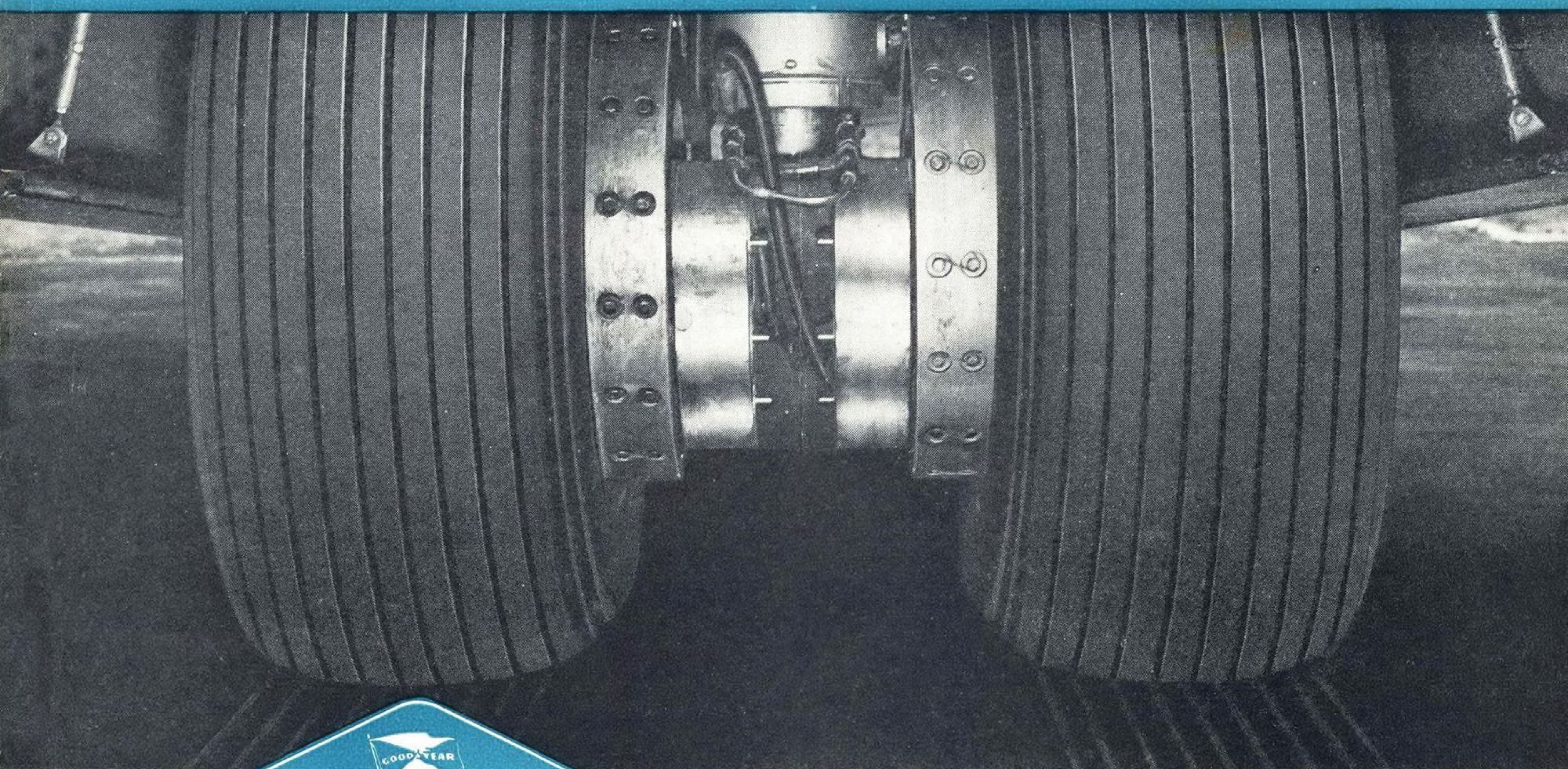


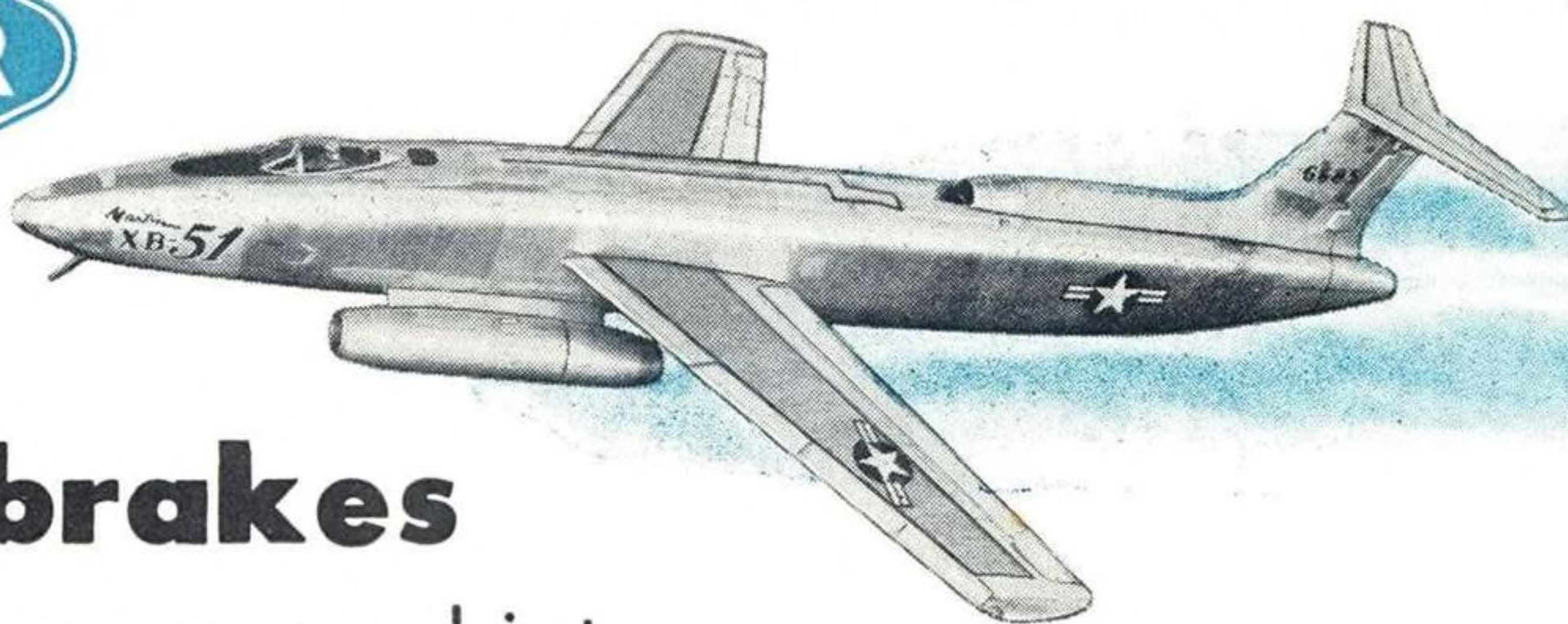
AVIATION WEEK

MAR. 6, 1950

A MCGRAW-HILL PUBLICATION



Close-up of rear main gear shows location of two Goodyear Single Disc Brakes



Super-safe brakes for a super-powered jet

To solve the braking problem on the new super-fast, three-jet XB-51, Goodyear designed and built Single Disc Brakes to fit its unique tandem-type landing gear. For years of experience prove these extra-dependable, super-safe Goodyear brakes are

unequalled for maximum energy absorption within a minimum space. That's why *more aircraft are equipped with Goodyear brakes than any other kind*. For details, write: Aviation Products Division, Goodyear, Akron 16, Ohio or Los Ang



...no control system
is better than the
company and the
engineering behind it



CREATIVE ENGINEERING

MINNEAPOLIS
Honeywell
AERONAUTICAL CONTROLS

MAKERS OF THE FAMOUS M-H ELECTRONIC AUTOPILOT, STANDARD ON ALL USAF 4-ENGINED BOMBERS



For Better End Results

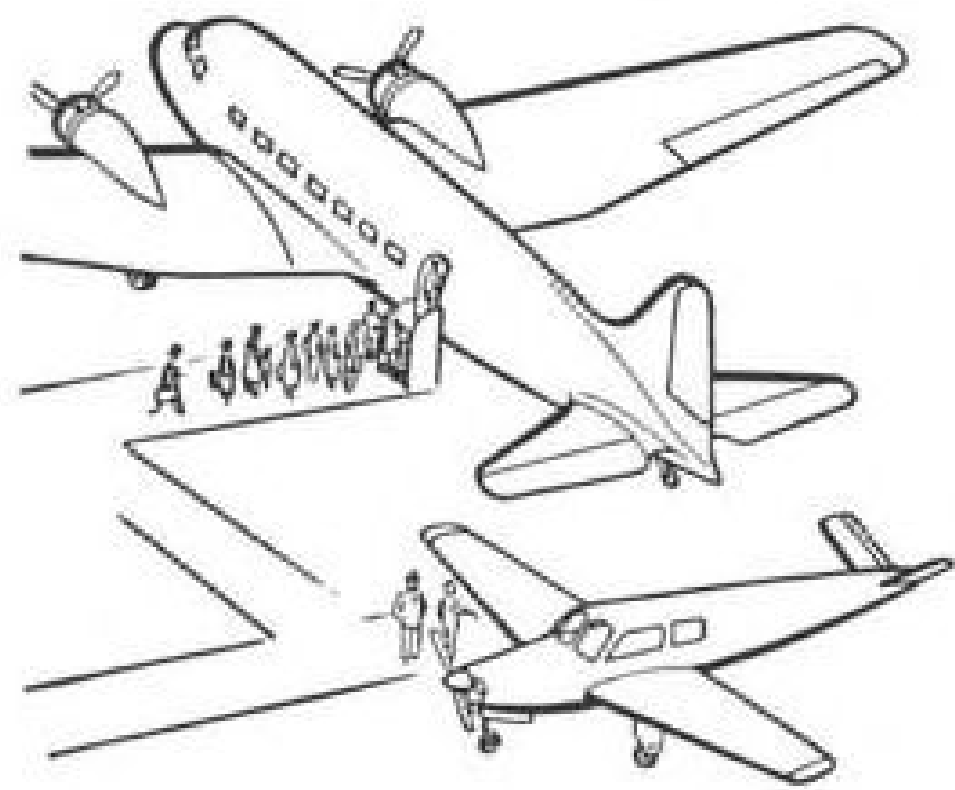
Whether in a delicate, precision instrument, a simple machine part, or a large complicated mechanism, ball bearings are used to achieve a certain preconceived standard of performance or end result.

Products of long experience, finer materials and the most advanced methods available today, New Departure ball bearings assure greater accuracy, smoother operation, longer life . . . in short, better end results, whatever the requirements may be.

Nothing Rolls Like a Ball

NEW DEPARTURE BALL BEARINGS

NEW DEPARTURE • Division of GENERAL MOTORS CORPORATION • BRISTOL, CONNECTICUT • BRANCHES IN ALL PRINCIPAL CITIES



Plane owners
agree—

there's more

H·P·R

(HOURS PER REPLACEMENT)

IN

PACKARD

HIGH-ALTITUDE

AIRCRAFT

IGNITION CABLE

Years of leadership in cable development and progress has resulted in Packard becoming the standard cable in the aviation industry.

It is no secret that Packard high-altitude aircraft ignition cable gives unequalled resistance to heat and cold, moisture and abrasion, age and corona under all atmospheric conditions—from sea level to ceiling—in all parts of the world.

It is well known among owners of all types of planes that Packard aircraft cable gives more hours per replacement.

Packard
REG. U.S. PAT. OFF.
TRADE MARK

PACKARD ELECTRIC DIVISION
GENERAL MOTORS CORPORATION
WARREN, OHIO

Aviation Week

Volume 52

March 6, 1950

Number 10

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POWER TO BURN...FROM AIR!

Chief among the startling new features of the radically designed Convair XP5Y-1, long range flying boat, is the first gas turbine *pneumatic* auxiliary power system ever built for aircraft. It was designed by AiResearch Manufacturing Company in cooperation with the Navy Bureau of Aeronautics and Consolidated Vultee Aircraft Corporation.

Vital to the system are the first air turbine-driven alternators for aircraft, which operate all major accessories. In the air they are operated by main engine bleed air from the new Allison T-40 turboprop engines. Each of the two alternator drives produces up to 70 shaft horsepower and maintains constant rpm regardless of the varying accessory loads.

When the airplane is afloat in some harbor or remote lagoon, power is supplied by the system's small AiResearch gas turbines, making the XP5Y-1 the first

turbine-propelled airplane capable of maintaining heat, light, radio communication and all necessary accessory activity without operating the main engines.

In addition, AiResearch pneumatic auxiliary power is utilized for starting the main engines. It is the first airborne starting system for turbine-propelled aircraft which makes possible an unlimited number of self starts without aid from any ground source of power.

● Whatever your field—AiResearch engineers—designers and manufacturers of rotors operating in excess of 100,000 rpm—invite your toughest problems involving high speed wheels. Specialized experience is also available in creating compact turbines and compressors;

actuators with high speed rotors; air, gas and liquid heat exchangers; air pressure, temperature, electronic and many other automatic controls.



● An inquiry on your company letterhead will get prompt attention. AiResearch Manufacturing Co., Los Angeles 45, Calif.

ZERO *reader*

the pilot's instrument

✂ Sperry's background and experience in developing precision flight instruments to make flying easier for the pilot under all conditions is reflected in the new ZERO READER*. . . truly, the pilot's instrument.

✂ For the Sperry ZERO READER combines the type of information usually supplied by five essential instruments — relieves the pilot of complex mental calculations — gives him more time to concentrate on other factors vital to the success of his flight plan.

✂ The ZERO READER — developed by Sperry with the encouragement and cooperation of All-Weather Flying Division, USAF and the Air Transport Association — makes military and commercial aviation increasingly independent of weather . . . helps pilots to make cross-country flights, approaches and landings with greater ease and safety regardless of visibility.

✂ The ZERO READER takes its place in a long chain of Sperry "firsts" including the Gyro-Horizon, Directional Gyro, Gyrosyn Compass and Gyropilot. Like them, it was evolved from Sperry research, engineering, precision manufacture and flight testing.

*TRADEMARK
PAT. PENDING

SPERRY **GYROSCOPE COMPANY**
DIVISION OF THE SPERRY CORPORATION
GREAT NECK, NEW YORK
NEW YORK • CLEVELAND • NEW ORLEANS
LOS ANGELES • SAN FRANCISCO • SEATTLE



NEWS SIDELIGHTS

Piasecki Advertises

A vigorous one-two punch aimed at an aircraft competitor may have recoil effects before its force is exhausted.

The "punch" was a Help Wanted ad placed by Piasecki Helicopter Corp. in the Bridgeport (Conn.) Post, hometown paper of Sikorsky Aircraft employees.

Headed: "Piasecki Wins Again!" the ad called for experienced engineers and draftsmen to "help design and build the H-21 for the Air Force," and concluded: "Advance With the Winner."

If Piasecki of Morton, Pa., hires away some of Sikorsky's experienced helicopter engineers, after beating Sikorsky in two successive competitions—the Navy shipboard helicopter competition and the more recent USAF rescue helicopter competition—the effect will be an additional body blow at the Bridgeport firm.

But the ad did raise a nice question for the newcomer in the helicopter big league to answer: "Why is the winner of a design competition advertising for help to design the helicopter with which he won the competition?"

A Piasecki spokesman told AVIATION WEEK that the answer to the question was that the technical personnel were not being sought specifically for the H-21 project but for other company work as well.

He also reported that the company had three of its HRP-1 helicopters back flying after the grounding in effect since Thanksgiving and that others were being restored to service by a new hydraulic pump installation. He denied newspaper reports that the grounding had been caused by transmission shaft, gearbox and bearing trouble.

Question of whether the H-21 design which won the USAF competition was a design still to be completed is significant under conditions of the competition. Competition called for a prototype flying. But if major design modifications are required from the basic HRP-2 type used as the flying prototype (in order to mount the larger Wright Cyclone R-1820-76A engine of 1020 hp. specified, instead of the 600 hp. engine used in the HRP-2), there may be protests raised by other manufacturers in the competition.

M-Day Plan

Joint chiefs of Staff's "M-Day" plans call for the requisitioning of all four-engine commercial aircraft by MATS, according to MATS commander, Maj.

Tired of Waiting

Almost astronomic costs and seemingly interminable procedural delays suffered by companies seeking route certificates from CAB have taken their toll in the Board's transcontinental coach-type service case. Eight of the twelve applicants in the case dropped out last month. The remaining four—Air America, Trans American Airways, Great Lakes Airlines and California Eastern Airways—have limited financial resources. Slick Airways, the all-cargo carrier, spent around \$100,000 during its 3½-year fight for a certificate. The nonskied coach airlines don't have that kind of money—or time—to spend waiting for a franchise.

Gen. Laurence Kuter. Initially, at least, the planes would be operated by the airlines, under contracts. At an executive session, Kuter reported to the Senate Interstate and Foreign Commerce Committee that present airlift capacity is only about one-third of estimated M-Day requirements, but he offered no concrete program to increase the potential.

Subsidy Separation

With expectation general that Congress will direct a separation of service mail payments from subsidies to air carriers, interest is now focusing on the matter of who will establish the compensatory rates. There are three prospects:

- Civil Aeronautics Board, which asks \$350,000 for necessary studies. Members of House Appropriations Committee, however, feel that the Board has sufficient data on airline operations to fix compensatory rates without additional research.
- Ernst & Ernst, the New York accounting firm which made a \$10,000 "pilot" study for the Senate Interstate and Foreign Commerce Committee.
- Citizens Committee for the Hoover Report, which includes Eastern Air Lines president, Capt. E. V. Rickenbacker in its membership, has volunteered to establish rates without a fee for the House Interstate and Foreign Commerce Committee. Langdon P. Marvin, Jr., who appeared as representative of the citizens group, offered to

raise money, hire accountants, and perform the job as a "public service."

Some congressmen, viewing CAB as air transport's "promoter," feel that the Board might be too lenient in setting compensatory rates.

To Farm or Not To Farm

Issue of subcontracting or "farming out" maintenance work, which figures in recent union strike threats against both Northwest Airlines and American Airlines, has a checkered background in labor arbitration history. Many arbitrators agree that a company retains the right to farm out work if the labor agreement doesn't specifically ban this practice. But other arbitrators have held that a company violates the "essence" of its labor contract if it intentionally engages in subcontracting for the purpose of depriving its employees of work which is covered by the labor agreement.

Juggling Group Strengths

Published reports emanating from Defense Department that B-29 and B-50 groups now pegged at 35 planes per group would be increased to 65 planes per group, thus doubling group strength, is misleading.

Air Force now has three B-36 groups; three B-50 groups; and nine B-29 groups. Three B-50 and three B-29 groups are to be raised to a 65-plane strength comprised partly of aerial tankers and partly of bombers.

Shift in strength is aimed at giving B-29 and B-50 groups range equivalent to B-36 groups—not at increasing group combat strength.

Hits Feeders

Railway Progress, monthly organ of Robert R. Young's Federation for Railway Progress, lit into the feeder airlines in its latest issue. The publication said that "CAB appears ready to go on indefinitely fostering local airlines which have little chance of ever achieving economic self-sufficiency . . . and which will always cost the taxpayer (far more) than the public receives in benefits." Certificated airlines, including feeders, are guaranteed a 7 percent profit after taxes, Railway Progress declared, adding bitterly that "this rate of return looks particularly good alongside the 3.6 percent profit averaged by the railroads since 1921.



***10**

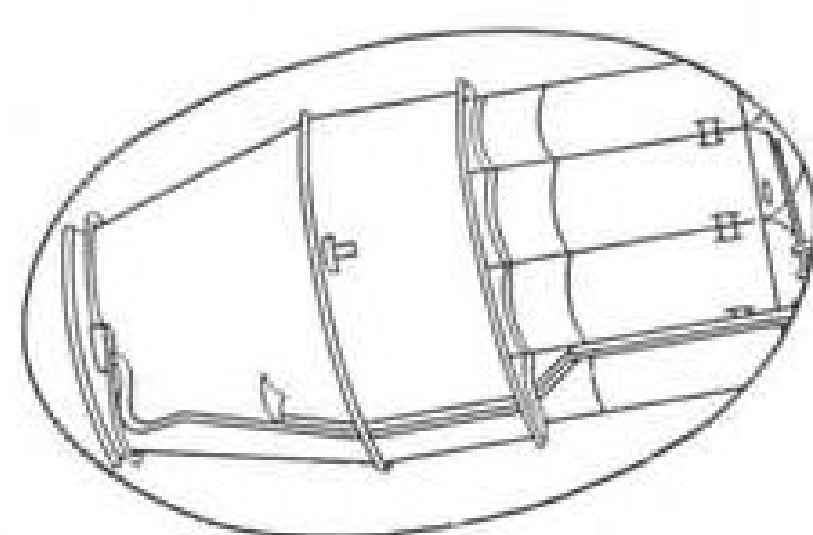
EXAMPLE PROJECTS

*1 AFT FRAME ASSEMBLY FOR JET ENGINES

Problem Seam Welding thin stainless to heavy carbon steel on large assemblies maintaining close dimensional tolerances.

Solution Solved by design know-how and special welding technique.

Result An accurate assembly—free of distortion—previously considered impossible.



AU **Unique**
sub-contractor
EXPERT FABRICATORS OF
METAL AIRCRAFT PARTS

Lavelle

AIRCRAFT CORPORATION
NEWTOWN, Bucks County, PENNA.

AVIATION CALENDAR

Mar. 6-8—Sixth annual Fourth Region non-scheduled operators meeting and second annual Agricultural Aviation Conference, Hotel Texas, Fort Worth.

Mar. 6-9—47th annual meeting, American Road Builders' Assn., Netherlands Plaza Hotel, Cincinnati.

Mar. 6-9—Annual convention, Institute of Radio Engineers, Hotel Commodore, New York City.

Mar. 24—Fifth annual flight propulsion meeting, sponsored by the Institute of the Aeronautical Sciences, Carter Hotel, Cleveland.

Mar. 27-28—American Society for Testing Materials, Committee D-14, spring meeting, 1916 Race St., Philadelphia.

Mar. 28-31—National Plastics Exposition, sponsored by Society of the Plastics Industry, Navy Pier, Chicago.

Mar. 30-31—Sixth annual helicopter forum, sponsored by the American Helicopter Society and the Institute of the Aeronautical Sciences, Ben Franklin Hotel, Philadelphia.

Mar. 31—Greater New York Safety Council conference on air travel safety, Hotel Statler, New York, N. Y.

Apr. 4-6—Engineering and Maintenance conference, Air Transport Assn., Hotel Continental, Kansas City.

Apr. 4-8—National Production Exposition, sponsored by the Chicago Technical Societies Council, Stevens Hotel, Chicago.

Apr. 10-12—Annual convention, American Society of Lubrication Engineers, Hotel Statler, Detroit.

Apr. 12—American Society of Mechanical Engineers, Aviation and Gas Turbine division, Hotel Statler, Washington, D. C.

Apr. 16-20—Annual business meeting, American Assn. of Airport Executives, Neil House Hotel, Columbus, Ohio.

Apr. 17-19—1950 aeronautic meeting, Society of Automotive Engineers, Hotel Statler, New York City.

Apr. 24-26—Airport Operators Council, third annual meeting, Hotel Carter, Cleveland.

Apr. 26—Stainless steel valve clinic, sponsored by Cooper Alloy Foundry Co., Hotel Statler, Buffalo.

May 5-6—Midwestern conference on fluid dynamics and the national meeting of the American Physical Society, fluid dynamics division, University of Illinois, Urbana.

May 27-30—Wright Memorial Glider Meet, South Dayton Airport, Dayton.

June 10-13—National Aeronautics Assn., annual convention, Hotel Statler, St. Louis, Mo.

June 21-25—Ninety-Nines 1950 convention, Ft. Clark Guest Ranch, Brackettville, Tex.

June 26-30—53rd annual meeting, American Society for Testing Materials, ninth exhibit of testing apparatus and related equipment, Chalfonte-Haddon Hall, Atlantic City, N. J.

Oct. 16-20—1950 annual general meeting of the International Air Transport Assn., Fairmont Hotel, San Francisco.

PICTURE CREDITS

13—Convair; 23, 24—Douglas Aircraft Co.; 32—Westinghouse Electric Corp.; 38—Aeroneca; 43—de Havilland.



19 YEARS OF CO-OPERATIVE SERVICE

Since October 1, 1931, PAC has been proud of its partnership with Pratt & Whitney in serving all branches of the aviation industry. Today, PAC maintains not only the oldest and largest commercial overhaul and parts stations servicing Pratt & Whitney aircraft engines, but is an authorized P & W distributor as well. This combination is recognized the world over in PAC's "OPERATION EFFICIENCY."



NEWS DIGEST

DOMESTIC

American Airlines maintenance workers went on strike throughout the system last Wednesday morning after suspension of negotiations on a new contract between company and the Transport Workers Union (CIO). Approximately 4600 workers went out. At mid-week company took the position that the strike was illegal under the Railway Labor Act and that therefore it could not resume bargaining until the strike ended. But chances were bright of quick settlement, as only point still at issue was effective term of contract—AA wanting it to be 18 months from Mar. 1, the union holding out for 18 months from Jan. 1. With supervisory and engineering personnel carrying on maintenance, no severe disruption of schedules was anticipated in the early stages of the strike.

Shipments of complete aircraft in 1949, according to final figures of the Census Bureau, totaled 36,541,200 lb., with military shipments accounting for 29,795,000 lb.; personal aircraft, 2,432,000 lb.; and transports, 4,313,800 lb. Personal aircraft shipments for the year numbered 3379, valued at \$16,100,135; and transports, 166, valued at \$105,346,199.

Personal aircraft exports in January of nine companies reporting to the Aircraft Industries Assn. rose to 22, valued at \$124,129. In December, same companies shipped 16 planes, valued at \$109,048.

Consolidated Vultee Aircraft Corp. delivered the first T-29 trainer to the Air Force at San Diego. Plane will be ferried to Wright-Patterson AFB, Dayton, Ohio, for a familiarization and testing program. Convair has orders for 48 T-29s, which are developed from the Convair-Liner transport.

Fairchild Engine & Airplane Corp. delivered the first R4Q-1 Packet to the Marine Corps at Cherry Point, N. C. R4Q-1 is the Navy-Marine designation for the Air Force C-119. Two recently were delivered to the Navy.

National Aeronautic Assn. has accepted the resignation of R. M. Phelps as executive vice president, with submission of a report by a special committee which met last December to study NAA's future.

James S. Ogsbury, Sr., president of Fairchild Camera & Instrument Corp., died at St. Augustine, Fla., while on vacation. He was 67 years old.

Braniff Airways asked CAB for new route extensions from Tulsa, Okla., to New York via Pittsburgh, and from

Tulsa to New York via Washington.

Pan American Airways mechanics and ground workers voted to be represented by the Transport Workers Union (CIO) in an election held in New York. TWU received 1855 votes and the contesting union, Federated Air Line Workers of America (independent), polled 1449.

Robert W. Ayer has been appointed vice president-engineering of Kenyon Instrument Co., Huntington, L. I., N. Y. He resigned Feb. 10 as assistant director of flight engineering of American Airlines. Previously he had been chief engineer of Fleetwings, technical director of Aircraft Industries Assn., chief engineer of Stinson, and co-designer of the famous Gee Bee racing planes.

Window of a Pan American Airways Constellation blew out while plane was at 20,000 ft. on a ferry flight to Miami, and a stewardess sleeping on the seat beside the window was pulled half-way through the opening before being rescued.

FINANCIAL

Grumman Aircraft Engineering Corp. reports sales and other income of \$59,965,277 for year ended Dec. 31, and net income, after provision for taxes and possible price readjustments, of \$3,191,520. Both sales and profit were substantially greater than in 1948.

Northwest Airlines reports a system-wide net profit after taxes of \$1,235,405 in 1949, compared with a net loss of \$787,474 in 1948. Revenues of \$40,479,781 last year were up more than \$5 million over 1948 and set a new company record. NWA flew 766,898 passengers on domestic and overseas routes in 1949, up 19 percent over 1948.

Consolidated Vultee Aircraft Corp. declared a dividend of one-tenth of a share of common stock of Airfleets, Inc., for each share of Convair common, payable Mar. 31 to holders of record Mar. 13. Convair recently transferred to Airfleets, its wholly owned subsidiary, \$75,000 cash, real property (including 15 Convair-Liners), securities and notes with total value of \$8,500,000, and in return received notes for \$6,825,000 and 235,000 shares of Airfleets stock.

FOREIGN

De Havilland Comet jet transport has made its longest test hop—flying for 5½ hours and covering a distance more than equivalent to the London-Gander, Newfoundland, flight.

Improved DC-4 ENGINE MOUNTING



New
LORD Dynafocal Core
Delivers
Smoother Performance
Longer Service Life

The new LORD MR-26-1B Dynafocal Core is now available. DC-4 operators should specify this superior core for replacements. Here is why.

- Increased Service Life.
- Increased Protection Against Metal-To-Metal Bottoming.
- Increased Passenger Comfort.
- Less Frequent Replacement.
- Lower Maintenance Cost.
- Directly Interchangeable With Those Now In Use.

MOUNTINGS FOR EVERY AIRCRAFT NEED

For any type of aircraft, or any aircraft application, LORD can supply the Mountings you require. Our specialized knowledge and experience in Vibration Control is at your service.

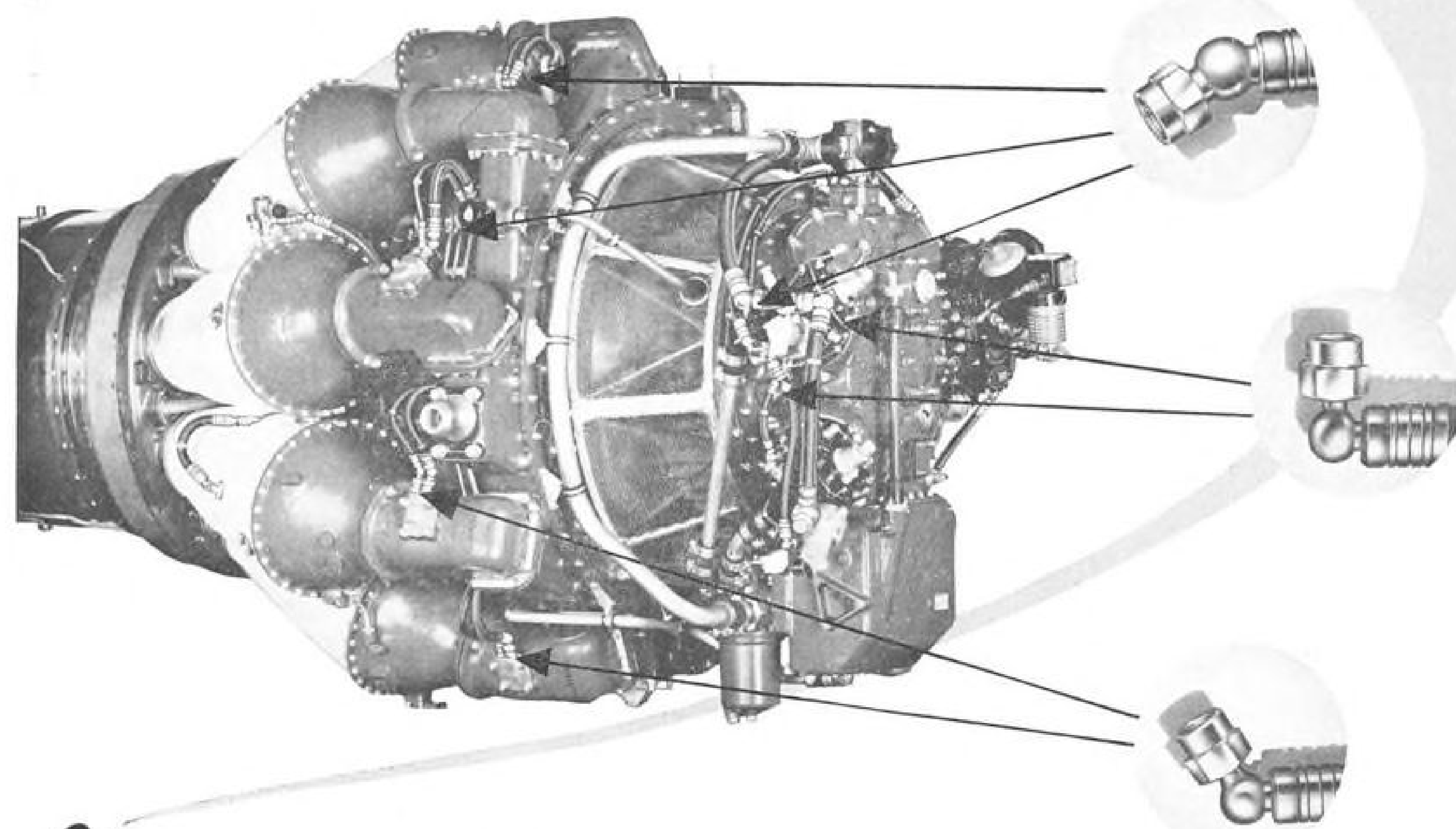
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LORD

Engineered Vibration Control

PRATT & WHITNEY AIRCRAFT J 42 "Turbo Wasps"



Use AVICA Hose Assemblies with integral **ANGLE** couplings

The illustration above shows clearly how Pratt & Whitney Engineers have obtained a neat and compact piping installation by the use of Avica hose assemblies with integral angle ends. Avica flexible pipes with integral angle couplings save weight, space, installation and maintenance time by eliminating the extra joints required when separate elbows, tees, etc. are used. These Avica assemblies enable designers to shorten their piping runs and avoid sharp hose bends.

SEND US YOUR BLUEPRINTS OR SKETCHES FOR QUOTATIONS

SEND FOR ILLUSTRATED AVICA FOLDER ➡

AVICA CORPORATION

(formerly AVICO INCORPORATED)

PORTSMOUTH, NEWPORT, RHODE ISLAND



WHO'S WHERE

Changes

► **New Appointments**—Amos Culbert, former American Airlines vp, will head Northwest Airlines' traffic department. He was with AA since 1942 . . . Port of New York Authority named John R. Wiley deputy director of the Department of Airport Development. He'll assist Fred M. Glass. Wiley was formerly AA director of planning and controls division.

Huck Manufacturing Co. named Robert N. Hendrickson vp-sales engineering and Frank A. Dobbe vp sales . . . H. C. Weidner, Jr., is now general superintendent of manufacturing at Townsend Co., New Brighton, Pa. . . . Van H. Leichter has been named assistant vp at American Steel & Wire Co. . . . Link Aviation, Inc., appointed E. Allan Williford vp and general manager. He succeeds George W. Emerson, retiring, who will serve in a consulting capacity.

W. H. Rowley, staff engineer at Aeroquip Corp., is now at Dayton to serve Air Materiel Command and other Aeroquip customers in the vicinity . . . Eugene Sibley has become chief of CAA's ICAO division, International Region . . . William C. Ray, formerly director of maintenance for AOA, is now vp of Aircraft Maintenance International, Inc. He heads operations at Idlewild . . . Piedmont Airlines has named George Willard superintendent of passenger service.

► **New Post**—Col. Clarence M. Young, formerly general manager of the Los Angeles Department of Airports, is now a vp of Pan American World Airways. Before his Los Angeles post, Young was a member of the Civil Aeronautics Board. He'll headquarter in Los Angeles and San Francisco.

► **Sales Shifts**—J. E. "Gene" Winchester is now sales manager for Curtiss-Wright Corp.'s Airplane division at Columbus after several years as sales engineer . . . Harold Watson becomes Convention Sales Manager for Eastern Air Lines . . . Edwards Co., Inc. has appointed John L. Taylor as sales manager . . . Benjamin S. Yaffe is technical sales representative for the Industrial-Aviation division of the R. M. Hollingshead Corp. . . . J. Larry Simpkins will manage eastern sales office in Baltimore of the Wm. R. Whittaker Co. . . . Burnham Adams, formerly vp of Lear, Inc., is now sales manager of AiResearch Manufacturing Co. He succeeds Roy Leekey, who becomes Washington representative. W. J. Pattison moves from Washington to Los Angeles as assistant to the president.

Elections and Honors

► **Menasco Changes**—Following its board meeting, G. Preshaw resigned as secretary-treasurer and as a director of Menasco Manufacturing Co. William B. Yeager became vp, secretary-treasurer and a director. G. T. Gerlach, patent director of Convair, was elected national chairman of the patent committee of the AIA. J. B. Haas, general traffic manager of Bendix Products division, is general chairman of the traffic committee, Eastern regional division of AIA.

INDUSTRY OBSERVER

► New competition in the helicopter field soon may be forthcoming from established fixed wing aircraft manufacturers, some of whom have been invited to submit bids in the Navy's forthcoming anti-submarine warfare helicopter competition. Most likely to accept are any of four: Convair, which has had a fringe interest in helicopters for years and once discussed buying Hiller; Lockheed; Martin, which still has an embryo helicopter division, and Hughes Aircraft, already working on a USAF development contract for the former Kellett XH-17.

► Pilot of a USAF C-47 recently mistook the slopline approach lights at Los Angeles Municipal Airport for runway boundary lights and landed between them, before reaching the runway. The airplane crashed and burned, without crew injury. This was only one of three such mistakes at the one airport, the others less serious. Pilots of a United Air Lines plane and a Compania Mexicana de Aviacion DC-4 who made similar misinterpretation of the slopline lights discovered their errors in time to make quick pullouts. Now all flights approaching LA Airport are being warned that the slopline lights are not runway boundary lights. Both slopline and neon approach lights are being used together.

► Delivery of the first RB-36 reconnaissance plane at Fairfield Suisun AFB, Calif., due last week, is to be followed by 29 more of the big recon planes by the end of the year to fill out the complement of the 9th Strategic Reconnaissance Group.

► Canadair Ltd. and Avro Ltd. of Canada have definitely decided to put the new Orenda turbojet into the Canadair version of the North American-designed F-86.

► Compound engines which will be installed in the new anti-snorkel submarine version of the Lockheed P2V-4 Neptune are Wright R-3350-30W, rated 3250 hp. at 2900 rpm., as compared to the 2500 hp. rating of the earlier R-3350-24W powering the P2V-2.

► Pan American World Airways' sale of four Convair-Liners to Mid-Continent Airlines is first tangible step in Pan Am's disposal of all its twin-engine Convair transports. Pan Am previously (AVIATION WEEK, Jan. 30) discussed sale of all 20 Convair planes with TWA, as alternate to the Martin 4-O-4 sales negotiation, and presumably would still like to get a buyer for the other 16. Back of Pan Am sale may be the feeling that four-engine planes are preferable for South American operations involving overwater routes, and a desire for more range than the Convair planes supply.

► Complications of certification are reported to have caused de Havilland to abandon plans to sell its successful D. H. 104 Dove twin-engine transport as a feederliner and executive transport in the U. S. The British firm had previously made a number of test flights in England looking toward CAA certification under the reciprocal agreement between CAA and the Air Registration Board.

► Indication of demand for magnesium sheet in airplane construction is decision of Aluminum Corp. of America to open a new division for rolling magnesium sheet at New Kensington, Pa., with 100 workers. Alcoa discontinued a similar operation at New Kensington in 1947 because of demand drop for magnesium sheet after the end of World War II. Best known examples of extensive magnesium use in airframes are in the B-36 and F7U.

► Sideline of jet engine manufacturing is the business of making elaborate metal containers for the engines, which is developing into a fairly good volume of itself. Military engine contractors are being required to subcontract much of this business.

► Expansion of the research and development buyers' section at Air Materiel Command procurement division headquarters, Wright Field, is an interesting tipoff to the expanding market for aviation vendors which is developing as a result of the newly-formed USAF Research and Development Command.

Report Spells Out Guided Missile Plan

Survey designed to coordinate programs and clear decks for greater development.

Elimination of five guided missile development contracts and consolidation of six other separate missile projects to three is called for in the Stuart Survey on Guided Missile Research now before the Joint Chiefs of Staff and to be transmitted for action soon to the Research and Development Board.

The report—by a group headed by Harold S. Stuart, Assistant Secretary of the Air Force—calls for review of seven other long-range projects, and summarizes research and development progress on 39 major interim missile projects, and defines areas of cognizance between the services.

► **No Fund Cut**—The Stuart survey covering Defense Department's entire missile program does not envision (nor has Defense Secretary Johnson asked) fund curtailment in research and development activity. It is the vehicle for conclusion of Phase II—elimination of less promising technique, proposal for consolidation of several projects. It provides entry to Phase III and a concerted drive for standardized production of a few. In the main it requests reallocation of funds under jurisdiction of Research and Development Board's committee on guided missiles.

Today the Army spends approximately \$18 million annually in support of seven separate guided missile projects; the Navy \$50 million on 15 projects and USAF \$35 million on 13 projects. Determining areas of cognizance is difficult at best. Missile research, in the eyes of Army and Navy Board, is regarded as a logical outgrowth of artillery. To the Air Force and Navy BuAer guided missiles are a pilotless extension of aircraft.

► **No Push Buttons**—Report is the culmination of Defense Department displeasure over uncoordinated missile research evolved following World War II when a press bombardment of optimistic claims to an American public tone-deafened to superlatives imbued the military with the rosy promise of push button warfare.

With a half-billion dollars being voted annually for research and development and \$100 million of that amount

given to development of guided missiles, industry pressure for missile contract authority has assumed a political significance of no mean proportions.

Missile research, delayed by emphasis on mass production of proved weapons during the war, was virtually unexplored except for dissection of captured German equipment.

To catch up, the services hastily let missile research contracts to virtually all research facilities that would take them. Meanwhile test firings of captured V-2s were assessed, German scientists interrogated and their findings assimilated. New military requirements were written and a large part of the less promising projects were cancelled. Phase I—investigation of virtually anything that showed promise—ended.

► **Missiles Complex**—Missile research difficulties stem from complexity of the development of components. The guided missile "package" is a complete weapon carrying everything it uses—engine, electronic equipment, fuel, armament and ammunition—and everything must work the first time or it is useless.

Devising the vital components concerned with making a missile work properly requires application of almost every field of technical knowledge. So complex is the technical application of aerodynamics, thermodynamics, ceramics, fuels and combustion, power plants, guidance systems, metallurgy, meteorology, explosives, ballistics, etc., that the services individually found them impossible to correlate.

As a result a major portion of missile research and development has been carried out under project contracts let by the individual services. For the most part, the coordination of the "contributions" from the myriad fields of technical knowledge needed in a missile's development is called for under the contract. Therein lay the basic cause of duplication.

Charging a contractor with responsibility for delivering complete missiles precluded assurance that no two contractors duplicated. A more promising line of research remained untouched. The Committee on Guided Missiles,

RDB, is now charged with coordination of research and development effort. No new projects may be undertaken without its prior approval.

► **Ten Panels**—The committee itself is divided into ten separate panels that cover the performance of a missile: Aerodynamics and structures; guidance and control; facilities; test range procedures and instrumentation; propulsion and fuels; warheads and fuses; launching and handling; target drones; test and training; and counter measures. Technical evaluation group composed of five scientists, each in a different field of guided missile research, monitors the overall program in an effort to keep relative emphasis on different fields in balance.

► **Basic Pattern**—Missile research of the three services, while competitive, has followed generally the same three basic patterns of evolution.

First category—or short-term program—consists of two projects:

• **Refinement of missiles** developed or near technical realization during the late war such as the Bat, Tarzan and Dove and the B-29 Drone, and.

• **Interim prototype models** such as the Wac Corporal which, built for experimental test purposes, could be converted to weapons in an emergency.

These represent the most advanced missiles which could be made available operationally early in the critical period envisioned by the Defense Department beginning in 1951 to crisis period in 1955 (AVIATION WEEK, Feb. 27).

Second category with which the Stuart report is concerned consists of medium-term developments. Projects in this group consist of missile development with maximum performance based upon existing engineering knowledge such as the Bell, Boeing, Hughes and Martin rockets. Currently scheduled for operational use after 1953, their development could be accelerated if warranted by military urgency.

Third category, the long-term guided missile program, seeks weapons that will likely revolutionize the aspects of war. Including transonic and supersonic air-launched and surface-launched missiles against air and surface targets at long range, these have little prospect of operational use before 1960 at the earliest. Prototype models of a few will appear in 1952 for service evaluation testing.

► **Air Defense Operation**—Nine guided missile projects comprise research in air defense operation.

► **Combat Air Support**—There are six guided missiles in research for combat air support activities.

► **Land Combat Operations**—There are seven guided missiles under development for land combat operations.

► **Sea Combat Operations**—In this field there are light separate projects all of which are Navy projects.

► **Strategic Air Operations**—There are nine Air Force guided missile projects.

Long-range weapons are still far from realization. They will be incredibly expensive. Guidance methods must be drastically improved to give the rocket an accuracy that makes its expending worthwhile. Undoubtedly the weapons will carry atomic warheads and will be capable of extreme high speeds to give them a low vulnerability. Of the remaining seven long-range surface-to-surface guided missile projects one is an Army missile, one Navy, and the remaining five are USAF's.

To date there are 51 major facilities contributing to guided missile research and development in the United States. All are now under scrutiny of Office of Secretary of Defense bent on eliminating duplicatory activity.

The facilities comprise: 9 test ranges; 15 supporting facilities (4 of which have

associated wind tunnels); 10 major wind tunnels (3 of which are experimental); 5 ramjet test facilities; 3 liquid rocket test facilities; 2 liquid rocket laboratories; 2 rocket test stands; and 3 laboratory and pilot plants.

► **Navy Administration**—Some disgruntled research and development personnel are convinced that "shaking the tree will only result in losing the fruit." Generally, however, scientists have been

aghast at the erratically aimless progress control of missile research.

There is growing feeling even in high Air Force circles that Navy should be given complete administrative control of all guided missile development. Belief is that Navy, with its knack for organization, cost control, and close coordination of activities, might evolve for this nation finally a cohesive guided missile program.

House Report Cheers Navy Friends

Armed Services Committee supports B-36, supercarrier; recommends JCS membership for Marine Corps.

House Armed Services Committee last week turned away from the Louis Johnson version of armed services unification in a hard-hitting, significant report which gave new hope to Navy adherents for:

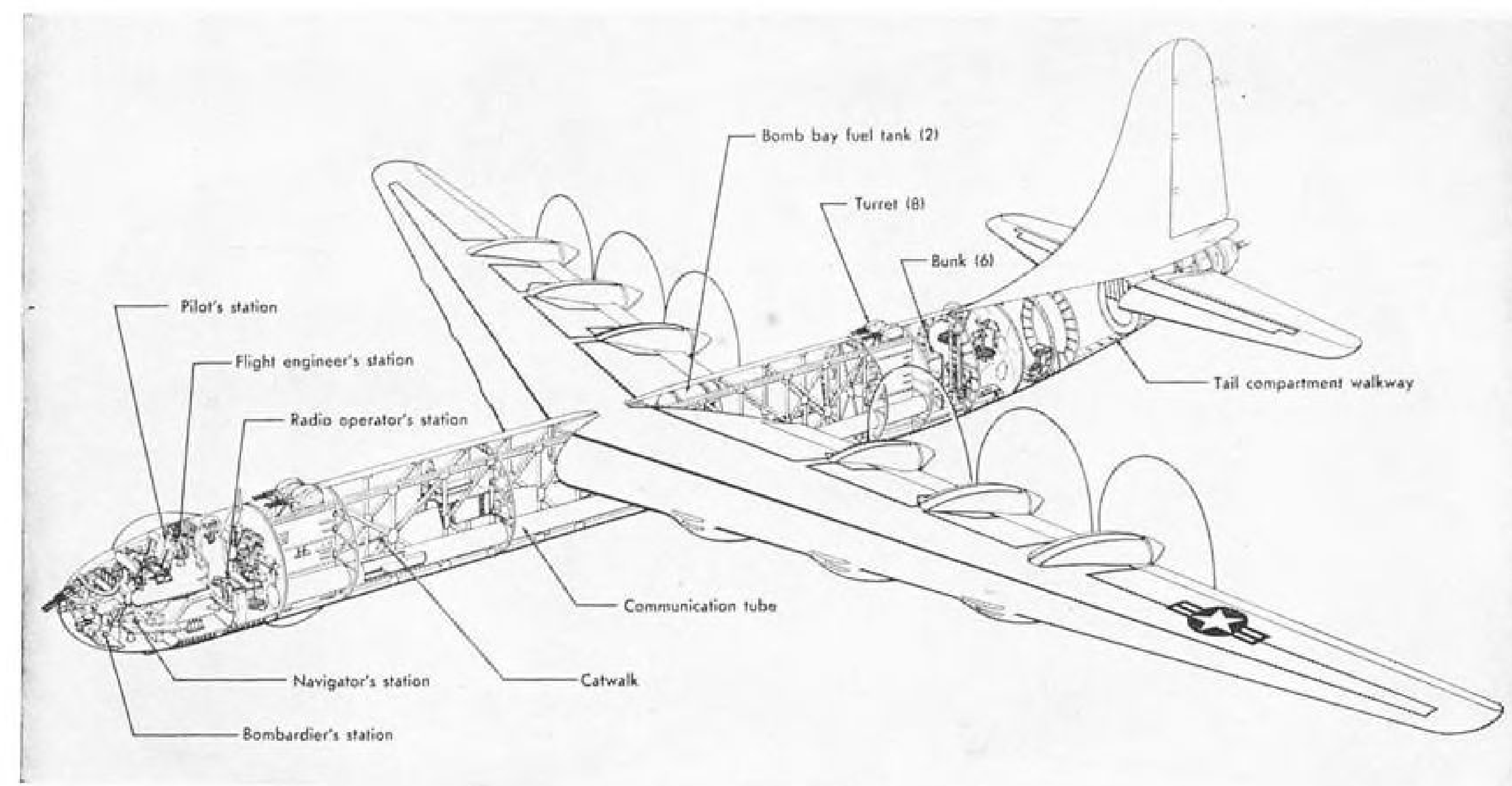
• **Possible restoration** of the 65,000-ton supercarrier to procurement schedules.
• **Increased Navy representation** on the Joint Chiefs of Staff by proposal for appointment of the Marine Corps commandant on equal status with Air Force, Army and Navy commanders.

The report, resulting from the committee's investigation into unification

and the purchase of the Convair B-36 superbomber conducted last October, took the general position that the Air Force knows what's best for the Air Force and that the Navy knows what's best for the Navy.

► **Supports B-36**—On such a basis the committee supported the Air Force selection of the B-36 as its key strategic weapon. Similarly it supported the Navy's program for a supercarrier, which had been chopped off by Defense Secretary Johnson.

In general the report was a crystallization of the growing congressional im-



47 MORE B-36S

First cutaway sketch of Convair's B-36 intercontinental bomber shows interior details of 162-ft. fuselage with bomb-bays in center section designed to carry and drop as much as 84,000 lb. of bombs. Communications tube runs along bottom of plane between pressurized front and rear crew compartments. Twelve of the 16 cannon (20-mm.)

which arm the bomber against enemy interceptors are seen. Latest reports are that purchase of 47 more of the B-36s in addition to the 170 now purchased or on order, is scheduled in the 1950 USAF fiscal year program, confirming the report originally published in AVIATION WEEK Dec. 12. Sketch does not indicate the pod

installations slung under the wings outboard of the six piston engines (3500 hp. Wasp Majors), which house two 5200-lb. thrust GE J-47 turbojet engines each, for added emergency thrust and performance. USAF previously reported the plane has achieved a speed of over 435 mph. and has flown to altitude of 50,000 ft.

patience with Secretary Johnson and his policies, previously indicated on several occasions by Rep. Carl Vinson (D., Ga.), chairman of the powerful committee. Said the report:

"The Air Force holds the primary responsibility for conducting strategic bombing. It has maintained that the B-36 bomber is its foremost weapon to carry out that mission . . . The committee holds that the nation must rely upon the judgment of its professional leaders in their respective fields . . . and that the nation's leaders in respect to weapons of the Air Force are the leaders of the U. S. Air Force."

► **Carrier Cancellation**—Stating that it "deplores the manner of cancellation" of the Navy's supercarrier, the committee said it would "withhold action—for the present—as regards the construction of the vessel" because of the pressure of other shipbuilding programs and budgetary limitation, but added:

"The committee considers it sound policy, however, for the nation to follow the advice of its professional leaders in regard to this subject in the same manner as has been heretofore done in respect to the B-36 bomber. In the committee's view, the nation's leaders in respect to naval weapons are the leaders of the U. S. Navy."

► **Board Role**—The committee emphasized that the role of the Joint Weapons Systems Evaluation Board is to evaluate weapons "after" they have been developed, "not to instruct the services what type of new weapons they will or will not develop." The B-36, however, it was stipulated, is now within the proper province of the JWSEB, and added that "future mass procurement of weapons should not be undertaken until the recommendations of this board . . . are available to the Joint Chiefs of Staff."

Highlights of the report:

- **Reputation of the removal of Adm. Louis Denfeld**, former Chief of Naval Operations, as "a reprisal against him for giving testimony" to the congressional committee (AVIATION WEEK, Jan. 30).

The ouster was pictured as "a blow against effective representative government in that it tends to intimidate witnesses and hence discourages the rendering of free and honest testimony to the Congress."

- **Disclosure** that the committee would sponsor legislation requiring that the Secretary of Defense "consult" with the House and Senate Appropriations Committees before withholding appropriated funds by administrative act, as Secretary Louis Johnson did on funds for a 70-group USAF this year.

- **A direct hit** at Johnson's economy program. Because of the terrible destructiveness of modern weapons, "this nation can no longer afford lackadaisical

planning or complacency as to its defenses. For an indefinite time, this nation must maintain sound, modern, alert defensive forces capable of anticipating and dealing with a sudden enemy attack," the report said.

► **Anticipate Differences**—The committee anticipated that USAF-Navy differences will continue because they are rooted in fundamental professional disagreements on the art of warfare, with service prejudices, jealousies, and the thirst for power barely entering into the picture. But these steps were recommended to quell antagonisms:

- **USAF** should promote a closer relationship with Marine Corps aviation and the ground forces to develop sound close air support tactics and techniques. A joint training center to accomplish this should be promptly established.

- **Joint training activities** should be established between USAF and Navy tactical aviation.

- **Ban** should be lifted barring Naval aviation personnel from the activities of USAF's Strategic Air Command.

- **Interservice war games** to resolve such questions as the Banshee versus the B-36 should be augmented.

Two policy recommendations by the

committee were major Navy victories.

The committee endorsed autonomy for the individual services on technical matters during the formative stages of unification.

It proposed membership on the Joint Chiefs of Staff for the Commandant of the Marine Corps, and that the chairmanship rotate every two years. The chairman does not vote on JCS decisions. Under the recommendation, the Marine Corps-Navy team would have two votes to the two votes of the Army and USAF, which frequently side together on strategic questions.

McGraw-Hill Change

The McGraw-Hill Publishing Co., Inc., publishers of AVIATION WEEK, has announced the resignation of James H. McGraw, Jr., as President and Chairman of the Board.

Curtis W. McGraw, who had been Vice-President and Treasurer, was elected to succeed him. Joseph A. Gerardi was elected Treasurer in addition to his former duties as Secretary.

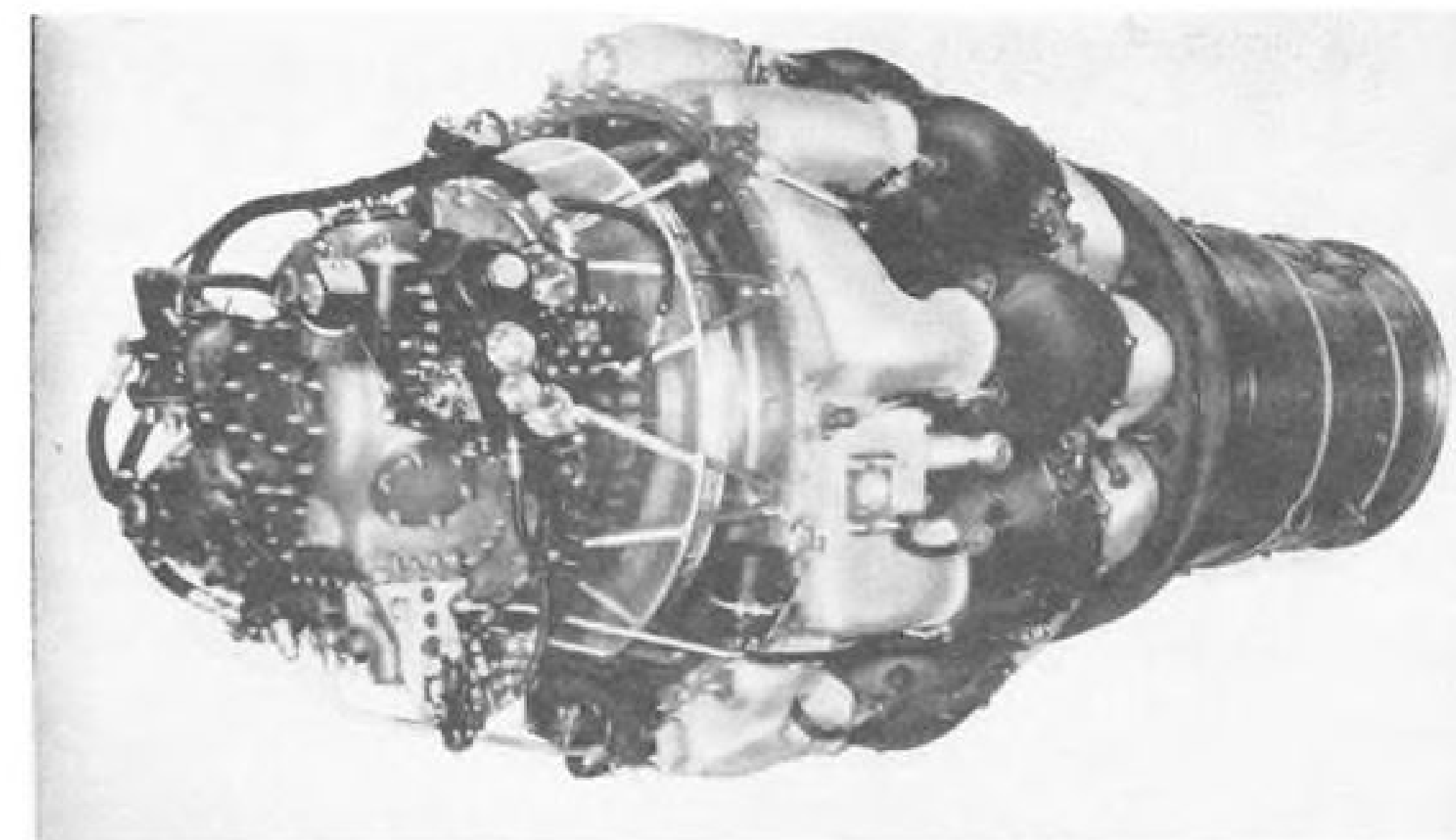
The office of Executive Vice-President was created and Willard Chevalier appointed to that post.



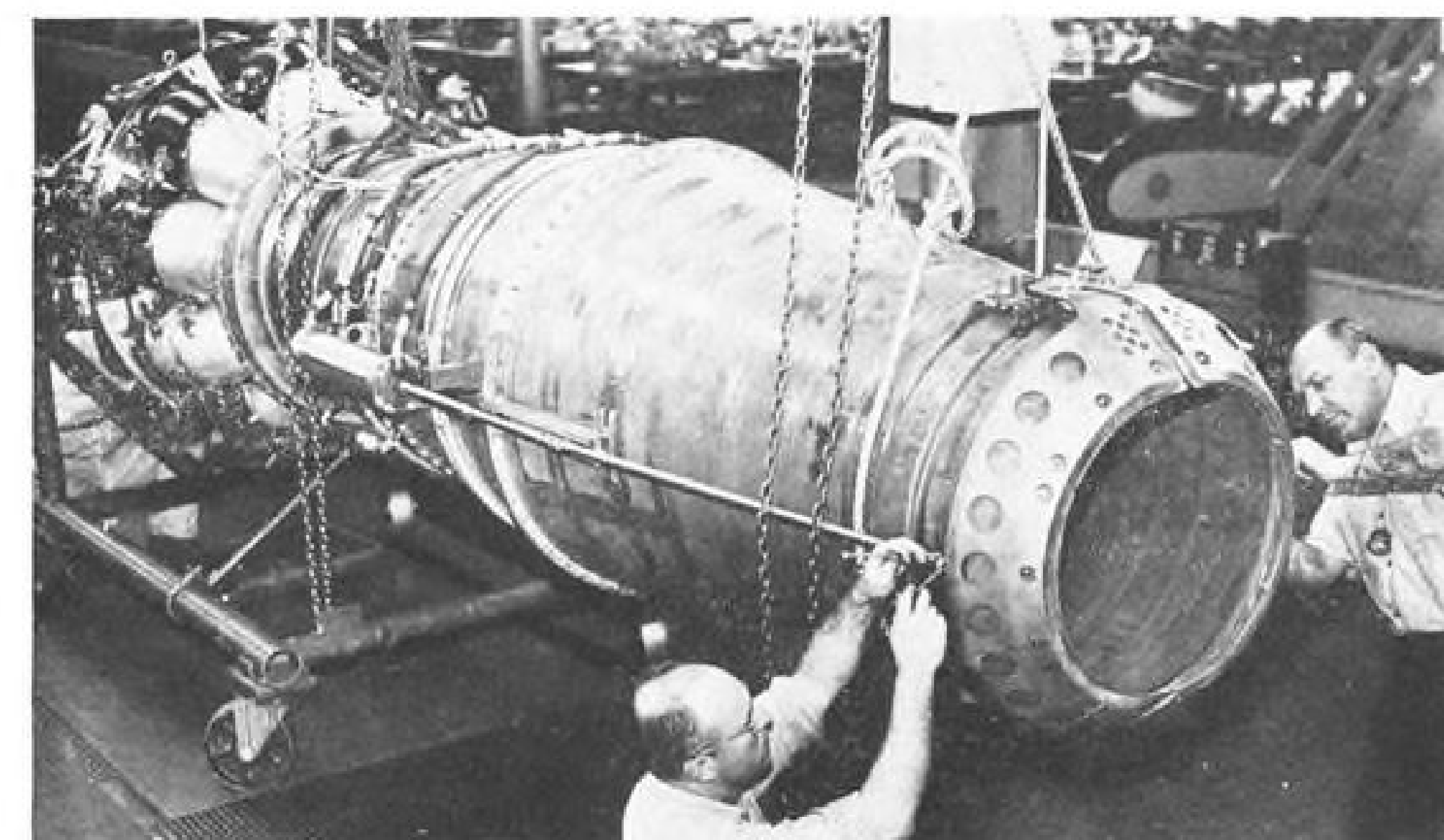
FIRST AEROCAR FLIGHT PHOTOS

After driving his roadable Aerocar from Longview, Wash., to Chehalis, Wash., at 40 mph, with the flight component hitched on behind, Molt Taylor, designer, made his first extensive test flights from the Chehalis hard-surface runway getting the craft up to a 450 ft. altitude above the field. Aerocar has abandoned two-control arrangement for a conventional three-control rudder pedal setup which uses three pedals on the floor, one for clutch and left rudder, a middle pedal for right rudder, and a right pedal for

footbrake. The three-passenger 100-hp. prototype has been sold to B. F. Goodrich Co. for \$10,000, Taylor reported. He expects the production version to sell for \$4-5000. When used as an automobile, Aerocar wings fold back against the tailboom, which detaches from the automobile component, and forms a trailer. The tail propeller, driven by an extension shaft running through the tailboom, makes the plane unusually quiet during flight, the designer reports.



P&W'S J-48 front view shows turbojet accessories grouped about nose with . . .



AFTERBURNER, having hydraulically operated "eyelids" for regulating exhaust area.

P&W Unveils 6250-lb.-Thrust J-48

New engine, giving 8000 lb. thrust with afterburning, slated to power one Navy and two AF planes.

By Alexander McSurely

East Hartford—Pratt & Whitney's powerful new turbojet J-48 roared out a challenge to other American jet engines last week from its test cell here as its manufacturers first staked out its claim as "the most powerful jet engine now flying in the U. S." and later added: "in the world."

William P. Gwinn, general manager of the Pratt & Whitney Aircraft division, United Aircraft Corp., announced an initial \$10-million Navy order for 264 of the J-48s to power Grumman F9F-5 fighter planes. Since the first J-48 order, P&W has received a \$9.8-million order for J-48 and J-42 engines.

The 6250-lb.-thrust engine (dry rating at sea level) has already flown in the

F9F-5 Panther, and in the North American F93A swept-wing penetration jet fighter, developed for the USAF.

► **Afterburner**—For brief bursts the huge afterburner pipe with ramjet effect added to the basic engine gives it a phenomenal increase of power beyond the dry rating to around 8000-lb. thrust. This flash power is achieved at fuel consumption approximately twice that of operation without the burner on the ratio of pounds of fuel to pounds of thrust.

Besides completing more than 20 successful flights in the USAF and Navy jet fighter prototypes, the J-48 has completed 1800 hr. of ground test runs including two 150-hr. endurance tests for military rating, and has delivered "considerably more" than its guaranteed

ratings, with and without afterburner, the manufacturer stated.

► **Anglo-American**—The engine traces its ancestry to British as well as American engineering skill, as a combined development of Rolls-Royce Ltd. of England, and the American Pratt and Whitney division. It is the second combined development of the two firms, preceded by the Pratt & Whitney J-42 Turbo-Wasp, developed from the Rolls-Royce Nene. The Tay is Rolls-Royce's counterpart of the J-48.

Gwinn said that he expected the engineering cooperation would continue on subsequent engines between the two firms. Rolls-Royce has not yet fitted an afterburner on its Tay which has the same 6250-lb. dry rating but Pratt & Whitney will make the engineering data available if the British want it. The Tay is scheduled for installation in an experimental British jet transport but has not yet flown in a primary installation.

► **Half-Inch Larger**—The new engine is only a half-inch larger in diameter (50 in.) than its predecessor the J-42 which has a basic dry rating of 5000 lb. and a 5750-lb. thrust rating with water injection.

Pratt & Whitney reported that the J-42 was tested in a Panther against another Grumman Panther powered by "another American-built engine also of basic British design" (Allison J-33) and that the J-42 powered Panther "decisively outclimbed its contestant to both 30,000 and 40,000 ft." The tests were conducted by Grumman and the Navy.

► **2000 Lb.**—Length of the J-48 without afterburner is 8 ft. 10½ in. But the addition of the big "reheater" nearly doubles the length of the powerplant. Weight is reported at less than 2000 lb. presumably also without afterburner.

Like its predecessor, the J-42, the new engine is a centrifugal-flow type with single-stage compressor. It has double-faced impeller and has double air entries, a single-stage turbine and nine combustion chambers.

► **Model Changes**—Improvements over the earlier model are in redesign of the impeller to compress the air, longer turbine blades to enable the engine to consume 30 percent more air, and higher fuel injection pressures at the combustion chambers than are found in any other American jet engine.

► **Eyelids**—Primary new interest of the J-48 is in the afterburner. Additional fuel nozzles in the reheat tube squirt gasoline into the engine's incandescent exhaust gases to produce additional thrust. Simultaneously as the afterburner is lighted, a partial enclosure at the exhaust end of the afterburner described as the "eyelids" is thrown open by hydraulic pressure to give greater exhaust area. The eyelids are closed again to reduce the exhaust area, as the afterburner is shut off.



INSTALLATION has been tested in F9F-5 Panther, similar to this tip-tanked F9F-2.

An ingenious additional use for the eyelids arrangement, AVIATION WEEK learned, is to slow a jet fighter, while using normal power. If the eyelids are opened under normal power condition, thus increasing the exhaust area, the airplane will instantly lose probably from 20 to 30 percent of its thrust, a useful trick in slowing down approaches, and perhaps under certain combat conditions.

► **Shorter Burner**—The North American F-93A is the only plane flying with the full-sized afterburner installation, as the Grumman F9F-5, a smaller plane, uses a shorter afterburner to hold total dimensions approaching those of the J-42 installation in the Panther.

A third plane in which the J-48 is expected to fly soon is the Lockheed F-94B night fighter.

► **Full Scale in Summer**—At the present, pre-production engines are undergoing ground and flight testing, while semi-production engines are being put together, with full-scale production scheduled to begin next summer, when production tooling of the 12,000 special tools required to make the J-48 is completed.

Interchange of technical data between the British and American firms involved frequent visits by personnel of both companies. Credited with principal engineering work on the J-48 development are Gwinn and Willard Gorton, in charge of turbojet engineering; Wright Parkins, engineering manager; William Brown, project engineer; and Rudy Yaros, Pratt & Whitney liaison representative at Rolls-Royce. E. W. Hives, Rolls-Royce managing director, and Ray N. Dorey and Cyril Lovesey, Rolls-Royce development engineers, visited the plant in Hartford to assist in the project.

► **Closing Gap**—Gwinn described the combination of British and American engineering skills as "closing the gap" between his company and its American competitors—General Electric, Allison

and Westinghouse—despite a "three-to-five-year head start" which he attributed to Pratt & Whitney's wartime assignment to continue piston engine production while the others were in jet engine development.

Main changes between the J-48 and the Tay in addition to the afterburner, were use of American accessories; different control system; increased capacity of pumps; use of gasoline instead of kerosene, due to American military tactical requirements, and design to be "easy on the government stockpile of critical materials."

Martin 4-0-4 Deal Reported With TWA

Glenn L. Martin Co.'s battle with Consolidated Vultee for the lion's share of the postwar twin-engine transport market rapidly entered a new phase last week.

TWA reportedly had reached tentative agreement with Martin for around 30-35 Model 4-0-4 transports—the longer, more powerful version of the 2-0-2. Eastern Air Lines was close to signing for a like number of planes.

The 4-0-4 development, first revealed in AVIATION WEEK, Dec. 19, warms up the cold war between Convair and Martin for commercial airline business. Convair won the initial skirmish, selling around 115 planes to U.S. carriers, compared to 25 for Martin. Consolidated Vultee also sold more of its transports abroad.

► **Deliveries Next Year**—First deliveries of the 4-0-4 will probably go to TWA during 1951. But Martin has agreed to assemble a dozen nearly-completed 2-0-2s (which were on the Martin line when orders ran out) and lease them to TWA until the 4-0-4s are ready for delivery.

TWA and Eastern engineers have coordinated closely with Martin on the 4-0-4 project. The two carriers have

been able to agree on practically every detail in the basic plane except on the color scheme (AVIATION WEEK, Feb. 13). There was even a meeting of minds on the galley—a rarity in new transport sales history.

► **Greater Capacity**—The 4-0-4 is planned to seat 40-44 passengers instead of 36 for the 2-0-2s. This would be accomplished by adding 39 inches to the fuselage length. The new ship would have Pratt & Whitney R-2800-CB-16 engines rated at 2400 hp. with water injection.

Speed of the 4-0-4 probably will be no greater than the 2-0-2, but maximum gross weight is expected to rise from 39,900 lb. to about 42,750 lb. The 4-0-4 will be pressurized and have added fuel capacity, permitting longer-range operations than are carried out with the 2-0-2.

CAA Certificates New Lycoming Engine

CAA has certificated the new Lycoming 125-hp. four-cylinder Model O-290-D engine which is now being delivered to aircraft companies for three- and four-place planes.

Developed from the Model O-235-D engine, the new powerplant has a slightly larger cylinder bore and a better horsepower to weight ratio, S. B. Withington, general manager, Lycoming-Spencer division, Avco Manufacturing Corp. announced.

Engine will develop a maximum of 130 hp. at takeoff rpm. (2800), the manufacturer states. At normal cruising speed of 2250 rpm. fuel consumption is 7.3 gal./hr. Engine weighs 258 lb. with starter and generator, and has a displacement of 289 cu. in.

Other data for the new powerplant: Bore is 4.875 in.; stroke is 3.875 in.; compression ratio is 6.5 to 1; wet sump oil capacity is 8 qt.; engine uses either 73 or 80 octane fuel. Equipment includes two Scintilla magnetos, starter, generator and voltage regulator.

Correction

In the listing of aircraft manufacturing unions on page 43 of the Feb. 27 issue of AVIATION WEEK, workers at Republic Aviation Corp. were listed as being members of a local lodge of the International Assn. of Machinists. There is no union at Republic, although IAM again is trying to organize the workers after having lost one election, in September, 1948.

AVIATION WEEK regrets the error.

AIR FORCE CONTRACTS

AF Awards of Over \$100,000

An Air Force contract totaling \$2,071,801 for OQ-19A aerial target spare parts and data was received by Radioplane Co., Van Nuys, Calif., a listing of USAF contract awards for January has disclosed. Contract was dated Dec. 9, 1949.

Other contracts awarded in excess of \$100,000 include:

Aeronca Aircraft Corp., Middletown, Ohio, type C-2 maintenance stands, Jan. 11, 1950, \$136,772.

American Finishing Co., Memphis, waterproof fabric, Jan. 27, 1950, \$103,800.

Bell and Howell Co., Chicago, photographic lenses, Jan. 3, 1950, \$207,328.

Bendix Products division, Bendix Aviation Corp., South Bend, Ind., wheels and brakes, Jan. 23, 1950, \$572,901.

Boeing Airplane Co., Seattle, inspection, maintenance and operational modification of B-50-D, Jan. 20, 1950, \$500,000.

Compco Corp., Chicago, film reels and cans, Jan. 5, 1950, \$143,055.

Eastman Kodak Co., Rochester, paper, Jan. 19, 1950, \$101,330.

Eclipse-Pioneer division, Bendix Aviation Corp., Teterboro, F-1 and F-2 autopilots, Jan. 23, 1950, \$545,430; generator, aircraft, engine driven, regulators, voltage, 115 alternating current, single phase, spare parts, Jan. 23, 1950, \$360,982; oil pressure indicators, Jan. 25, 1950, \$101,495; fuel pressure indicators, Jan. 23, 1950, \$107,232; vertical gyros, type A-3, Jan. 5, 1950, \$618,410.

Everybody's Office Outfitters, Inc., Dayton, chairs, Jan. 15, 1950, \$111,696.

Gaveco Laboratories, Inc., New York, exciter regulators, Jan. 13, 1950, \$292,202.

General Electric Co., Syracuse, electronic component parts, Dec. 9, 1949, \$100,000.

Goodyear Tire & Rubber Co., Akron, wheels and brakes, Dec. 21, 1949, \$107,709; wheels and brakes, Dec. 23, 1949, \$216,216.

Goodyear Aircraft Co., Akron, development of molding die manufacturing process for forming plastic radomes, Dec. 28, 1949, \$122,392.

Haloid Co., Rochester, paper, Jan. 19, 1950, \$378,432.

Harvard College, Cambridge, personnel, facilities and materials and commence construction of a Mark IV calculator, Jan. 21, 1950, \$150,000.

Kollsman Instrument division, Square D Co., Elmhurst, N. Y., indicator, tachometer, type E-29, Jan. 18, 1950, \$144,082.

Lindberg Engineering Co., Chicago,

regulators and maintenance data, Jan. 4, 1950, \$126,560.

Loewy Construction Co., New York, erect forging presses and furnish necessary parts missing or not repairable, Dec. 8, 1949, \$999,700.

McDonnell Aircraft Corp., St. Louis, extension of ramjet rotor development program, Dec. 28, 1949, \$140,000; modification of a McDonnell XF-88 airplane S/N 46-525, Jan. 26, 1950, \$350,000.

Minneapolis-Honeywell Regulator Co., Minneapolis, E-6 autopilot, Dec. 22, 1949, \$488,571.

Nelson Herman Corp., Moline, Ill., maintenance parts for F-1 and F-1a heater, Jan. 9, 1950, \$131,678.

Phaotron Co., Pasadena, multimeter TS-353/U, Jan. 18, 1950, \$185,998.

Portabilt Structures, Inc., Janesville, Wis., field maintenance shelters, type B-2A, Jan. 18, 1950, \$173,076.

Reed Products, Inc., Milwaukee, air crew cap, jacket, trousers-heavy, Jan. 20, 1950, \$286,545.

Refinite Corp., Ralston, Neb., 90 water demineralizers, Dec. 23, 1949, \$316,035.

Sperry Gyroscope Co. division, Sperry Corp., Great Neck, L. I., N. Y., miniaturized airspeed control systems, Dec. 13, 1949, \$120,128.

Stevens, L. E. Co., Cincinnati, jet engine test stands at Ladd AFB, Alaska, Jan. 16, 1950, \$260,185.

Stott, Charles G. & Co., Washington, D. C., chairs and stools, Jan. 4, 1950, \$126,913.

Summers Fertilizer Co., Baltimore, fertilizer, Dec. 29, 1949, \$104,045.

Sylvania Electric Products, Inc., Emporium, Pa., services and production development to increase producibility of vacuum tubes, Jan. 5, 1950, \$248,250.

Thompson Products, Inc., Cleveland, spare parts for pumps and valves, Jan. 5, 1950, \$401,403.

U. S. Thermo Control, Minneapolis, type A-1 portable coolers, Dec. 29, 1949, \$431,381.

Vic Pastushin Industries, Inc., Hollywood, fuel tanks, Jan. 9, 1950, \$855,558.

Webster-Chicago Corp., Chicago, system-recording, system-play-back and services not to exceed 120 man days, Jan. 24, 1950, \$450,000.

Westinghouse Electric Corp., Dayton, alternators, 8 kva, Jan. 13, 1950, \$281,140.

Wright Aeronautical Corp., division, Curtiss-Wright Corp., Wood-Ridge, N. J., conduct industrial mobilization planning program with 3 licensees for R-1300-1 engines, Jan. 10, 1950, \$129,500.

Awards of Less Than \$100,000

Following contracts for less than \$100,000 were awarded by the Air Force in December. List of December contracts in excess of \$100,000 appeared in AVIATION WEEK, Feb. 13.

Abrams Instrument Corp., Lansing, Mich., stereoscopic, \$22,364; intervalometer, \$14,940.

Aerocrafts, Austin, Tex., hose fitting assembly, \$2256; safety belts, \$4696.

Aero-Motive Mfg. Co., Kalamazoo, Mich., spare parts for pumps, \$3570; spare parts for valves, \$4750.

Aero Supply Mfg. Co., Inc., Corry, Pa., spare parts for valves, \$7216; spare parts for valves, \$4087; misc. spare parts, gaskets, etc., \$1483.

Aero Products div., General Motors Corp., Vandalia, Ohio, two remote engine power lever positioners, \$19,997.

Aerquipl Corp., Jackson, Mich., hose fitting assembly, \$10,700; hose assembly, \$28,837; coupling half nuts, \$2880.

Aerovox Corp., New Bedford, Mass., capacitor, \$3289.

Ahlberg Bearing Co., Chicago, bearings, \$1328.

Air Associates Inc., Teterboro, N. J., aircraft hardware, \$2960; nuts, \$10,949.

Air Maze Corp., Cleveland, spare parts for cleaner and bracket assembly, \$11,273.

Aircraft Fitting Co., Cleveland, elbows, tees, etc., \$1228.

Aircraft Radio Corp., Boonton, N. J., transformer, \$1220.

Airsearch Mfg. Co., Los Angeles, starter, \$54,450; door actuator switches, \$7608.

Akeley Camera, Inc., New York, magazines, \$9417; tachometer field tester, \$1229; intervalometers and spares, \$50,165; portable field type tachometer tester, \$1200.

Alar Products Inc., Cleveland, regulators and conversion to regulators, \$27,012.

Alaska Fur Co., Seattle, wolf strip fur, \$9407.

Allied Control Co., Inc., New York, relays, \$3370.

Aluminum Co. of America, Washington, D. C., aluminum alloy rod and bar, \$4862.

American Blower Corp., Detroit, electric-motor operated, multi blade-wheel centrifugal blowers, \$6846.

American Chain, Detroit, American Chain Cable Co., spare parts, truck tractors, \$9012.

American Coleman Co., Omaha, winterization kits for towing vehicles, \$42,591.

American Felt Co., New York, wool felt, \$2773.

American Gas Accumulator Co., Elizabeth, N. J., transformer, \$68,705; relays, \$1500.

American Inst. for Research, Pittsburgh, clarification of officer effectiveness report, \$24,750.

American Instrument Co., Inc., Silver Spring, Md., oscillograph, auto-collimator extensometer extension, \$1928.

American Mineral Spirits Co., New York, fuel oil, \$1676.

American Transformer Co., Newark, transformers, \$9778; transformer, \$1600.

Ampro Corp., Chicago, spare parts for photographic equipment, \$3861.

Anso, Binghamton, N. Y., chemicals, \$15,138.

Anso Film Corp., Binghamton, N. Y., photographic film paper and kits, \$41,365.

Antenna Research Laboratories, Inc., Columbus, Ohio, automatic polar recorder, \$2950.

Appleton Electric Co., Chicago, lamp assembly, \$15,058.

Armour Research Foundation, Chicago, research on low temperature additives for aircraft engine lubricating oils, \$48,094.

Armstrong Cork Co., Lancaster, Pa., tape, \$6079.

Aro Equipment Corp., Bryan, Ohio, hydraulic pump, \$25,000.

Aronson Machine Co., Arcade, N. Y., towing and steering bar assembly, \$1397.

Auto Valve, Inc., Dayton, Ohio, drain valves, \$11,850.

Baron Steel Co., Toledo, Ohio, steel angle and plate, \$21,414.

Barry Corp., Cambridge, Mass., medium impact variable duration drop test machine, \$1750.

Bassick Co., Bridgeport, Conn., casters, \$7705.

Battelle Memorial Inst., Columbus, Ohio research and development on the delta seal design, \$16,985; investigations of compressive creep properties of aluminum columns at elevated temperatures, \$53,086.

Bausch & Lomb Optical Co., Rochester, N. Y., photographic projector spare parts, \$2000.

Beaumont Crandell Inc., Kansas City, Mo., aircraft protective shields, \$4054.

Belcrank Inc., Cincinnati, fuel cans and funnels, \$1539.

Bell and Howell Co., Chicago, miscellaneous photographic equipment, \$67,941; photographic spare parts, \$2869.

Bell Aircraft Corp., Buffalo, N. Y., development of hydraulic rotary seals, \$20,162; flight strain gage stress survey of all metal main rotor and blades, \$35,000; design and fabrication of adapter shaft assy., \$1008.

Bell Aircraft Corp., Niagara Falls, N. Y., additional studies to determine roll stability of Tarzon missile, \$3614; spare parts for H-13, \$3789; spare parts for H-12 and H-13 aircraft, \$37,000; spare parts for H-12 and H-13 aircraft, \$29,644.

Bendix Aviation Corp., Pacific Division, Hollywood, Calif., regulator assembly, \$16,807.

Bendix Products, South Bend, Ind., spare parts for misc. aircraft, \$38,722; development of synthetic rubber seals, \$11,759.

Bendix Radio, Towson, Md., socket, \$1956.

Bennett Feragen Inc., South Bend, Ind., bearings seals slinger, \$2734.

Biederman Motors Co., Cincinnati, spare parts for bearings, \$29,993; spare parts for truck tractors, \$17,190; spare parts for truck tractor and crane, \$42,257; spare parts for truck tractors, \$21,653.

Boeing Airplane Co., Seattle, kits for retroactive master changes, \$13,116; accelerated flight test program, \$49,920; spare parts for aircraft, \$5228; kits for installation of bomb bay tanks, \$7535.

Boston Auto Gage Co., Pittsfield, Mass., gage assembly, \$1729.

Bronson, Homer D Co., Beacon Falls, Conn., aircraft hardware, \$2880.

Browning Lab., Inc., Winchester, Mass., Ioran signal generators, sketches, drawings, spare parts, reports and maintenance data, \$3040.

Bruck Electronic Corp., New York, 10 mc band width oscilloscope, 25 micro-sec, 14 mc preamplifier, \$1110.

Budd Co., Detroit, spare parts for maintenance fuel service trailers, \$1110.

Buffalo Forge Co., Buffalo, N. Y., motor-driven horizontal reversing type binding roll, \$3910.

Bureau of Fed. Supply, Cleveland, filing cabinets, \$76,763.

Bureau of Standards, Washington, D. C., research covering effects of laminating pressure on low-pressure polyester glass fabric base plastic laminates, \$10,000.

California Research Corp., San Francisco, research and development of high temperature, non-flammable aircraft hydraulic fluid, \$59,500.

Cardox Corp., Chicago, spare parts for Class 150 crash fire trucks, \$35,780.

Carlson, Oscar F. Co., Chicago, automatic light control board, \$1472.

Carnegie Ill. Steel Corp., Cincinnati, steel angle and plate, \$3991.

Cannon Electric Development Co., Los Angeles, solenoid assembly, \$4909.

Chandler Evans, Hartford, Conn., spare parts for pumps, \$48,885; spare parts (pump), \$3358.

Chase Chemical Co., Newark, chemicals, \$24,564.

Chicago Aerial Survey Co., Chicago, speed control units and spares, \$66,317; misc. spare parts for photographic equipment, \$48,926.

Cine Devices Inc., New York, motion picture printer, \$19,417.

Cine Products Supply Co., Haddon Hts., N. J., misc. photographic equipment, \$60,809.

City Chemical Corp., New York, chemicals, \$19,652.

Clare, C. P. and Co., Chicago, relay, \$1742.

Clayton Mfg. Co., El Monte, Calif., pressure vapor cleaner, \$6925.

Cogan Gordan Co. Enterprises, N. Hollywood, Calif., chemicals, \$1192.

Cole Laboratories Inc., Long Island City, N. Y., chemicals, \$1666.

Collins Radio Co., Cedar Rapids, Iowa, communication receiver, \$1750.

Colonial Radio Corp., Buffalo, N. Y., electric products, \$29,612.

Conray Products, New York, chemicals, \$3487.

Consolidated Vultee Aircraft Corp., San Diego, Calif., training parts, tools and equipment, \$19,586; maintenance, \$5581; additional maintenance, \$5581.

Conway Camera Co., Chicago, lens, \$6610.

Cook Elec. Co., Chicago, Ill., recorder transcriber systems, \$34,970; technical data, \$2432.

Cook Research Laboratory, Chicago, bonding jumpers, \$16,500; magnetic tape recorders, \$13,822.

Cornell Aeronautical Laboratory, Inc., Buffalo, N. Y., services to investigate helicopter rotor blade flutter and fabrication of a model test rig in accordance with approved design, \$52,299.

Coxhead, Ralph C. Corp., Newark, N. J., composing machine, variety-type 20-in. carriage, Coxhead model, \$2487.

Crescent Film Laboratory, Chicago, training film, \$20,000.

Crouse-Hinds Co., Syracuse, N. Y., kit, \$13,246.

Curtis-Wright Corp., Woodbridge, N. J., investigation of machine methods in connection with machine steel alloy, \$40,000.

Danis, B. G. Co., Inc., Dayton, Ohio, additional work in connection with installation of wood block flooring, \$8700.

Davidson Rubber Co., Charleston, Mass., sponge rubber, \$1155.

Delcon Co., Los Angeles, nuts, \$33,950; aircraft hardware, \$31,248.

Denison Engineering Co., Columbus, Ohio, hydraulic pump, \$15,000.

Designers for Industry, Inc., Cleveland, miniaturization and mechanized assembly of automatic volume control, \$4803.

Deutsch Co., Los Angeles, hardware nuts, \$1001.

Dictaphone Corp., New York, dictaphone model, \$7844.

Donaldson Co. Inc., St. Paul, spare parts for ground vehicles, \$1524.

Douglas Aircraft Co. Inc., Santa Monica, Calif., spare parts for aircraft, \$12,444; spare parts for maintenance of aircraft \$7739; spare parts for maintenance of aircraft, \$2631; spare parts for maintenance of aircraft, \$18,792; spare parts for aircraft for Turkish aid program, \$1642; technical representatives overseas, \$55,000.

Dow Corning Corp., Midland, Mich., pressure silicone-engineering reports, \$31,505.

Dumont, Allen B. Laboratories Inc., Clifton, N. J., primary power cathode ray oscillograph, \$1705.

Dupont, E. I. De Nemours, Wilmington, Del., photographic film paper and kits, \$56,194.

Dzus Fastener Co., Babylon, N. Y., cowl-ing fasteners, \$1359.

East Coast Aeronautics Inc., Mt. Vernon, N. Y., isolators, shock absorbers, shipping instructions, \$1489.

Eastern Rotocraft Co., Willow Grove, Pa., design, fabricate and test rigid tow bar, \$7337; design, fabricate and test tow releases, \$5767; tie-down device, \$5800.

Eastman Kodak Co., Rochester, N. Y., photographic film and paper, \$12,038; film and paper, \$7985; chemicals, \$18,523; oscillograph and linagraph paper, \$1531; misc. photographic equipment, \$2066.

Eaton Mfg. Co., Detroit, fuel pump, \$3125.

Eclipse Pioneer, Teterboro, N. J., pressure indicators and transmitter, \$27,621; torque pressure gage system, \$28,386; vertical gyro indicators, \$17,250; generator voltage regulators, engineering maintenance data, \$5938; spare parts for pressure indicators and transmitters, gyro balancing stand, \$3966; procurement for components for fuel metering systems required for modification of fuel systems, \$4303.

Edgerton Germeshausen Grier, Cambridge

Mass., stroboscope lamps, \$4026.

Ednalite Optical Co., Peekskill, N. Y., filters holders, \$1804.

Edwal Laboratories Inc., Chicago, research and development program for the catalytic method of producing hydrazine, \$21,700.

Eisemann Magneto, Cleveland, misc. spare parts assemblies and sub-assemblies, \$2500.

Elastic Stop Nut Corp. of America, Union, N. J., aircraft hardware, \$27,761; nuts, \$5474.

Electronic Transformer Co., New York, N. Y., transformers, \$1462; coil reactor, \$2800.

Engineering Mfg. Co., Sheboygan, Wis., drawing tables, \$53,134.

Essex Corp., Logansport, Ind., motor relay, \$1066.

Fafair Bearing Co., New Britain, Conn., bearings, \$2098; ball bearings, \$3098.

Fairchild Aircraft, Hagerstown, Md., spare parts for aircraft, \$64,499.

Fairchild Camera & Instrument Corp., Jamaica, N. Y., gun cameras, \$30,500; heater filter, \$1654.

Fairmont Chemical Co., New York, chemicals, \$3383.

Fameo Machine Co., Racine, Wis., foot-power gage squaring shear, \$1594.

Federal Motors Truck Co., Detroit, truck tractor, \$70,244.

Federal Prison Industries Inc., Washington, D. C., waste baskets, \$4965.

Fenwal, Inc., Ashland, Mass., thermo switches, \$1375.

Firestone Tire and Rubber Co., Akron, Ohio, airplane casings and tubes, \$45,830; airplane casings, \$48,941.

Ford Instrument Co., Inc., Long Island City, N. Y., single phase self synchronous motors, \$1,455.

Frampton Electric Equipment Co., Dayton, Ohio, radiator \$3000; misc. spare parts, washer, etc. \$1291.

Frankle, Joseph E. Co., Philadelphia, chamols, \$1617.

Franklin Institute, Philadelphia, services and materials in connection with adaptation of V-2 and other high altitude missiles for upper air experiments, \$24,000.

Freed Radio Corp., New York, recording device, \$72,516.

Gardonyl Eugene Co., New York, furnish missing parts and essential spare parts for 63000 Mkg. swaging hammer, one 4500 trim press and one 2500 trim press, \$47,260.

Garwood Industries, Wayne, Mich., spare parts for maintenance of M-2 Cletrae tractors, \$2354.

Gas Turbine Division, Westinghouse Electric Corp., Essington, Pa., misc. spare parts, assemblies, sub-assemblies and services for engines, \$14,835.

Gaveco Laboratories Inc., New York, control pulleys, \$1150.

Gebhardt, A. L. Co., Milwaukee, leather, cattlehide leather strap, russet, \$9549.

General Automotive Supply, Scranton, Pa., hydraulic valve, \$6390.

General Cable Corp., Cincinnati, Ohio, cable, \$59,625.

General Electric Co., Dayton, Ohio, electronic kits, \$3150; transformer, \$3,225; regulator and maintenance data, \$7960; switch, \$6000; photographic lamps, \$81,896.

General Electric Co., Newark, N. J., motor generator set, \$2051.

General Electric Co., Schenectady, N. Y., tachometer shafts for turbo superchargers, \$2679; regulators, \$2400; indicator tachometers, \$11,078; voltage regulator 120 VDC, \$30,000; indicator, \$5850; firing control boxes, \$13,374; alternator drive governors, dry sump drives, \$29,833.

General Electric Co., Syracuse, N. Y., switch assembly solenoid, \$21,750; AC induction motors, \$5271; power plate transformers, \$2846; amplifier sub-assembly cable mixer, \$3395.

General Electric Supply Corp., Dayton, Ohio, switches and receptacles, \$7786.

General Tire and Rubber Co., Akron, Ohio, aircraft casing and tubes, \$10,362; airplane casings, \$77,436.

Giannini, G. M. and Co., Inc., Pasadena, Calif., differential pressure transmitters and linear accelerometers, \$2590.

Gibbs Mfg. and Research Corp., Janesville, Wis., Antenna Assembly, \$9465.

Gillman Bros. Inc., Los Angeles, mirror assembly, \$5772.

Globe Wernicke Co., Washington, D. C., weather station fixtures, \$67,036; tabulating card cabinets, \$6520.

Goodrich, B. F. Co., Akron, Ohio, selection of spare parts, \$73,130; spare parts for aircraft, \$23,795; spare parts for aircraft, \$39,658; nose wheels, \$1910; rivets, \$1180; airplane casings, \$32,365; airplane casings, \$48,941.

Goodyear Aircraft Corp., Akron, Ohio, aircraft canopies, \$16,261.

Goodyear Tire & Rubber Co., Inc., Akron, Ohio, spare parts for wheels and brakes, \$6941; services to deliver a magnesium alloy aircraft landing wheel center forging process, \$48,710; wheels, brakes and spare parts, \$43,235; casings and tubes, \$3058; airplane casings, \$89,175; wheels and spare parts, \$1808; airplane casings and tubes, \$95,672.

Gordon Strube Air Industries, Burbank, Calif., misc. spare parts heater-gun turret motor computer, etc., \$1098.

Graf, V. I. Co., N., Baltimore, Mich., elbows, tees, etc., \$7897.

Graflex, Inc., Rochester, New York, misc. photographic equipment, \$1487; spare parts for photographic equipment, \$1267.

Grant Photo Products, Inc., Cleveland, Ohio, photographic paper, Aviation, Navy, 1950, \$44,045.

Graybar Electric Co., Dayton, Ohio, tower, \$4092.

Greer Hydraulics Inc., Brooklyn, N. Y., starter assembly stand, \$13,306.

Hamilton Standard Propellers, Hartford, Conn., results of ground and flight tests on vibratory stress survey of Hamilton Standard model constant speed propeller on airplane engine, \$40,000.

Hansen-Lynn Co., Inc., Burbank, Calif., technical data, \$2319.

Hartman Electrical Mfg. Co., Mansfield, Ohio, reverse current cut-out, \$20,788.

Harvard Col-Pres-Fellows, Cambridge, Mass., computation services for the solution of various air force research problems on the Mark 1 automatic sequence, \$82,192.

Haskel Engineering Supply Co., Glendale, Calif., technical data, \$1278.

Heil Co., Milwaukee, maintenance parts for fuel servicing trailers, \$19,276.

Hercules Motors Corp., Canton, Ohio, shaft and impeller assembly, \$3881.

Hoffman, P. R. Co., Carlisle, Pa., electrodes for radio crystal, \$8235.

Homelite Corp., Ft. Chester, N. Y., spare parts for maintenance, \$3575.

Houghton, E. F. and Co., Philadelphia, packing rings, \$1086.

Houston Corp., Los Angeles, conversion kits, \$8711.

Hughes Aircraft Co., Culver City, Calif., spare parts for B-29 and B-50, \$5925; study of loss of aircraft hydraulic system fluids, \$31,540.

Hunt, Philip A. Co., Brooklyn, N. Y., chemicals, \$19,290.

Hucon Mfg. Co., Pasadena, Calif., research and development required to improve performance of high pressure air compressor, \$22,744.

Hydrographic Office, U. S. Navy Dept., Washington, D. C., chart, 200 copies of each, \$12,000.

Ideal Electric & Mfg. Co., Mansfield, Ohio, cubicle aircraft data and basic handbook data, \$23,650.

Industrial Precision Prod. Co., Chicago, aircraft hardware, \$1116.

Industrial Timer Corp., Newark, N. J., high speed control unit, \$2200.

Institute of Textile Tech., Charlottesville, Va., parachute fabric study, \$23,700.

Islip Radio Mfg. Corp., Islip, N. Y., power transformer, \$1164.

Jack & Heintz Precision Industries, Cleveland, inverter assembly, \$64,610; engine driven generator Engineering and maintenance data, \$99,283; spare parts for accessory power plants, \$6957.

Jackson and Moreland, Boston, handbook on aircraft armament, \$15,000.

Jackson Electric Instrument Co., Dayton, Ohio, portable dynamic output tube tester, \$7005.

Jackson, Keene S., S. Pasadena, Calif., combining glass for gunsight, \$2340.

Jacobs Aircraft Engine Co., Pottstown, Pa., spare parts assemblies and sub-assemblies for engine installed in aircraft, \$2752.

Jamestown Metal Corp., Jamestown, N. Y., weather station fixtures, \$70,535.

Jumbo Steel Corp., Azusa, Calif., multi-level service stands, \$34,800.

Jumbo Steel Products Co., Azusa, Calif., tail wheel tow fork assembly, \$1932.

Kay Electric Co., Pine Brook, N. J., Mega match noise diode, \$1810.

Kings Electronics Co., Brooklyn, N. Y., cord, \$7240.

Kinney Mfg. Co., Boston, rotary type stationary vacuum pump, \$3171.

Kinsey, E. A. Co., Inc., Cincinnati, gap, engine, geared head, \$15,122.

Kinsey Optical Co., Washington, D. C., vertical binocular stereoscopic microscope, \$3317.

Kinsman Optical Co., Washington, D. C., microscopes and spare parts, \$3143.

Klein Painting and Decorating Co., Dayton, Ohio, additional labor for washing and painting windows, \$3900.

Kochler Aircraft Products, Dayton, Ohio, drain valves, \$4700.

Kollsman Instrument Div., Elmhurst, N. Y., spare airborne unit for wiresonde set, \$1680.

Korry Co., Seattle, light assemblies, \$1294.

Krouse Testing Machine Co., Columbus, Ohio, investigation of fatigue characteristics of extruded alloys, \$19,215.

Kunkle Valve Co., Ft. Wayne, Ind., safety valve assembly, \$1634.

L. A. B. Corp., Summit, N. J., package tester with non-synchronous and synchronous drives, with fence, \$1441.

Lambert Engrg. Co., St. Louis, Mo., photo-flash cartridge projector units, \$61,500; photographic projectors, \$25,910.

Lamson and Sessions Co., Cleveland, aircraft hardware, \$1472.

Lench Relay Co., Los Angeles, relays, \$2437.

Lear, Inc., Grand Rapids, Mich., material necessary to furnish two remote engine power lever positioners, reports covering progress of fabrication and testing, \$19,836; direct current actuators, \$14,274.

Leland Electric Co., Dayton, Ohio, collector rings, \$1323.

Lepel High Frequency Laboratory, New York, industrial electronic radio frequency induction heating machine, \$7250.

Lewis Engineering Co., Naugatuck, Conn., indicator, \$5674.

Libbey-Owens-Ford Glass Co., Toledo, Ohio, spare parts for B-50 aircraft, \$11,747.

Lieb-Jackson Co., Columbus, Ohio, additional water, steam lines, \$3317.

Lincoln Electric Products Co. Inc., Orange, N. J., panel board, \$3685.

Linear, Inc., Philadelphia, raskets, \$8968.

Lipe-Rollway Corp., Syracuse, N. Y., spare parts for truck tractors, \$5200.

Lite Mfg. Co., Inc., New York, jungle caps, \$11,640; field maintenance shelter, \$57,408.

Lockheed Aircraft Corp., Burbank, Calif., spare parts for C-121, \$80,000; maintenance bomb pylons and wing tips or wing tip modification parts, \$37,864; fabrication of spare parts for F-80 and T-33A aircraft, \$23,085; fabrication of spare parts for F-80 and T-33A aircraft, \$4988; spare parts for F-80 aircraft (five contracts), \$4674, \$50,000, \$22,650, \$7875, \$19,920.

M. C. Mfg. Co., Lake Orion, Mich., spare parts for pumps, \$31,167; lubrication system, \$30,355.

Majneri, Ludwig A., Grosse Point, Mich., hydraulic accumulator, \$1550.

Mallinckrodt Chemical Works, St. Louis, Mo., chemicals, \$15,942.

Malone Camera Stores, Inc., Dayton, Ohio, misc., photo equipment, \$3888.

Manhattan Lighting Equipment Co. Inc., New York, lamp assemblies, \$3069.

Manufacturing Co. Inc., New Haven, Conn., vibration exciter, \$6695.

Marine Aircraft Corp., Ft. Worth, Texas, stand assembly, \$54,620.

Marble-Rockwell Corp., Jamestown, N. Y., bearings, \$21,569.

Marquette Metal Products Co., Cleveland, Ohio, windshield wiper assembly, \$2070.

Marsh, Jas. P. Corp., Snokie, Ill., gaskets, diaphragms, \$6019.

Martin, Glenn L. Co., Baltimore, analysis of landing velocity measurement, \$11,590; flutter research, wing spoiler combination in AMC wind tunnel, and reports covering investigation, \$24,903.

Massachusetts Institute of Technology, Cambridge, Mass., continuation of studies and experimental investigations on validity and applicability of hydraulic analogy, \$15,520.

Master Vibrator Co., Dayton, Ohio, ammeter class 19-E, \$1200; spare parts for C-6 hoists, \$1279.

Mastercraft Metals Co. Inc., Dayton, Ky., modification of stainless steel photographic sinks, \$21,254; stainless steel wall cabinets, and floor cabinets, \$48,888.

McFarlane, Warren V., Brooklyn, N. Y., blueprint folding machines and parts catalog, \$7440.

McGill University, Montreal, Canada, services and materials for theoretical and experimental investigation

mental investigations on flush mounted antennae for plane cylindrical and conical surfaces, \$54,225; continuation of literature surveys on high and low temperature thermo-dynamics, \$19,000.

Oknonite Co., Chicago, cable, \$1785.
Old Colony Aviation, Inc., Vineyard Haven, Mass., folding refueling ladder, \$1710.
Ostranger Electrical Supply, New York, silicon carbide, \$1860.

Pacific Piston Ring Co., Los Angeles, tee elbow, \$7488.

Pacific Scientific Co., Los Angeles, cable disconnect assembly, \$3996.

Pan American Tool and Machine Corp., Dayton, Ohio, adapter, \$2670.

Parker Appliance Co., Cleveland, Ohio, gaskets, \$10,058; elbow adapters, \$1400.

Perkins, Prof. Courtland C., Princeton, N. J., consultant services, \$7000.

Pesco Products, Bedford, Ohio, Warner Corp., spare parts for pump assembly, \$82,516; hydraulic pumps, \$7140.

Pesco Products, Cleveland, Ohio, spare parts for pumps, \$51,343.

Petroleum Accessories Inc., Detroit, spare parts for fuel filter elements, \$12,420.

Phaostroon Co., Pasadena, Calif., antennas, etc., \$49,665.

Philadelphia Valve Co., Philadelphia, parts for valve assemblies, etc., \$18,048.

Phillips Mfg. Co., Chicago, vapor type degreasers, \$3635.

Photostat Corp., Rochester, N. Y., photographic paper, \$4335.

Pioneer Electric and Research Corp., Forest Park, Ill., Electrowriter, \$20,155.

Piper Aircraft Corp., Lock Haven, Pa., spare parts for L-4 aircraft, \$1028.

Plastic-Rubber Products Co., Los Angeles, gaskets, \$6594.

Polytechnic Research and Development Co., Brooklyn, N. Y., crystal and bolometer mounts, tunable 1-10 mc/s oscillator cavities, tunable frequency meters, slotted sections, \$4129; termination sections and probes, \$1650; variable wave guide attenuator, \$2528; tuner screw prod slide type, \$2010; slotted section precision wave guide, \$1300.

Post Frederick Co., Chicago, drawing tables, \$12,101.

Queen City Mfg. Co., Cincinnati, Coffin Co., spare parts frame assembly glass-windshield bumper retainer, etc., \$46,855.

RCA Victor Division Radio Corp. of America, Harrison, N. J., services and investigation directed toward development of 26 5 V audio power amplifier tube, \$27,394.
Radio Receptor Co. Inc., New York, amplifier, \$48,229.

Radio Plane Co., Van Nuys, Calif., rotary launchers for OW-19A targets, \$12,144.

Radio Shack Corp., Boston, input power transmitter, \$1150.

Raytheon Mfg. Co., Waltham, Mass., in-flight monitoring test, \$84,869.

Recordak Corp., Washington, D. C., microfilm camera, \$10,000.

Reed-Prince-Mfg. Co., Worcester, Mass., screws, \$1964.

Reeves Instrument Corp., New York, modification kits, \$50,700.

Remington Rand, Inc., Dayton, Ohio, tabulating files, \$7494.

Remington Rand, Inc., Washington, D. C., rental of tabulating equipment, \$2640.

Rensselaer Polytechnic Inst., Troy, N. Y., magnesium alloy research and development, \$25,687.

Reo Motors, Inc., Lansing, Mich., core and tank assembly, \$9450.

Republic Aviation Corp., Farmingdale, N. Y., repair of F-84 aircraft, \$14,169; kits of parts in accordance with installation of elevator bob weight, \$83,602; spare parts for F-84 aircraft, \$31,000; prototype installation for lowering elevator stick forces, \$22,236.

Republic Metal Co., Brooklyn, N. Y., solder, \$11,532.

Resistoflex Corp., Belleville, N. J., rubber refrigerant line, \$3202.

Reynolds Meta's Co. Inc., Louisville, Ky., aluminum alloy rod and bar, \$9912.

Rhodes Lewis Co., Culver City, Calif., gun heater heating element cartridges, \$3775.

Rhodes Lewis Co., Los Angeles, aircraft radome dollies, \$7500.

Robertshaw Thermostat Co., Youngwood, Pa., technical data covering actuator as-

sembly, \$4948.

Rockford Clutch, Rockford, Ill., engine clutch assembly, \$2970.

Rocky Mountain Steel Products, Los Angeles, technical data, \$1063.

Romee Pump Co., Elyria, Ohio, spare parts for pumps, \$9131.

Ruemelin Mfg. Co., Milwaukee, sand blast cabinet complete with exhaust and dust collector, \$2979.

Ryan Aeronautical Co., San Diego, Calif., spare parts for B-25J aircraft, \$85,000; spare parts for B-50 aircraft, \$54,000.

Ryan Industries, Inc., Detroit, change in draining system, \$3485.

Ryerson, Joseph T. and Son, Cincinnati, steel angle and plate, \$3523.

Ryerson, Joseph T. and Son, Chicago, stainless steel sheet, \$35,970.

Saval, Inc., Los Angeles, valve assembly, \$4924.

Schenuit, F. G. Rubber Co., Baltimore, airplane casings, \$77,477; airplane casings and tubes, \$42,930; airplane casings, \$40,298.

Schwien, L. N., Engrg. Co., Los Angeles, vacuum regulating valve, \$4530.

Security Steel Equipment Corp., Avenel, N. J., filing cabinets, \$24,488.

Semon Bache and Co., New York, misc. photographic equipment, \$3600.

Servomechanisms Inc., Mineola, N. Y., range servo adaptor units, test sets and drawings, \$32,758.

Shell Oil Co., Inc., New York, fabrication, construction and installation of a large ram-jet test facility, \$99,000.

Sherman Manson Corp., St. Marys, Ohio, tables, \$6383.

Sidney Machine Tool Co., Sidney, Ohio, geared engine lathes, \$96,819.

Simmonds Aerocessories, Inc., Tarrytown, N. Y., spare parts, control assemblies, \$4009.

Simmons Brothers Inc., Long Island City, N. Y., processing printing kit, \$72,069.

Slick Airways, Inc., San Antonio, Tex., transport 36 L-4 aircraft by surface means from contractor's facility to Port Houston, Tex., \$2952.

Small Motors, Inc., Chicago, contractors, \$33,000.

Smith, A. O. Corp., Milwaukee, inspect, rework, replate and rebalance of government furnished Spa-9-200 propeller blades, \$92,800.

Society of Motion Picture Engineers, New York, motion picture film strips, \$27,255.

Solar Aircraft Co., San Diego, Calif., spare parts for F-80 aircraft, \$25,000.

Sorenson and Co., Inc., Stamford, Conn., motor generator set, \$25,957; transformer, \$1916.

South Wind Division, Indianapolis, Ind., aircraft heater, \$3500.

Specialty Assembling and Packaging Co., Brooklyn, N. Y., container, \$3886; antenna coupler, etc., \$8766.

Sperry Gyroscope Co., Inc., Great Neck, N. Y., lapping machine ball race, \$3588; Sperry type Klystron tube, \$5458.

Sponge Rubber Products Co., Shelton, Conn., sponge rubber, \$1966.

Sprague Electric Co., North Adams, Mass., study directed toward development of a representative line of high temperature single cell capacitors, \$19,927.

Springfield Tent-Awning Co., Springfield, Ohio, seat cushions, \$5655.

St. Regis Paper Co., New York, N. Y., fibre rod and sheet, \$5772.

Standard Electric Products Co., Dayton, Ohio, knob lampholder connectors and resistors, \$1229.

Standard Felt Co., Alhambra, Calif., gray wool felt, \$42,782.

Standard Pressed Steel Co., Jenkintown, Pa., aircraft hardware, \$12,898.

Standard Products Co., Philadelphia, chemicals, \$10,053.

Standard Steel Works, N. Kansas City, Mo., spare parts for fuel servicing equipment, \$43,642.

Struthers-Dunn, Inc., Philadelphia, relay, \$20,126.

Sundstrand Machine Tool Co., Rockford, Ill., hydraulic pump development, \$39,600.

Sylvania Electric Products, Inc., Boston, components and modification of radar beacon, \$12,315.

Sylvania Electric Products Inc., Cleveland, photoflash lamps, \$55,656.

Taft-Pierce Mfg. Co., Woonsocket, R. I.,

export pack for plate-lapping, cast iron with cover, \$1667.

Taylor, Thomas and Sons Inc., Hudson, Mass., elastic cord, \$10,089.

Telesco Products Co., Chicago, multi-purpose sub-miniature beacon, \$6740.

Tension Envelope Corp., Kansas City, Mo., envelopes, \$8395.

Tensor Electric Development Co., Brooklyn, N. Y., portable, ac. and dc. volt-ohm-milliammeter, \$1290.

Thompson Products, Inc., Cleveland, centrifuges, \$25,000.

Thwing-Albert Instrument Co., Philadelphia, Tester Assembly, Electric Thermometer field type N-2, \$1075.

Timken Roller Bearing Co., Canton, Ohio, roller bearings, \$21,044.

Titellex Inc., Newark, N. J., misc. spare parts, assemblies and sub-assemblies, \$3000.

Torrington Mfg. Co., Torrington, Conn., ball bearings, \$1377; needle bearings, \$2125.

Trico Products Corp., Buffalo, N. Y., spare parts for C-2 and F-1 truck tractors, \$11,142.

Truck Body, Inc., Red Bank, N. J., modification of trailer, \$13,190.

United Aircraft Corp., Hartford, Conn.; research studies, transonic wind tunnel test sections, \$96,000.

U. S. Blue Print Paper Co., Chicago, drawing tables, \$7644.

U. S. Government Printing Offices Superintendent of Documents, Washington, D. C., publications, \$1469.

U. S. Motors Corp., Oshkosh, Wis., radiator assembly, \$4125.

U. S. Rubber Co., Detroit, Mich., airplane casings, \$91,209; airplane snow and ice casings, \$89,753.

U. S. Rubber Co., Mishawaka, Ind., spare parts for B-29 aircraft, \$9498.

U. S. Rubber Co., Maugatusck, Conn., development of room temperature setting, metal to metal structural adhesive, \$17,490.

Vickers, Inc., St. Louis, Mo., magnetic amplifier, \$7640.

U. S. Thermo Control, Minneapolis, spare parts for coolers, \$3611.

Universal Moulded Products Corp., Bristol, Va., rocket launching clusters, \$2146.

University of Rochester, Rochester, N. Y., research on human visual factors in aircraft instrument lighting, \$45,339.

Verona Chemical Co., Newark, N. J., chemicals, \$3150.

Viewtex Inc., Long Island City, N. Y., photographic projectors and manuals and repair kits, \$14,885.

Westinghouse Electric Corp., Pittsburgh, telemetering equipment and additional lamp plates, \$1754.

Wallace and Tiernan Products Co., Belleville, N. J., mercurial altitude barometer, \$21,250.

Weldenhoff, Joseph, Inc., Chicago, relay assembly cabinet, \$6386.

Weldon Tool Co., Cleveland, pump assembly, \$1289.

Western Electric Co., New York, WECO OSC amplifier, \$22,140; misc. parts and components, \$25,000; AC generator, \$2979; transformer, \$1113; attenuator, \$2735.

Western Felt Works, Chicago, graywool felt pad, 72 in. wide, \$6525.

Westinghouse Electric Corp., Dayton, Ohio, protection exciter relays, \$20,592; ARC portable welders, 300 Amp., \$11,463; induction heating electronic radio frequency machine, \$4864; DC motor, \$3195.

Westinghouse Electric Supply Co., Dayton, Ohio, bakelite receptacles, \$9207.

Weston Electric Instrument Corp., Newark, N. J., aluminum front, \$2140.

Whittaker, William R. Co., Los Angeles, spare parts for valves, \$31,859; fuel level control, \$9500.

Wilkening Mfg. Co., Philadelphia, spare parts, ring sets, \$3797.

Wilson Mechanical Instrument Co., New York, block and hardness testing machine, \$2475.

Wisconsin Motor Corp., Milwaukee, spare parts for trucks, tractors and fuel servicing equipment, \$12,354.

Workshop Associates Inc., Newton Highlands, Mass., parabolic reflector with K-band feed, \$1153.

Yawman-Erbe Mfg. Co., Washington, D. C., tables, \$51,526.

Zenith Carburetor, Detroit, carburetor assembly, \$13,458.

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ESSO AVIATION GASOLINE available at modern circular refueling islands shown in photograph.

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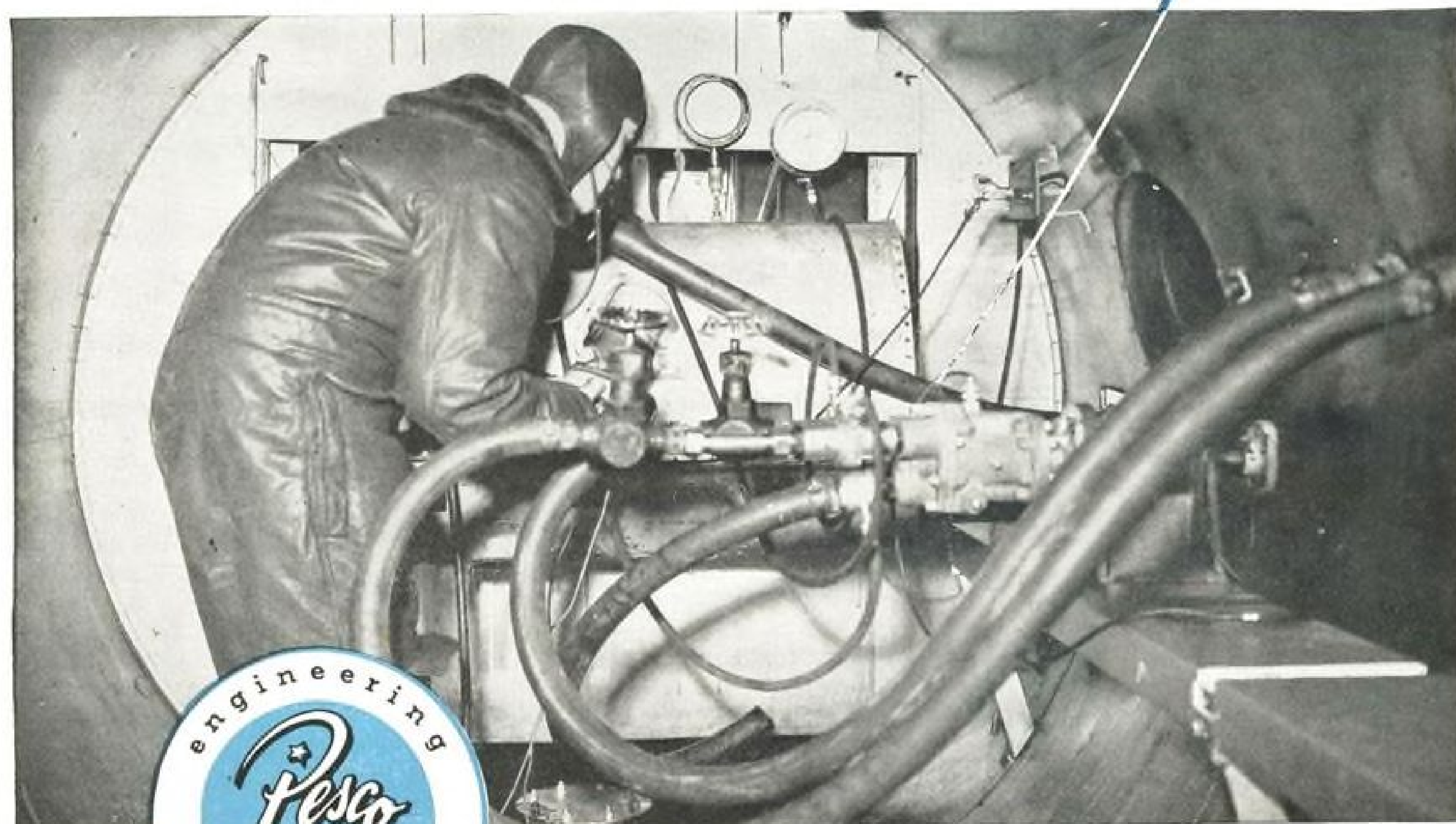
In Pesco's new fuel system test laboratory—a special building, specially equipped—Pesco engineers are constantly subjecting Pesco fuel pumps to operating conditions which reproduce perfectly the same conditions under which fuel pumps must perform in actual flight . . . conditions of abrupt altitude, temperature and pressure changes . . . changes even in the physical characteristics of the fuel.

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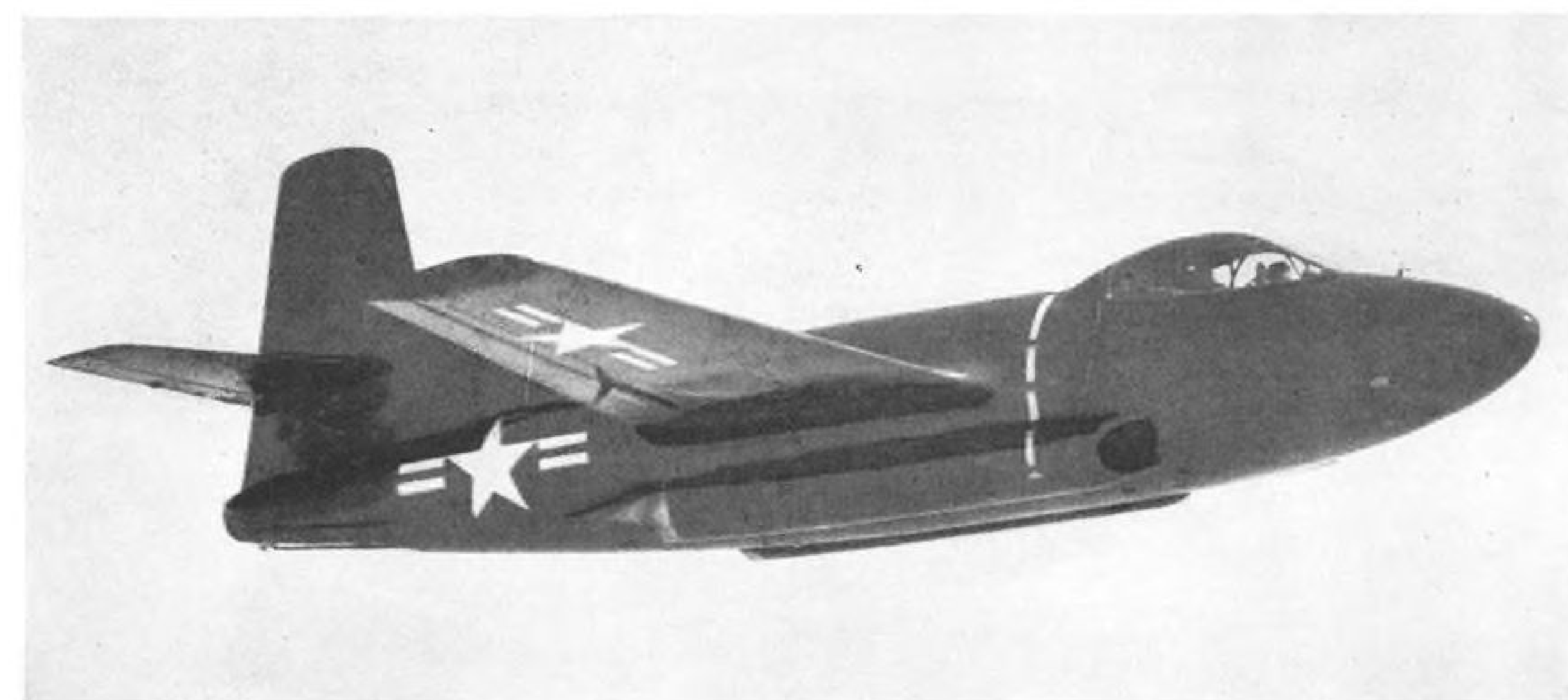
Looking inside the huge altitude chamber in Pesco's new fuel pump test laboratory building. Every extreme and normal atmospheric condition under which aircraft of today and tomorrow must operate can be simulated here.

Pesco Model 021077 high-pressure fuel pump. This unit has a capacity of 42 gallons per minute of gasoline at 750 p.s.i.



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AERONAUTICAL ENGINEERING



First Details of F3D Skyknight

Twin-jet, two-place, high-altitude, Navy night fighter designed to meet stiff requirements. Bailout is through tunnel to belly door.

By E. H. Heinemann*

Most night fighters have been converted from day fighters. But the Douglas F3D Navy Skyknight, from its inception, was designed strictly as a night fighter and is of the first vintage of jet propelled craft in this category.

Principal difference between day and night fighters is that the latter must depend on a large amount of radar equipment for vision in darkness and under adverse weather conditions.

This usually results in increased weight and lowered performance in comparison with day fighters. But despite this radar-weight penalty, performance of our night fighters must be superior to that of bombers developed anywhere. Anything else would be unacceptable.

The F3D was developed with such performance in mind. Conceived in 1945, it was built to operate against high performance bombers expected to be in evidence in the early '50s.

► **Requirements Stringent**—The original specification requirement for this aircraft came somewhat as of a shock to the designers. High speed requirements appeared to be completely incompat-

ible with those for a two-place cockpit arrangement and a large space forward of the cockpit for electronic night-fighting equipment. It was only after trying many arrangements of equipment, crew, fuel, and powerplants that the final arrangement for the F3D was chosen.

The Navy's wisdom in establishing such exacting design requirements has been well proven during the past year of testing, since it has been amply demonstrated that the airplane, engine, and radar combination can operate successfully above the 40,000-ft. level for which it was intended.

► **Basic Makeup**—In most respects the F3D's airframe is relatively conventional, employing a large percentage of 75S aluminum alloy and details of construction well-proven on other Douglas aircraft.

A nose-wheel landing gear was chosen for increased stability and safety during high speed takeoffs and landings. An auxiliary tail wheel was added to prevent tail structure damage during landings. Landing gear is retractable and hydraulically operated.

Speed brakes similar to those developed on the AD Skyraider type craft are extended hydraulically from the aft part of the fuselage.

► **No Tip Tanks**—All normal fuel is housed within the fuselage above the

engines, aft of the pilot's compartment. Auxiliary fuel is carried in drop tanks underneath each wing near the folding joints.

Considerable thought was given the installation of wingtip tanks. They were not utilized, however, because of the serious problem of obtaining the necessary lateral control with one tank empty, increase in wing weight resulting from landing loads with tanks full, additional complications of folding wings with tanks full, and the problem of filling tanks when wings are folded.

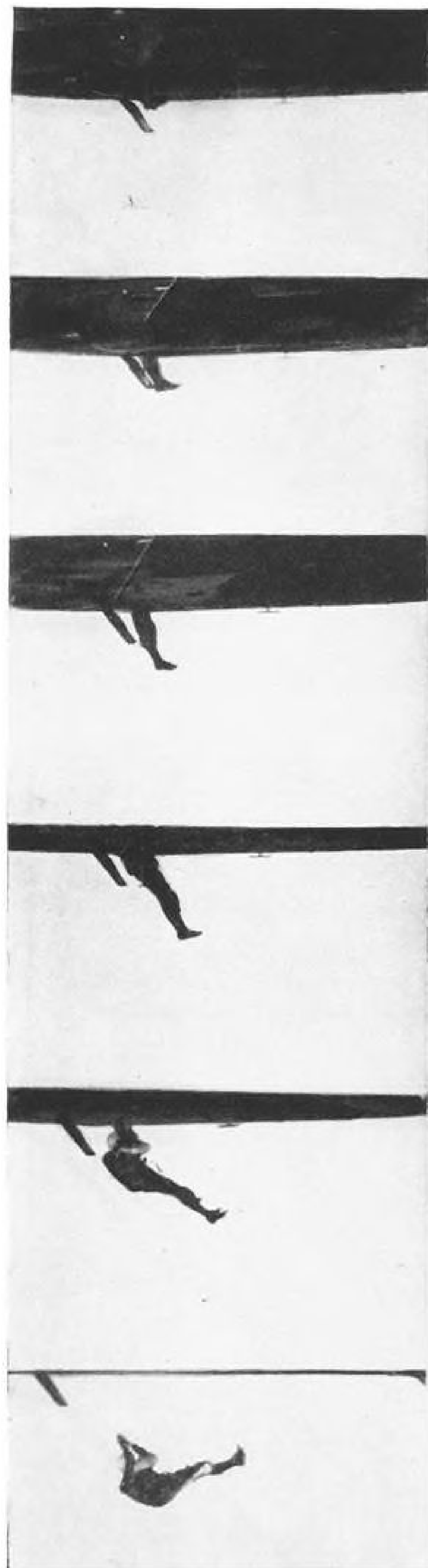
Provisions are made on the outer wing to carry bombs, rockets and other armament devices, in lieu of drop tanks, to increase the craft's versatility.

► **Engine Details**—Two Westinghouse J-34 jets were selected as the most suitable engines for this particular airplane arrangement. The powerplants are so mounted in the fuselage that after the removal of cowlings they can be lowered to handling trucks with a standard bomb hoist.

With this arrangement it is possible to obtain a complete engine change time of only 60 min.

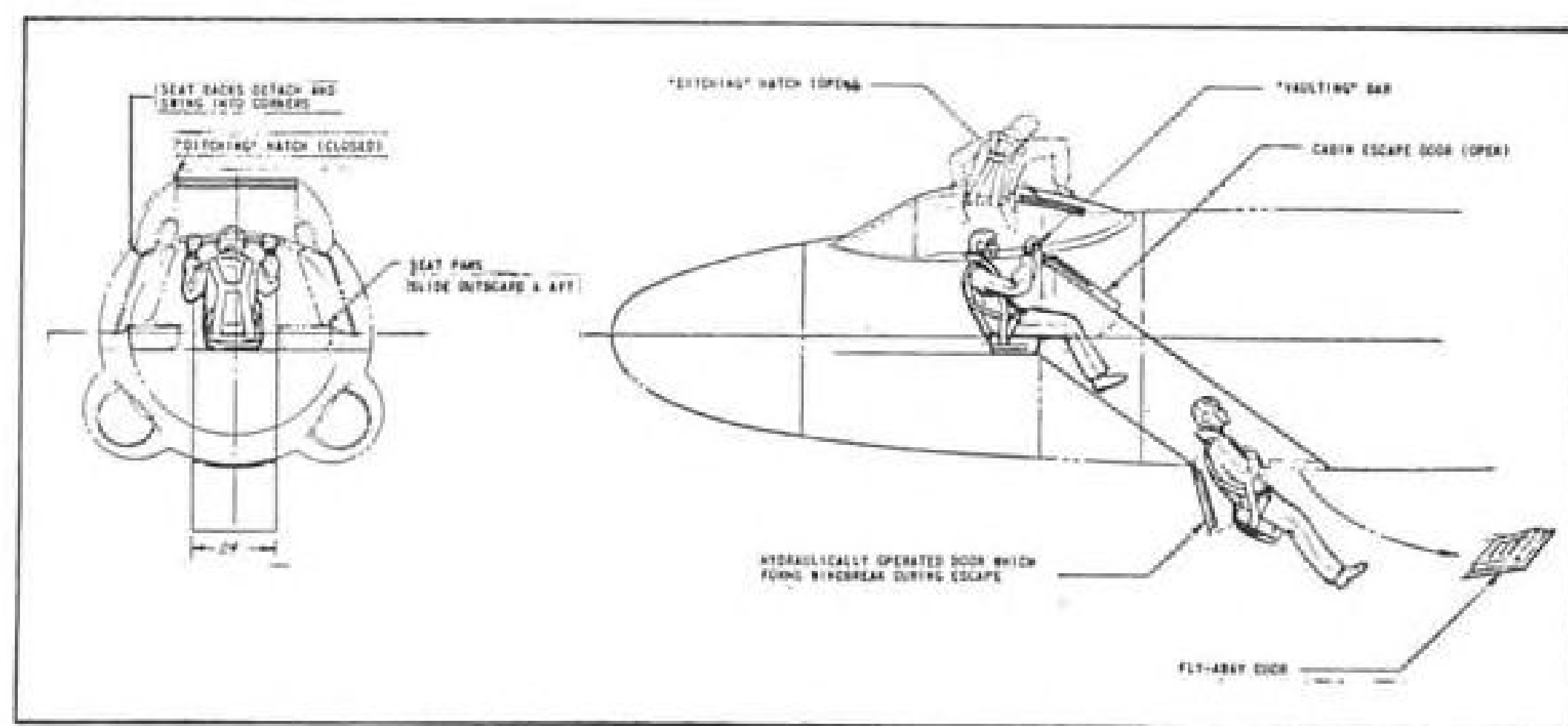
There was much concern, originally, over the possible loss of intake duct and tailpipe efficiency because of the semi-flush nature of the air intakes and skewed axes of the tailpipes. But after

* Chief engineer, El Segundo Plant, Douglas Aircraft Co., Inc.



a considerable amount of wind tunnel testing it was found that it was possible to obtain normal duct and tailpipe efficiencies with these arrangements.

► **Cockpit**—Cabin pressurization and cooling are provided by an AiResearch expansion turbine fed by the engine compressors.



Sketch (above) reveals F3D cabin details and escape procedure for pilot through exit tunnel. Sequence photos (left) show stages of pilot bailout through craft's belly door.

Cockpit arrangement is Navy standard, except as necessarily modified by the side-by-side seating.

All instruments and panels are red lighted indirectly. All secondary control handles resemble the components they operate.

Aerodynamicists will probably shudder at the large flat windshield, but after testing many windscreen arrangements, it was concluded that the one chosen offered the lowest possible drag to meet all requirements, including gun sighting and night vision.

► **Slide Out Bottom**—Aero-medical studies quickly showed that it would be impossible to bail out of an airplane of this performance, in the usual manner, without injury.

Jettisonable seats were first recommended and were considered the solution to the high-speed bail-out problem. But these seats involved additional objectionable weight, and had the disadvantage of requiring the cockpit enclosure to be sliding, hence much more subject to possibility of pressurization troubles.

Improved methods of egress were studied at great length, with the final conclusion that the safest means of escaping at high-speed would be to slide feet first, downward and aft, through an escape chute so arranged that its bottom door acts as a windscreen to break the free air blast.

This system recently has been tested extensively with many actual bail-outs. And as a result it is considered not only very successful, but a great improvement over jettisonable seats for aircraft in this speed range.

► **Antenna**—From the outset it was considered aerodynamically essential that all radar antennas be mounted within the airplane's normal contours. This required a considerable amount of antenna research, and the development of non-metallic structures such as the fuselage nose, fuselage tail, vertical tail tip, and dorsal fin, which house various forms of antennas.

While these laminated glass-cloth structures are considered satisfactory for the purpose intended, it is doubtful that this construction will be used extensively for parts that can be made of aluminum alloy.

When the Skyknight was conceived, calculations showed that the minimum combat radius requirements could barely be met. Very strict weight control was put into effect and extra tankage was provided so that extra fuel could be carried in the event guaranteed weights could be bettered.

So successful were these efforts that combat radius and performance in general have been improved to the point where the F3D Skyknight is comparable in many respects to contemporary day fighters.

Safer Blind Flying For Braniff Trainees

New blind flying equipment, developed by Bill Walner, assistant chief pilot for Braniff International Airways, is being used by DC-6 pilot trainees at the carrier's Dallas base.

Walner designed an eyeshade out of dime store eyeglasses with the lenses removed. Sheet metal workers at the base fashioned blinders for the glasses and a narrow shield to extend across the bottom of the student's windshield during training flights.

Formerly, a trainee used visors made of blue plastic, and orange colored plastic shields were fitted over the cockpit windows on his side. The polaroid effect of the colors limited his vision to the instruments.

This equipment, according to Walner, not only was cumbersome, but, because of the orange shields over the windows on the student's side, reduced visibility for the instructor riding in the copilot's seat.

With students wearing the new blinders, the instructor has normal view from all windows.

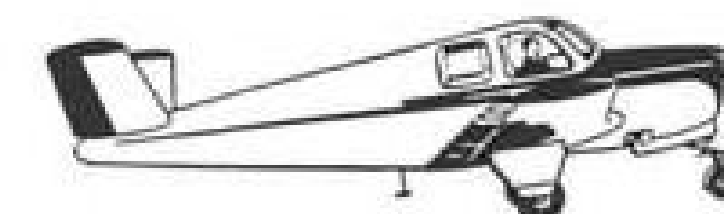
Features like these make this **NEW**



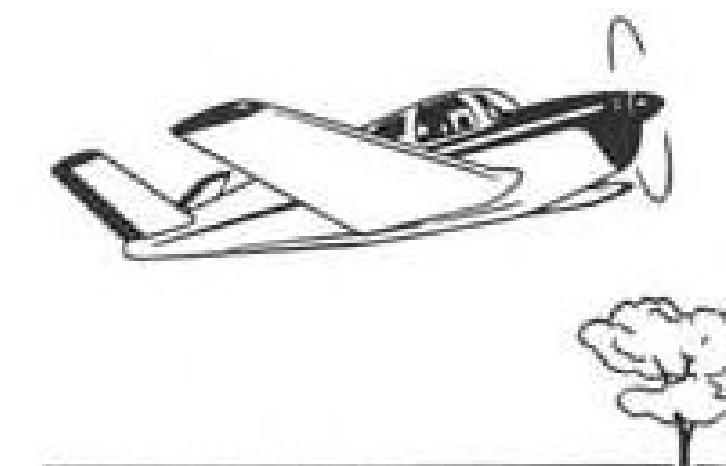
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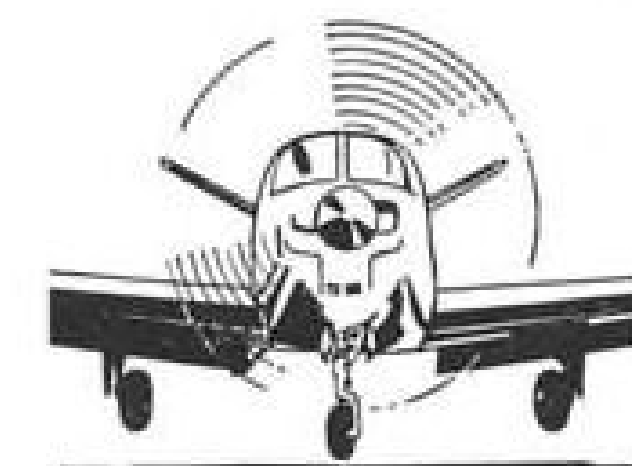
New Beechcraft propeller



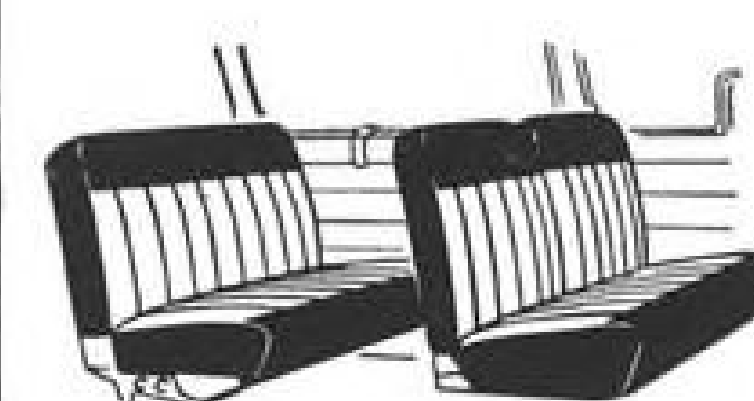
Increased take-off horsepower



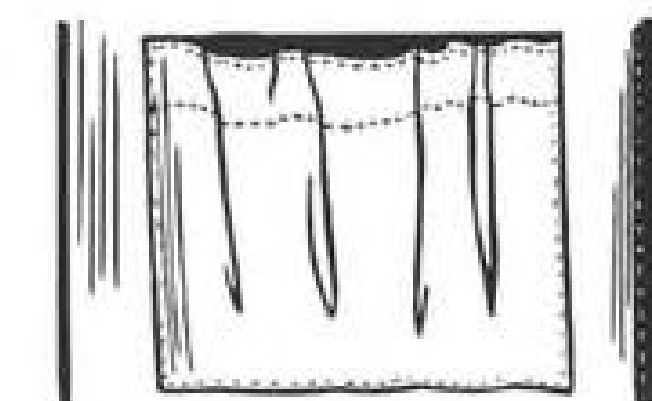
Faster-action landing gear



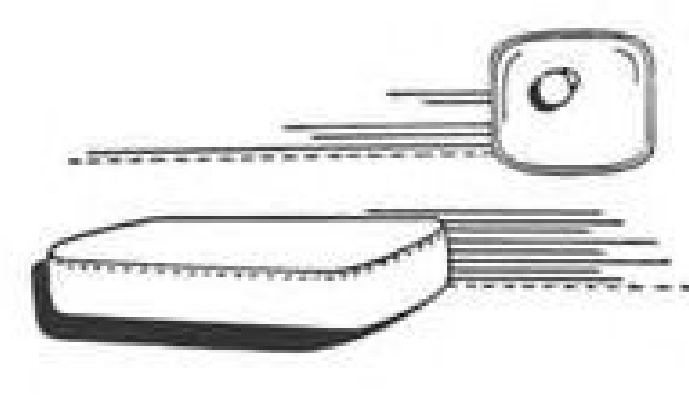
Increased, faster flap travel



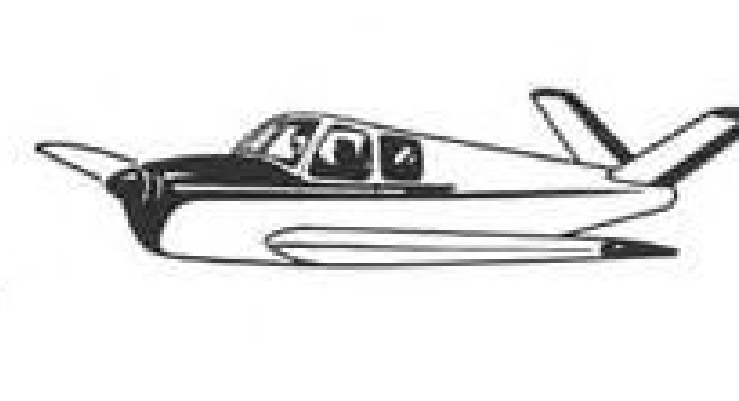
New upholstery combinations



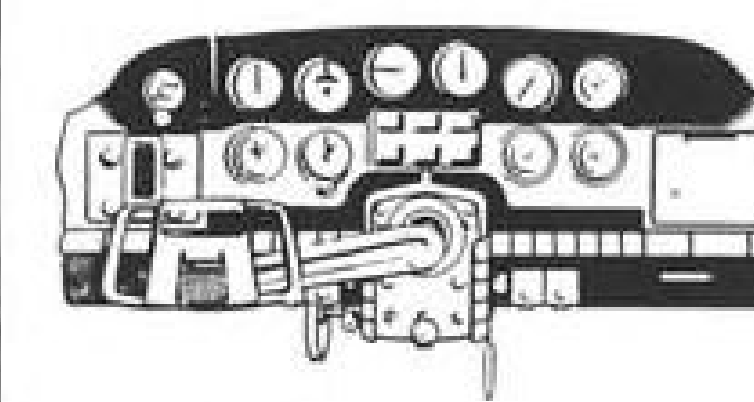
Three new map pockets



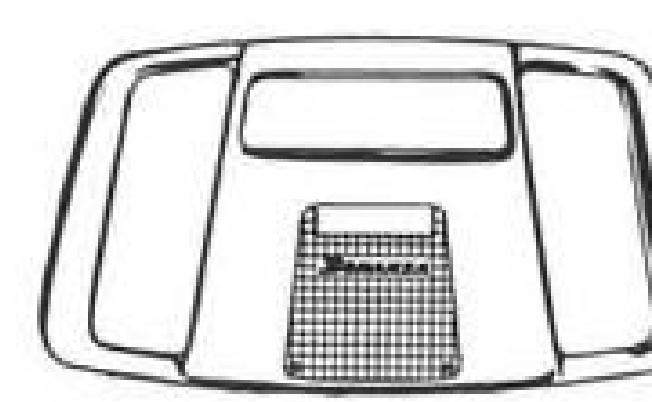
Four new arm rests



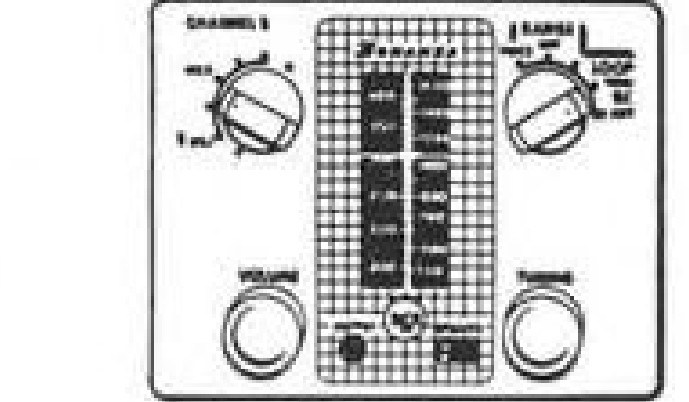
New exterior paint design



New instrument panel design



Safety-type control wheel



New radio with VHF channels



Access door for oil tank

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level! New operating conveniences and luxury appointments plus scores of refinements call for a personal inspection because there's room here to show only a few. See it! Get all the facts! You'll agree this greater-than-ever Beechcraft Bonanza is a better-than-ever value!



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The kid that once was you...

The boy in the window looks upward. His eyes are shining . . . his attention riveted on a plane in the sky.

As you watch him, you know he is not with you at all. He is piloting a plane through wind and clouds to the stars. He is no longer earth-bound—but a man with wings.

You know what he is thinking, for once you stood somewhere—in a window, at a school desk, on a hill—and had the same dream of glory.

It was the same dream, and yet it wasn't.

When you were a youngster, chances are your first love affair was with a wire-strutted Jenny, or later, with a Winnie Mae, or a Spirit of St. Louis. Today's youngsters are enchanted with a Buck Rogers world come true—sleek, streamlined rocket planes; planes without pilots; jet-propelled planes that fly faster than sound.

All of these are a part of modern aviation. It is a world fantastic beyond belief. And it becomes bigger and more incredible by the day.

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Why Crash Protection Is Needed

Analysis of military and transport safety standards and accidents pinpoint seat and belt design.

Adequate crash protection takes on increasing importance with the possibility of crash fire. When such fires occur, a delay of even a few seconds in evacuating the aircraft may prove disastrous.

Failure of seats and belts may result in injuries to the occupants, which render them incapable of escape without assistance, and, at the same time, the pile-up of broken seats and other furnishings will impede the efforts of rescue personnel. Even uninjured passengers may be completely trapped, or seriously hampered in their efforts to reach exits.

Aside from the physical aspects, the chaos resulting when seats and occupants are thrown around the cabin can add greatly to the danger of panic. Even the passenger who is not prone to panic may, under such conditions, have difficulty in orienting himself, and so be delayed in locating and using available exits.

Crashworthiness as it applies to private-owner aircraft has been dealt with extensively. Therefore, emphasis is placed here on transport planes and on military craft to the extent permitted by security regulations. Further reason for this emphasis is that completeness and form of the records in airline accidents make accurate analysis possible.

► **Requirements**—Crash load requirements of various civil and military agencies are summarized in the accompanying table.

The wide discrepancy in the values shown are immediately obvious. It is difficult to reconcile the 6 G requirement of the CAB for transport aircraft with the proposed Australian value of 25 G.

It is equally difficult to reconcile the 40 G of the U. S. Navy and the RAF with the 17 G of the USAF.

Another discrepancy difficult to understand is that between the CAB requirements for the transport and non-transport categories. While there may be a greater probability of an accident occurring to a personal plane than to a transport, does it follow that the crash will be of greater severity?

Certainly the differences in the requirements cannot be ignored, and indicate the need for a careful analysis of

the problem to determine sound criteria.

It should be noted, in this regard, that the Navy requirements were adopted in 1945, and the Australian transport requirement is currently proposed. This would indicate that the personnel responsible for these requirements had, on the basis of a comparatively recent study of the problem, concluded that crash protection of the magnitude indicated is required. The Australian memorandum recommending the 25 G requirement includes a complete study of the current literature on this subject.

► **Strength of Belts**—In order to evaluate the strength of existing safety belts under dynamic load, tests were conducted by the Naval Medical Research Institute on 61 new commercial belts meeting the requirement of CAR 15 for use by two persons. These belts had a rated strength of 2000 lb., as demonstrated in static tests.

In the drop tests, there were 4 cases in which attaching hardware failed, 2 where buckles failed, 2 in which buckle slippage occurred with resultant damage to the webbing, and 4 where no failure occurred.

The remaining 49 belts failed in the webbing. Percentage distribution of failing loads for these 49 belts is shown in Fig. 1. It should be noted that only 3 belts, or 6 percent of the total, failed at less than 2300 lb., and only 7 belts, or 14 percent, at less than 2500 lb.

Sixty-one percent of the belts carried loads between 2500 and 3000 lb., and 25 percent failed at loads between 3000 and 3800 lb. Mean strength of all

belts tested was approximately 2800 lb.

While these tests were limited to "two-person" belts, it should be noted that the results indicate an apparent ratio of the strength in dynamic test to that in static test. It therefore seems reasonable to assume that the same ratio of dynamic to static test strength should obtain for belts rated at 1000 lb.

This would give a probability value of strength of 1250 lb., and a mean strength of 1400 lb., for "one-person" belts.

► **Record Analyzed**—An analysis has been made of CAB statistics on airline accidents for the 11-year period from Jan. 1, 1938, through Dec. 31, 1948.

While an Australian aviation medicine memorandum states: "... accidents in which cockpit or cabin is not collapsed or disintegrated should be regarded as 'survivable,'" for the purposes of this analysis the term "survivable" has been restricted to those accidents in which there were actually one or more survivors. (Some of the accidents thus inferred not to have been survivable may actually have been so under the broader sense of the term.)

During the period under consideration, there was a total of 49 fatal accidents, of which 23, or 47.9 percent, were survivable. Forty-five percent of the passengers and 62 percent of the crew were killed in the survivable accidents.

The distribution of the minimum percentage of fatalities in terms of the survivable accidents is shown in Fig. 2, and in terms of the total number of fatal accidents in Fig. 3.

Total number of passenger fatalities in all accidents was 672, of which 169 occurred in the survivable accidents. Hence, if it is assumed that adequate crashworthiness could have effected 100 percent passenger survival in the survivable accidents, there would have been a reduction of 25 percent in the total number of fatalities.

► **Fatality Rates**—Since the safety records of the airlines are computed in terms of passenger fatalities per 100 million passenger miles, the record would have been improved by this same percentage, and the mean rate for the period would have been 1.6 instead of the actual 2.2.

Fig. 4 shows the year-by-year reduction in the fatality rate which might have resulted from increased crash protection. The best airline safety records in the 11-year period were achieved in 1939 and 1946, when the rate was 1.2 fatalities per 100 million passenger miles.

But, had all occupants survived in the survivable crashes, the rate would have reached a low of 0.27 in 1939 and 0.36 in 1943. Such rates are directly comparable with those of the railroads.

Crash Load Requirements

Agency	Crash Load Factor	Remarks
U.S. Air Force	17 G	Ultimate
U.S. Navy	40 G	Ultimate, Introduced 1945
RAF	25 G	40 G Ultimate
CAB	6 G	Ultimate, Transport Category
CAB	9 G	Ultimate, Non-Transport Categories
Australian Dept. Civil Aviation	25 G	Presently Proposed

Based on a paper by William I. Stieglitz, design engineer—safety, Republic Aviation Corp., presented at the recent 18th annual meeting of the Institute of the Aeronautical Sciences, in conjunction with the Flight Safety Foundation, in New York City.

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- ✓ **EXCLUSIVE TWO-CONTROL** feature for smooth, effortless, coordinated control.

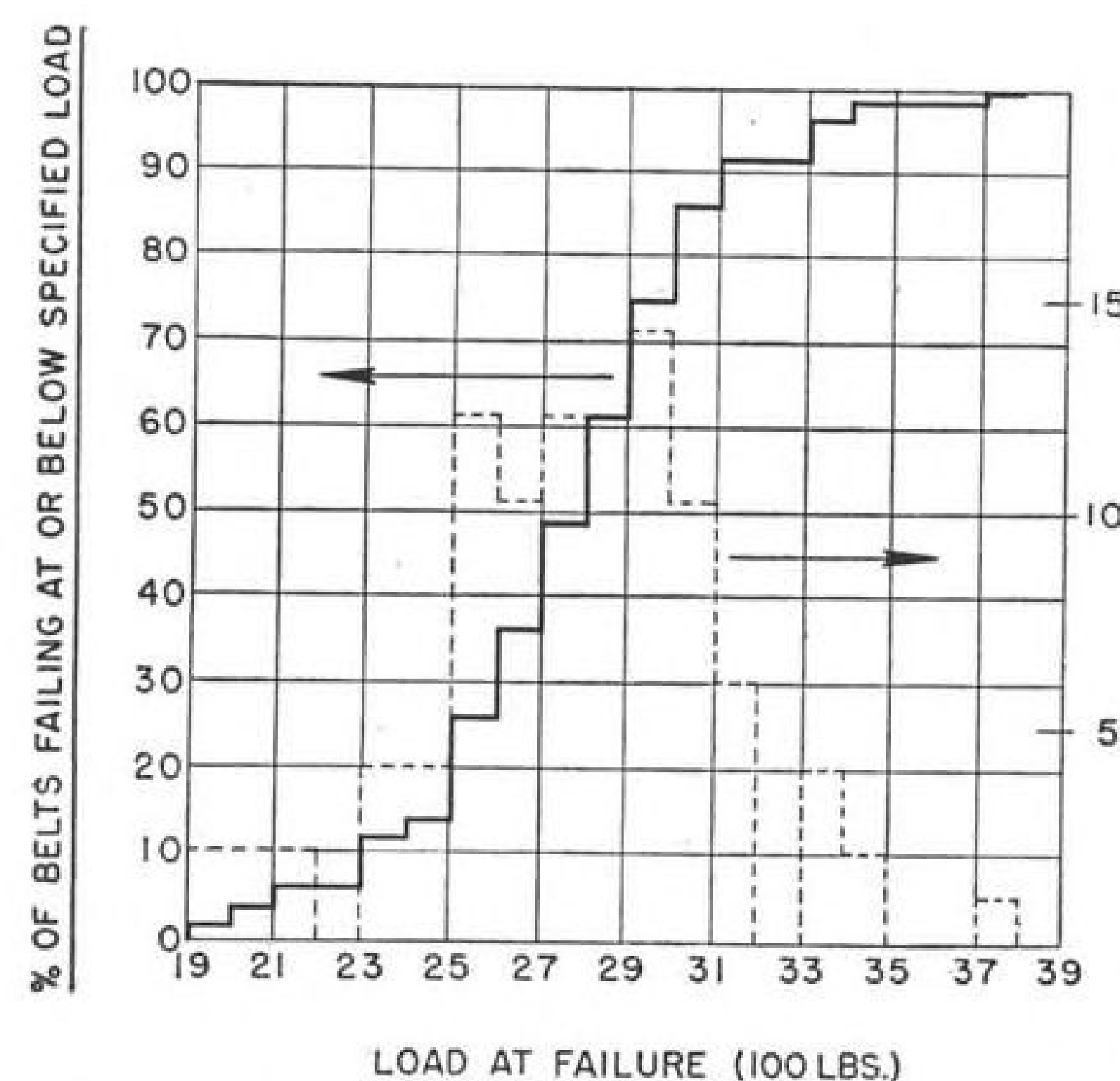


Fig. 1. Distribution of failing loads of forty-nine 2000-lb. belts in which the webbing failed.

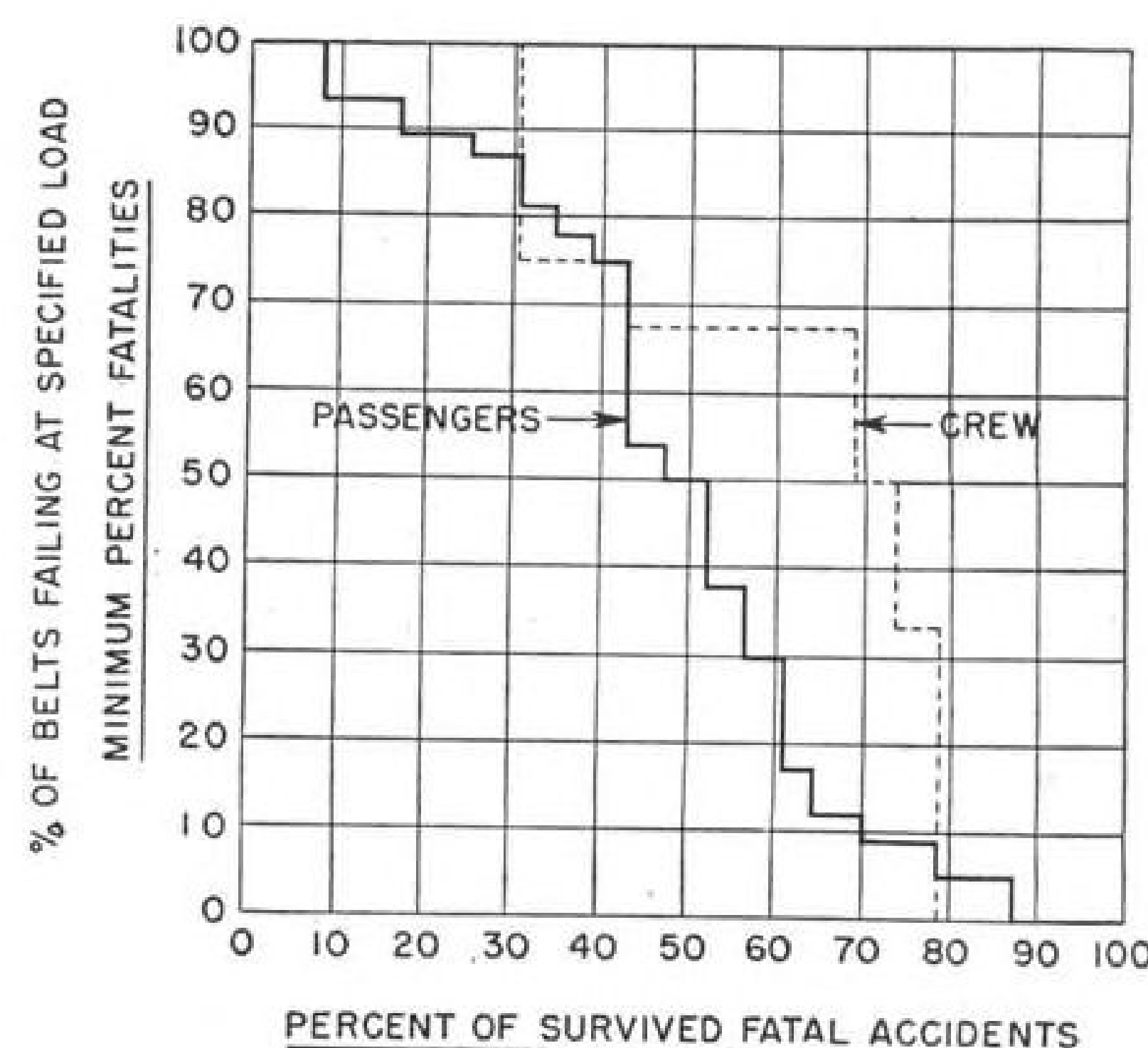


Fig. 2. Distribution of minimum percentage of fatalities in survivable airline accidents, 1938-1948.

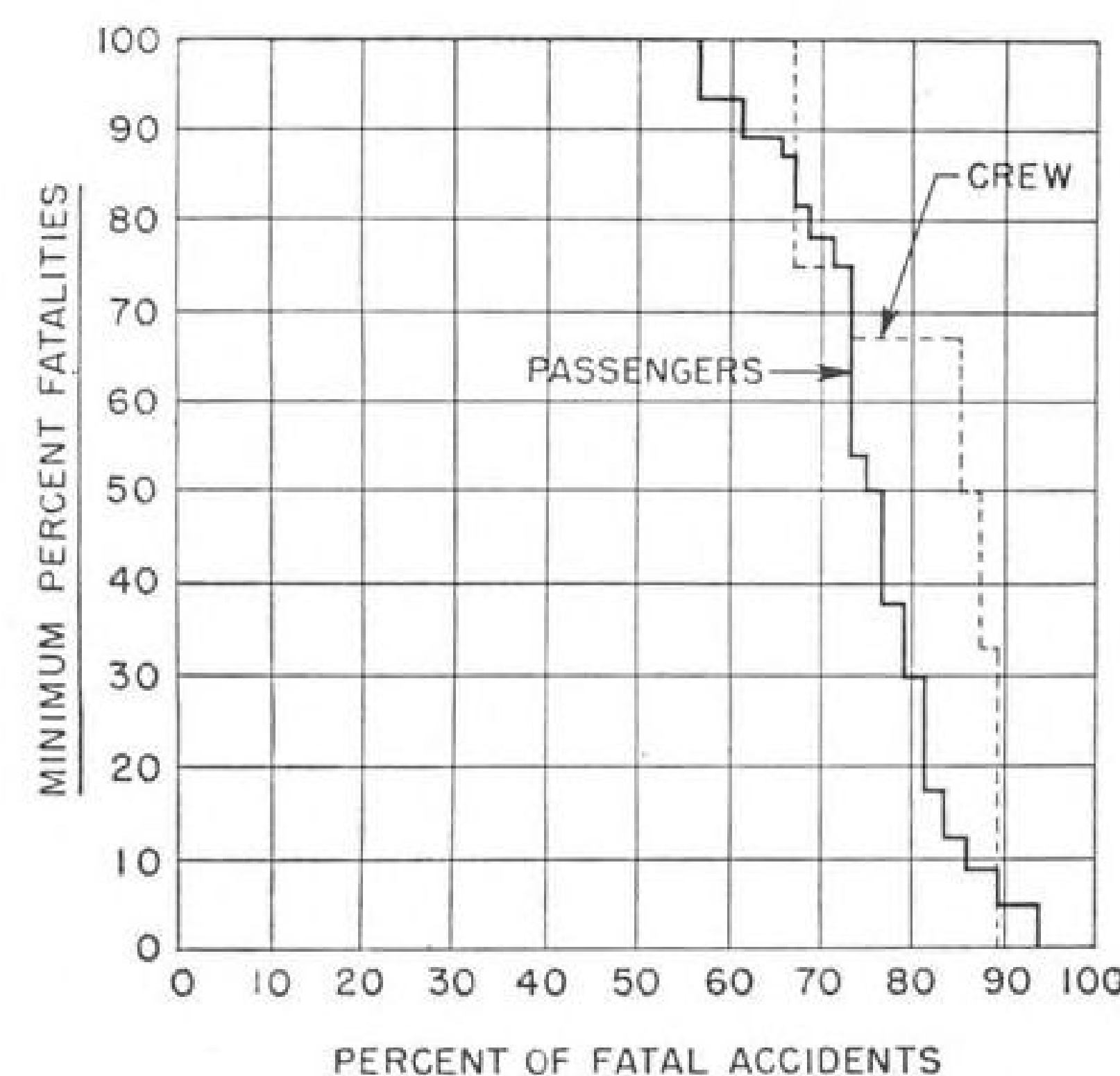


Fig. 3. Distribution of minimum percentage of fatalities in fatal airline accidents, 1938-1948.

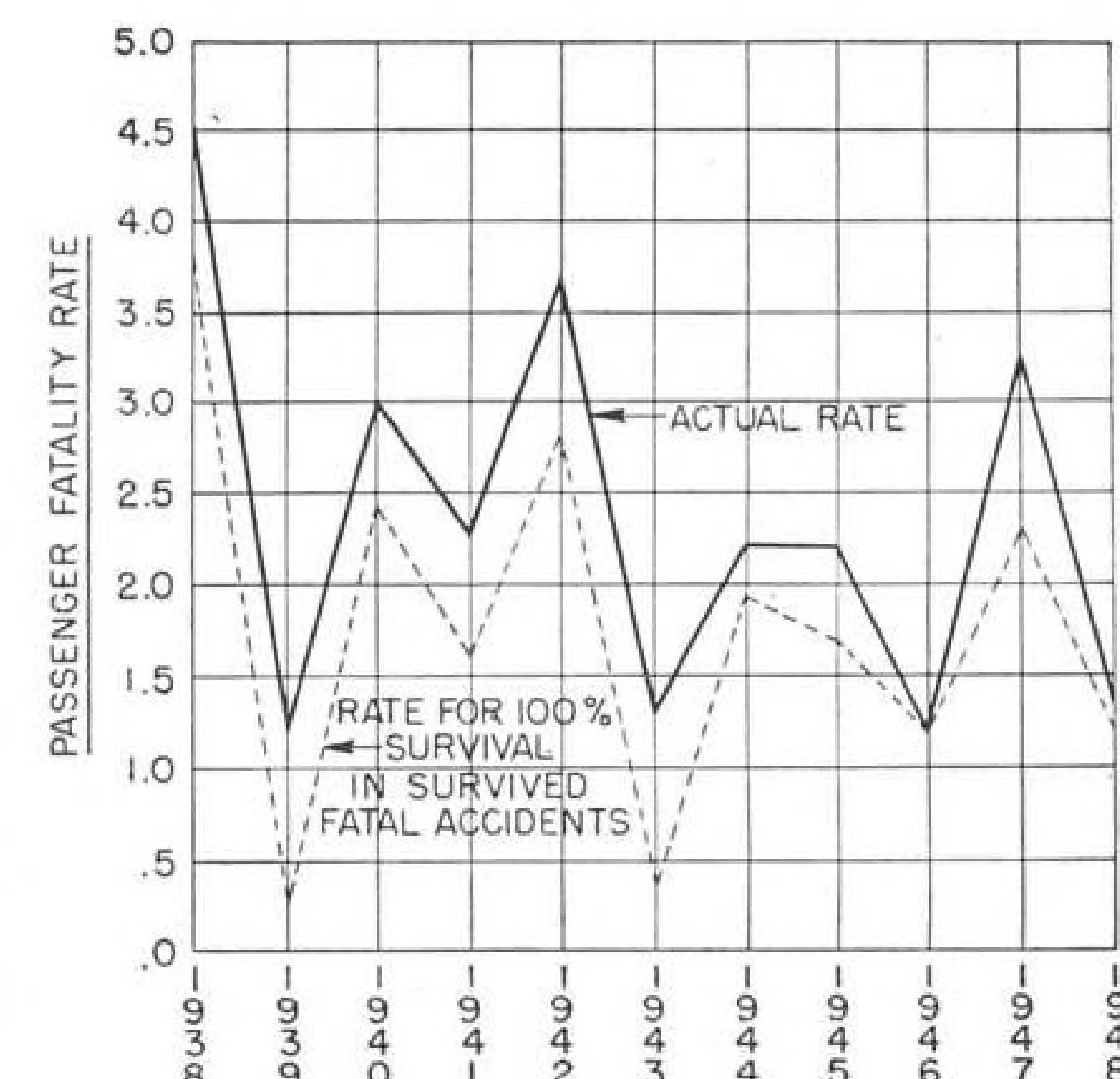


Fig. 4. Effect of 100 percent passenger survival in survivable accidents on airline safety records, 1938-1948.

Even with greater crashworthiness, all occupants might not have survived in all of these crashes. On the other hand, it is possible that some occupants might have survived in crashes in which there were no survivors. Hence, the improvement noted above may be considered as an approximate indication of the record which might have been attained.

While the above discussion has been limited to fatalities, it must be noted that during the same period 100 passengers received serious injuries, in both fatal and non-fatal accidents. Many of these injuries resulted from seat and belt failures. Unfortunately, complete statistics on the frequency of such failures, particularly in non-fatal accidents, are not available.

► Examples Cited—While data are not directly available as to the cause of injury in all of the accidents considered, a few specific examples may serve to illustrate the fact that many of these fatalities could have been prevented by stronger safety belts and seats.

One case in point is a crash of a 4-engine transport during takeoff, in which 41 of the 44 passengers, and 2 of 4 crew members, were killed.

This particular crash was not of extreme violence, as indicated by the fact that immediately following the impact, and until destroyed by fire, the cabin was comparatively intact; yet all seats, with the exception of the hostesses' seats, were found detached from the floor.

Testimony of rescue personnel at the CAB hearing indicates that many people were seriously injured by overturned chairs, and that rescue crews

were severely hampered by the resulting wreckage in the cabin.

► Load Factors—Fire destroyed most of the safety belts, so that it was impossible to determine the extent of belt failure. However, one of the hostesses' belts was comparatively unburned, and found to be broken, thus permitting an evaluation of the crash load involved in this accident.

If it is assumed that the stewardess weighed approximately 125 lbs., the minimum load factor would have been approximately 10 G, using the probability value of belt strength of 1250 lb. indicated previously for "one-person" belts.

But, if the belt developed the mean strength of 1400 lb., the resulting load factor would have been over 11 G. (It should be noted that many transport aircraft provide each occupant with a belt approved for two persons—a 2000 lb. belt. If this were true of the aircraft involved in this accident, load factors of double the above values would be indicated.)

These are minimum values of the load factor, since there is no proof that the belt did not fail before the peak deceleration was reached.

The above load factors are based on the assumption that the resultant forces acted in the plane of the belt. If the actual deceleration were in the horizontal plane, the load factor in this direction would be less than that cited, by the cosine of the belt angle.

The load factor at the stewardess' station would be lower than that forward in the cabin, because of energy absorption from structural deformation. This would tend to offset the effect of

neglecting the belt angle.

While not directly connected with seat and belt loads, one other aspect of crashworthiness in this accident merits attention. The pilot testified that the copilot was unconscious, and was wedged in his seat as a result of failure of baggage compartment structure immediately behind him. The pilot was unable to revive the copilot, and in the time available before the fire became too intense, could not get him out of his seat.

The pilot also testified that he attempted to go back into the cabin to assist occupants, but was prevented from doing so by baggage blocking the passageway, because of failure of web-gates.

► Seat Action—A second accident involved a crash landing of a twin-engine plane immediately after takeoff. In this instance there were no fatalities, but the condition of seats and belts permits an estimation of the magnitude of the decelerations involved.

The airplane made a belly landing in an open field, and slid approximately 85 yards before striking a 4½-ft. embankment along a road. The aircraft rode over the embankment, and came to rest on the opposite side, with the empennage still overhanging the road. The nose of the aircraft had struck the embankment at an angle, opening a wide gap in the right side of the fuselage, just aft of the cockpit. Crash fire broke out, but was extinguished promptly.

Only three seats tore completely free from the supporting structure. These were on the right side, immediately adjacent to the fuselage failure. There

was large deformation of many seats, however, and on some the rear legs pulled up between 2 and 4 in., although the fittings did not come completely free from the floor.

It seems highly probable that a small increase in either the magnitude or duration of the peak load would have produced complete failure. Therefore, the accident tends to define the limiting severity of crash which this aircraft can withstand without seat failure.

Testimony at the CAB hearing indicated that the seats and supporting structures had been tested for the loads specified in CAR 4b, and had shown little or no deformation at these loads. Therefore, although the loads are specified as ultimate loads, they are actually less than the limit load for this particular type of airplane. The aircraft was equipped with belts approved for use by two persons, that is, 2000 lb. rated strength, for each occupant.

Only one belt failed. This occurred on a seat which was near the middle of the cabin, and on which the rear legs had pulled up, as described above. It is believed that the passenger occupying this seat weighed approximately 245 lb. On the basis of the minimum probable belt strength of 2500 lb., found in the tests, a load factor of slightly over 10 G is indicated. A more conservative assumption of belt strength of 2300 lb., which would encompass 97 percent of the belts tested, would indicate a load factor of nearly 9.5 G.

If the belt strength were equal to the mean test value of 2800 lb., the load factor must have been over 11 G. (The 245-lb. weight is that of the

heaviest passenger on board the airplane, so that if the seat had been occupied by anyone else, higher load factors would be indicated.)

Yet this was a comparatively moderate crash, when judged either by the extent of the damage to the fuselage, or by the circumstances of the accident itself.

► Leg Load—As in the case of the first accident discussed, these values are representative of the minimum load factor in the accident. A maximum value of the peak deceleration cannot be determined, because of the absence of data on the ultimate strength of the seat anchorages.

The fact that the rear legs failed on the seat on which the belt failure occurred, however, would tend to indicate that the yielding of the rear seat anchorages would occur at approximately the same load as the belt failure. Therefore, the corresponding yielding of rear legs on other seats would indicate that these had been subjected to loads approximately equal to the belt strength.

Since the occupants of these other seats were lighter, the peak load factor was apparently higher than that indicated by a consideration of the failure of the belt restraining the heaviest occupant.

On the basis of the foregoing, it may be seen that this airplane provides approximately 15 to 16 G protection for an assumed passenger weight of 170 lb.

Since the load factors estimated above indicate that the two accidents just considered were of approximately the same severity, they provide an illustration of the effect of increased crashworthiness.

The airplane involved in the first accident had been certificated under CAR 4a, which required the equivalent of a forward acting load factor of approximately 4 G, so may not be capable of meeting the 6 G specified in CAR 4b.

However, even had the airplane conformed to the newer regulations, the results of the accident would probably not have been greatly affected, as the indicated load factor exceeds that specified in CAR 4b.

The airplane in the second accident, on the other hand, has been shown to provide crash protection of approximately 2½ times that required. In the first accident, all seats tore loose, and 41 of the 44 passengers, and 2 of the 4 crew members, were killed; in the second, most of the seats and belts held, and all of the 41 passengers and 3 crew members survived, even though many passengers were injured in varying degrees.

► Adequate Crashworthiness—The foregoing has established the inadequacy of the current level of crashworthiness, but has not established how great that inadequacy is. The accidents which have been discussed were, as previously pointed out, comparatively moderate.

The level of protection in most commercial airplanes in the past has been too low to provide much direct data on the necessary degree of protection. When belts fail, or seats tear loose, it is usually impossible to determine how much the peak loads exceeded the breaking strength of the failed units.

Fortunately, however, some data are available which are of value in this regard. A Crash Injury Research report, issued two years ago, stated that out of

a total of 608 accidents involving injury to 955 persons, there were 108 cases of 2000-lb. safety belts broken by crash survivors. The previously cited tests have shown that such belts may be expected to develop not less than a 2500-lb. strength under dynamic loading.

Therefore, if it is assumed that the average weight of the occupants in the cases reported to Crash Injury Research was 170 lb., corresponding to that assumed for design in the CAR, the average load factor in these accidents was of the order of 15 G.

However, on a basis of these same records, a well-known researcher states: "There have been cases in which persons weighing as little as 120 lb. broke standard 2-in. '2000-lb.' safety belts..." and survived. In such cases the load factor would have been slightly over 20 G.

Crash Injury Research "Informative Accidents" give details of many accidents in which the load factors were of this magnitude or higher, and include one in which the pilot survived where the value was approximately 36 G, as determined by the speed and stopping distance of the aircraft.

► **Military Craft**—Accident records for military aircraft also provide information as to the magnitude of crash decelerations. One example which may be used lies in the history of the F-47 Thunderbolt. On the earlier production models of this airplane, there were frequent accidents in which the cockpit structure remained intact, but in which belt failure occurred or the seat tore loose, resulting in fatal injury to the pilot, even though the crash protection met the Air Forces' requirements then in effect.

In view of this accident record, it was decided to provide additional strength on the F-47D, and to this end a research program was carried out jointly by Republic Aviation Corp. and Air Materiel Command. Outcome of this program was the incorporation of protection against a crash load of approximately 8000 lb., or 40 G for a 200-lb. man. In the later models of the Thunderbolt, which provided this crash protection, seat failures were extremely rare, although there were instances in which they occurred.

Apparently the accident experience of the RAF and the U.S. Navy indicated the existence of high decelerations in survivable accidents, and the consequent need of a high level of crashworthiness, if one is to judge by their adoption of the 40 G requirement.

► **Minimum Values**—It has been seen that survivable crashes frequently involve load factors of 20 G and higher. It has also been indicated that protection of the order of 15 G was no more than adequate in a moderate crash of a transport airplane. Certainly, protection should be provided for accidents of greater severity.

It is felt that if loss of life in survivable accidents is to be effectively reduced, a crash load factor of 20 G represents the minimum acceptable value for any airplane, and that values up to 40 G are desirable, and should be provided wherever practicable. The 20 G proposed represents an engineering compromise which should be adequate for a large percentage of accidents, at a minimum penalty in weight.

A corresponding degree of protection is also needed against upward and side-ward acting forces. Hence, in conjunction with the 20 G forward, load factors of 10 G upward and 5 G side-ward should be required.

► **Head Injury**—The full benefit of seats and belts meeting the requirement recommended above will not be realized unless protection is also provided against head injuries, which have been shown to be the commonest cause of fatality in aircraft accidents. Under even moderate G loads, the occupant jackknifes over the belt, unless restrained by shoulder harness. It is obviously impractical to require airline passengers to wear such harness. Reasonable protection can, however, be provided by properly designed seat backs. The use of light sheet-metal structure, well upholstered, in place of a rigid tubular structure, can go a long way toward eliminating head injury.

For pilot and copilot, shoulder harness is indicated, to prevent head injury on instrument panels, windshields, etc. The value of such protection has been fully established in military aircraft. The use of an inertia-type reel in conjunction with the harness permits the pilot full freedom of motion, while still providing restraint against crash loads.

► **Rearward Facing Seats**—Another means of affording passenger protection is the use of rearward facing seats. While an evaluation of this method lies beyond the scope of this discussion, extensive research has demonstrated the value of this approach to the problem of crashworthiness.

The opinion is frequently expressed that passengers would dislike riding backward, yet in a report on the experience of a group of the RAF Transport

Command, which operated with this seating arrangement for one year, it was observed that:

- Only one passenger in five objects to facing backwards, and the majority strongly prefer it. The proportion of objectors is almost exclusively made up of aircrew personnel.
- Ninety-nine percent of the passengers consider that the view from the windows is better.
- One passenger in three considers that he definitely feels less airsick when facing backward, and the remainder could feel no difference.
- Bumps are less noticeable.
- Noise is less noticeable.

The entire problem of crashworthiness may be summed up by a statement contained in Aviation Medicine Memorandum No. 2, June 28, 1949, Australian Department of Civil Aviation:

"A reorientation of the attitude of the aircraft designer and abandonment of the polite fiction that transport aircraft do not have accidents are overdue. Accidents are still occurring and there is nothing to indicate that they will not continue to occur in the foreseeable future. It is reasonable that aircraft should meet crashworthiness as well as airworthiness requirements."

Unless governmental agencies require increased levels of crashworthiness, the lead must be taken by the airlines and other users.

If a purchaser evaluates rival designs by comparing cost, payload, and performance, without giving due credit to safety features, a competitive advantage accrues to the manufacturer omitting such features, thereby discouraging their incorporation.

Details of NACA Hypersonic Tunnel

The National Advisory Committee for Aeronautics has revealed for the first time that it has been operating for over two years probably the largest and one of the fastest hypersonic wind tunnels in existence.

In operation since November, 1947, the tunnel is a blow-down type located at Langley Laboratory, Hampton, Va. It is capable of speeds up to Mach 10 and can be used for testing models of aircraft. Its test section is 10 x 11 in. across. This over twice the size of the Mach 10 tunnel for guided missile research which opened only a few months ago at California Institute of Technology (AVIATION WEEK, Dec. 12, '48).

The Cal Tech tunnel has a mere 5 x 5-in. test section. But it does have a major advantage over the NACA tunnel. It can operate continuously, while the Langley unit maintains airflow only

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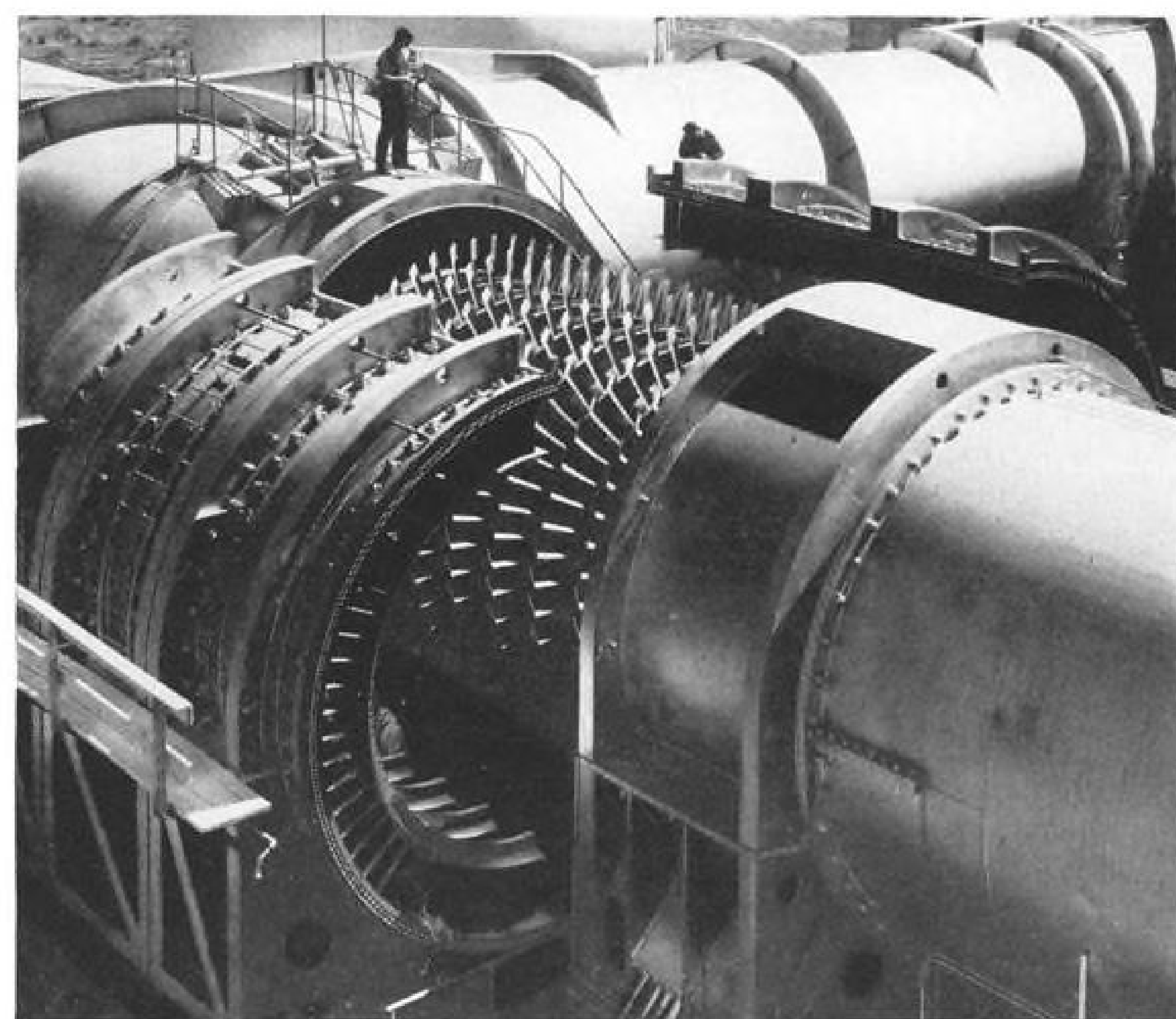
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WIND-MAKER AT AMES

This closeup of compressor section, with stator casing opened, in 6x6-ft. supersonic tunnel at Ames Aeronautical Lab, Moffett Field, Calif., gives striking impression of size of unit required for this huge test facility. Designed and produced at Ames, 416 precisely machined rotor blades are set

in 8 stages of 52 blades each. Stator blades are seen on casing interior in foreground. Two 25,000-hp. Westinghouse motors are teamed in tandem to drive compressor at speeds between 775 and 900 rpm. to push air through facility at 840 to 1500-mph. speeds. Air flows are up to 1,700,000 cfm.

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for short stretches before it must be shutdown for another pressure build up. First details of the NACA tunnel were revealed by John V. Becker, chief of the compressibility research division at Langley Lab, at a recent meeting of the Fluid Mechanics section of the American Physical Society at the University of Virginia.

In a paper entitled, "Results of Recent Hypersonic and Unsteady Flow Research at Langley Aeronautical Laboratory," Becker pointed out that "at air speeds approximately seven times the speed of sound, the air temperature would fall to about -410 F., which is much colder than the temperature at which air liquifies (-318 F.)."

To offset this, the tunnel has a heat exchanger consisting of about 4000 lb. of metal tubing which is designed to raise the initial air temperature to over 800 F. In tests with the heater, there still was evidence of actual liquefaction of a part of the airflow. Airflow had a foggy appearance and the airspeed in the tunnel dropped sharply.

The 11-in. tunnel currently is being operated at about Mach 7, equivalent to 5320 mph. at sea level. To produce this speed, air is packed into a supply tank until the pressure reaches 750 psi., then forced through the test section into a vacuum tank of 12,000-cu.-ft. capacity.

Becker said NACA saw the need for a hypersonic wind tunnel in the Mach 5-10 range in 1945, and revealed that Langley undertook the development of a pilot model at that time. Pressure ratios and other important design factors then were unknown. This uncertainty, he explained, made it advisable to build a blow-down type installation which was sufficiently flexible in design to permit easy modification.

Douglas Rain Tunnel

A new, low-cost rain tunnel which simulates conditions ranging from a light mist to tropical cloudbursts, with accompanying wind forces varying from zero to 100 mph., is being utilized for windshield studies at Douglas Aircraft Co., Inc.'s El Segundo plant.

With this facility, the pilot or test engineer can sit in a simulated cockpit and experience conditions existing during a "wet" approach—checking the windshield for visibility, leakage.

Cost of the installation is about one-third that which would normally be involved. A 150-hp. Climax engine obtained from stores is used to drive three tandem-mounted, lightplane propellers. These are two-blade, wooden units, purchased for less than \$30 each. By precutting and marking the materials, and facility was completed in eight days.

NEW AVIATION PRODUCTS



Plane-Tower Talk Tape-Recorded

A new multi-channel magnetic tape recorder, which stores for later reference all communications between control tower and plane, has been installed at Los Angeles Municipal Airport. The system also is under study by the USAF and RCAF.

A "live" demonstration of the equipment was given at the recent Airways Communications Conference at Cleveland, Ohio. Control tower operators from Cleveland Municipal Airport issued instructions to Air Force Reserve pilots, duplicating flight conditions. After the recording period there was a playback.

The recorder installation should fill a basic need for the elimination of contradictions and confusion in determining exact conversation in investigation of accidents to planes during takeoff, approach and other operational phases.

One example of distinctly advantageous application would have been in connection with the investigation of the recent P-38 Lightning-Eastern Air Lines DC-4 collision over Washington National Airport.

Designed and built by the Brush Development Co., Cleveland, Ohio, the system embodies this company's long-time experience in sound detection work and Aeronautical Radio Inc.'s know-how in airways communication devices. In effect, it completes a cycle of communication uses in airline operations—first, one-way radio communication from tower to pilot; then, two-way radio contact; and finally, "freezing" of two-way conversation, to permit later playback.

► **Tape Benefits**—Magnetic tape record-

ing is intended to offer these advantages:

- No process is required after recording, prior to reproduction.
- Many channels can be provided within a limited space.
- Recording can be made continuous without excessive bulk of equipment.
- Recording medium can be reused if data prove to be of no permanent value.

On a 0.7-in.-wide, 4500-ft.-long paper tape, as many as 14 independent messages can be recorded simultaneously for a continuous period of 4 hours. Since the paper tape is only 0.002 in. thick, a total of 56 hours of recording can be stored in a space of approximately 75 cu. in.

The tape is held on 3/4-in.-wide reels having a diameter of just under 14 in. It moves in a manner similar to that of a motion picture projector, from a supply reel to a takeup reel, passing over a series of recording heads with a speed of 3 1/2 in. per sec. There are as many recording heads as there are messages to be recorded.

► **Switchover**—Since the recorder has to be ready to accept the full content of a pilot's message, it must be in operation all the time. To afford such service, a minimum of two tape transport mechanisms is required. Whenever one mechanism has been in use for approximately four hours and comes close to exhausting its tape supply, the second tape transport mechanism must start operating. For a short period, the same message is recorded on the end of one tape and overlapping at the beginning of the other.

A feeler associated with the supply reel checks continuously the amount of tape available and automatically initiates the operation of the next unit when it senses the end of the tape supply.

And a third standby tape transport mechanism is usually provided, which will automatically take over if for any reason failure should occur to either of the other units.

► **Amplifier Replacement**—The messages from the communication receivers are fed to as many independent recording amplifiers as channels are in operation, and are supplied from these recording amplifiers with an appropriate level to the individual recording heads.

All amplifiers are fed from a common power supply, with a standby power supply ready to take over automatically if the operating power supply should break down. Two amplifier channels are always combined in one easily removable chassis, each channel having a tube which continuously indicates its proper operation. If failure occurs, the chassis can be removed easily and replaced in a matter of seconds by a spare.

In the normal mode of operation, an attendant serves the equipment for changing the reels once every eight hours. Otherwise, the device requires no particular attention.

► **Playback**—For reproduction, a fourth tape transport mechanism is provided, associated with two playback amplifiers. Each of these can be connected to any one of the 14 channels. Thus, it is possible to listen simultaneously to two recordings which have been made at any instant and correlate the respective times to the events.

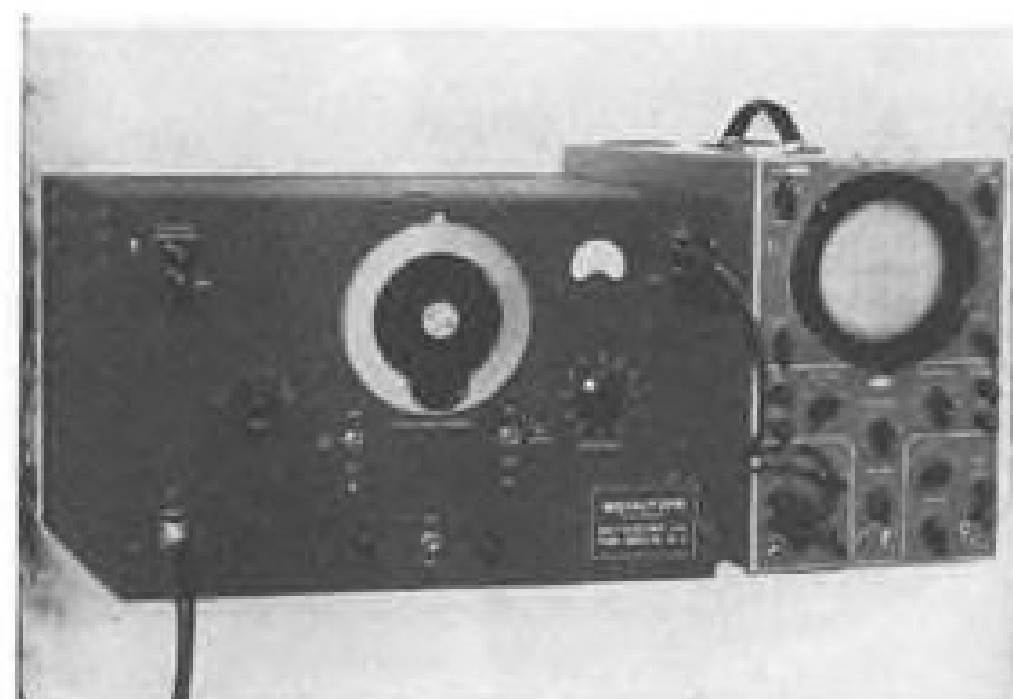
Because the playback units will be consulted only rarely, the drive mechanism of the reproducer can be used to replace any recording tape transport mechanism for maintaining program continuity.

Operation requires approximately 500 watts. It is considered satisfactory, generally, to keep recordings for about 15 days, after which the recordings can be erased and the tape used again. A total of 90 tape reels is required for each installation. It is reported that the tape will give satisfactory service for at least 5 years, and that 0.3 cents per hour per channel will amortize the initial investment for the recording medium, approximately 0.5 cents per hour per channel amortizing the total initial cost of the equipment.

The complete airport recorder mounts on three 7 1/2-ft. standard relay racks. First rack includes two tape transport mechanisms and master recorder control panel.

Second rack contains a third tape transport mechanism and the complete electronic setup for the entire recorder.

Third rack contains the playback and speaker units.



Measures Rotation

For measuring average rotational speed of shaft and indicating variations in speed versus time, Rotalyzer, made by Kay Electric Co., Pine Brook, N. J., is claimed to be accurate to .1 percent over wide speed range and .01 accurate at single speed.

Equipment includes pickup devices for attachment to shaft, cabinet containing electronic amplifier, analyzer elements and oscilloscope (modified Du Mont 304 H). This last also can be used for general work. If desired, equipment is supplied without oscilloscope.

High frequency magnetic disc and pickup are used on shaft to be measured. Also included is tunable, calibrated local oscillator to indicate average shaft rpm. in conjunction with null-reading voltmeter. Oscilloscope indicates variations in speed in vertical direction and time in horizontal direction.

By use of suitable synchronizing or sweep signal proportional to shaft rotation, oscilloscope horizontal axis may be made proportional to shaft motion. Standard speed range is 900 to 7200 rpm., but may be extended from 33 1/3 to 50,000 rpm. on special order of the customer.

Fights Frost

Stratofrost deicing and anti-frosting compound, offered by Aviation Chemicals division of Fine Organics, Inc., 211 E. 19th St., New York City, can be brushed or sprayed on aircraft surfaces and is represented to meet all requirements of USAF Specification No. 3609.

Intended for application on wings and tail surfaces as an icing preventive or on iced surfaces to melt accumulated frost, product is homogenous liquid which may be diluted to 50 percent solution with water.

Product may be applied to surfaces before application of wing covers to prevent fabric freezing to airfoil.

Another advantage, according to maker, is that it leaves a residual film which inhibits icing on surfaces during takeoff periods.

Stratofrost contains poly and mono hydroxyl alcohols, dextrose, and corro-

sion inhibitors. It is said to be non-corrosive to steel, aluminum alloy, Al-clad, brass and copper; does not craze Plexiglas and acrylics, and has no effect on doped fabric finishes, lacquers, enamels or rubber deicer shoes.

Flash point is 85 F., while slush point when diluted to 50 percent solution with water is -74 F. Product is available in 5 and 53 gal. drums.

(Stratofrost is one product of a line of aviation chemicals, each having root name of Strato plus suffix denoting type or primary purpose. In Feb. 6 issue of AVIATION WEEK, in this section, root name was inadvertently referred to as Stratos.)



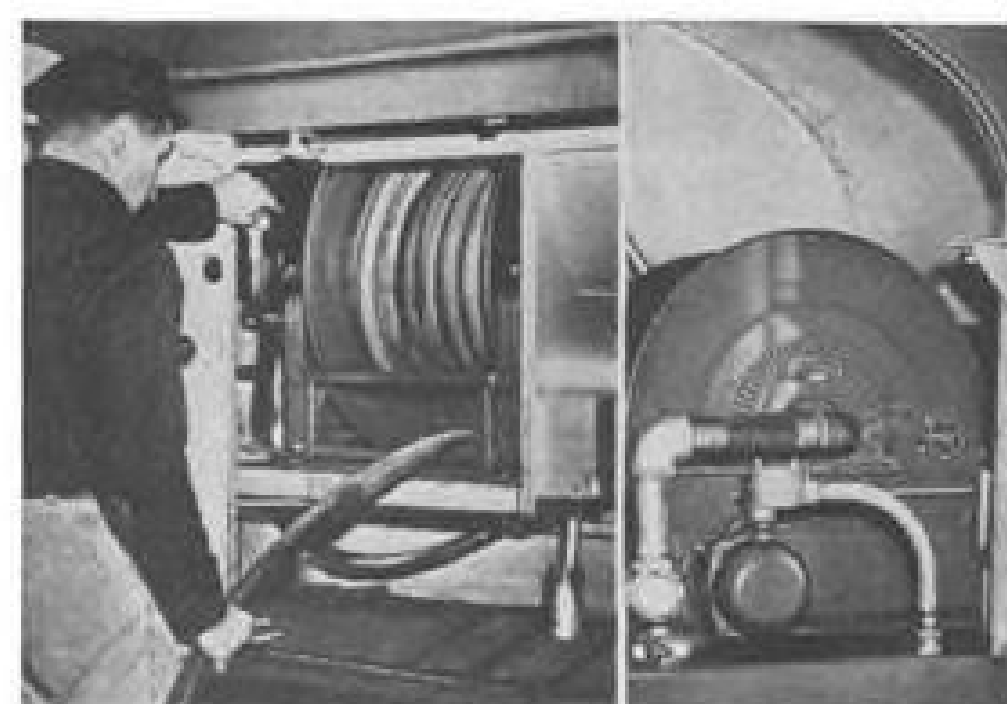
Millisecond Timer

Of interest to manufacturers or persons engaged in research work, where equipment is required to measure very short time intervals associated with physical or chemical changes, is Chronotest millisecond timer, offered by Electronic Instruments Ltd., Richmond, Surrey, England, and distributed in the U. S. by Herman H. Stricht Co., Inc., 27 Park Place, New York, N. Y.

Designed for measuring time intervals between .1 and 10,000 milliseconds with an accuracy of 1-2 percent, device is available in two models. One has maximum range of 1 sec. in 6 steps, while the other has maximum of 10 sec. in 6 steps.

Requiring 110-250v. a.c., 40-100c., single phase power source, instrument can be used for timing short intervals between changes in voltage, current, resistance, light intensity, sound level, liquid level, conductivity, pressure, color, other factors. Maker says almost any abrupt change in physical or chemical conditions can be arranged to operate unit. A straightforward use, for instance, is the timing of intervals between simple events, such as the time elapsed between electrical contacts being opened or closed.

This portable unit weighs 25 lb., is said to be ruggedly built and uncomplicated. According to maker, operation "is so simple that it can be learned in a few minutes by an unskilled operator."



For Fuel Jobs

New hose reel with explosion-proof motor, claimed to eliminate many hazards associated with conveying flammable and volatile materials, is offered by Clifford B. Hannay & Son, Inc., Westerlo, N. Y., for use in fueling pits and trucks and in many other locations where electrical hose reel installations have been barred previously.

Motor, classified as Underwriters Approved Class 1, Group D, heavy-duty unit, features permanently lubricated ball bearings. Drive uses only two sprockets and chain. Sealed pushbutton is only control. Manufacturer says sealed motor needs no attention.

Device is supplied complete with approved junction box, switch, tubing, fittings, 2/0 ga. cable, twin wire solenoid switch, connectors and terminals.



Fork Truck Device

To add even further to the versatility of fork-lift trucks, Yale & Towne Mfg. Co., Roosevelt Blvd., Philadelphia 15, Pa., has developed hydraulically-operated, side-shifter attachment designed for use with both Worksaver and Lift King trucks.

Side-shifter makes it possible to accurately "spot" loads in odd corners, close to walls, near pillars, or in other confined storage and transfer areas. Device often eliminates manual positioning in such enclosed spaces as trailer trucks and freight cars.

FINANCIAL

Differing Aviation Market Views

Bendix annual report shows greater concentration on aviation, while Continental's reflects lightplane decline.

Interesting contrasting results are disclosed in two major management policy decisions, in one case to pursue greater emphasis in aviation and, in the other to de-emphasize. This is highlighted by the annual reports released by Bendix Aviation Corp. and Continental Motors Corp. The 1949 annual report recently issued by Bendix, showed a shift toward greater emphasis on aviation products. For the fiscal year ended Sept. 30, 1949, sales of aircraft products totaled \$84,780,000 or 47 percent of total volume as compared with \$68 million in 1948.

• **Ratio Up**—During the prewar period of 1936 to 1939, aviation products accounted for only 33 percent of the total Bendix sales. In the postwar period this ratio increased to 38 percent in 1947 and 42 percent for 1948.

In the prewar period, automotive products accounted for the bulk of overall Bendix billings. But they contributed only 31 percent of total sales for the 1949 fiscal period. However, the declining importance of automotive products to Bendix last year resulted not from any lack of demand in this market but is directly attributable to a strike at the company's major division supplying this field. With this strike settled, it is likely that Bendix will increase actual billings on automotive products this year.

► **Value Up**—The company significantly reported that the increased aircraft products billings was not generally attributable to greater unit sales, but to the constantly mounting unit values of new components, instruments, and systems capable of performing necessary and desirable functions in larger and faster airplanes of all types.

The Bendix annual report also reveals the company's participation in various aircraft manufacturing developments. The engineering problems on which the company's divisions are engaged in collaboration with the military services, manufacturers and users of airplanes are termed "challenging."

These problems deal with the operation of very large reciprocating engines and jet engines of many types, involving ignition and radio shielding, fuel supply and control, starting, electrical generation and control, and other functions; including many types of struts,

brakes, and wheels; revolutionary new radio communication and navigation systems for aircraft; a wide range of radar developments for military and civilian use; the rapidly developing fields of guided missiles, rockets, and pilotless aircraft.

► **Sales Up**—Sparked by aircraft products billings, total sales of Bendix for the 1949 fiscal year reached a postwar peak, amounting to \$182,674,462 and up from the \$162,495,665 reported for the 1948 fiscal year. While sales were up, net earnings declined slightly from \$11,280,742 to \$11,086,781.

Presumably, earnings would have followed the trend of sales were it not for the strike of last year. Profit margins for the separate divisions of the company are not revealed in the annual report. It is logical to assume, however, that the contribution to net earnings by the aircraft products was far greater than indicated by its ratio to total company sales.

Dividends paid by Bendix amounted to \$2.50 per share during 1949, the same as in 1948. This annual disbursement came to \$5,293,632 on the 2,117,453 shares outstanding, and represented slightly less than one-half of net earnings in both years. Divided payments for many major corporate enterprises have had a tendency to average between 60 and 75 percent of earnings in recent years.

► **Working Capital Up**—Retention of earnings has permitted Bendix not only to build up its working capital, but also has greatly facilitated a major expansion program.

As of Sept. 30, 1949, the Bendix net working capital was \$73,328,670 an all-time high and a gain over the \$69,917,091 reported as of Sept. 30, 1948.

During the four-year period ended Sept. 30, 1949, Bendix spent \$24,038,000 for additions to, and replacements of plant facilities. This program was accomplished without benefit of any additional financing. The funds were provided from specific depreciation reserves amounting to \$10,530,000; \$9,267,000 was derived from accumulated earnings prior to 1946, and the balance of \$4,241,000 came from retained earnings during the four-year period. The management notes that the major part of its plant expansion pro-

gram has now been completed.

Total stockholders' equity of Bendix at Sept. 30, 1949 amounted to \$89,853,477, or \$42.43 per share, an all-time peak. Backlog of unfilled orders at Sept. 30, 1949 was reported at \$165 million, slightly improved over the \$162 million backlog existing at Sept. 30, 1948.

► **Continental**—A sharply contrasting experience, with de-emphasis in aviation products, is revealed in the 1949 annual report just released by Continental Motors Corp.

In the postwar period, Continental's aircraft engine sales amounted to \$14,740,317, contributing almost 25 percent of the company's total billings. As such it represented the leading category. For 1949, aircraft engine sales contributed but 3.7 percent or only \$2,742,218 of Continental's total billings.

In commenting upon its changing fortunes in the aircraft engine field, the Continental management merely declares that it has experienced wide variations in demand for such engines over the past 20 years. Moreover, the trend of airplane engines in 1947, 1948 and 1949 has been downward "as the personal plane industry has been undergoing the throes of a major postwar adjustment."

► **Other Markets**—All indications support the belief that Continental is concentrating on other industrial markets. During 1949, the agricultural industry accounted for 43 percent of the company's total sales. Although once more active in the automotive field, Continental appears to have lost ground in this market as well. Nevertheless, sales to this industrial group accounted for 12 percent of the company's total during last year.

Continental's net sales for the fiscal year ended Oct. 31, 1949, amounted to \$73,192,294, down sharply from the \$108,157,527 recorded for the previous year. Net earnings showed an even greater relative drop by declining from \$3,378,123 to \$1,801,205 during this period. While below its 1946 mark, net working capital as of Oct. 31, 1949, showed an improvement over the previous year, amounting to \$22,797,306.

► **Two Approaches**—The postwar period shows that Bendix determined to maintain its interest in aviation. It did so by constant engineering and development of new product diversification which gained broader markets in aviation.

Continental Motors, while not forsaking the aviation industry, presumably sought its destiny in other fields. It appears that its entire stake in aviation was represented by its airplane engine line, with no attempt made to diversify for this market. With sales to other industries gaining, the emphasis on aviation products may become even less pronounced. —Selig Altschul

SALES & SERVICE

Piper Distributors Briefed for '50

Men and women over 45 are top-drawer prospects, W. T. Piper tells salesmen. Sixty Pacers delivered.

Eighty-six top aircraft salesmen, representing every state in the union, converged on the Piper Aircraft Co.'s Lock Haven plant recently to take initial deliveries of the company's 1950 models and participate in a briefing geared to up Piper sales approximately 15-20 percent over last year.

W. T. Piper, president and general manager, told the men that the real market comprises the men and women over 45 years old—that these are the people with the money and spare time to use the airplane for sport, and they have the need for long-distance transportation.

► **Large Fly-Away**—Sixty new Piper Pacers were flown away by the distributors at the end of the one-day session, indicating that Piper's production lines are rolling early this year. Deliveries to customers will be made in seven weeks from time order is placed with the distributor.

Only about 30 Piper Stinsons will be available for delivery in 1950—a new model is slated for appearance next year.

► **Hi-Hat Club Celebrates**—The traditional Piper Hi-Hat Club ceremony honoring top salesmen, was observed during the meeting.

Among those who were cited were:

John V. Baker, Jr., Martin Aircraft Sales, Long Beach, Calif.; Angelo DePonti, DePonti Aviation Co., Minneapolis; A. W. Whitaker, Portland, Ore.; Howard V. Gregory, Des Moines Flying Service, Billings, Mont.; Roy W. Neal, Jr., Wes-Tex Airport, Lubbock, Tex.; E. E. Isaacs, Ken-Mar Airpark, Inc., Wichita; A. R. McEwen, St. Louis Flying Service, St. Louis; and Frank S. Jonas, Frank Sheridan Jonas, Inc., New York City (export).

Together these men sold 500 planes last year.

Piper Cruisers Patrol Hanford Area

Two Piper Cruisers are being used effectively by the Atomic Energy Commission in conducting an aerial patrol of its Hanford plutonium works near Richland, Wash.

The air over the plant is closed to all aircraft except the patrol planes, but planes occasionally do wander over the restricted area. The area is screened by radar from the Air Force base at nearby Moses Lake and, when this radar picks up a strange plane approaching the area, its position and speed are relayed to the patrol.

If the plane in question is too fast for the Piper Cruisers, the Moses Lake base sends over a P-51 or a jet F-84. If the offending plane is small enough, it is ordered to land at the patrol's airport. If it is an airliner or other large plane, the patrol or Air Force plane gets its number and it is traced.

Offenders have included student flyers following the Columbia River as a landmark, thus running into the restricted area; pilots trying to save a few minutes' time by cutting a corner, and a few like the commercial transport pilot who thought he would give his passengers a special treat.

The CAA handles civilian cases, meting out fines from \$50 to \$500, while the military court-martials its offenders.

The Cruisers hedge-hop over the perimeter fence of the 600-sq. mi. area to take a close look at cars near the fence. If car's license plates tally with previously-issued permit, the patrol planes leave it alone. Should the plates be obscured or not on the permit list, the pilot lands his plane on the road and investigates.

The air patrol is connected through radio communication with the field control tower, and with the ground patrol, whose responsibility is the operation area itself. The tower has a direct line to the ground patrol.

Three Versions Of Navion in '50

A lower-priced utility version of the Ryan Navion, priced at \$9485 flyaway San Diego, completes the three-model 1950 line of planes being offered by Ryan Aeronautical Corp. Utility model has less luxurious interior furnishings and equipment than the de luxe model sold at \$10,985. Completing line is the 270 hp. Lycoming-powered Super Navion capable of 170 mph. and priced at \$13,985, which is due on the market this month.

Major differences between utility and de luxe versions: De luxe model has new manually controlled cowl flaps and cylinder head temperature gauge; flexible hose replacing rigid plumbing to flap and nose gear actuation cylinders; new fin-to-elevator radio antenna, in addition to that previously carried from fuselage to fin; new cabin air intake arrangement; three new colors for de luxe model.

Utility version has fewer accessories, but uses same basic airframe and same 205 hp. Continental engine, same RCA Model 116 radio with six-channel VHF transmitter, same power hydraulic actuation for landing gear and flaps. Purchaser may choose any specific added accessory used on de luxe model as optional extra equipment.



NEW AERONCA CHAMPION

Latest model Champion for 1950, the 7EC, features a new Packard straw and sedan red color scheme giving impression of longer fuselage. Continental C-90 gives the craft top speed of 110, cruising speed of 100, and 800-fpm. climb. A 12-volt electrical system with starter is fitted, and wiring for landing and instrument lights. Flush-type locking door handles, and locking left-slid-

ing windows are standard. Optional equipment includes: left wing 5.5-gal. auxiliary fuel tank, Seacoglass full-cabin soundproofing, wool carpeting, wheel fenders, metal prop, sensitive altimeter, Bendix PATR-10 radio transmitter including shielding, head-set, mikes, and speaker, navigation and landing lights, in addition to a recording tachometer.



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AIR TRANSPORT

Nonskeds Rally in Last-Ditch Fight

IACCA leads struggle to get congressional support on easing federal regulations. Seek probe of major lines.

Nonscheduled airlines are trying again to rally their forces against the stringent federal economic regulations which threaten to push all but a few hardy independents out of the air transportation picture.

With their numbers badly thinned by bankruptcies and Civil Aeronautics Board enforcement crackdowns, the irregulars have only meager resources to throw into the battle. But they have again stirred up interest—and some sympathy—on Capitol Hill.

► **Pressure on Congress**—Leading the current fight for broader nonsked operating rights is the Independent Air Carrier Conference of America, with headquarters in the La Salle Building, Washington, D. C. IACCA's original membership was mainly among Pacific Northwest-Alaska carriers but now includes nonscheduled lines (operating transport-type equipment) in all sections of the country.

Headed by Amos E. Heacock, president of Air Transport Associates, Inc., a Seattle-based nonsked, IACCA has influenced the Senate Commerce Committee to pass over President Truman's renomination of Josh Lee to CAB.

► **Lee Opposed**—The nonsked group is centering its fire on Lee primarily because his renomination makes him vulnerable at this time, although his eventual confirmation seems assured. Actually, IACCA charges that all CAB members have subscribed to policies which will force the independents to the wall and give presently certificated carriers a monopoly on air transportation.

In deferring action on Lee for a third time the Senate committee adopted a resolution requesting CAB to give Heacock a hearing at which to air the nonskeds' grievances against present Board economic regulations.

Heacock told the Senate committee that CAB has undermined the development of adequate, economical and efficient air transportation. He said the Board has discriminated against the nonskeds by paying the certificated lines large subsidies for operating over competitive routes and has "acted to destroy the large irregular operators by unreasonably oppressive regulations and drastic enforcement action."

► **CAB Hit**—The IACCA president as-

serts that CAB's endorsement of congressional moves to separate subsidy from compensatory mail pay is a sham. He said CAB tried first to delay subsidy separation legislation and then attempted to emasculate the bill through amendments.

Heacock intimated that there is close coordination between the actions of CAB's office of enforcement against nonskeds on the Pacific Northwest-Alaska run "and the needs of Pan American Airways."

Last month, Heacock's company and another nonsked, Golden North Airways, formally offered to carry mail between Seattle, Anchorage and Fairbanks, Alaska, for \$1 a year if permitted to operate regularly. The nonskeds said their proposal would save the government millions of dollars in mail pay now allotted to Pan American, Pacific Northern, and Northwest Airlines.

► **Justice Probe**—Meanwhile, Heacock called on Rep. Emanuel Celler (D., N. Y.), chairman of the House Judiciary Committee, to persuade the Department of Justice to undertake a grand jury investigation of the "monopolistic and restrictive activities of the major airlines and later institute appropriate civil suits if warranted."

IACCA wants the Justice Department to intervene in a \$1.5 million suit filed last year by S.S.W., a Concord, Calif., nonscheduled operator, against 10 certificated airlines and the Air Transport Assn. S.S.W., a member of IACCA, charged the certificated carriers with conspiracy and combination to restrain interstate air commerce in violation of the Sherman Anti-Trust Act.

► **Changes Unlikely**—Despite IACCA's counter-attack against CAB, most observers see little prospect that federal regulations restricting the frequency of nonscheduled operations will be eased. The independents took their case against CAB's allegedly harsh policies to Congress a year ago, and several times before, to no avail.

As a result, CAB last spring abolished the blanket exemption under which the nonskeds had been flying. The independents were required to apply for individual operating exemptions, and 95 of them did so.

But CAB has taken no formal action on these applications in the eight

months since they were filed. The Board is expected to issue a policy statement on the matter shortly.

► **Enforcement Pressed**—Meanwhile, the federal agency has pressed its enforcement action against alleged nonsked violators of its regulations. Nineteen large irregulars currently are involved in CAB proceedings aimed at revoking their operating franchises.

The list of alleged violators—virtually a who's who in the industry—includes Air America, Air Transport Associates, Arctic-Pacific, Inc., Arrow Airways, Economy Airways, Golden Airways, Golden North Airways, Great Lakes Airlines, Inter-American Airways, Meteor Air Transport, Mt. McKinley Airways, New England Air Express, Peninsular Air Transport, Seaboard & Western Airlines, Skytrain Airways, Trans American Airways, Trans Caribbean Air Cargo Lines, Trans Ocean Air Lines and Viking Air Lines. Several other nonskeds have been ordered by CAB to show cause why they shouldn't be required to cease and desist from further illegal activity.

► **Court Decision**—Recently, CAB was given another weapon in its drive against alleged nonsked violators when the U. S. Court of Appeals for the Second Circuit confirmed a lower court order granting the Board's request for an injunction against Modern Air Transport, New York. CAB had alleged that Modern violated the Civil Aeronautics Act by operating with excessive regularity between New York and Puerto Rico.

Modern appealed the lower court's decision, claiming that CAB's standards of regularity were vague. The nonsked also contended that CAB, before seeking a court injunction, should have held a proceeding of its own to determine if there had actually been a violation of the Civil Aeronautics Act.

The Court of Appeals ruled that CAB's regulations on what constitutes excessive frequency and regularity of service are clear. It added that because there could be no doubt of Modern's violation of regulations, CAB was justified in turning directly to the courts for swift action to prevent further violations.

UAL Still Studying Air Coach Service

United Air Lines, only one of the "Big Four" still holding out against air coach service, could begin such service within 90 days after deciding to enter the field, according to Curtis Barkes, vice president-finance.

But he also indicated no early decision is in sight. The economic picture so far as coach is concerned is still cloudy, he told the New York Society

of Security Analysts, and "we do not like to start something new unless we have a pretty good idea as to where we are coming out."

► **Equipment Plans**—United's equipment plans point to eventual inauguration of skycoach. Barkes said that of the eleven DC-6s on order, six are DC-6Bs, the version which can be used as a high-density transport seating 92 passengers. These are to be delivered in the spring of 1951. The other five Sixes are scheduled for delivery this spring.

No program for ordering new twin-engine equipment has been formulated, Barkes said, as the present DC-3s of United are considered superior to any existing replacements available for the company's operations.

► **Costs Cut**—Barkes paid tribute to the air transport industry's ability to reduce unit costs of operation during 1949.

On the basis of reports for the first nine months of 1949, the United official asserted that American was the low cost operator at about 46½ cents per revenue ton mile; United second, at 50 cents per revenue ton mile and TWA third, at 53 cents per revenue ton mile. Inference was that American's 18 percent more volume than United's last year was a reason for the former's better showing.

Probably the most important thing United was able to do last year was to increase employe efficiency, according to Barkes. The average number of employes on the payroll in 1949 was 10,047 as compared with 10,822 in 1948, or a reduction of 7 percent. This resulted in a 3 percent reduction in payroll cost and an employe turnover averaging only 2 percent per month, considered the best in ten years.

A major factor in United's economy drive was the complete utilization of its new maintenance base at San Francisco. It is estimated to have saved \$750,000 last year. In addition to its own maintenance, United does similar work at this base for the Philippine Airways, British Commonwealth Pacific Airways and PAA.

► **Financing Improved**—At the 1949 year-end, United's working capital position was reported as slightly higher than as of Dec. 31, 1948. This was after retiring long term debt of \$5,720,000 and paying for five Boeing Strato-cruisers as well as other capital additions. Commitments for future capital obligations, largely represented by the DC-6s, come to about \$14 million. Barkes does not believe that the company will be required to undertake any special financing for this purpose as payments will be made from current funds over a period of time as deliveries are completed.

Prospects for 1950, barring unforeseen developments, are expected to fol-

low fairly closely the pattern set in 1949, in Barkes' opinion. Air parcel post showed encouraging gains during 1949 and is expected to do even better this year.

American Airlines Tops the Field

American Airlines last year rolled up a net profit of \$6,511,237 after taxes and apparently clinched the title of top money-maker among domestic carriers.

The excellent 1949 earnings compared with a net loss of \$2,893,671 in 1948. AA paid \$1,800,000 in federal income taxes last year. It had a carry-forward tax credit of \$950,000.

With passenger traffic up 15 percent and freight business up 42 percent over 1948, AA's total revenues of more than \$103 million were the highest in company history. Passenger revenues accounted for most of the gain, soaring from \$76,861,000 in 1948 to \$88,308,-

000 last year. Express and freight revenue rose from \$6,503,000 to \$8,028,000.

Mail revenue was up only moderately—from \$4,769,000 to \$5,555,000. This increase resulted mostly from the larger volume of mail traffic handled.

American's expenses last year were \$96,694,000 against \$92,179,000 in 1948. Even so, the carrier is expected to be the lowest-cost operator among domestic carriers in 1949.

The company reported its current financial position is strong. As of Jan. 11, 1950, American had purchased \$4,050,000 of its debentures. This provides for sinking fund requirements of 1951, 1952 and 1953.

A provision of the debenture agreement specifies that dividends on the common stock will not be paid unless earned surplus exceeds \$10,640,000. Although earned surplus increased \$5,745,000 during 1949, the total of \$10,331,000 at year-end does not permit a common stock dividend at this time.



Mobile Instrument Tester

A mobile laboratory equipped to test all types of aircraft instruments in half the time previously spent by airlines in this task, has been placed in service at N. Y. International Airport, Idlewild, by Durham Aircraft Service, Inc.

The lab is housed in an 8 x 30 ft. air-conditioned trailer staffed by two DAS technicians. The unit, working with airlines and other aviation mechanics, forms an on-the-spot test center for any aircraft using the airport.

Spare instruments of all types are stocked.

Designed by John Marrotte, supervisor of overhaul at Durham's Woodside, N. Y., headquarters, and built there by DAS employees, the trailer installation exactly duplicates the test equipment installed in the main laboratory, which still maintains its usual services. Rates at the mobile tester are the same as at Woodside.

ICAO to Study Met Problems

International Civil Aviation Organization's meteorological division will attempt to have existing gaps in world's network of upper air weather reporting stations filled in. The radiosonde networks in North America and Western Europe are fairly complete, but in some spots in the world there are only two or three stations serving an entire continent. ICAO officials point out that with modern airlines now flying on scheduled operations throughout the upper atmosphere, better knowledge of weather conditions are necessary.

Financing of new stations is seen as the major handicap—cost of operating a radiosonde station for one year is estimated at \$30,000.

► **Other Studies Planned**—Among other items on the meteorological division's agenda are:

- **Study of upper atmosphere physics** to gather data on gust characteristics. This knowledge will be necessary for safe operation of jet airliners at very high speeds.
- **Consolidation of specifications** for meteorological services necessary for international air navigation with the object of producing a world standard.
- **Coordination of aeronautical met broadcast systems** to get fullest value from limited number of channels being used, and review of consequences of replacing radio telegraphy with voice telegraphy in ground-to-air exchange of weather data.
- **Classification of various types of aircraft icing** to aid in forecasting icing conditions and their probable character and severity.
- **Possibility of reporting cloud height and visibility** existing at airport approaches rather than at several miles away which is now the general procedure.

Italian Carriers

Italian air lines operated over a total area of 38,346 miles in 1949, according to the Ministry of Civil Aviation. Italian carriers flew 47,944 hr. and carried 166,852 passengers during the year.

Figures indicate the Italian lines carried about half the total traffic in Italy.



Britain's Bid for Feeder Market

De Havilland is grooming Heron, 4-engine, short-haul ship to replace D.H. 86s and DC-3s; price \$98,000.

Great Britain's de Havilland Aircraft Co. is grooming a new and larger light transport for the feederline market.

A four-engine, short-haul ship, dubbed the Heron, is nearing completion and should be flying this summer. Carrying a \$98,000 price tag (minus radio), the Heron is a development of the twin-engine de Havilland Dove and embodies many Dove components in the wings, cockpit, main fuselage and empennage units, control surfaces and internal parts.

► **May Replace DC-3s**—The new plane will carry from 14 to 17 passengers, compared with eight to 11 for the Dove. It is designed to replace Britain's prewar D.H. 86 four-engine "Express Air Liners," but it may also be touted as a DC-3 replacement on some routes. The Dove—300 of which are now operating in 30 countries—was a replacement for the prewar, twin-engine D.H. 84 Dragons and D.H. 89 Dragon Rapides.

De Havilland says the Heron has been designed to give takeoff performance comparable with the Dragon Rapide and greater simplicity than has been offered in the Dove. The Heron has a fixed undercarriage, uses unsupercharged and ungeared engines, non-feathering propellers and no hydraulics. For use on longer stage lengths, a version of the Heron with retractable undercarriage is offered.

► **Short Runs**—Because of the small fields used by many of the world's feeder operators, the Heron has been designed for short takeoff and landing runs. It uses four 250-hp. D.H. Gipsy Queen Series 30 direct-drive, unsupercharged six-cylinder engines.

De Havilland says use of four engines gives a standard of engine-out performance not easily obtained with economy in small twin-engine aircraft.

► **Uses Many Dove Parts**—Because it in-

corporates many Dove components, the Heron can be produced quickly from existing tooling, and early deliveries can be promised at a lower cost. De Havilland points out that these components have been tested in four years of experience with the Dove, adding that all Dove operators who buy the Heron can reduce their spare parts stocks because of the interchangeability.

► **Capacity and Range**—Initial maximum gross weight of the Heron will be 12,500 lb. with 14 passengers at 165 lb. each and with baggage stowed at 10 lb. per cubic foot of available space, making a capacity payload of 3420 lb. The ship has a maximum still-air range (without reserve fuel allowances) of about 400 miles with the 3420-lb. capacity payload. Corresponding practical stage length is 150 miles with required fuel allowances.

With a payload of 2750 lb., the still-air range becomes about 700 miles and the practical stage length, with reserve fuel allowances, is 400 miles. Maximum still-air range with full tankage of 300 gal. and 1750 lb. of payload is 1250 miles, while the practical stage length (with reserve fuel allowances) at this loading is about 850 miles.

Recommended cruising speed with the fixed undercarriage version is 160 mph. (on 60 percent takeoff power at 8000 ft.), but lean mixture cruising speeds up to 177 mph. can be used is desired. Recommended cruising speed of the retractable undercarriage version is 175 mph., and maximum stage length with full 300-gal. tankage is given as 975 miles.

De Havilland claims the Heron will have good economy at all stage lengths up to about 600 miles. It says that because of the Heron's larger size it will operate at slightly less cost per ton mile of payload than the Dove.

LAS-S&W Pact

Exclusive maintenance agreement calls for fixed flight-hour prices.

Capping the trend toward fixed-price maintenance and overhaul, Seaboard & Western Airlines and Lockheed Aircraft Service, Inc., have entered into the most extensive agreement ever signed for this type of work. LAS will maintain and overhaul S&W's entire fleet of five DC-4s at a fixed price per flight hour.

Under provisions of the agreement, Seaboard guarantees an annual minimum of 6700 flight hours, involving an estimated minimum expenditure of \$350,000.

► **Exclusive**—Lockheed, under the pact, has the exclusive right to inspect, maintain and repair all S&W aircraft except for engines and in-transit inspections performed outside the continental limits of the U.S.

In addition to routine work in line with CAA standards and Seaboard's CAA-approved maintenance manual, LAS will be responsible for non-routine items including compliance with mandatory CAA airworthiness directives and renovation of interiors.

LAS will be responsible for overhaul of all components other than engines and will stock and supply spare parts other than major components such as landing gear assemblies, outer wing panels, engines, control surfaces, fuselage sections, flaps, propellers, engine mounts, doors, radio equipment and major pieces of interior furnishing.

LAS will also administer and maintain all necessary service and maintenance records.

Final responsibility for inspection, maintenance and overhaul requirements remains with the Seaboard staff under W. H. Renninger, vice president-engineering and maintenance, who will control the operation from headquarters in the hangar of Lockheed Aircraft Service International, the LAS subsidiary at N. Y. International Airport.

► **Not First, But Now**—While the new contract is not the first fixed price-per-flight-hour maintenance agreement ever signed, it is the most extensive for a four-engine fleet operation, according to spokesmen for both companies.

What is believed to be the first such contract was one of limited scope entered into between Seaboard and LAS early in 1948 when Seaboard was headquartered at the LAS Base at MacArthur Airport, Sayville, Long Island.

As far back as two years ago, LAS established fixed prices for the overhaul

of hydraulic components for its bases at MacArthur Airport, Sayville, N. Y., and Burbank, Calif.

► **Wide Coverage**—Since that time, LAS has expanded its fixed price structure to include almost every type of maintenance and overhaul work on executive-type and airline transports, ranging from component, accessory and instrument overhaul to re-licensing inspections, tank sealing and including major overhaul work.

With its Seaboard contract closed, Lockheed Aircraft Service last week was trying to sell fixed-price contract maintenance to several foreign airlines operating out of New York's International Airport.

IATA to Meet Here

The 1950 annual general meeting of the International Air Transport Assn. will be held at San Francisco's Fairmont Hotel from Oct. 16 to 20. It will be the first IATA general assembly to be held in the United States.

Warren Lee Pierson, Trans World Airlines board chairman, who was elected president of IATA at the association's last annual general meeting in The Hague in September, 1949, will take office on the opening day of the San Francisco session.

U.S. flag airline members of IATA

will act jointly as hosts to the heads of more than 50 other international airlines from about 45 countries. U.S. members of IATA are American Airlines, American Overseas, Braniff, Chicago & Southern, Eastern, National, Northwest, Pan American, Panagra, TWA and United.

SHORTLINES

► **Air Transport Assn.**—Estimates that domestic scheduled airlines are receiving about 50 percent less from the Post Office per airmail letter than they did ten years ago.

► **American**—Completed 98.4 percent of its scheduled miles in 1949, against 96.6 percent in 1948 . . . A CAB examiner has recommended that the carrier be permitted to serve Springfield, Mass., through Bradley Field, Windsor Locks, Conn., instead of through Barnes Municipal Airport, Westfield, Mass. . . . AA flew 417,570 lb. of Anahist cold tablets in December and claims it is the largest monthly shipment from one company in the history of airfreight.

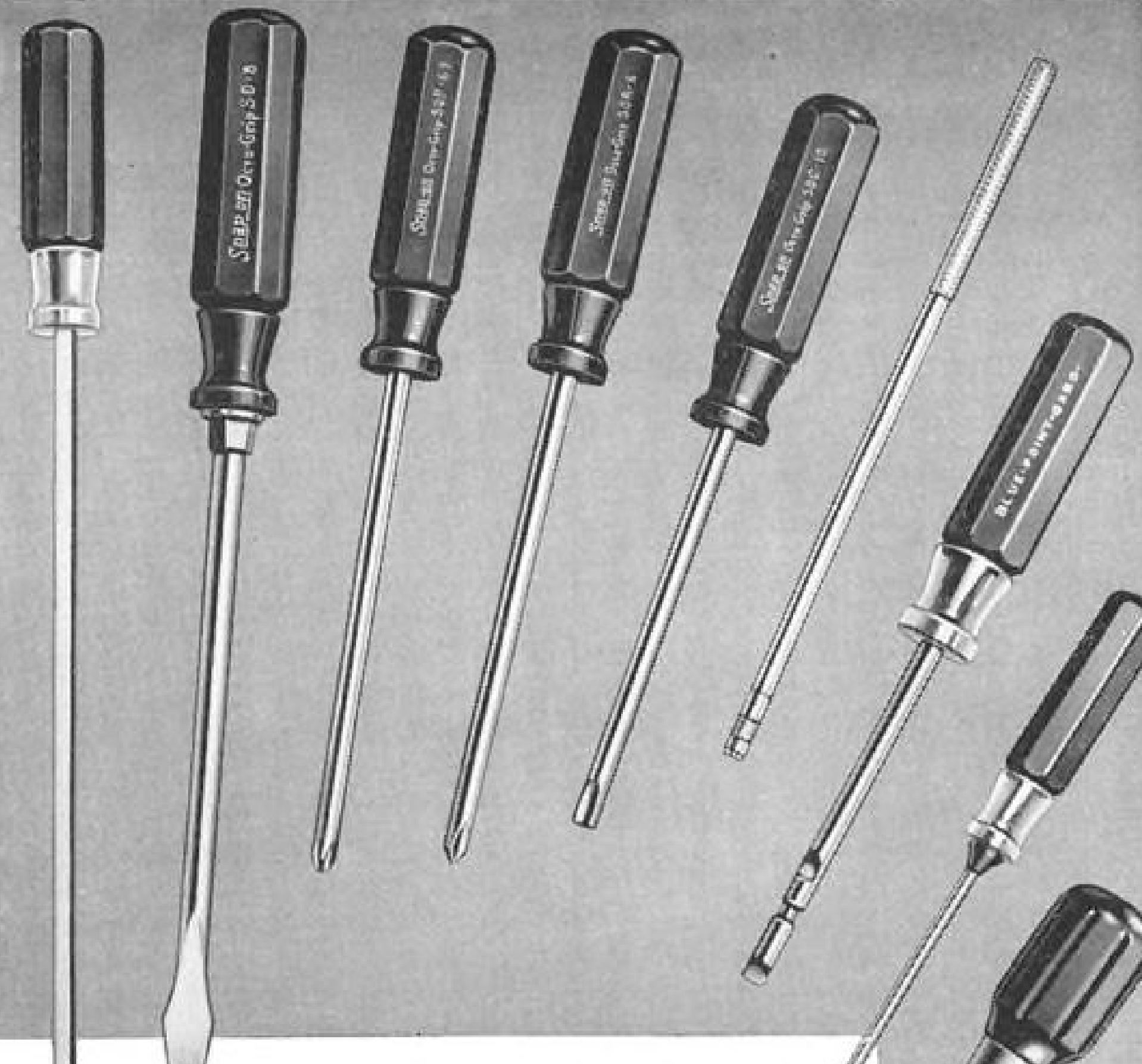
► **American Overseas**—Has inaugurated service to Hamburg, Germany. . . . Company recently used a Stratocruiser and a Constellation to fly 105 Minnesota Catholics to Europe on a Holy Year Pilgrimage.

► **Braniff**—Plans to inaugurate service to Asuncion, Paraguay, this week.

► **British European Airways**—Capt. Richard Rymer, BEA pilot, has become the world's first commercial pilot to be qualified officially to fly turboprop transports. The qualification is in the form of a special endorsement on his regular commercial pilot's license.

► **BOAC**—Plans to inaugurate Stratocruiser service on its Montreal-London route on Apr. 2. Eventually, BOAC hopes to operate the link entirely with Stratocruisers, transferring its Constellations to the mid-Atlantic run . . . Since March, 1947, BOAC's personnel has been reduced from 24,464 to about 17,250, while passenger and cargo capacity increased. Financial results for the last half of 1949 were disappointing because of currency devaluation, delayed deliveries of new aircraft and losses due to withdrawal of Tudor transports from service.

► **Central**—Despite protests from Braniff and Continental, CAB will permit the lightplane feeder operator to cut fares 15 percent to about 5.2 cents a mile on its Beech Bonanza service for a six-month period (AVIATION WEEK, Feb. 6). . . . Company flew 28,693 lb. of mail in December, compared with 20,012 lb. in November, but passengers carried fell slightly to 416. Central completed 82.7 percent of its scheduled



there's a finer
Snap-on
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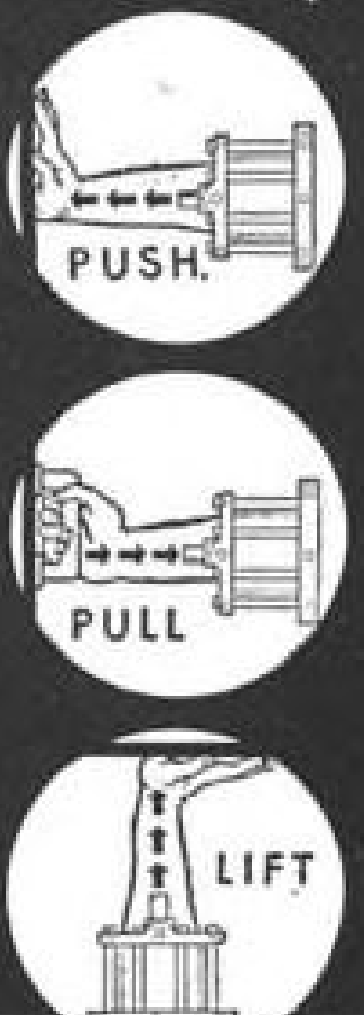


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flights in December, and revenue mile operating costs were 32.6 cents.

►Continental-CAB has denied the carrier's application for an exemption to serve the oil boom town of Snyder, Tex.

►Flying Tiger Line-Flew 1,438,000 freight ton miles in January, making it the second best revenue month in the cargo carrier's history. Volume was up 70 percent over January, 1949. . . . Company has signed interline agreements with Braniff, Chicago & Southern and the New England Greyhound Bus Lines.

►National-Reports an \$886,469 net loss in last half 1949 against \$826,774 loss in the same 1948 period when retroactive mail pay of \$235,029 had an abnormal effect on revenues. Total revenues were up 36 percent in the 1949 period.

►Northeast-Passenger revenues in January were down slightly from the same 1949 month, largely because of bad weather.

►Northwest-President Croil Hunter predicts 1950 airline business will set new records for both passengers and cargo.

►Panagra-In 1949 flew 2 million revenue passenger miles more than in 1948. Cargo traffic also was up.

►Piedmont-Has been certificated to serve Myrtle Beach, S. C., as an inter-

mediate point between Fayetteville and Wilmington, N. C., between May 1 and Oct. 31, 1950.

►Pioneer-Plans to modify its 11 DC-3s during 1950 to provide for drop doors, large rear baggage doors and rear baggage compartments and modified buffets and front baggage compartments. Work will be done by Southwest Air-motive Co., Dallas.

►Scandinavian Airlines System-Flew about 28,000 passengers over the North Atlantic and 13,000 on the South Atlantic route in 1949, against 20,300 and 6100, respectively, in 1948.

►Swissair-Flew 153,812 passengers last year, up 40 percent over 1948.

►TWA-Flew 1,516,352 passengers on its domestic and international routes in 1949, up 14 percent over 1948. Domestic load factor went from 57.9 percent in 1948 to 60.7 percent last year, while the international passenger load factor rose from 57.1 percent to 61.8 percent.

CAB SCHEDULE

Mar. 6-Hearing in National Airlines route transfer case. (Docket 3500 et al)

Mar. 7-Prehearing conference on TWA and American Overseas Airlines requests to suspend service at Philadelphia on trans-Atlantic routes. (Dockets 428 and 4229)

Mar. 8-Oral argument in reopened Mississippi Valley and Southeastern States area route cases. (Dockets 548 et al and 501 et al)

Mar. 13-Resumption of hearing in West Coast Airlines certificate renewal case. (Docket 3966 et al)

Mar. 13-Hearing on Twin Cities-Washington and Detroit-Washington through service investigations. Docket 3661)

Mar. 14-Hearing on enforcement action against Peninsular Air Transport Associated Airlines Agency and National Air Coach Systems. (Docket 4084)

Mar. 15-Hearing on enforcement action against Arrow Airways. (Docket 4199)

Mar. 27-Hearing on enforcement proceeding against National Travel Club, Inc. (Docket 4194)

Apr. 17-Hearing on enforcement action against Trans American Airways, Great Lakes Airlines, Golden Airways, Edward Ware Tabor and Sky Coach Airtravel, Inc. (Docket 4161)

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ECONOMIC RESEARCH Man: Wanted an economic research man capable of building exhibits for various proceedings before the Civil Aeronautics Board. Must have actual experience in building exhibits and must have original ideas. Write Keith Kahle, President and General Manager, Central Airlines, Inc., 6109 Camp Bowie Boulevard, Fort Worth, Texas.

POSITIONS WANTED

RETIRED NAVY Captain Naval Academy Class 27 desires position with aviation organization San Francisco area, has had 15 years experience Naval aviator last two years top executive NATS Division. PW-3588, Aviation Week.

DESIRE POSITION as Flight Mechanic on personal or exec. airplane fully qualified for any type ship, 11 yrs. aviation experience, stable character, if interested please request full particulars. PW-2416, Aviation Week.

COMMERCIAL PILOT seeking position with corporation. Executive pilot and mechanic. Non schedule 3600 hrs. Non accident. ASEL & AMEL. Instrument rating, valid A&E and flight instructor. Howard D. Campbell, 1125 East Taylor St., Phoenix, Arizona.

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14, B-1 Model 10 hydraulic lift platform stands. Work range 3 to 10 ft., 1500 lbs. capacity. Excellent condition, \$300 each. 5 Model 20's, work range 13 to 20 ft., excellent condition \$450 each. Aircraft Conversion and Maintenance Co., Box 536, Tucson, Arizona.

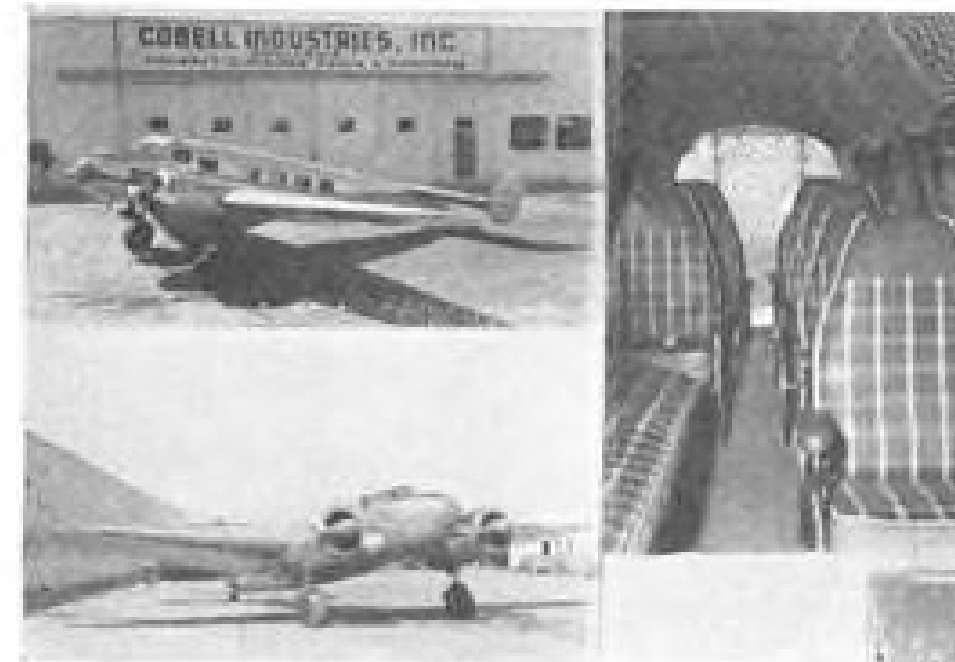
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EXCUSE THOSE RED FACES AT ANSUL—Thanks to a conspiracy between Dick Baker of a certain manufacturer of fire fighting equipment and Barney Freeman of Kenyon & Eckhardt agency's publicity department, we pass along this alibi for the record:

"A fire extinguisher company has been taking a lot of ribbing recently because its Beechcraft Bonanza was caught in a freak hangar fire in Milwaukee and was destroyed. The firm, Ansul Chemical Co., of Marinette, Wis., has already ordered a replacement plane. Ansul pilot, R. A. Nelson, replies to the razzing by explaining that 'the hangar people mustn't have had any of our extinguishers around.'"

* * *

9 LIVES FOR JATO—Rudolph C. Schulte of Ft. Worth postcards us an order: "Please send me a dozen JATO units that give 250-lb. thrust for 12 minutes. My book shows only 12 seconds." Our guilty writer of a sentence in our Nov. 7 issue is still trying to explain how he could have done such a thing.

* * *

MANANA DEPARTMENT (MEX.)—Our airlines operating with Mexican personnel have their unique moments. This one is a true story from G. H. Macomber, Lamsa's general traffic and sales manager in Mexico City:

Two ticket agents were busy with six customers (the man says). The office manager sat at a desk writing a report. Suddenly, he glanced up, noticed the agents were busy. He walked over to the counter and asked a customer, "Are you being taken care of?"

"No, not yet," answered the customer.

"Then you will be pretty soon," advised the manager cheerily, and walked back to his desk to complete his report.

P.S. We got a kick out of Mr. Macomber's covering letter as transcribed by his secretary. It reads: "We are enclosing some antidotes on Lamsa . . ."

* * *

NATIONAL'S DOUBLE-TAKE MATCHES—We keep getting samples of National Air Lines' latest match covers, with their breezy advice. The public doesn't always catch on but industry people familiar with National's "roomier" seat arrangements on their Sixes do. The slogan says: "Don't travel half-fast."

* * *

HOYT AND A TALL TALE—Elveron Hoyt out at Snyder Aircraft Corp. in Chicago will never forget how a roaring engine next to you can distort the spoken word. Herewith his tale:

In 1947 I undertook to manage a small country airport in Indiana, mainly to instruct GI's in light aircraft. On one of my first flights with a brand new student, we flew over a nearby community to see the sights and make him feel more at ease in the air. Near the edge of town I noticed the student was concentrating his attention on a large semi-residential type building, which was outstanding in that agricultural, hilly country, with few edifices of any particular prominence. I turned in my seat and above the din of the Continental 65 asked him what the building was. I was astounded at his answer.

"You're kidding," I said, amazed.

"No, not at all. They do all right there too," came his surprising answer.

I could well believe it. Now, I had traveled extensively, but never had I seen so large an establishment of this kind. I circled the splendid old building several times, at lower altitude, and I was still wondering how a palace of this magnitude could support itself in this rather sparsely settled region.

I headed back to the home field and landed the Cub. As soon as we disentangled ourselves from the ship I expressed in considerable detail my wonderment at the estate.

The student suddenly looked very shocked, and then spoke:

"I told you it was the POOR house."

—R. H. W.

WHAT'S NEW

New Books

"How to Plan Pensions—A Guidebook for Business and Industry" by Carroll W. Boyce, associate editor of Factory Management and Maintenance. Here is a non-technical survey of one of the most pressing problems confronting businessmen today. Covered are all phases of pensions as related to business and industry, reviewing the practical implications of those sections that are best left to skilled technicians. A glossary of technical terms is included.

The chapters on planning are organized in three sections: Management review, negotiator's review, and a reference review which includes a check list and sample negotiated clauses.

A very comprehensive appendix covers, among other things: Comparison of Ford, Bethlehem, and CIO plans; text of United Auto Workers' "Basic Minimum Standards for Supplementary Security Programs"; tables for approximating pension plans—uninsured plans; and specimen self-insured pension and trust agreement.

Publication date March 1, by McGraw-Hill Book Co., Inc., 330 W. 42 St., New York 18, N. Y., 350 pages (estimated), price approximately \$4.50.

"CAA Statistical Handbook of Civil Aviation," is latest edition containing all available statistics through June 1949. Nine chapters and 21 graphic illustrations cover the CAA and its functions, airports, federal airways, aircraft and airmen certificates, aviation, education, civil flying, aviation production and exports, scheduled carrier operations and accidents.

There is a much-expanded chapter on international scheduled airline operations, so that direct statistical comparisons may be made with figures for domestic carriers.

Available from U. S. Government Printing Office, Washington 25, D. C. price \$.50.

"The Airplane and its Engine" by C. H. Chatfield, C. Fayette Taylor, professor of automotive engineering, and Shatswell Ober, professor of air engineering, MIT. Stressing present-day developments, this volume covers all types of aircraft and aircraft power plants from the standpoints of construction and capabilities, and explanations on the basic principles of physics involved. Included are detailed descriptions of latest constant-speed, full-feathering and reversible pitch props.

Published by McGraw-Hill Book Co., 330 W. 42 St., New York 18, N. Y., 380 pages, price \$4.50.

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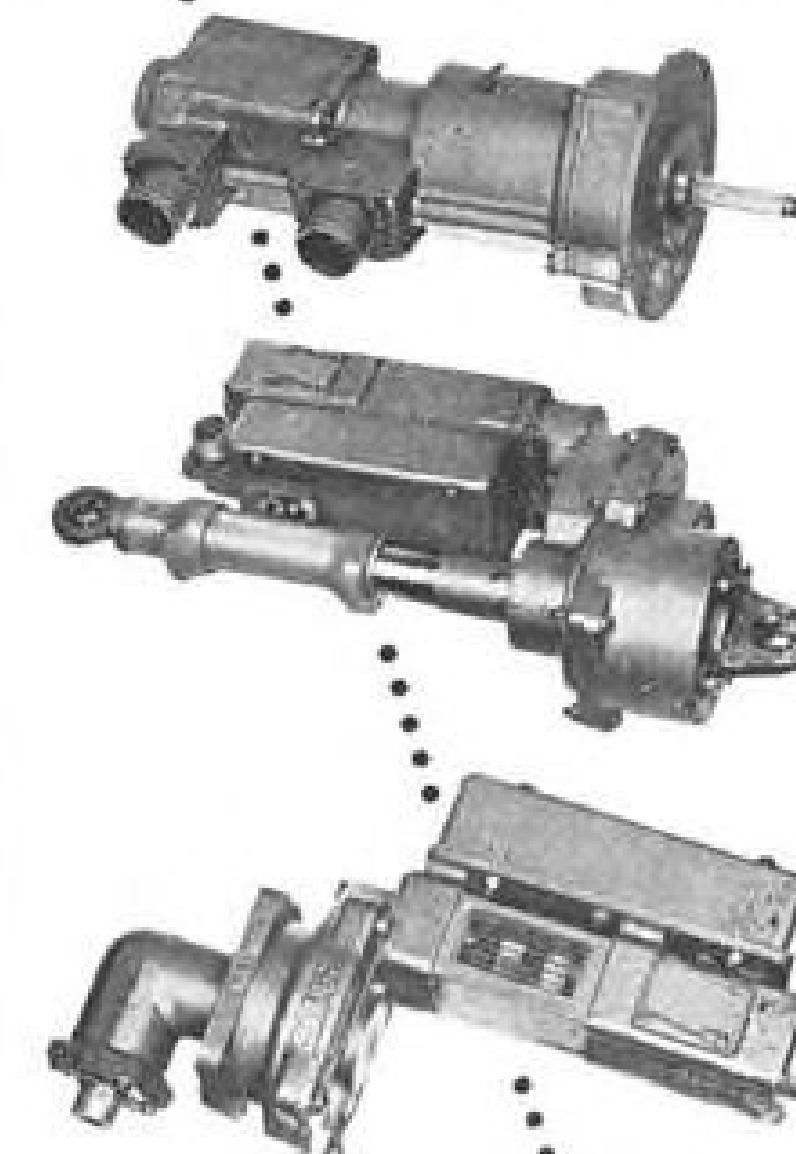
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Today's Coach Sermon

Today's text for the latest sermon on air coach and its long-term importance to aviation in attracting millions instead of thousands of customers comes from a speech.

The speech was made by Thomas W. S. Davis, now assistant secretary of commerce. Before his promotion we all knew him as just Tom Davis, United Air Lines' executive assistant in Washington.

Tom spoke these words to the American Assn. of School Administrators at Atlantic City:

In spite of widespread public interest in aviation, too few Americans utilize this great network of air transportation. I mentioned that more than 15 million of our citizens flew on our domestic airlines in 1949. But I have learned from industry sources that about 80 percent of these 15 million air passengers are repeaters—which means that in 1949 only about 3 million of these passengers were using air transportation for the first time. This is a poor showing for a nation of some 150 million people.

I am convinced that this slow acceptance of air travel by the majority of our people is not caused by fear of flying—but by the cost of flying. In the very early days of the railroads only the wealthy could afford to ride trains. In the early days of air transportation a similar condition existed. But gradually, since the end of the war, there has developed within the air transport industry a recognition of the need to lower rates in order to carry more people, and more of the goods of commerce.

Today, a number of our airlines are operating temporary "coach type" air service. . . . The air carriers that are performing this service, and the CAB which authorized it, both describe these lower-fare air coach operations as an "experiment."

It is my belief that this obvious and long overdue development is the only device that will begin to tap the mass market of potential air passengers that have thus far been economically reluctant to buy air transportation.

I believe that within five years this great new bulk of our air travel will be "air coach" travel, in addition to the type of service which we now have—this in the same way, and for the same reasons, that the great bulk of rail travel is coach instead of Pullman.

Those new surroundings are good for you, Tom. These words make mighty good sense to us.

Caboose Is Ahead of the Engine

In a moment of generosity we wrote here Feb. 20 that the Assn. of American Railroads practices good public relations.

We take it all back. The Assn.'s latest advertisement running in national magazines proves how wrong we were. Ads and press releases should be convincing and face facts.

But the AAR's latest message to America does neither. And we in aviation can learn from its mistakes.

The ad is topped by an illustration of a motorist at the wheel looking ahead at a giant trailer truck supposedly retarding his progress down the highway. Then comes this message:

Does This Look Familiar?

Next time this happens to you, here's something you might think about:

We have railroads to carry freight—all sorts of freight in any quantity, for anybody, to any part of the country, in any season of the year.

These railroads are built for heavy-duty hauling—more so than ever after the four billion dollars they have spent for improvement since the end of the war.

And the more freight railroads are called upon to carry, the more efficiently and economically they can do the job—and at the same time your public highways will be less expensive to maintain, safer and more convenient to use.

Now, friends, the next time you read an ad like the one above, here's something you might think about. At least, these thoughts will be on the subject!

Why is that loaded truck—and the thousands of others—going down the highway? Because some shipper by his own free will and for what he considered a good reason decided to send that shipment by truck instead of train.

It seems a reasonable assumption to say that most of the trucks we see are making a profit. They cannot keep running indefinitely if they don't pay off. If they continue to pay off, that means millions of trucks are performing a needed service for the public. Apparently thousands of shippers—many of them motor car owners and drivers themselves—consider this cheaper, quicker public service worth some personal driving delays on the highway, and even perhaps more, of their tax dollars.

If the railroads had never sunk into their disastrous "public be damned" attitude it seems doubtful if the "competing" highway system ever would have been deemed worth all the billions of public dollars we spent on it. And even if you do not go along with us on that assumption, surely you will on this one:

The rails, even in this so-called enlightened age, when they should have learned so much from their errors, ought to be advertising to get new customers on a competitive, business basis.

Instead, we see them sitting back, pompously unperturbed by the passing parade, waiting for customers to stray in. As they smugly proclaim: "Americans, here are your railroads; we have them all set up and running for you. They were built just to carry things. They must be good; we spent billions on them. It is your duty to use them. And look, now. Here is something we might possibly be able to promise. If lots of you will forget about those smelly, bothersome trucks and faster service or cheaper rates, and if you come over and hand us your business on a platter, we will then be more efficient and our service won't be as bad as it is now and you can pay us those extra dollars you are throwing away on highway improvements. Isn't that a tempting inducement for you lucky shippers?"

Come, come, AAR—that's putting the caboose ahead of the engine. Did you ever hear of the good old American business habit of first setting up a better service than your competitors, then going out and beating on doors trying to SELL, SELL, SELL? We hope the airlines never run an ad like yours.

—ROBERT H. WOOD

AVIATION WEEK, March 6, 1950

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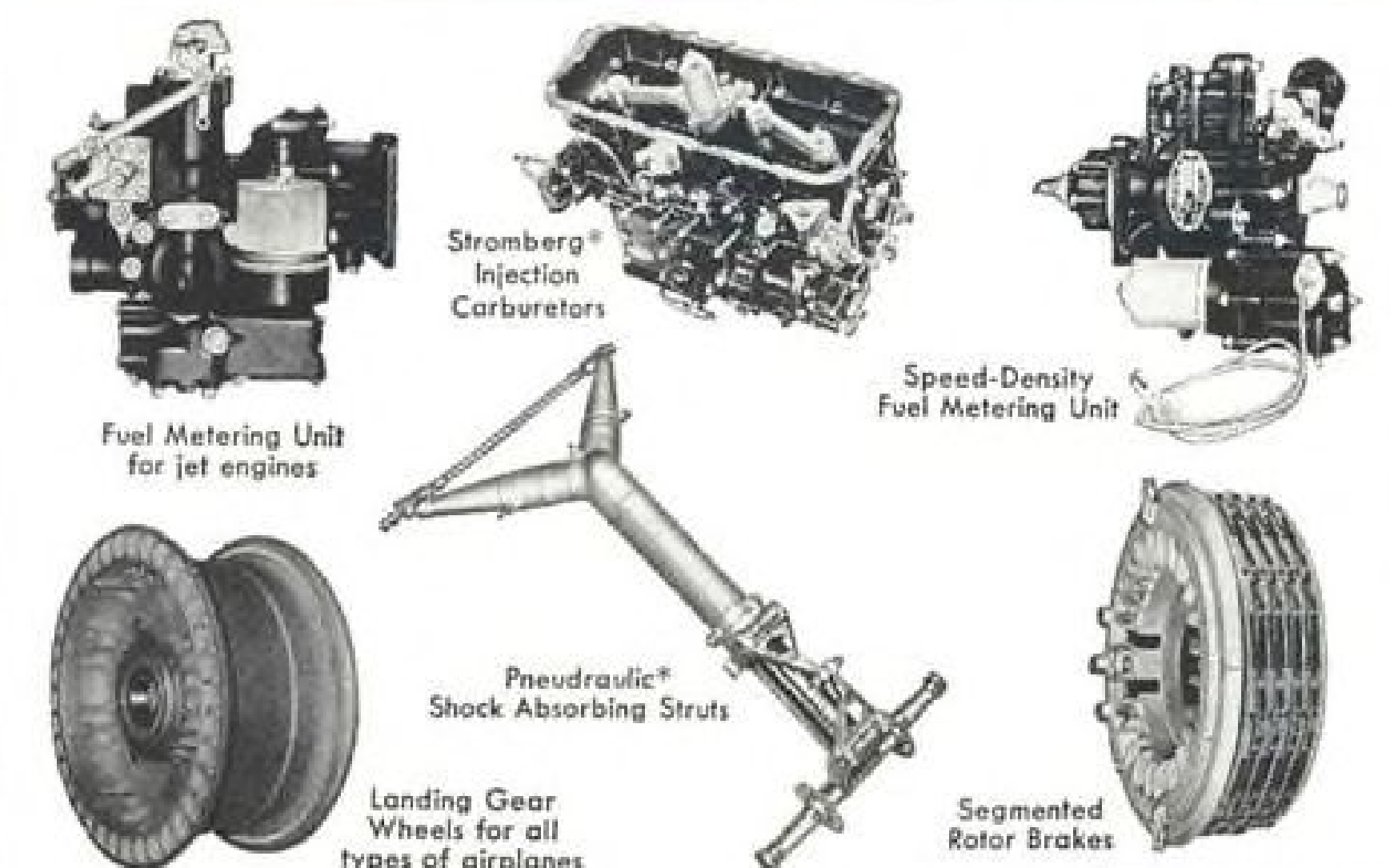
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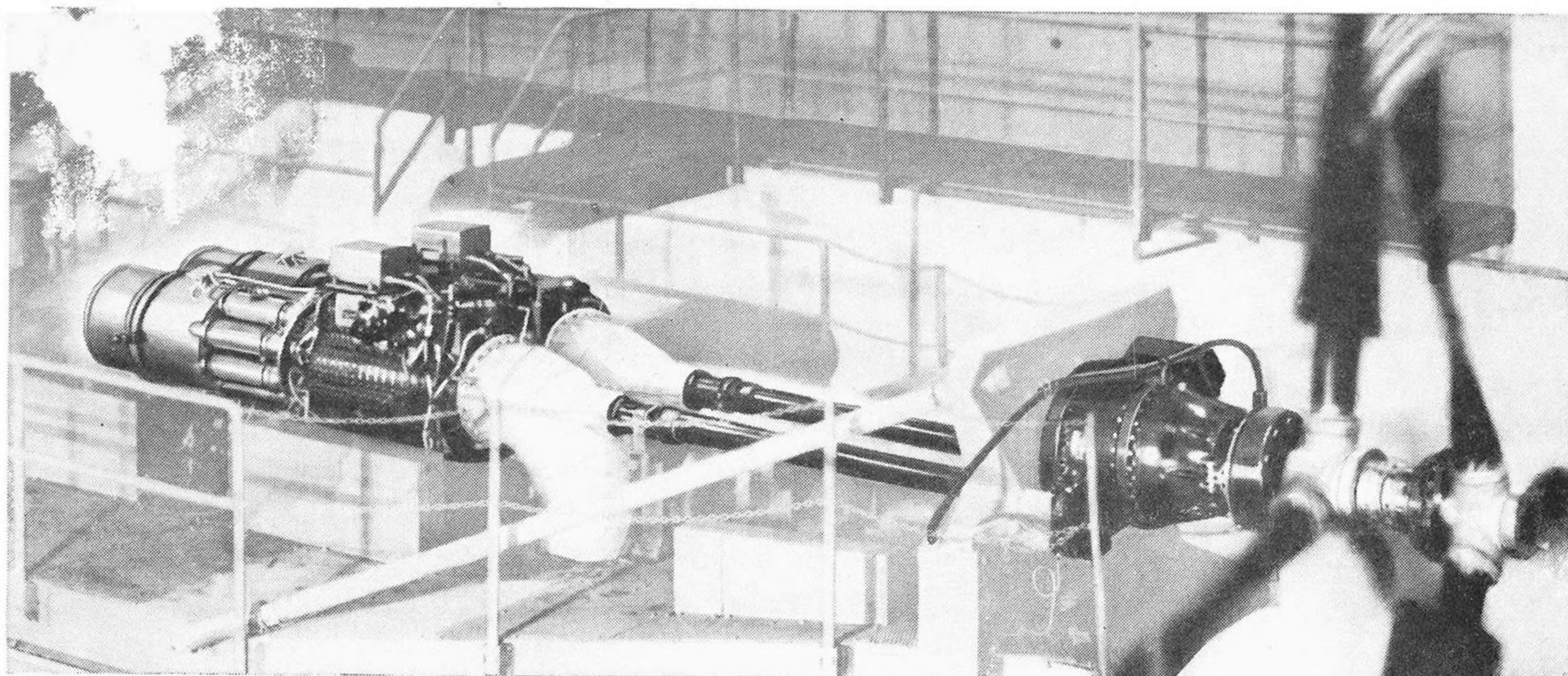
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Allison Turbo-Prop Engine ***MOST* power per pound** ***LEAST* fuel per horsepower**

The new 5500 horsepower Allison T40 Turbo-Prop is the most powerful propeller-type engine in the world today. It develops more than two horsepower for each pound of weight. Its fuel economy is better than that of any other Turbo-Prop engine in the world.

Its twin engine-unit design permits full power for shorter take-off, faster climb and top cruising speed. In flight, to gain best fuel economy for cruising, one power unit may be shut off entirely, allowing the other to operate at its most efficient setting. Through shafting, clutches and a reduction gear, either engine unit drives both propellers. Thus there is no drag from a feathered propeller when one power unit is shut down. This feature, permitting maximum power and maximum fuel economy, cannot be matched by a single unit engine.

Allison

Builder of the famous J33 and J35 Turbo-Jet aircraft engines

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