum gross weight. With the -92s, the situation can be critical. With the R2000s, the plane will climb out with a prop windmilling—"no sweat at all," to quote Sheriff.

• **Fuel consumption** jumps from about 100 gph. to approximately 125 gph. but the increased speed gives the Hi-Per a slightly greater range. (Fuel consumption figures are average and include warm-up, take off, climb, cruise and let down.)

Sheriff says that fuel consumption problems which existed when the engines were first installed have been licked.

• **Prop vibration** has been eliminated by balancing the units dynamically.

Commenting on the "clam shell" doors, Sheriff said that, in effect, they allow the plane to cruise at the same speed with 650 hp. from each engine as it did at 750 hp. per engine before the doors were installed.

The net effect is to increase range and reduce wear and tear on the power plants.

An added bonus is the fact that the main gear retracts much faster—in eight seconds as compared with 21 seconds—increasing safety by cutting drag quickly in case of a go-around.

Wright and P&WA

Another highlight of the conference was the announcement by Canadian Pratt & Whitney that they were going into the manufacture of a Wright Aero engine—the R1820 since the Canadian Navy has bought the Grumman S2F which mounts the engine. The plane is being built in Canada by de Havilland.

The Canadian government wanted to build its own engine to avoid having to depend on a foreign design. Canadian P&W is the only manufacturer of piston engines in Canada. Result: the firm is building Wright powerplants.

An innovation at this Forum was a panel discussion by representatives of six divisions of Bendix Aviation Corporation concerning their various products. Divisions represented were: Bendix Red Bank, Bendix Radio, Scintilla, Bendix Products, Eclipse Pioneer and Utica Division.



R-2000 ENGINE on Thompson Products' Hi-Per DC-3. (1) shows short exhaust stack; (2) "clam shell" doors.

New Facilities

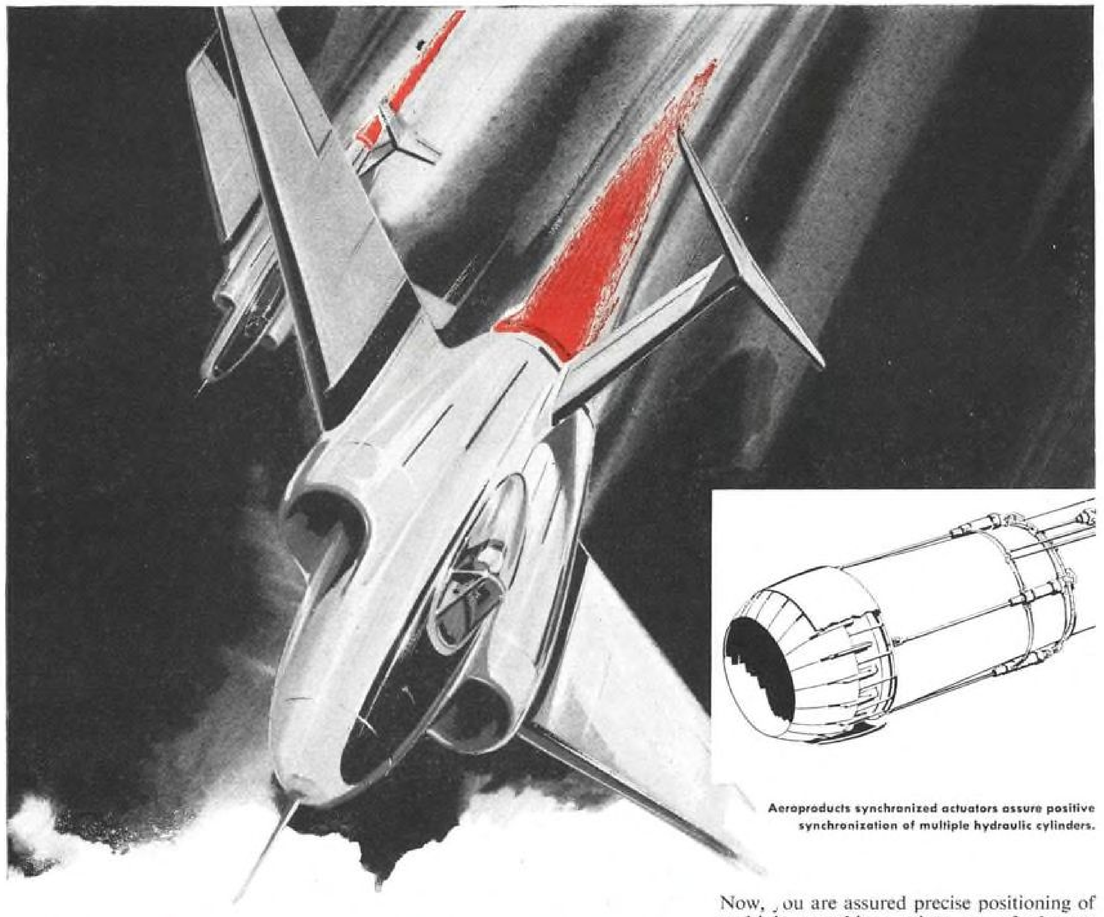
J. S. Gillespie, Airwork's vice president-sales, outlined some of the new facilities his firm has established since the meeting last year. They include two new warehouses to speed parts delivery, one in Newark, N. J., and other in Atlanta, Ga.

To improve the quality and scope of its work, the company has added $35,000 worth of new machinery. Included are: shot peening facilities to check plating bond; new cylinder bore lapping machine, universal milling machine and several new test stands.

The success of the forums can be judged by the increase in attendance in 1955 over 1954. The guests increased from 118 to 175 and the number of companies represented jumped from 59 to 102.

Southwest Fills Quota

Southwest Airmotive Co. delivered its full July quota of overhauled J33 jet engines to the Air Force. It was the first shipment in a contract involving more than 1,200 powerplants and worth about $3 million. The Dallas overhaul agency built additions to its buildings, erected jet engine test cells, trained personnel and had its production lines rolling in 150 days to make the initial delivery.



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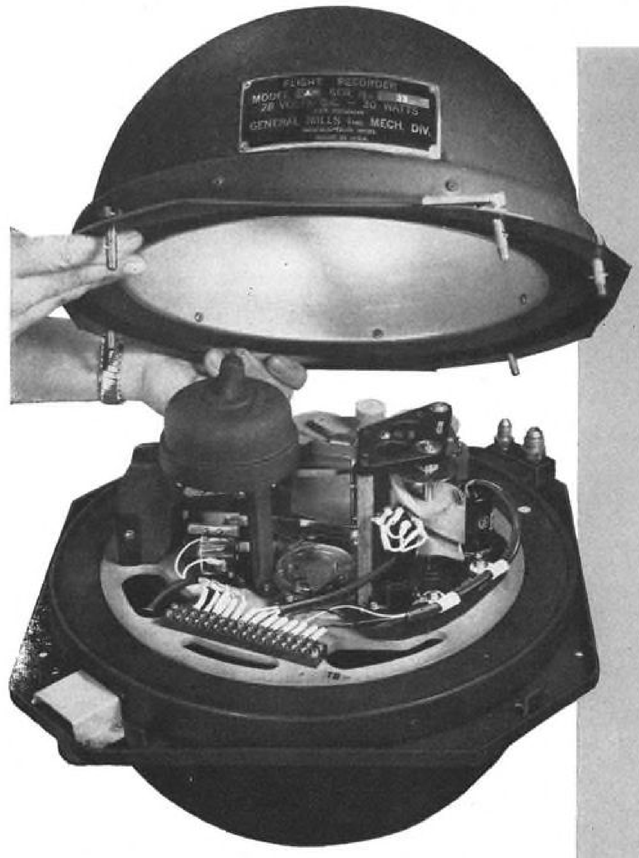
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Aero Supply Mfg. Co. Inc. of Corry, Pa., announces a series of general engineering data bulletins of a non-advertising nature prepared by Aero Supply's Research and Development Center recently established in Cleveland, Ohio. The bulletins consist mainly of technical data with charts, graphs and other valuable information related to the design of aircraft, rocket and missile fuel systems.

The first four bulletins show viscosity vs. temperature data for approximately 120 different fluids and has been prepared for availability on or about September 6, 1955. Subsequent bulletins will appear at approximately one month intervals.

For over 39 years Aero Supply Mfg. Co. Inc. has been a leading designer and manufacturer of fuel system components, cockpit controls and related articles for all flight applications. Qualified representatives and engineers are readily available upon request to offer assistance on specific engineering and application problems.

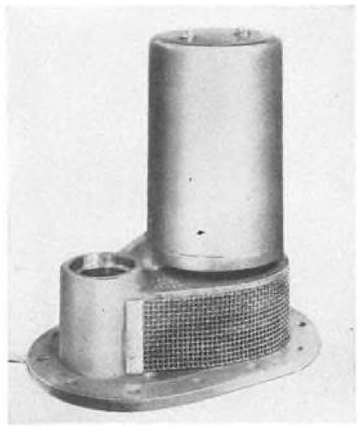
Address Request to

Aero Supply Mfg. Co. Inc.,

Research and Development Center,

P. O. Box 402, Corry, Pa.

NEW AVIATION PRODUCTS



Aircraft Fuel Booster Pump

Electric motor driven centrifugal pump, Model RG-11280-1 weighing 6.5 lb., is rated at 6,200 pph. at 27.5 psi. minimum discharge pressure using jet engine fuel and has continuous duty life of 200 hours minimum. The unit has excellent high altitude performance and may be operated at extreme ambient temperatures of −65 to 160 F. and fuel temperature range −65 to 110 F.

Motor is 0.63 hp., 27v., d.c., 26 amp. It is vented through the flange and a seal drain prevents fuel seepage into the motor.



Filter Purifies Hydraulic Oil

To provide clean oil for hydraulic systems and servo-mechanisms, Farnham Hydra-Filter cleans out contaminates to within ½ micron from new and used material, the maker reports.

The mobile unit can also be used for flushing and testing and for transfer of hydraulic oil directly from drums.

The equipment has non-corrosing piping and reservoir and a filtering system which includes one comb type, one magnetic and seven micronic disk type filters.

Farnham Manufacturing Division, Wiesner-Rapp Co., Inc., Buffalo 10, N. Y.

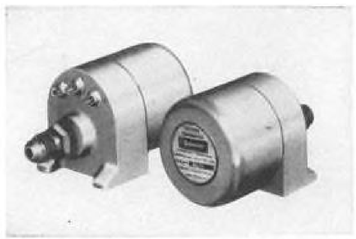
Emergency Power Battery

Ultra-lightweight 24-v. nickel-codiumin battery for emergency duty in high-speed aircraft provides power for turn and slip indicators and cockpit lighting.

The battery reportedly operates without electrolyte leakage during aerobatics at altitudes as high as 60,000 ft.

The 21 cells are cemented together in a block and bound with glass fiber tape impregnated with poyester resin for increased strength. Weight is less than 3 lb., with dimensions of 4-25 x 4.25 x 3.375 in. Individual cells weigh 2 oz.

Nife Batteries, Redditch, Worchestershire, England.



Pressure Transmitter Handbks 25G

Model 45154S "high vibration" pressure transmitter operates in range of 0-20 psi. . . absolute, differential or gage . . while subject to a sinusoidal vibration of 25G at frequencies up to 2,000 cps.

Repeatability is limited by the resolution of the potentiometer winding of 230 wires (0.45%). Weighing less than 6 oz., the unit has a length of 2.4 in. and a diameter of 1.75 in.

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

Clutch Weighs 5.5 Oz.

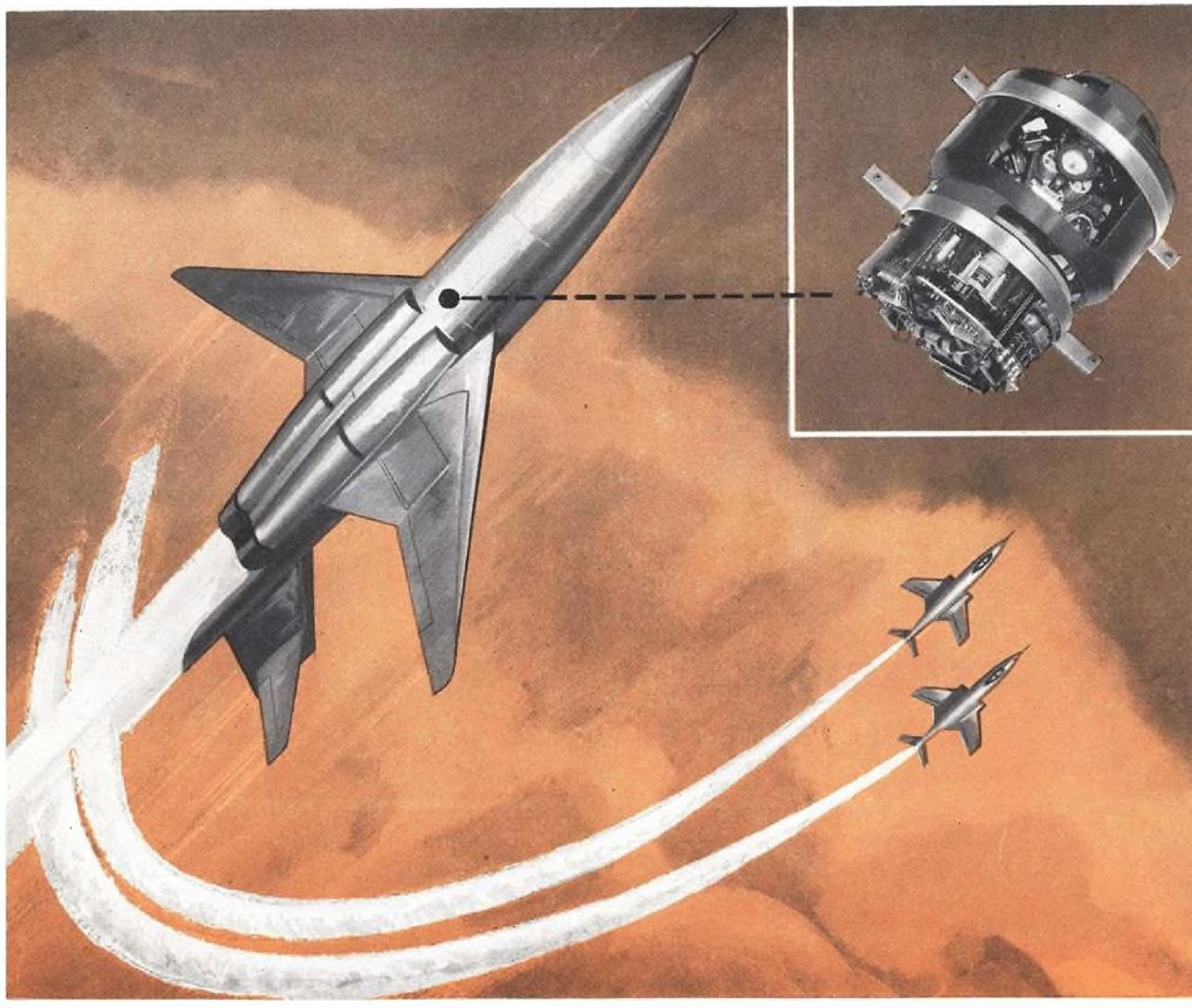
Model C-130 miniature electromagnetic clutch has a power consumption of 3 watts. The unit, with a response speed of about 10 to 15 milliseconds, may be used as a highspeed nonchattering brake and for slip applications for restricted periods of time, as well as for on-off clutch service.

Design allows for considerable misalignment between driving and driven members without malfunction of the overall instrument. The clutch weighs 5½ oz., has a torque output of 7 in. lb.

Dial Products Co., 7 Bergen Court, Bayonne, N. J.

Bendix 3-GYRO STABLE PLATFORM*

*Developed in conjunction with Flight Control Laboratory, Wright Air Development Center



NO GIMBAL LOCK. Functions through loops, rolls, turns in 360° rotation about any aircraft axis without encountering gimbal lock . . . at rates that meet performance requirements of highly maneuverable aircraft.

UNPARALLELED ACCURACY/WEIGHT RELATION. Weighs 28 lbs. . . . occupies only ½ cubic foot of space. Azimuth drift rate** is 1° per hour max.; vertical drift rate** is 2° per hour max.; threshold of vertical sensors** is ±3′ of arc.

***Values based on more than 2000 hours of performance testing.*

VERSATILE IN APPLICATION. As master reference, the Bendix 3-Gyro Stable Platform can replace all vertical and directional gyros used for such functions as indication, auto pilot control, fire control, radar stabilization, navigation, etc. It can be used as either free or slaved platform, but normally is slaved to vertical.

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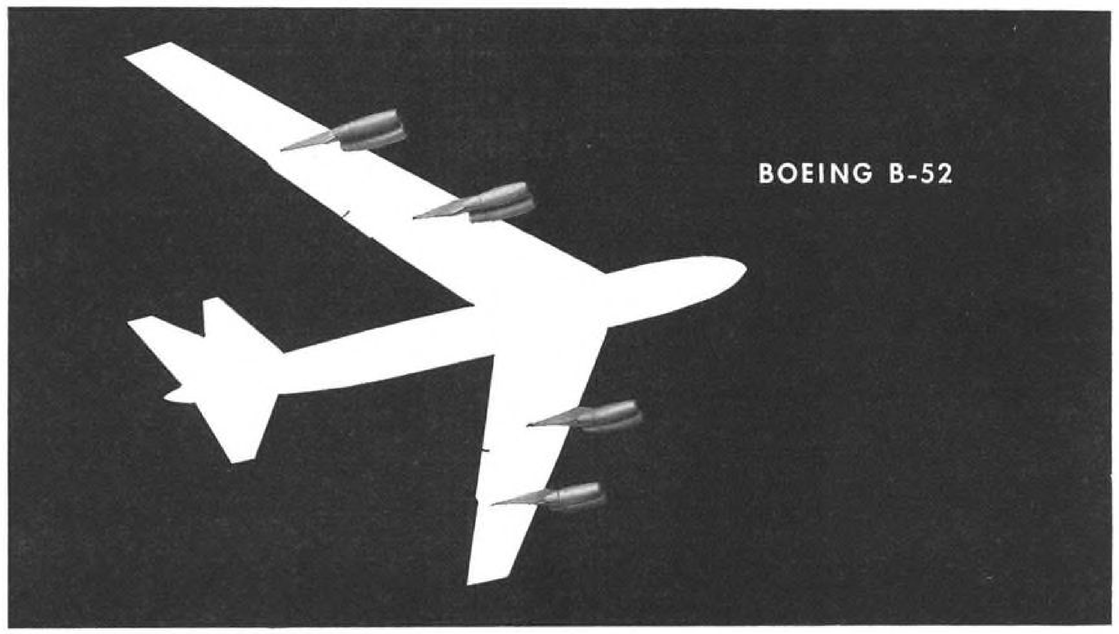
For complete information on the Bendix Stable Platform, write ECLIPSE-PIONEER DIVISION, BENDIX AVIATION CORPORATION, TETERBORO, NEW JERSEY.

West Coast Office: 117 E. Providencia Ave., Burbank, Calif.
Export Sales and Service: Bendix International Division, 205 East 42nd St., New York 17, N. Y.

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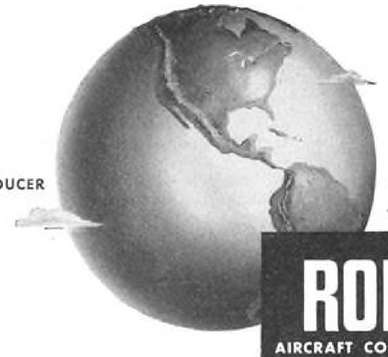




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Neo-Flasher flashing lights are used as industrial warning lights. Model 1-100 LSR is mounted atop portable pedestals adjacent to landing gear of Douglas A3D Skywarrior twin jet bomber. The lights require no maintenance, no fuel and no day-to-day servicing and are weatherproof. Light is operated by one battery and produces up to 1,000 hours.—Neo-Flasher Manufacturing Co., 3210 Valhalla Drive, Burbank, Calif.

Rack mounting for Type 5-119 recording oscillograph was designed to permit use of the oscillograph in ground-mobile installations as well as a fixed rack-mount in permanent installations. The entire oscillograph tilts forward from the rack on a special hinge, permitting removal of the record magazine without taking the oscillograph from the rack. The new mount is constructed of .093 in. steel stock and measures 12 in. deep by 19 in. wide for insertion in a standard vertical rack. Its features include: 36 or 50 channels, linear frequency response from 0 to 3,000 cps, record speeds from 0.1 to 100 in./sec., timing lines, trace identifier, reference traces.—Consolidated Engineering Corp., 300 N. Sierra Madre Villa, Pasadena, Calif.

"Walkie" electric truck, designed for handling cable reels weighing up to 10,000 lb, also is available in capacities to 20,000 lb. Maximum reel diameter which can be handled is 90 in., minimum is 36 in. Maximum reel width is 68 in. Truck operates with the handle in any position—including vertical, and where reels of varying diameters must be handled.—Lewis-Shepard Products, Inc., Dept. R-25, Watertown, Mass.

Type II viscometer, weighing 8 lb., is supplied as a portable unit for laboratory or field use or as a panel-mounted unit for use on either new or existing test equipment. Includes thermometer, filter, filter cartridges and AN outlet fittings. A flow system design employed in the instrument makes possible readability within 1% of indicated viscosity at any point of the scale. Ranges are .5 to 5.0 and 3.0 to 30 centistokes permitting use for measurement of all liquids used in testing aircraft fuel and hydraulic system components.—Commercial Research Laboratories, Inc., 20 Bartlett Ave., Detroit 3, Mich.

Air clutch press includes an electro-pneumatic control permitting instantaneous finger-tip starting and stopping. The press may be single-tripped with

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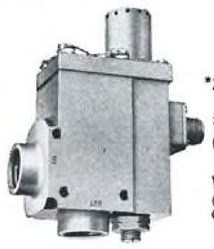
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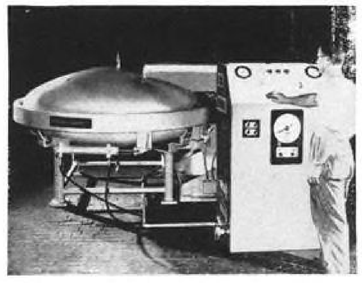
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hand or foot control or operated continuously. Federal #8 100-ton unit features higher speed operation with maximum safety.—Federal Press Co., Elkhart, Ind.

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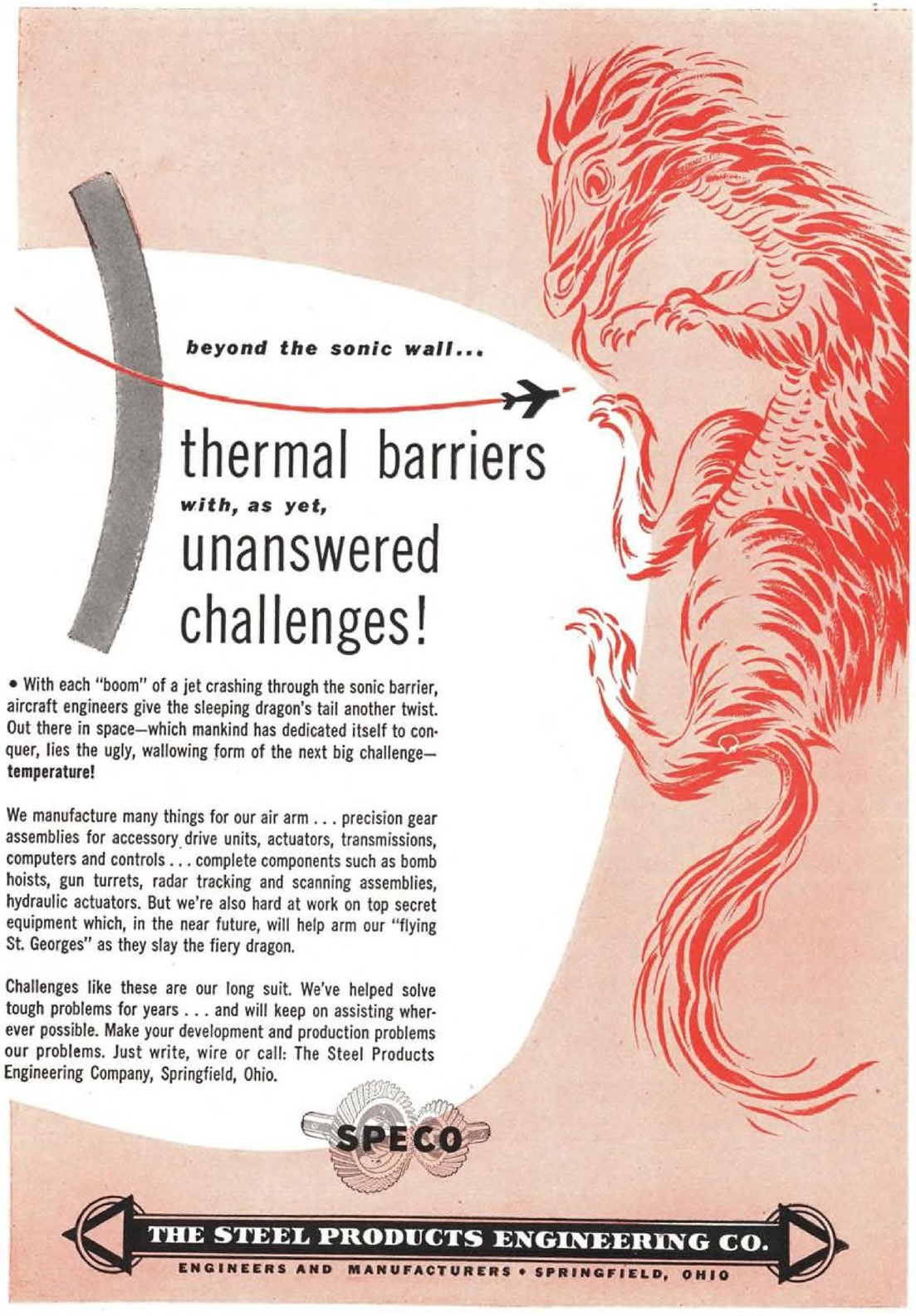
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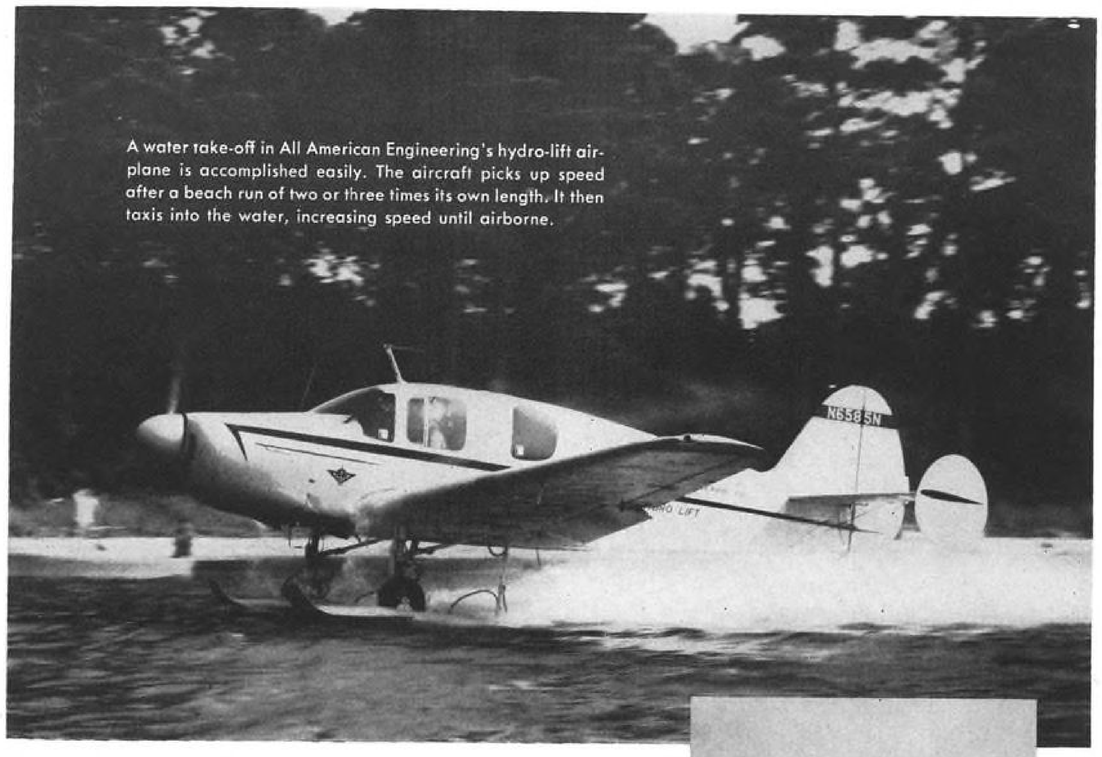


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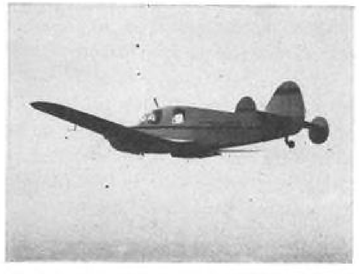
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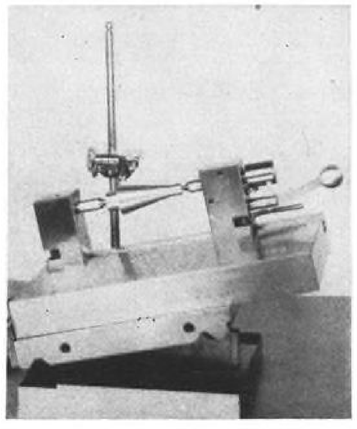
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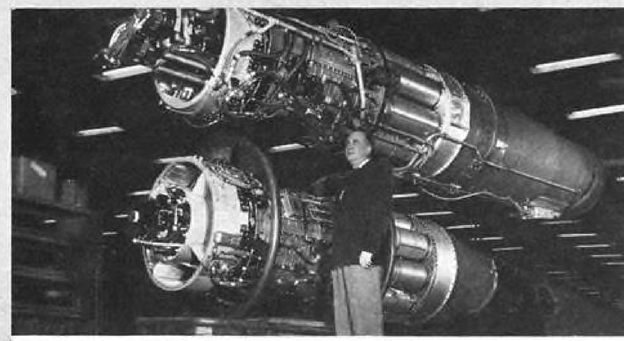
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AVIATION SAFETY

CAB Report on NEA DC-3 Accident

High Approach Caused Overshoot

THE ACCIDENT

A Northeast Airlines Douglas DC-3, N 19942, Flight No. 568, overshot the end of runway 18 and struck a ditch during a landing at Lebanon Airport, Lebanon, N. H., May 31, 1955, at 1826[1].

There was no injury to the passengers or crew. The aircraft was substantially damaged.

HISTORY OF THE FLIGHT

The flight originated at La Guardia Airport, N. Y., for Lebanon with a stop scheduled at Keene, N. H.

The aircraft departed La Guardia on a VFR (Visual Flight Rules) flight plan at 1612 with a crew consisting of Capt. Parker F. Schofield, First Officer C. Peter Blouin, and Stewardess Sybil Walker; twelve passengers were aboard.

The flight proceeded to the vicinity of Greenfield, Mass., where observing a thunderstorm ahead, the crew requested and received an IFR (Instrument Flight Rules) clearance to Keene.

Near Keene, Flight 568 was cleared to the Lebanon radio beacon via Blue Airway 45, to maintain 6,000 ft.; this was later revised to descend and maintain 5,000 ft. Keene was overflown because of thunderstorms and poor radio reception. After finding a 5,000-ft. ceiling at Lebanon and canceling its IFR clearance, the flight proceeded VFR for a landing at Lebanon. Northeast Operations had relayed to Flight 568 the following 1807 Lebanon special weather observation: "Sky partially obscured; 800 scattered, estimated ceiling 3,000, overcast; visibility 2; light rainshowers and fog; wind calm; altimeter 29.86. Remarks: Visibility to north 1; scattered clouds variable to broken."

Capt. Schofield circled the airport to the left in the descent and approach to runway 18. On the base leg the landing gear was extended and the wing flaps were placed in the full-down position. The gear and flaps remained in these positions throughout the approach and landing roll. The airspeed crossing the airport boundary was reported at 90 knots and touchdown on the wet runway as 900 ft. from the approach end. Steady application of the brakes followed by intermittent "pumping" failed to stop the landing roll. The aircraft rolled off the end of the runway, struck a drainage ditch, and came to rest on the underside of its fuselage 57 ft. from the end of the runway. After checking for fire the crew allowed the passengers to remain in the aircraft because of the rain until cars arrived. There were no injuries.

The 1828 (2 minutes after the accident) Lebanon weather report was: Sky partially obscured, 800 scattered, estimated 3,000, overcast; visibility 2; light rainshowers and fog; temperature 58; dewpoint 58; wind calm; altimeter 29.86. Remarks: Scattered clouds variable to broken.

INVESTIGATION

The Lebanon Airport is 579 ft. above sea level. There are two runways (4,000 feet x 150 feet and 3,500 x 150 ft.). Runway 18-36 is 4,000 ft. long and the south end is approximately 14 ft. higher than the north. A downward slope occurs in the first 1,700 ft. and the runway then slopes upward to the south. The runway is surfaced with coarse bituminous material and there are numerous small depressions where rain collects. An airport rule requires that landings be made to the south when the wind is calm. A drainage ditch about 6 ft. deep and 30 ft. wide runs at right angles 11 ft. south of the runway end. There is no traffic control on the airport.

Examination of tire marks on runway 18 indicated that touchdown was 900 ft. from the approach end on the main gear with the tail wheel off the runway surface. Alignment with the runway was maintained to the runway end. The captain stated the aircraft was in a three-point position as it left the runway. The landing gear wheel struck the far side of the drainage ditch 3 ft. below its top.

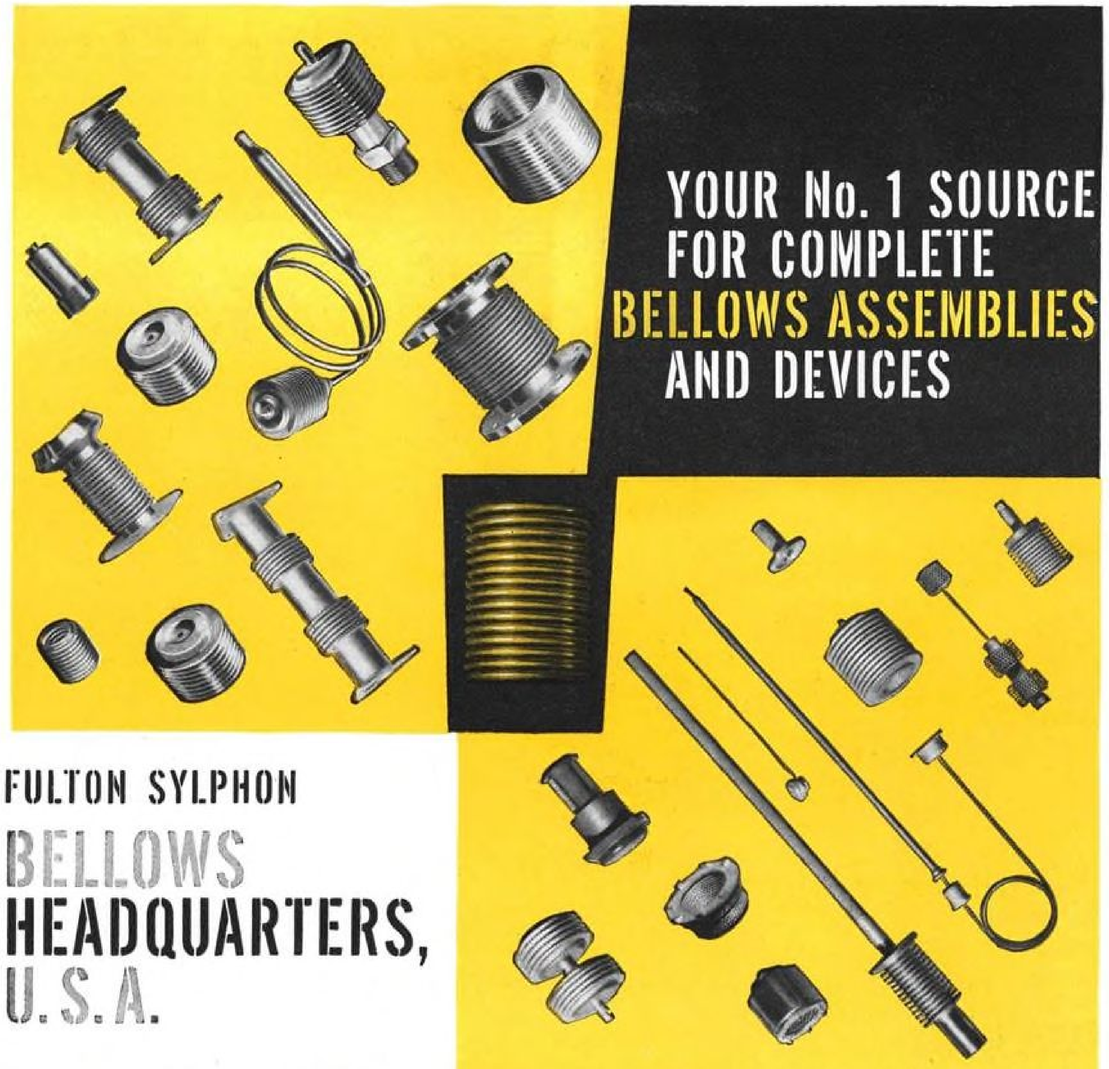
Capt. Schoefield said he did not consider a go-around because of rising terrain and low clouds south of the airport. He unlocked the tail wheel to groundloop but changed his mind because of the aircraft's speed and the hazard involved. Power was applied before leaving the runway in the hope of clearing the drainage ditch; ignition switches were cut as the aircraft left the runway.

Examination of the aircraft after the accident disclosed that the tail wheel was unlocked, wing flaps were fully extended, and all control surfaces were movable. Left and right landing gear struts were forced rearward. The tires were inflated and had no visible scuff marks. Both engines and their nacelles drooped downward. All propeller blades, except one on the left engine, were bent rearward or damaged by ground contact. Examination of the crew compartment disclosed no irregularities of controls or instruments. Further examination disclosed no indications of failure or malfunctioning prior to the accident. This was substantiated by statements of the crew.

Witnesses at the airport stated that the approach appeared to be slightly high and fast.

The crew stated that after they left the aircraft they observed indications on the trees of an overriding tail wind. The INSAC (Interstate Airways Communcations) station is in the northwest quadrant of the field and the anemometer is located nearby at a height of 35 ft. above the ground. After the accident the anemometer was found to be functioning normally. The observation made by the INSAC station immediately after the accident indicated

[1]All times herein are Eastern Standard and are based on the 24-hour clock.



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a continuing calm condition. The runway surface was wet at the time.

Gross weight of the aircraft on landing at Lebanon was 21,998 lb., 3,348 lb. under that allowable. This load was properly distributed with respect to the center of gravity of the aircraft.

ANALYSIS

An approach airspeed of 90 knots over the boundary and a touchdown 900 ... past the threshold of a dry 4,000-ft. runway would normally be safe. However, a landing made at this speed on a wet runway is a marginal operation. The circumstances left very little time for corrective action by the captain when he found braking action ineffective.

Keeping the tail up on the DC-3 in order to maintain good directional control and to put more weight on the main gear for better braking is a practice often used in landing. Since the captain stated that the tail wheel was not in contact with the runway until near its end, the speed at touchdown must have been somewhat excessive in order to permit keeping the tail in the air for approximately 3,000 ft. That there was still considerable speed when the aircraft ran off the runway is indicated by the fact that the landing gear struck only the top half of the far bank of the 30-ft. wide ditch. The captain stated that he did not attempt to groundloop because of the speed.

The crew reported observing indication of an overriding wind after the accident. Analysis indicates that a very light northwest breeze existed above the surface, increasing slowly to 6 to 8 knots at 400 ft. above the field. Under the conditions that existed at the time, it is extremely unlikely that a strong wind could have existed within 500 ft. of the surface and the surface wind remain calm.

Wet runways affect braking action adversely. The captain's statement reports his braking effectiveness as "poor to nil" and when this condition was definitely established there was not sufficient time or distance remaining to stop the aircraft.

High speed and resulting momentum in the landing roll would retard dissipation of the wing lift, adversely affecting braking action and increasing the distance required for stopping.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The flight crew, the aircraft, and the air carrier were currently certificated.
2. The gross weight of the aircraft at the time of the landing was more than 3,000 lb. under the allowable weight.
3. It was raining and the wet runway caused poor braking.
4. The approach was high and fast and the flight did not use all the available runway.
5. There was no mechanical failure or malfunction in the aircraft or its components, including the braking system, prior to the accident.

PROBABLE CAUSE

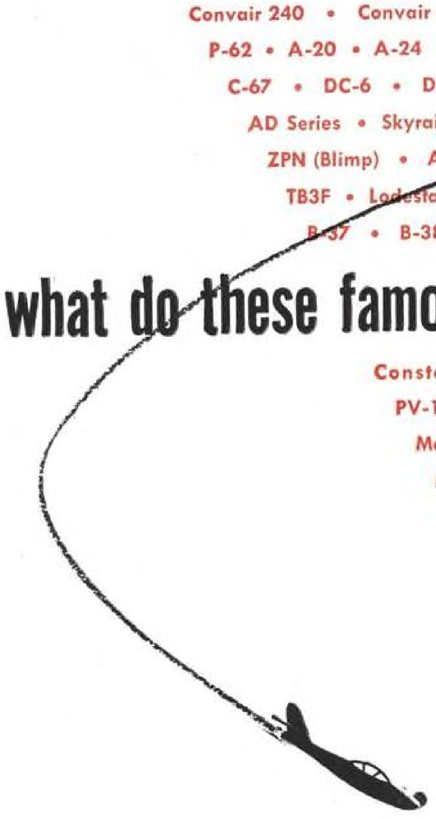
The Board determines that the probable cause of this accident was an approach too high and too fast under existing calm wind and wet runway condition and the subsequent ineffective braking action.

By the Civil Aeronautics Board.

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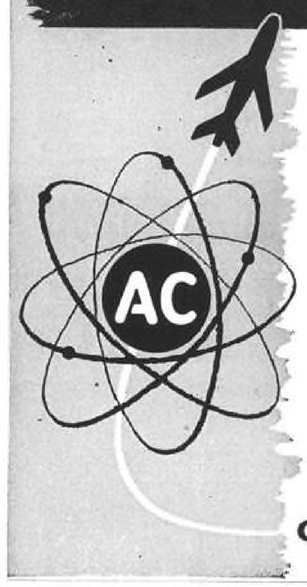
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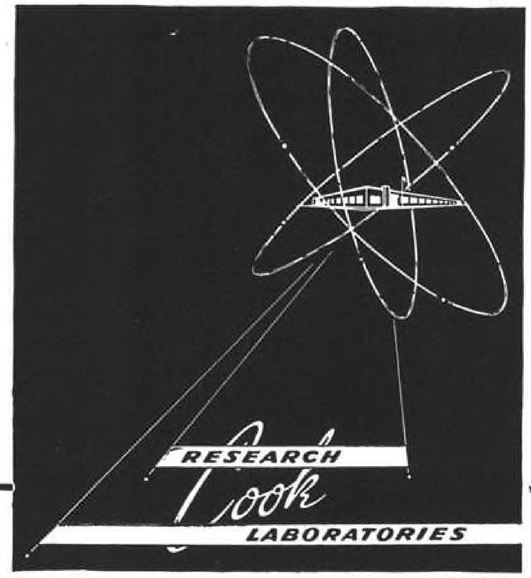
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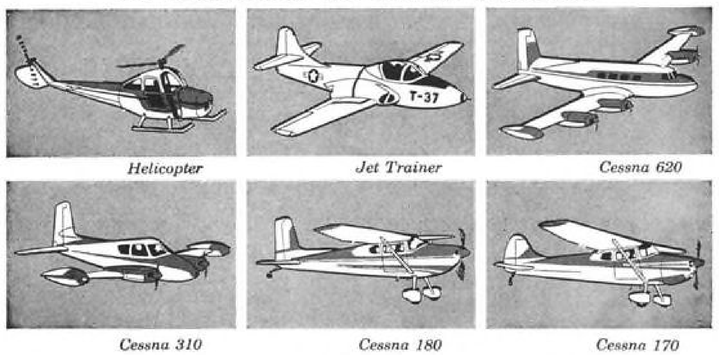
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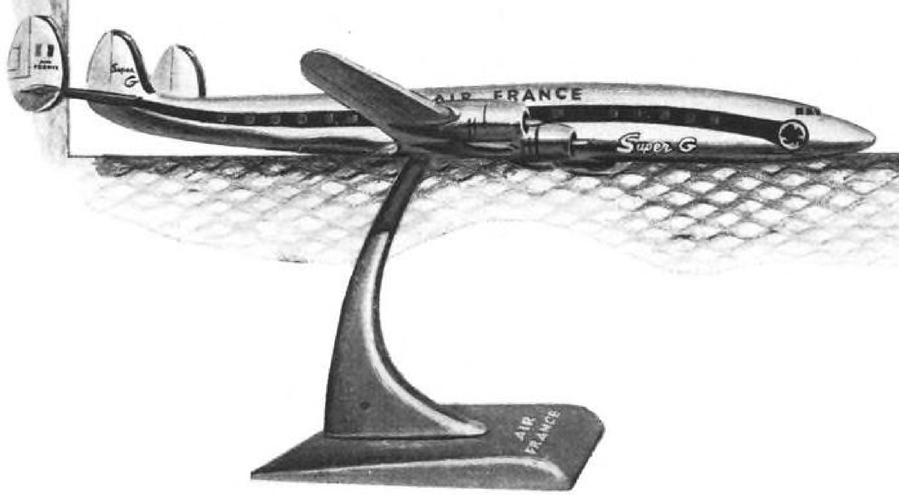
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Henri J. Lesieur
General Manager
North, Central American
and Caribbean Division



Vigorous Air Coach Growth Continues

Prospect is that 65% of domestic trunkline business will be sold in the low rate category within a few years.

By Katherine Johnsen

Washington, D. C.—Bargain-rate coach business now accounts for more than $250 million of the scheduled domestic airlines total $1 billion-a-year business.

The coach volume of the trunk lines was $254 million for the year ended last June 30. It was $207 million for the calendar year.

One carrier—Eastern Air Lines—has a definite coach traffic goal: 65% of total business. The prospect is that in a few years this will be the coach percentage throughout the industry. Coach now amounts to about 44% of Eastern's total business.

The attitude of the industry toward coach ranges from the aggressive approach of Eastern and Trans World Airlines, in particular, to the cautious approach of United Air Lines and American Airlines whose coach services appear to be dictated, in considerable measure, by competitive necessity.

The three areas of greatest competition in trunkline service are also the areas in which the growth of air coach has been particularly notable:

East Coast

The stiff competition is primarily between Eastern and National Airlines for the New York-Miami traffic. The number of coach passengers carried by Eastern for the year ended June 30 was over 1 million more than for the previous year. The number of National coach passengers increased by 122,000. But more indicative, 57% of National's total domestic business—in revenue passenger-miles—was in coach service for the last year. More than 43% of nation's revenue passengers flew coach.

West Coast

United Air Lines—despite the theoretical opposition of its President. W. A. Patterson, to coach travel—is going all-out with coach services, operating six coach flights daily over the Los Angeles-San Francisco-Seattle route, and even using luxury DC-6B airliners in off-hours. This is United's answer to the aggressive policy of Western Air Lines and the additional competition of non-scheduled and intra-state carriers in the area.

Transcontinental

TWA is emphasizing low cost coach service. The major current fight is between TWA's coach flights and the luxury service of the DC-7s of United and American Airlines. So far, the DC-7s appear to be holding a substantial part of the transcontinental business. Flight customers continue to pay $158 for one-way transcontinental service. Now there is the new reduced fare of $80, initiated by TWA, to lure them to coach service.

Two Carriers Decline

Civil Aeronautics Board's approval of TWA's plan for "combination" service—coach and first class passengers on the same flight—raises another new, and major, factor in the competition for transcontinental traffic. American openly opposed the TWA plan in its petition to CAB. United also was opposed but did not file a petition. But executives of both airlines are already considering abandoning their opposition and inaugurate similar "combination" service.

"It may not be a question of what we want and what we believe is right," an American official commented. "It may be a matter of what we have to do to meet competition."

American's concern: will the transcontinental tourist pay about $80 more for somewhat more spacious accommodations, a meal, or a cup of coffee on the same airplane?

The coach business of only two domestic trunklines shows a decline—Capital Airlines and Colonial Airlines.

Although Capital was a pioneer in

Coach Traffic for Domestic Trunklines

	Revenue Passengers			Revenue Passenger-Miles (000 Omitted)			Load Factor Percentage	
	Year Ended June 30, 1954	Year Ended June 30, 1955	Percentage of Total Scheduled Business	Year Ended June 30, 1954	Year Ended June 30, 1955	Percentage of Total Scheduled Business	Year Ended June 30, 1954	Year Ended June 30, 1955
Trans World	887,985	1,214,723	33.67	1,192,215	1,432,312	52.69	70	71
United	714,700	1,026.305	19.71	689,912	988,369	27.77	71	73
Eastern	638,602	1,716,492	27.58	570,463	1,375,773	43.85	70	67
American	516,376	788,671	12.55	700,653	916,877	25.16	70	70
National	369,526	491,437	43.29	357,261	456,285	56.55	70	68
Northwest	312,392	330,474	27.76	290,474	290,607	37.28	64	61
Capital	307,206	278,700	11.14	142,434	131,054	16.90	56	57
Western	263,680	323,608	33.38	124,409	163,805	35.55	61	63
Delta	186,755	315,483	15.84	137,601	234,896	26.09	62	69
Colonial	35,362	25,328	6.15	10,461	7,760	7.57	61	67
Braniff	.....	46,462	2.92	.....	25,787	4.40	.....	70
Continental	.....	*	.....	.....	18,681	9.74	.....	62

* Not available

coach business, its short-haul system is not well suited to this type service. A saving of $5 or $10 a flight is not a great inducement. Capital has discontinued daylight flights. This resulted in a decline for the year ended June 30 of 28,506 revenue coach passengers (11,380,000 revenue coach mileage) below the previous year. The carrier plans to sustain its present coach patterns. In addition, company executives are considering the possibility of new coach flights over new route awards from CAB between New York-Buffalo, Detroit, Chicago.

Colonial's decline in coach business is largely due to less modern equipment (DC-4s) compared with its competition. For the year ended June 30, Colonial's air coach business dropped by 10,034 revenue passengers and by 2,701,000 revenue passenger-miles below the previous year.

Promotion Continues

The scheduled airlines—willingly, or reluctantly by the pressure of competition—are promoting and plan to continue promoting low-fare air coach. But there is great concern that coach is simply a back-door approach to a lower air fare rate level. Many industry officials complain that the difference between first class and coach is inconsequential, particularly in view of the rate difference.

The possibility of "bus" type service (without reservations) to more clearly define the difference between first class and coach service has been discussed for several years, but still appears to have little favorable industry reception, with the possible exception of American. Company officials say that the overhead cost of making reservations is minor, and does not balance the disadvantages of the "no reservation" policy, particularly customer irritation at having to wait several hours for a one hour flight. Capital started its coach service seven years ago on a "bus" basis. Competition from other carriers, offering the same price coach service on a reservation basis, though, forced Capital to follow suit.

Revenue Gains

Here is the dollar volume increase of the airlines from coach business between the year ended June 30, 1955 (listed first) and the previous year:

- **TWA:** $60.1 million, compared with $50 million, a $10.1 million increase.
- **United:** $41.5 million, compared with $28.9 million, a $12.6 million increase.
- **Eastern:** $57.8 million, compared with $23.9 million, an increase of $33.9 million.
- **American:** $38.5 million, compared with $29.4 million, an increase of $9.1 million.
- **National:** $19.2 million, compared with $15 million, an increase of $4.2 million.
- **Northwest:** $12.2 million, for both years.
- **Western:** $6.9 million, compared with $5.2 million, an increase of $1.7 million.
- **Delta:** $9.9 million, compared with $5.8 million, an increase of $4.1 million.

Revenue Losses

Capital's coach revenue dropped from $6 million for the year ended June 30, 1954 to $5.5 million for the following year.

Colonial's revenue dropped from $439,362 to $325,920.

Braniff Airway's domestic coach revenue was $1 million for the year ended June 30. Continental Airlines' was $784,602. These two carriers were not in coach operations for the full previous year.

Here are observations on coach by individual carriers:

- **TWA Expects** to convert its Constellations to "combination" service promptly—"a matter of hours." Officials of the company anticipate that in a few years there will be no "coach" service, that what today is "coach" will become "standard" air service, supplemented by a relatively insignificant amount of "luxury" service, offering such advantages as sleepers or private booths.
- **American officials say** they will push coach service "while still keeping our feet on the ground." American will probably increase its coach flights next spring.
- **Eastern credits** its phenomenal development of coach business over the past year to increased sales effort and first class equipment—DC-7s and Constellations.

Company officials say that the company's aggressive policy in coach business—65% of total business—is simply Eastern's response "to the demands of the public for more for their money." One example of Eastern's sales efforts was courtesy flights for 31,000 school teachers, a widely travelled group. A survey showed that 21,000 had never before put a foot in an airplane. In the program Eastern also had an eye on the long range intangible benefit of promoting airmindedness among children.

- **United will put** new schedules into effect in a few weeks with more emphasis on coach. The company predicts that coach will account for 35% of its total business in 1955, compared with 29% in 1954. United plans a major effort in air coach in 1956 and 1957. When 38 new four-engined aircraft are delivered in these years, the company contemplates conversion of its DC-6s to coach.

Independents Hit Air France Subsidies

Paris—A spokesman for three privately-owned French airlines recently charged that government aid to the nationalized Air France in the last few years has permitted the carrier to increase its capacity by 40%, while the independents suffered a 25% loss.

The complaint came in rebuttal to an open letter addressed to all members of the French National Assembly by trade members of unions linked with Air France accusing the government of favoring private airlines in French Union operations. Last year Air France's profits on its French Union routes are said to have offset half the losses incurred on international operations. During the year, Air France lost more than $9 million before taking account of direct government aid.

The private carriers say that Air France has received $140 million assistance since 1947 in the form of subsidies or government-guaranteed loans.

Italy Will Expand Airline Operations

Rome—The Italian government plans to spend approximately $2.6 million expanding domestic and international airline services during the next three years. The money will be divided evenly between LAI and Alitalia.

LAI's domestic service in the "depressed" areas in Southern Italy are to operate on lower fares to encourage increased traffic. Rates will vary depending upon the economic status of the communities. An increase in traffic will result in reduction of this subsidy.

Alitalia will be encouraged to develop international service to the Far East and Australia and from Rome to Nairobi and South Africa.

American Protests

American Airlines has protested to the Civil Aeronautics Board that a combination air travel-auto rental tariff planned by United Air Lines is "clearly unlawful."

American's complaint states: "The fares in the tariff . . . would provide passengers between selected pairs of points with 15% discounts on both the air transportation provided by United and the automobile rental service but only if both services are used."

American claimed that round-trip passengers traveling on such segments would be paying more for an ordinary round-trip ticket than they would if in addition to the round-trip ticket they obtained the tie-in automobile rental.



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In the T-37 a flight instructor is literally the cadet's right-hand man. As a result, the cadet gets the benefit of closer, more personal instruction. Thus, side-by-side seating makes an important contribution to the overall mission of the new trainer by permitting smoother, safer transition to jets at an earlier stage of pilot training. This, in turn, reduces training time and costs.

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All the missions of the Tactical Air Command have one thing in common: urgency! Whatever the need, TAC must answer it *fast*. That's why *mobility* is so vital.

Suppose the call is for paratroops. USAF's new C-130 Hercules, built by Lockheed, is the ideal paratroop transport. Look how the Hercules provides paratroop mobility:

64 fully equipped paratroops can run aboard four abreast on the rear-door ramp. In minutes the Hercules is loaded.

Up goes the ramp and, with turboprop power, the Hercules is airborne in seconds.

Flying faster than most commercial transports, and with great range, the Hercules gets where the paratroops are needed in a hurry. Inside, each paratrooper has his own seat, 2 feet wide. The cabin is pressurized and air conditioned, minimizing in-flight fatigue.

Two special side doors at the rear of the Hercules were designed for easier troop dropping. An effective wind-stream deflector and a unique floor extension make paratroop drops easier, faster and safer.

USAF's Hercules is now in production at Government Aircraft Plant No. 6 at Marietta, Ga., America's first turboprop production line for transports.

GEORGIA DIVISION

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Trunks Battle for New Routes In Final Round of Denver Case

Washington—Civil Aeronautics Board concluded the 10-year-old Denver Service Case with oral arguments last week that produced an explosive final round.

American Airlines attacked both Trans World Airlines and United Air Lines.

United then tackled TWA and TWA struck back at both American and United. All three of the transcontinental carriers were accused of being "scared" of competition by the regional trunklines.

The intensity of the airlines fighting in the Denver Service Case highlights the current scramble by the industry for new routes, a development that has occurred with the recent change in policy at CAB.

The Board is at present making new route awards after a long reliance on interchanges as a substitute for route expansions.

All of the airlines have not necessarily welcomed the Board's change in attitude. Commenting on the rash of new route applications and the Board's stated desire to rush them through, United's president, W. A. Patterson, claimed: "There is obviously an uncertainty on the part of airlines as to how far CAB intends to go in creating new airlines and paralleling routes. As result airlines are filing for new routes in order to maintain a balance of competition.

Competition Balance

"Certain airlines have filed applications into territory we service. In fear of how the Board may act on such applications, we are forced to file into others territory to be sure we maintain a balance of competition.

"Frankly, this explains our Florida application. In my opinion it is difficult to present any outcome of the confusion that exists today."

United's major line of argument in the Denver case bore out the company's desire for "protection." Attorney H. Templeton Brown claimed "something must be done for United to counterbalance costly diversion." He said United would sustain a diversion of $23 million per year under the examiner's recommendations in the case and from Board decisions already made in the New York-Chicago case.

The only offset available to United would be its certification at Kansas City and Pittsburgh, according to Brown.

The Board was urged to approve United's applications for service at both Kansas City and Pittsburgh. He said neither city was receiving the kind of air service it should and particularly scored TWA for "providing Kansas City with fewer transcontinental services today than in 1947." Brown also asked the Board not to lift the restrictions on American Airlines' transcontinental services out of the San Francisco-Oakland Bay area.

American's Views

American answered the opposition to its requests for relief from restrictions as "selfish" appeals to prevent needed competition. Howard C. Westwood, American attorney, called on the Board to cease "coddling" United and Trans World. He said the situation reflects a serious and unhealthy competitive unbalance. American's application in the case is concerned with:

- **Removal of the restriction** on transcontinental service to San Francisco-Oakland.
- **Certification for service at Denver.**
- **Permission to fly nonstop** between Detroit and Los Angeles.

Trans World, in turn, strongly objected to further increasing American's size, claiming that unrestricted rights at San Francisco would make that carrier beneficiary of more than 1,800 wholly new route miles. TWA counsel James K. Crimmins urged the Board to give first consideration to TWA's application for Denver service—the basis for the entire case and reject all other applications.

"Actually, American and United are primarily using the proceeding as a "grab-bag" for new route awards and extensions completely unrelated to the needs of Denver," he declared.

The Board was asked to recognize the existing deficiencies in Denver's air service, which Crimmins attributed to "United's east-west monopoly."

He claimed TWA is best suited to meet Denver's urgent need of long-haul service, particularly in the air coach field.

CAB Proposes Feeder Mail Rate

Civil Aeronautics Board proposed a multi-element service mail rate structure for the 13 local service air carriers last week which will result in an annual saving to the Post Office Department of $257,000.

An equal amount of money, however, will be paid out in subsidy by CAB to the same carriers (AW Sept. 19, p. 135).

The changes in the local industry's mail pay scales are based on those made recently for the domestic trunk airlines.

CAB estimated that the dual-rate structure proposed for the local lines will produce an average yield of $1.05 per mail ton-mile compared to the current average of $1.35.

This two-part rate will consist of a line-haul charge of 30.17 cents per mail ton-mile plus a terminal charge per pound of mail enplaned ranging from 3.32 cents to 33.21 cents varying by class of station.

Annual total service mail pay for the local service industry under the multi-element structure will be approximately $883,000. This is a reduction of $257,000 from $1,140,000 in service mail pay under present rates.

The individual rates per mail ton-mile proposed for the 13 local air carriers (see box) are to be for the period July 1, 1955 through Sept. 30, 1955.

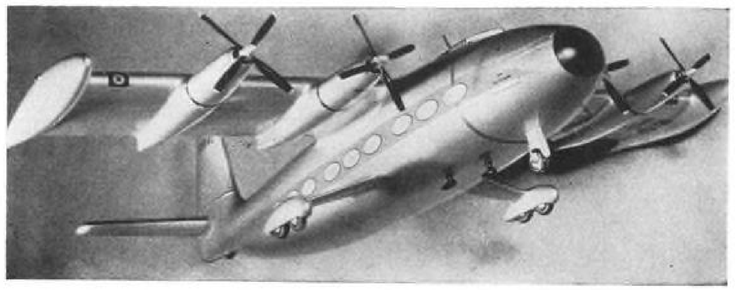
The mail compensation for each carrier after Oct. 1 will be paid monthly after computing the sum of the line-haul charges and the terminal charges.

Therefore the Board's estimated yield per mail ton-mile will immediately change. Major changes will be occasioned by route adjustments and airport changes and in some cases an arbitrary application of a terminal rate. A new airport service will require a recomputation of mileages and a corresponding change in the line-haul charges.

Any station that is not specifically classified by the Board will automatically fall under the terminal rate of 9.96 cents per pound.

Mail Rates

Carrier	Estimated Yield per Mail Ton-Mile
Allegheny	114.20 Cents
Bonanza	97.16
Central	106.94
Frontier	75.76
Lake Central	176.40
Mohawk	100.46
North Central	101.60
Ozark	124.09
Piedmont	91.11
Southern	99.14
Southwest	123.21
Trans-Texas	97.18
West Coast	121.96
Average	104.78 Cents



Frye Short Takeoff Transport Ready to Leave Drawing Board

The Frye F. 1 large-capacity, four-engine transport being tailored as a "DC-3 replacement" is taking on final drawing-board form while its owners search for a contractor to manufacture the aircraft and, as importantly, for future customers.

Final wind tunnel tests are being conducted at the University of Wichita to work out the best possible nose configuration, and prototype construction is scheduled to begin next spring. Concurrently, the newly-formed Frye Corp. in Fort Worth, Tex., is receiving inquiries from both foreign—the first sale probably will be made to a Far Eastern airline—and U.S. local-service carriers.

Jack Frye, company head and former Trans World Airlines' president, told AVIATION WEEK that five feeders are following the project closely. Frye plans to confer with officials of these airlines and others to work out a standard configuration for the F. 1 for feederlines.

The company also proposes to offer the new plane to the military services on an "off-the-shelf" basis, Frye said.

At present, the company has placed a $350,000 price tag on the F. 1.

Contract Production

The photograph of a model (above) depicts an early version of the F. 1. A more accurate configuration gives the airplane a slab-sided fuselage and, tentatively a nose resembling a flying boat bow to ease cargo loading. The cockpit also has been moved forward for better visibility. The landing gear will have a single main strut coming down from the inboard engine nacelles and connecting with structs splaying out from the lower fuselage.

Frye Corp. expects to start construction of a mockup as soon as it can locate facilities close to its present offices at 617 Texas St., Ft. Worth.

The firm plans to stick to engineering and development, with F. 1 production contracted to an outside company. Frye explained that the new firm does not want to dissipate both capital and time through the building manufacturing facilities, when there is considerable production capability available as a result of this country's military buildup.

He reported that negotiations have been under way for some time with a number of aircraft manufacturing facilities but that no final decision has been made. The airplanes will be produced under "one roof," he said, with the contractor responsible for producing and assembling the plane.

The F. 1 may also be produced in Europe and, possibly, Latin America, in the company's own facilities, by arrangement with an existing manufacturer or by license. Frye said that the firm is now discussing the possibility with firms in two European countries.

Easy producibility, assembly and maintenance will be featured in the plane, with all major structures designed to operate without replacement for 50,000 flying hours and 15 years, company officials say. The key man behind this philosophy is Frye's right-hand assistant, Kurt H. Weil, who figured importantly in the design of the rugged Junkers JU-52 tri-motor transport and operated a JU-52 airline in the Middle East before coming to the U.S.

Weil's main job has been, and is to watchdog the F. 1's design and production so it remains simple. Only conventional materials will be used.

A number of equipment manufacturers have been called on to develop components for the F. 1; three landing gear manufacturers are working out designs on a competitive basis.

Short-Field Flying

The Frye F. 1 is not designed for beauty or speed—its main purpose is to take 8,000-10,000 lb. payloads off the ground in less than 1,000 ft. at a takeoff speed of less than 55 mph. and then carry it some 250 mi.

It was initially designed for use in underdeveloped world areas where road and rail transportation facilities were at a minimum. Frye emphasized that the F. 1 is not intended to be competitive to another, more sophisticated "DC-3 replacement," the new Handley Page Herald, which features a pressurized cabin, retractable landing gear and a 200 mph. cruise speed on 50% power.

"In fact," he said, "we have told some potential customers that they would be better off if they took a look at the Herald, because we feel it will suit them better than the F. 1."

Frye said he feels that the basic F. 1 has considerable design "stretch" so that further performance gains can be built in at a later date. The company has been evaluating a number of turboprop powerplants in the 900-hp. class, he said, which will give the F. 1 a cruise speed of about 170 mph. and top speed of 195 mph. and cut takeoff distance over a 50-ft. obstacle to about 600 ft. Boundary layer control is another possibility under study.

Apparently no firm decision has been made on a water-based version. Weil says that the F. 1's operating costs will be so low that an operator would be better off hacking out the necessary airstrips rather than putting on expensive floats. Weil indicated that he would rather go to hydro-ski-type landing gear than conventional float arrangement.

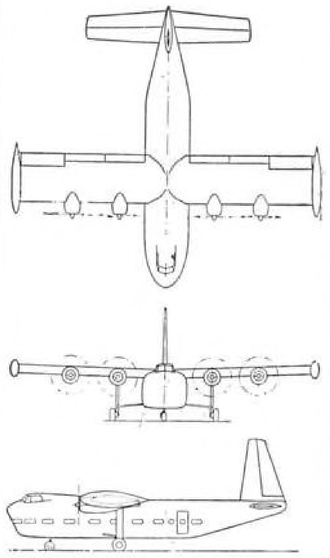
Frye's Structure

Frye Corp., organized some six months ago, is a privately-financed group. In addition to Jack Frye and Kurt Weil, other firm members are:

Guy W. Vaughn, former president of Curtiss-Wright Corp.; Robert Heller, of Robert Heller Associates, a Cleveland industrial engineering and consulting firm; A. William Morriss III, partner in Morriss Realty Co., Granite City, Ill.; John D. Murchison, Dallas, Tex., and Perry R. Bass and Francis H. McKillip, both of Ft. Worth.

The chief engineer is William Rosseau, formerly of McDonnell Aircraft Corp. Other associates include: Capt. D. W. Tomlinson IV (USN, ret.), former TWA vice president-engineering and deputy commander of the Berlin Airlift; Capt. Walter S. Diehl (USN, ret.) specialist in airplane design and research and applied aerodynamics, and Dr. J. M. Frankland, aircraft structural specialist.

Frye F. 1 Transport Specifications



Wing span	95 ft.
Wing area	1,350 sq. ft.
Length	86.7 ft.
Overall height	34.4 ft.
Cargo door loading height	52 in.
Nose cargo door	7 ft. x 11 ft.
Side cargo door	7 ft. x 7 ft.
Normal gross weight	30,000 lb.
Passenger seats	50-70
Unobstructed interior	40 ft. x 10 ft. x 6.5 ft.
Usable cargo area	3,400 cu. ft.
Wing loading	22 lb./sq. ft.
Maximum speed	170 mph.
Cruise speed	150 mph.
Minimum speed (at normal gross)	55 mph.
Service ceiling (three engines)	20,000 ft.
Normal cruise altitude	12,000 ft.
Landing distance over 50 ft. obstacle	800 ft.
Takeoff distance over 50 ft. obstacle	900 ft.
Powerplants—	
Four 600-hp. P&WAs S1H1-G Wasp	
Price	approx. $350,000

Erratic Approach Blamed in Crash

Probable cause of the crash of a Linee Aeree Italiane DC-6B near Idlewild Airport Dec. 18, 1954 was an erratic approach which resulted in a descent to an altitude too low to avoid striking a pier which supported the left row of slope line approach lights, the Civil Aeronautics Board reported last week.

Pilot fatigue due to the particular and difficult circumstances was a contributing factor, the Board said. The entire crew of ten and 16 of the 22 passengers were killed.

The flight from Rome to New York was uneventful and the aircraft reported to Idlewild tower and was cleared to enter a holding pattern located about 13 nautical miles from the airport and was "laddered down" to the number one position to approach. Weather conditions deteriorated below the ceiling minimum of 400 ft. and the flight continued to hold.

Weather conditions improved and the flight was cleared for an approach to Runway 22 using the back course of the Instrument Landing System. The flight reported that it had discontinued this approach and was issued missed-approach instructions and returned to the holding pattern. Shortly thereafter the weather conditions again went below the minimum.

Approach control then asked if the flight would be able to make an approach to Runway 4 considering the tailwind component. The flight accepted and started its approach and then advised the tower that the approach had been missed. The flight then attempted a ground controlled approach, which it missed, and returned to the holding pattern again.

The flight was again cleared for an ILS approach to Runway 4. This was the third approach to this runway and its fourth to the airport. It was on this approach that the DC-6B struck the pier. Ceiling at the time of the crash was 200 ft. with a visibility of 2½ miles.

Approximately 80% of the aircraft was recovered and the examination disclosed no evidence of fatigue cracking, structural failure or malfunctioning controls.

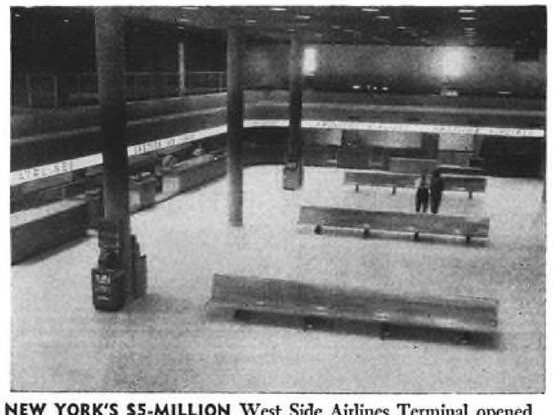
The report stated: "During the Board's investigation and analysis of this accident, careful consideration was given the possible misinterpretation of the approach lights or an illusion associated with them. Evidence regarding misinterpretation or illusion would be primarily the testimony of the crew. This was not available for consideration, the entire crew being fatally injured. The Board recognizes these as possible factors; however, from all the available evidence, the Board was unable to determine whether or not the lights were a factor."

In its official report, CAB noted that a discussion of approach light misinterpretation was carried in AVIATION WEEK Jan. 31, Feb. 21 and Apr. 11.

National Plea Denied

National Airlines may seek a review by the Supreme Court to block an Eastern Air Lines-Colonial Airlines merger following a denial last week by the U.S. District Court of Appeals of National's plea for a stay of the procedural steps in the Eastern-Colonial merger case.

The appeals court also dismissed a National petition for review of Civil Aeronautics Board orders limiting issues in the merger case.



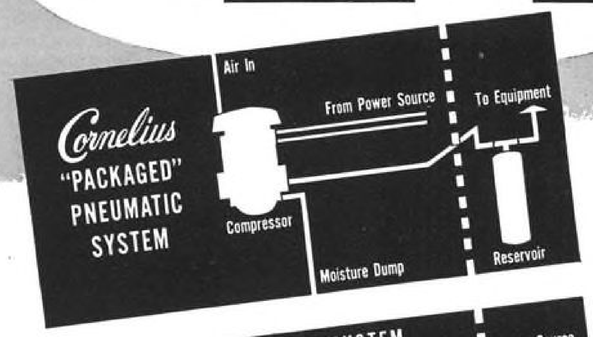
NEW YORK'S $5-MILLION West Side Airlines Terminal opened this month, offering relief for Newark-bound passengers who formerly left by bus from the East Side Terminal only to find themselves caught in traffic jams that sometimes required up to an hour to negotiate. Now buses slide directly into Lincoln Tunnel.

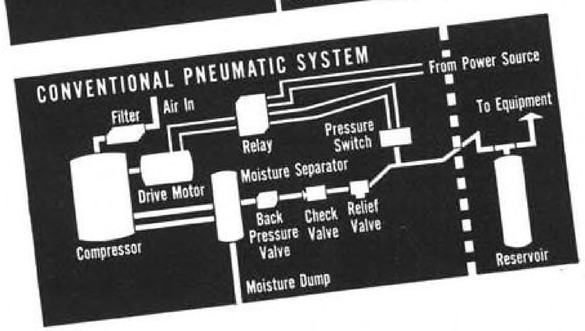


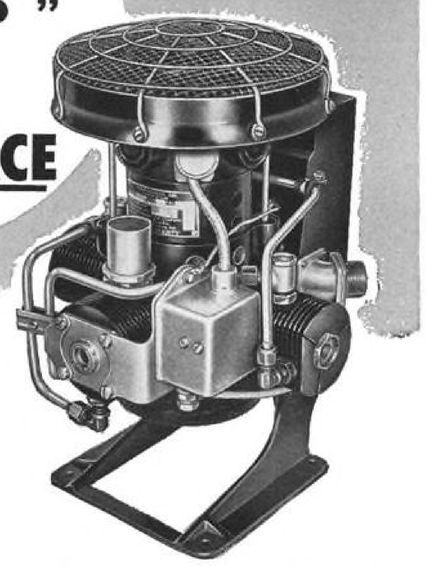
At present, the four-story building houses the facilities of seven U. S. airlines—Allegheny, American, Eastern, Mohawk, National, United and Trans World. Northwest Orient is scheduled to move in in the near future. The building itself is located between Tenth and Dyer Avenues with its main entrance on 42nd St.

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*The Cornelius Compressor, Model 130, 2CFM, 3000 PSI, is used in the McDonnell F2H-3 and F3H, North American FJ-2, FJ-3 and FJ-4, Chance Vought F7U-3, Grumman F9F-9. Also on order for the Lockheed P2V, Grumman S2F and Martin P5M. Thousands of service hours under all operational conditions is proof of outstanding performance.

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PIONEERS IN THE DEVELOPMENT OF AIRCRAFT PNEUMATIC SYSTEMS

CAB ORDERS

(Sept. 8-15)

GRANTED:

Pan American World Airways leave to intervene in the matter of application of Mackey Airlines for certificate renewal.

Port of New York Authority leave to intervene in the New York-Nassau case.

San Antonio, Tex., and Chamber of Commerce leave to intervene in the case of Continental Air Line's application for route extension to Houston, Tex.

DENIED:

Northwest Airline's application for dual use of O'Hare Airport and Midway Airport at Chicago on same flights as adverse to the public interest.

Delta Air Lines and Eastern Air Lines requests for reconsideration of authorization granted Capital Airlines for direct non-stop air service between Norfolk, Va., and Atlanta, Ga.

Allegheny Airline's application for leave to intervene in North Central-Lake Central acquisition of control and interlocking directorate proceeding.

ORDERED:

Frontier Airlines to show cause why a final mail should not be established for the period after Sept. 15, 1954.

North Central Airlines to show cause why the Board should not issue a permanent certificate for local service allowing 26 points permanent certification and 6 points temporary.

Additional petitions for leave to intervene in the case of Erie Municipal Airport Authority's request for an investigation of the need for air service between Erie, Pa., and Detroit, Mich.

APPROVED:

Allegheny Airline's request for a temporary exemption authorizing an extension of service at Cape May, N. J., until Nov. 1.

Western Air Line's petition to suspend service temporarily at Jackson, Wyo., from Sept. 25, 1955 until June 16, 1956.

Catalina Air Transport's abandonment of its route and cancellation of its certificate.

Supplemental agreement between Pan American World Airways, National Airlines and Pan American-Grace Airways relating to interchange service between New York and South America.

Trans-Canada Air Line's request for a 30-day extension of authorization for certain operations between Tampa, Fla., and Mexico City pending a transfer to Canadian Pacific Air Lines of the operation on Oct. 31.

SHORTLINES

► **Air Transport Assn.'s** Purchasing Committee fall meeting will be held Oct. 18-21 at the Saxony Hotel in Miami Beach, Fla., The group will take up a new program of special studies which include value analyses, markets, applicability of present policies and procedures to turboprop and turbojet aircraft.

► **Central Airlines** this month marked its sixth anniversary. During this time, Central has carried 247,203 passengers totaling more than 36,303,000 passenger-miles.

► **Sabena, Belgian World Airlines,** starting Oct. 2 will provide service to three European gateways: Shannon, Eire, Manchester, England and Brussels. Sabena recently was granted "Fifth Freedom" traffic rights in an agreement with Eire which permits the carrier to book and transport passengers between New York and Shannon, Shannon and Brussels.

► **Trans World Airlines** documentary film strip, "Aviation and World Understanding," is available to schools and aviation education groups.

► **KLM Royal Dutch Airlines** carried 327,700 passengers 54,637,100 miles in the first six months of 1955.

► **United Air Lines** plans to introduce new plane-auto package deals Oct. 1. First class travelers on certain routes will be able to rent automobiles at cut rates.

► **Hawaiian Airlines** is converting its DC-3 aircraft into a "Viewmaster" version, featuring windows with a total space of 6,000 sq. in. as compared with the usual 2,600 sq. in.

► **Lockheed Aircraft Service-International** will perform service inspections, based on a 10-hour daily utilization factor, on three DC-4 aircraft for Slick Airways.

► **Syria's** parliament is reported to have forced postponement of government plans to build the Damascus International Airport at Marj Sultan, near Damascus.

► **Japan and Australia** have held discussions on a bilateral air agreement to replace the present agreement which expires in April 1956.

► **LAV and AVENSA,** Venezulean airlines, will begin daily service this month between Maracaibo and oil areas Mene Grande, Lagunillas and Calimas.

► **Pan American World Airways** resumes first class service to Bermuda Sept. 30. PAA will operate a weekly roundtrip service with Super Stratocruiser equipment.

► **United Air Lines** has installed self-claiming baggage service at 23 of its stations.

man from the "flyingest" business talks about Airwork.



"Construction is probably the 'flyingest' business of all those using corporation aircraft. At Brewster, we average a take-off and a landing every hour.

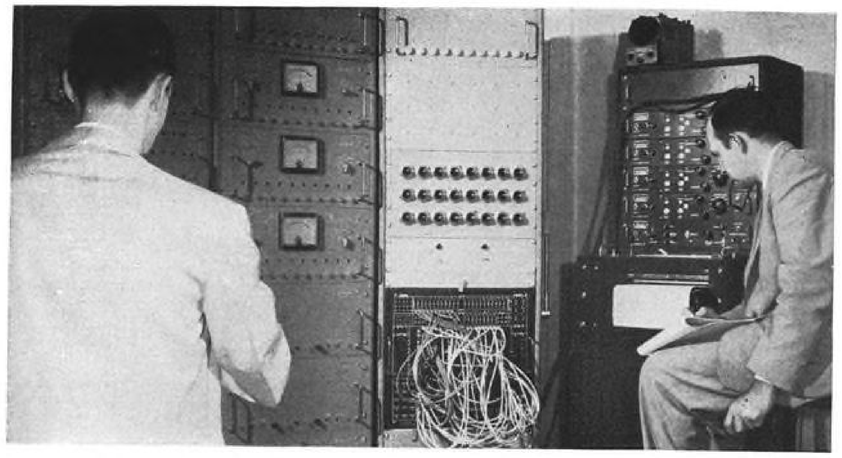
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Chief Pilot
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- Determination of new design criteria
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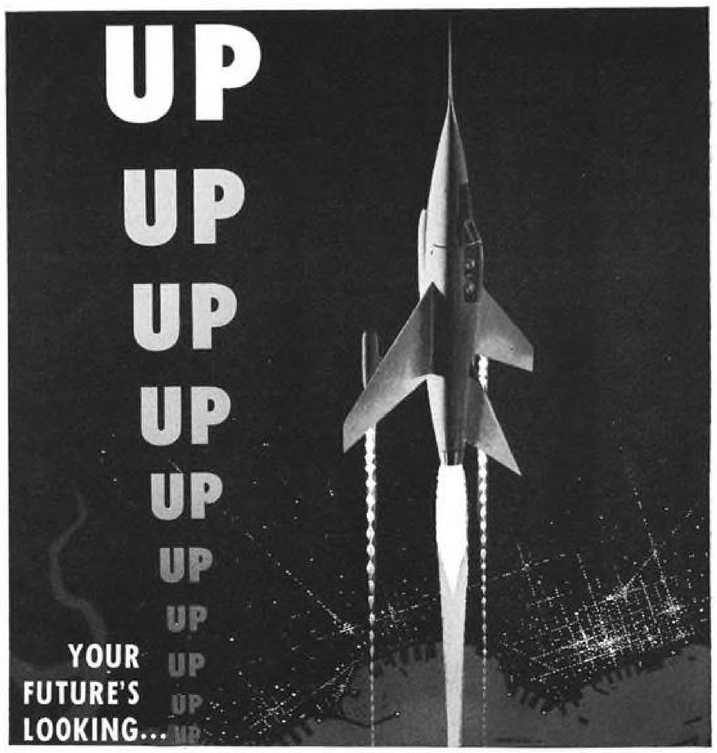
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EDITORIAL

Management Challenge

Admiral Arthur W. Radford, chairman of the Joint Chiefs of Staff, is the latest top American official to warn of the increasing gravity of our technological race with Russia in developing new weapons (see page 15). The increasing pressure of this race is evident in the changing pattern of research, development and procurement of aerial weapon systems reported in recent issues of AVIATION WEEK. The military are making increasing demands on the aviation industry and its supporting structure to develop equipment faster, produce it cheaper and deliver it sooner.

Successful operations in this newly evolving development and procurement system pose new and tougher challenges to the management of airframe, engine, avionic and component manufacturing firms. For the large industrial giants in the aviation business, the task of weapon systems manager will provide a new barometer to success or failure. For the sub-system and component manufacturers, heavier emphasis on development and new relations with the weapon systems managers will impose heavier loads.

Competition is getting stiffer with better rewards for the successful and lean pickings for those organizations that lag in development or production performance.

There is going to be increased pressure from the military to persuade industry to invest larger portions of its profits in research and development facilities and efforts to push the state of the art ahead at a much faster pace.

There is going to be less nursing along of technically troubled production programs and more hard-boiled wiping out of products that don't fulfill a manufacturer's promise.

There are going to be major shifts in the financial fortunes of individual companies, depending on how well they adjust to the changing pattern.

In the face of a wide variety of pressures from the military customers our industry must develop a strong independent voice of its own, capable of exerting effective counter-pressure against impractical and restrictive government policies. Unless the industry develops effective spokesmen and sound techniques to support its case it can easily be swamped by a rising tide of political and military bureaucracy in the weapons business.

Never before has management of the aviation industry faced such a difficult challenge. Never before has it had a better opportunity to serve the interests of this country better.

Keep the Sabre Knights

Air Force brass has made a grave mistake in disbanding its Sabre Knight jet acrobatic team from the 325th Fighter Interceptor Squadron at Hamilton AFB, Calif. Apparently USAF feels that one jet acrobatic team is sufficient to represent it publicly and has picked the Thunderbirds as its official stunt group. We strongly disagree with this policy.

USAF badly needs public support not only generally for its entire program but also specifically from the youth of the nation from whom it must draw its future pilots, air crews, missile technicians and all of the high grade human skills that it takes to turn weapons and material into a top notch fighting force.

Jet acrobatic exhibitions conducted with the precision, skill and safety that have characterized the operations of the Sabre Knights, Thunderbirds and the Navy's Blue Angels are a dramatic method of stirring public interest in general and the specific interest of young men in their country's airpower. USAF needs more jet acrobatic teams, not less. It should reverse this shortsighted policy and re-organize the Sabre Knights.

British Misinformation Service

Here is a little gem of aeronautical misinformation just received from the British Information Service, an official agency of the British government. In press service bulletin P. 8249, dated Sept. 20, 1955 and marked for the attention of aviation writers, this official propaganda agency says:

"British Engine in World Speed Record One of Several Made Under License in the United States."

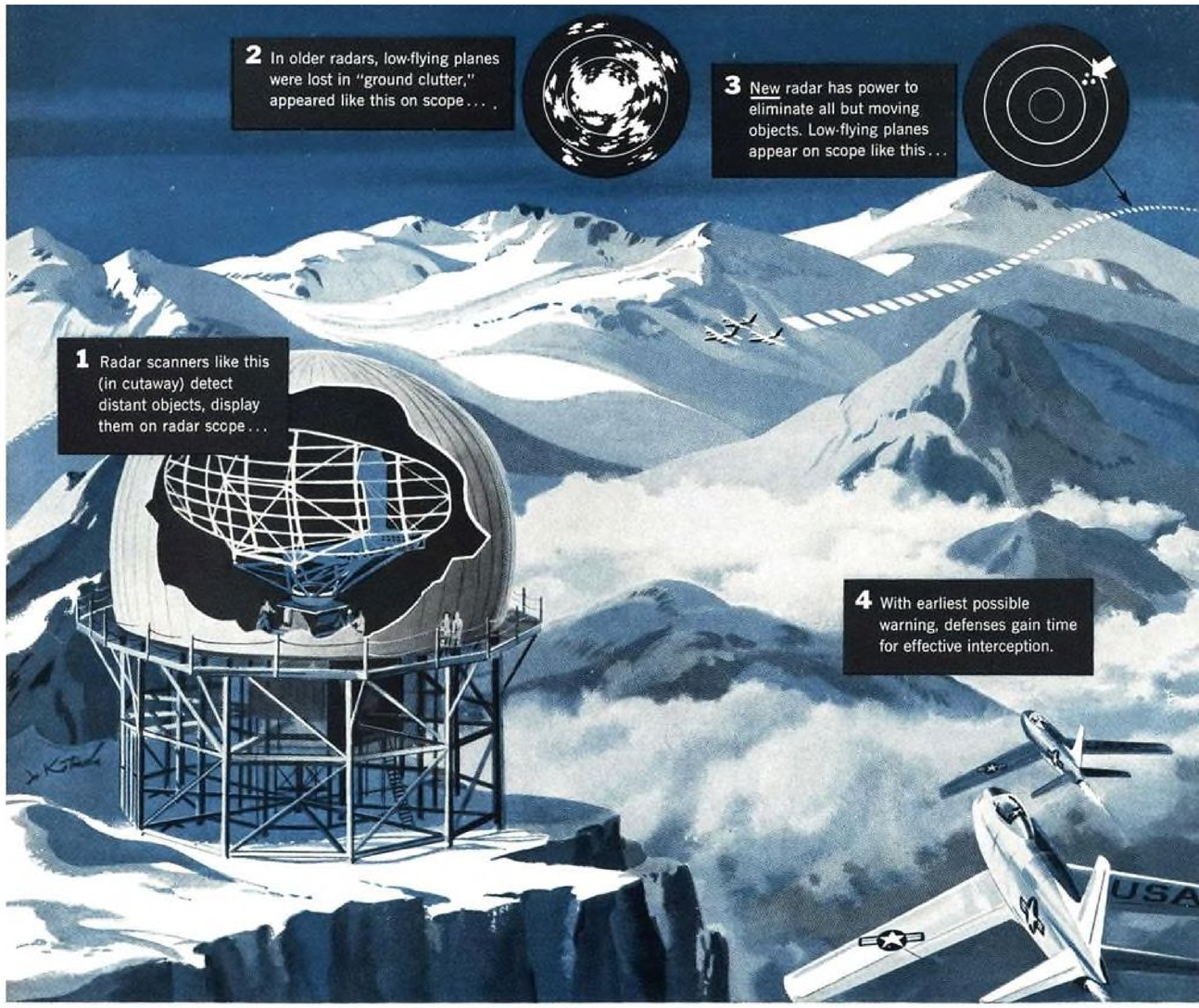
This release goes on to "inform" aviation writers as follows: "The USAF Super Sabre's magnificent feat of flying an average of 822 mph. to gain the world speed record is affording considerable satisfaction to British aircraft manufacturers.

"Beside their natural pleasure at the success of a friend they are also cheerfully reminding each other that the F-100C engine is the famous British Sapphire made under license in the United States by Pratt & Whitney as the J57 and by Curtiss-Wright as the J65."

This release goes on to "inform" aviation writers that the Bristol Olympus "developed to produce 15,000 lb. thrust is also being made by Pratt & Whitney as the J67."

As U. S. aviation writers and British aircraft manufacturers know, the J57 engine is strictly an American product designed, developed and built by Pratt & Whitney Aircraft. The only license involved in the J57 is that issued by Pratt & Whitney to the Ford Aircraft Engine Division in Chicago to augment production to meet the tremendous USAF and Navy demand for this turbojet. U. S. aviation writers and British aircraft manufacturers also know that the design data on the British Olympus has been licensed to Curtiss-Wright, not Pratt & Whitney, for development of the J67 turbojet.

British aircraft manufacturers must also be "cheerfully reminding each other" that this type of misinformation peddled abroad by an official British government agency does them incalculable harm. Their "natural pleasure at the success of a friend" must be tempered by the conviction that they need a new aviation writer in the British Information Service. —Robert Hotz



NEW POWER SOURCE TIGHTENS RADAR DEFENSES

Million-Watt Klystrons Aid Detection of Distant, Low-Flying Planes

THE STORY BEHIND THE STORY:

What is the significance of the headline above? To borrow from an old baseball expression, *"You can't hit 'em if you can't see 'em"*— approaching planes that formerly evaded radar detection can now be "seen" at greater distances than ever before.

■ Behind this improved radar vision is a new family of high power tubes known as Megawatt Klystrons. These new tubes not only provide greater ability for beaming radar impulses against small and distant objects, but provide a new improvement to a technique known as M.T.I. or Moving Target Indication. In radars without M.T.I. everything within the beam of the radar appears on the viewing scope. Images from trees, terrain, buildings, all combine to form "ground clutter" on the scope. M.T.I. eliminates this "ground clutter" by indicating moving objects only. Therefore with Megawatt Klystrons, approaching aircraft can be spotted sooner and defenses can be alerted more quickly.

■ Producing millions of watts of electronic power, these giant tubes make possible illumination of small objects with radar impulses at greater distances to provide clear, sharp images on the radar scope. Furthermore, the Megawatt Klystron's stable performance and long life assure that these radar sentries are constantly on guard.

■ The Klystron tube made microwave radar possible. Developed by Sperry, it generates, amplifies or multiplies microwaves. Today, Sperry produces Klystrons covering a wide range of powers and frequencies for specific requirements — both military and industrial. To meet demands for these tubes, a new plant has just been opened devoted exclusively to Klystron research and production.

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