AVIATION WEEK

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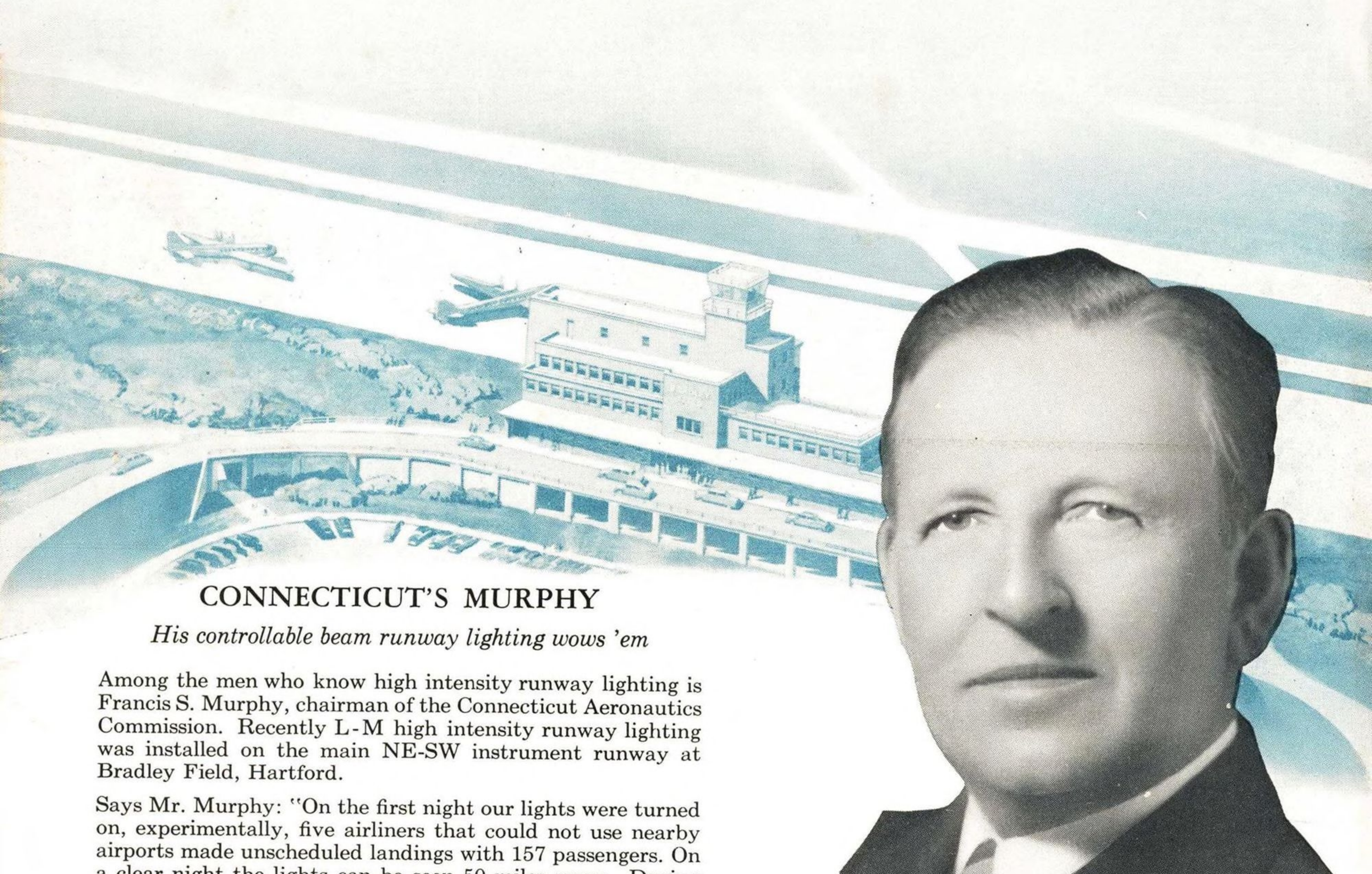
A YEAR



CONNECTICUT'S MURPHY

His controllable beam runway lighting wows 'em

Among the men who know high intensity runway lighting is Francis S. Murphy, chairman of the Connecticut Aeronautics Commission. Recently L-M high intensity runway lighting was installed on the main NE-SW instrument runway at Bradley Field, Hartford.

Says Mr. Murphy: "On the first night our lights were turned on, experimentally, five airliners that could not use nearby airports made unscheduled landings with 157 passengers. On a clear night the lights can be seen 50 miles away. During this test we asked a pilot in a plane five miles east of Springfield to watch for the lights—and we turned them on. 'Can you see them?' we asked. 'Wow!' was the answer. We're satisfied!"

* * * *

Installation by Bauer & Co., Hartford electrical contractors. Plans and supervision by Donald J. Lynch, Connecticut Aeronautics Dept. Engineer, CAA-Engineer Winslow B. Smith, Arthur G. Flynn for Bauer & Co., and W. F. Blackford, Line Material Company Airport Lighting Engineer.

One of L-M's 180,000 cp runway lights, with the controllable beam, the type now in operation at Bradley Field.

Francis S. Murphy,
Chairman of the Connecticut Aeronautics Commission

LINE MATERIAL . . . Airport

Aviation Week

ABP Member ABC

Volume 53 November 20, 1950 Number 21

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NEWS DIGEST

DOMESTIC

Loss of another AJ-1, North American's composite Navy bomber, is attributed to failure of hydraulic line which caused engine fire in left nacelle. Plane was in AJ-1 formation flight out of Patuxent, Md., when fire started. Crew of three bailed out safely.

Capt. J. S. Pricer, 53, American Airlines pilot, collapsed and died of a heart attack in the cockpit of his DC-6 15 minutes before a scheduled takeoff from New York. Capt. Pricer had passed his CAA physical check in June, and a company examination a year ago.

Pratt and Whitney Aircraft production employe members of the International Association of Machinists voted in favor of a strike. Union-company contract expired Nov. 13.

License agreement has been signed between Sikorsky Aircraft and Westland Aircraft covering building of the 10-place S-55 helicopter in England by the latter firm. Westland has been building S-51 helicopters under a similar agreement dated 1947, and intends to build 600-hp. P&W R-1340 engines to power the S-55.

Bell Aircraft Corp. has received a "moderate size" production order from Navy for its XHSL-1 anti-sub helicopter. It is understood the contract is for more than the usual service test quantity of about 13. Bell won award for three experimental models of the 13,000-lb. craft last June. XHSL-1 is powered by a P&W R-2800 engine.

William Gage Brady, Jr., chairman of the board of National City Bank of New York, has been elected to United Aircraft Corp.'s board of directors.

Industrial Liaison Branch of the Directorate of Public Relations has been created by the Air Force. Purpose of the new office is to serve the aircraft and allied industries in public relations aspects of mutual problems. Air Force also wants to use office to obtain continuous counsel, criticism and comment from the industry.

Airframe weight shipments for September, 1950, totaled 4,326,800 lb., of which 88 percent went to U. S. military customers, the Census Bureau reports. Engine horsepower shipped was 4,550,100, with 97 percent going to the military. Employment in airframe plants was 191,649; in engine plants, 39,410. Personal plane shipments totaled 293, at a value of $1,592,000. Figures are from government and industry sources.

Joseph F. Meade, Sr. died at the age of 59 at Bath, N. Y. The aviation pioneer started as an engineer with Curtiss at Buffalo and later joined Aerial Service Corp. at Hammondsport. Meade organized Mercury Aircraft Corp. which is still active.

National Air Council has broadened its affiliations to include Aeronautical Training Society, Air Freight Assn., Aviation Distributors and Manufacturers Assn. and University Aviation Assn.

Pan American World Airways last week closed the last link of the first round-the-world voice radio communications system. Thirty-two high frequency stations now link the airline's 19,687-mi. voice chain.

William B. Davis has been named deputy director of CAA's Office of Aviation Safety. Davis began his flying career in 1929, is a veteran of 12 years in safety work with CAA.

FINANCIAL

Sperry Corp. has declared a dividend of 50 cents per share payable Dec. 18 to stockholders of record as of Dec. 1. Dividends total $2 per share in 1950.

Bell Aircraft Corp. profit for quarter ending Sept. 30 is $786,219 after taxes on $18,778,223 income. For like 1949 period, profit was $49,045 on income of $8,184,158.

Glenn L. Martin Co. reported net income of $2,495,663 for first nine months of 1950. Sales for the first three quarters of 1950 were $33,857,832, with backlog of $162 million as of Sept. 30.

Pan American World Airways declared a dividend of 50 cents per share payable Dec. 12 to stockholders of record Nov. 24. This is twice 1949 dividend and thirtieth paid by PAA.

INTERNATIONAL

Britain's Canberra jet bomber may be built in Canada, according to intimations of British Defense Minister Emanuel Shinwell. Canadair's plant at Montreal, now producing F-86 Sabres, would be a likely choice, stated Shinwell.

Crash of Curtiss-Reid DC-4 on a mountain in southeastern France killed all 51 passengers and seven crew members. Almost all passengers were returning Holy Year pilgrims.

AVIATION CALENDAR

Nov. 23-26—Snowbird Soaring Meet, sponsored by Elmira Area Soaring Corp., Elmira, N. Y.

Nov. 26-Dec. 1—71st annual meeting, American Society of Mechanical Engineers, Hotel Statler, New York.

Nov. 28-30—Airport fire safety clinic sponsored by the National Fire Protection Assn. committee on aviation and airport fire protection, Baker Hotel, Dallas.

Nov. 29-Dec. 1—Eighth annual meeting of Aviation Distributors and Manufacturers Assn., Ambassador Hotel, Los Angeles.

Nov. 30—Airport fire safety clinic, sponsored by Committee on Aviation and Airport Fire Protection of the National Fire Protection Assn., Baker Hotel, Dallas.

Dec. 7-8—Auction sale of aeronautical books, furniture, paintings, prints and furnishings, Plaza Auction Rooms, 9 E. 59 St., New York.

Dec. 8—Aviation Associates show and dance, Town Hall, Philadelphia.

Dec. 16—14th Wright Brothers Lecture, Institute of Aeronautical Sciences, U. S. Chamber of Commerce Auditorium, Washington, D. C.

Dec. 16—Annual Wright Day dinner of the Aero Club of Washington, Presidential Room, Statler Hotel, Washington, D. C.

Jan. 2-7, 1951—Miami Aviation Week, Miami, Fla.

Jan. 5-6—Third annual Kansas aerial spray conference, engineering lecture hall, Kansas State College, Manhattan, Kan.

Jan. 6-7—Florida Air Pilots Assn. air show and exposition of planes and equipment, Opa Locka Airport, Miami, Fla.

Jan. 8-10—Eighth annual air cruise Miami-Havana, and return, of Florida Air Pilots Assn.

Jan. 15-18—Plant maintenance show and concurrent conference on plant maintenance techniques, Cleveland, Ohio.

Jan. 29-Feb. 1—19th annual meeting of the Institute of Aeronautical Sciences, Hotel Astor, N. Y.

Mar. 19-23—Seventh Western Metal Exposition, Oakland Auditorium and Exposition Hall, Oakland, Calif.

Apr. 24-26—ATA annual engineering and maintenance conference, Hotel Drake, Chicago.

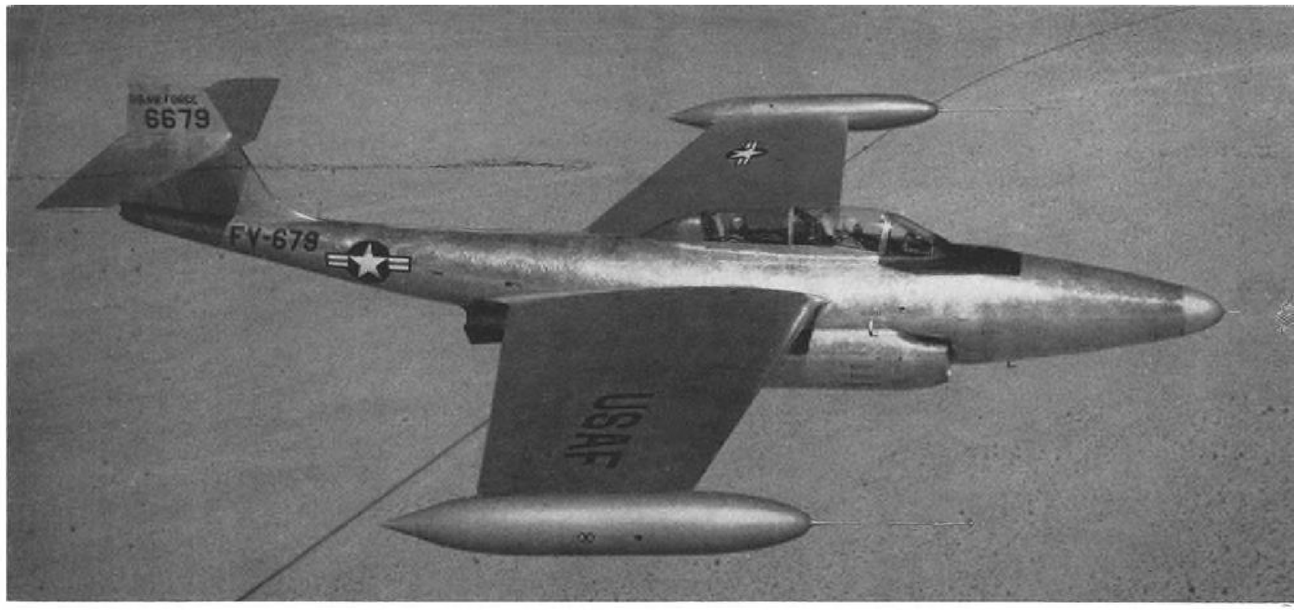
June 11-15—Second annual conference on industrial research, conducted by Columbia University Dept. of Industrial Engineering, New York.

Sept. 7-11—Third annual Anglo American Aeronautical Conference, convened jointly by Royal Aeronautical Society and IAS, Brighton, England.

Sept. 10-14—Sixth national instrument conference and exhibit, sponsored by Instrument Society of America, Sam Houston Coliseum, Houston, Tex.

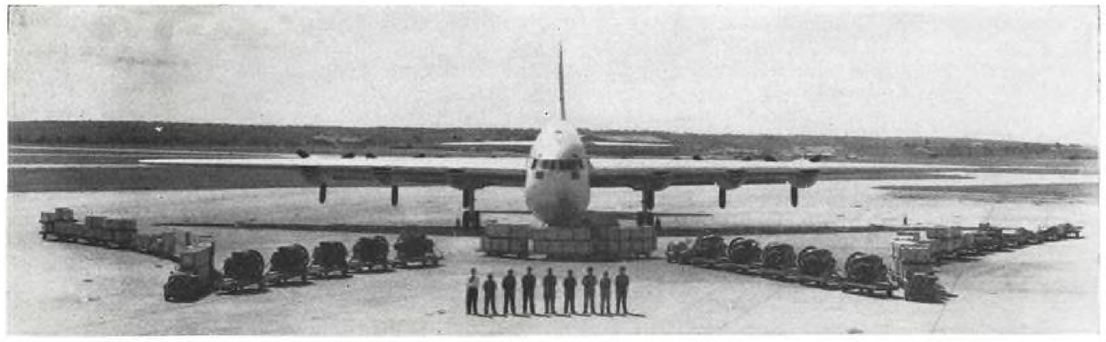
PICTURE CREDITS

9—(F-89) Northrop, (XC-99) USAF, (Iberavia I-11, Helioplane) Howard Levy; 13—David A. Anderton; 29—NACA; 52—(Dove) Charles E. Brown.



NIGHT BIRD—A shiny Northrop F-89 Scorpion all-weather fighter with its crew of two cruises over the California desert. Now in large-scale production, the 600-mph. F-89 is fitted with two Allison J-35 axial-flow turbojets equipped with afterburners.

News Picture Highlights



RECORD SMASHER—Convair's giant XC-99 cargo plane undergoing evaluation at Kelly AFB, Tex., recently flew 200,000 ton-miles of cargo (42 engines) from San Antonio to Spokane to Tacoma to Sacramento and back to San Antonio.

SPANISH SPORTSTER—This neat little I-11 two-seat side-by-side trainer-sport plane is built in Spain by Iberavia, S. A. It has an 85-hp. Continental, giving the 1496-lb. gross craft a top speed of 122 mph.

HELIOPLANE MODIFIED—Prototype slow-flying Helioplane has been modified to incorporate these changes: Shorter (80 percent) flaps, "feeler-ons" (small ailerons), full-length rudder.

WHO'S WHERE

In the Front Office

Roy J. Sandstrom, chief engineer for Bell Aircraft, has been named vice president in charge of engineering for the company. He joined Bell in 1938 and has been in charge of all of the company's military engineering. He also served as project engineer on the famed X-1.

What They're Doing

Winnett Boyd has resigned as assistant chief engineer and chief designer of Avro Canada's gas turbine division, effective as of Dec. 31. Boyd intends to establish his own consulting engineering practice in Toronto, and it is anticipated that he will continue to be associated with the aviation gas turbine industry.

Changes

Karl L. Fickes has been appointed plant manager of Goodyear Aircraft's reactivated Litchfield, Ariz., facility. . . . **George H. Buchner** has been named manager of the order and contract department of Curtiss-Wright's propeller division. . . . **Neil P. Whitney** has been promoted to manager of Cessna Aircraft's Hutchinson, Kan., plant. . . . **C. J. McDowall** has been named chief design engineer with Allison division of General Motors. . . . **Charles D. Perrine, Jr.,** has left Fairchild E&A's electronics department to join the electronics and guidance section of Convair's San Diego division engineering department. . . . **Melville E. Stone** has been named advertising manager of Pan American World Airways.

Honors and Elections

20-YEAR VET—T. E. Braniff, (left), head of Braniff Airways, is seen getting the first 20-year service pin awarded a member of the airline. Pinning it down is Braniff vice president Ray C. Shrader. Although the Braniff name first took to the air 22 years ago, the company was not incorporated until two years later, and service pin awards are dated from then.

INDUSTRY OBSERVER

► **McDonnell Aircraft Corp.'s midget ramjet helicopter XH-20 has recently made a series of successful power-off auto-rotative landings from various altitudes, indicating it is overcoming what was believed to be probably its most serious drawback as a practical aircraft. Combination of more efficiently streamlined ramjet engines on the rotor tips and carefully worked-out pilot technique on the flareout are responsible for the new advance. With this obstacle overcome, way is cleared for further ramjet copter developments at McDonnell.**

► Doman Helicopter Inc. is test flying the large helicopter it built for Curtiss-Wright's entry in the Arctic rescue helicopter competition (AVIATION WEEK Jan. 30). First flight was made Nov. 7, and it is believed the copter will be ready to turn over to C-W shortly.

► **Lockheed Aircraft Corp. wants to lengthen a runway at Lockheed Air Terminal, Burbank, Calif., to 7100 ft. (from 6000 ft.) for jet plane use, and has asked USAF to provide $150,000. Company would put up $100,000 for the project.**

► How Ford Motor Co. tackles the assignment of manufacturing the Pratt & Whitney Wasp Major R-4360 engine at its new Chicago plant will be watched closely by aviation industry manufacturers. Ford has just named William Pioch manager of manufacturing engineering at the new engine plant with responsibility for applying mass production techniques for high-volume output of the complicated 28-cylinder 3500-hp. engine. In World War II he was chief engineer for the Ford Willow Run plant which at peak was turning out Convair-designed B-24 bombers at the rate of one an hour. The automobile company also has advantage of previous experience in making Pratt & Whitney Aircraft engines. The big Ford Rouge plant produced 57,851 of the 2000-hp. Double Wasp R-2800s in World War II.

► **By the time Piasecki's big H-21 helicopter gets flying it will have considerably more than the 1000 hp. which it specified for the Wright R-1820 engine powering the big copter. Newer models of the same engine are up around the 1500-hp. mark. It won't be pure gain for the helicopter however, because the bulky "omniphibious" gear on the rescue copter—for use on land, sea or snow—is weighing out heavier than was anticipated.**

► Statement in a Westinghouse publication that the J-40 and J-46 axial-flow turbojets produced by that company for Navy are "in final development stage and will soon be ready for commercial use," is probably premature. The J-40 is a higher-powered development of the 3000-lb. thrust J-34, and the J-46 is a larger turbojet rated at at least 6000-lb. thrust. Neither is expected to be released by the military services for certification by CAA very soon.

► **Not generally known is the fact that the Martin XB-51 tri-jet bomber not only has a variable incidence wing, but that its horizontal stabilizer has variable incidence as well, in the new "all-moveable tail" fashion recommended by NACA. The new North American F-86E is following this pattern also, and it will be a coming thing among other new high-speed airplanes.**

► Another Navy step to adapt existing carriers to heavier, larger, longer-range planes will be installation of a new-type arresting gear on Essex and Midway-class carriers. Tests on the new-type gear are expected to start early in 1951. Improved arresting gear valves are also being installed on some of the smaller carriers.

► **Under-wing pod-type engine installations for multi-engine aircraft eventually will supersede the more conventional types of wing nacelles seen in most of today's airplanes. Reason is smoothness of airflow over the wing is so much better when unbroken by the nacelle, and the flow under the wing is considerably smoother when it slides by a slender pylon which attaches the pod to the under surface of the wing.**

Washington Roundup

Marked changes in the congressional picture for aviation next year will result from the Nov. 7 election. There will be new faces and a reshuffling of many key posts on Capitol Hill. These developments are noted by aviation observers in Washington:

• **Sen. Joseph O'Mahoney** staunch air power advocate, is the top preference for the new majority leader of the Senate—although he does not want the post. Majority Leader Scott Lucas was defeated in Illinois. O'Mahoney fought for the 70-group Air Force program in '49 as a member of the Senate Appropriations Committee.

• **Sen. Richard Russell** of Georgia, the second possibility for the key position, has O'Mahoney's backing. An able veteran of 17 years Senate service, Russell is also first in line for the chairmanship of the Armed Services Committee, now held by defeated Sen. Millard Tydings—if Russell does not step into the Democratic leadership. Russell is middle-of-the-road on defense. Cautious on federal spending, he went along with former Defense Secretary Louis Johnson's cutback program on air power.

• **Sen. Harry F. Byrd** is second in line for the Armed Services chairmanship. A powerful political figure, Byrd, in this post could challenge—if not eclipse—Rep. Carl Vinson's leadership on military affairs. Vinson, chairman of the House Armed Services Committee, puts defense first, economy second. Byrd has always emphasized economy in government.

• **Sen. Lister Hill,** who sacrificed seniority as a member of the Armed Services Committee to take a bottom-of-the-ladder post on the Appropriations Committee last year so he could fight for air power funds, also looms as a possibility for majority leadership.

• **Capt. John Crommelin,** World War II naval hero, lost out to Hill in his try for the Alabama Senate seat. During the bitter USAF-Navy feud over the B-36 strategic bomber, Crommelin was in the national spotlight for unauthorized release of a confidential letter written by Adm. Gerry Bogan attacking USAF. First suspended, Crommelin later requested and was granted retirement with the rank of rear admiral.

• **Sen. Elmer Thomas,** Senate strategist for former Defense Secretary Johnson's Air Force and Naval aviation cutbacks as chairman of the Armed Services Appropriations Subcommittee, was a casualty in the Oklahoma primary.

• **Rep. Mike Monroney,** who will replace Thomas, joined in Vinson's fight last year to restore air power funds clipped by Thomas' subcommittee.

• **Sen. Pat McCarran,** longtime and hardworking friend of aviation, won in Nevada. Author of the 1938 CAA Act, the 1946 Airport Development Act, he has pushed through numerous bills promoting civil aviation and consistently backed military air power. In the pre-World War II days, he led the calls for equal status for the Air Force with Army and Navy. He is chairman of the Appropriations Subcommittee on CAA and CAB.

• **Paul Aiken,** former assistant postmaster general in charge of air mail who tried to block New York helicopter service as uneconomical, lost to Gov. Frank Carlson in the Kansas race for the Senate.

• **James Devereux,** commander of the Marine detachment that held Wake Island against overwhelming Japanese forces for 16 days in one of the historic episodes of World War II, was elected to the House from Maryland. Although a freshman, he is a national figure who may be an influential voice on defense policies. Count on him to give Vinson's plan to triple the Marine Corps—increasing its air strength from the 18 squadrons now authorized to 24—the shove it might need.

• **Gill Robb Wilson,** former president of National Aeronautic Assn. and aviation columnist for the New York Herald Tribune, lost out to Democratic Rep. Charles Howell in his bid for a House seat from New Jersey.

• **Rep. Albert Engel,** the "one-man investigating committee," leaves the House after 18 years service. He lost in a primary bid for the governorship nomination in Michigan. Noted for his disclosures of waste and inefficiencies in the armed services, Engel supported strong defense programs as a member of the Appropriations Committee.

• **Rep. James Van Zandt,** the Naval Reserve captain who touched off the B-36 investigation by the Armed Services Committee of which he is a member, was re-elected from Pennsylvania.

Well known and key aviation figures re-elected to the House included:

• **Rep. Carl Vinson,** chairman of the Armed Services Committee over 15 years, has successfully pushed through Congress military programs opposed by the Administration.

• **Rep. Dewey Short,** top ranking minority member of the Armed Services Committee, has maneuvered Republican support for Vinson.

• **Rep. Robert Crosser,** chairman of the House Interstate and Foreign Commerce Committee.

• **Rep. Lindley Beckworth,** chairman of the Commerce Committee's transportation subcommittee.

• **Rep. Carl Hinshaw,** vice chairman of the 1948 Congressional Aviation Policy Board which blueprinted a build-up for peacetime air power. He has continued active on air defense and air transport matters, is second-ranking minority member of the Commerce Committee.

• **Rep. George Mahon,** chairman of the Armed Services Appropriations subcommittee. At first supported the 70-group USAF. But when the Administration became adamant, he went along the 48-group cutback.

• **Rep. John Rooney,** chairman of the Commerce Department Appropriations subcommittee, which slashed CAB appropriations this year after a personal conflict with ex-CAB Chairman Joseph O'Connell. His approval of Delos Rentzel's appointment means easier sailing for CAB funds in Congress.

• **Rep. Karl Stefan,** member of the 1948 Congressional Aviation Policy Board and top Republican on the Commerce Department Appropriations subcommittee. He has dealt severe criticism to CAA and CAB for inefficiency, but has firmly backed funds to promote civil aviation programs.

AVIATION WEEK VOL. 53, NO. 21 NOVEMBER 20, 1950

Next Step in Bombers: B-36F or XB-52?

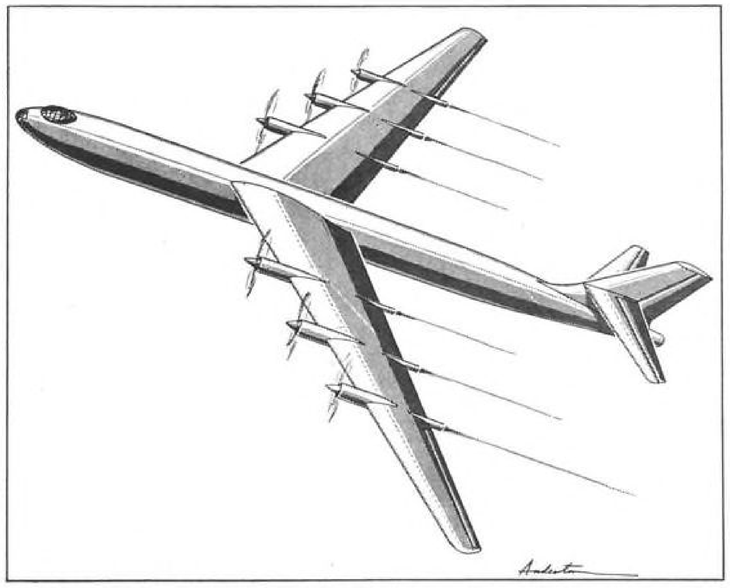
AF to choose between Convair's turboprop and Boeing's jet.

By Ben S. Lee

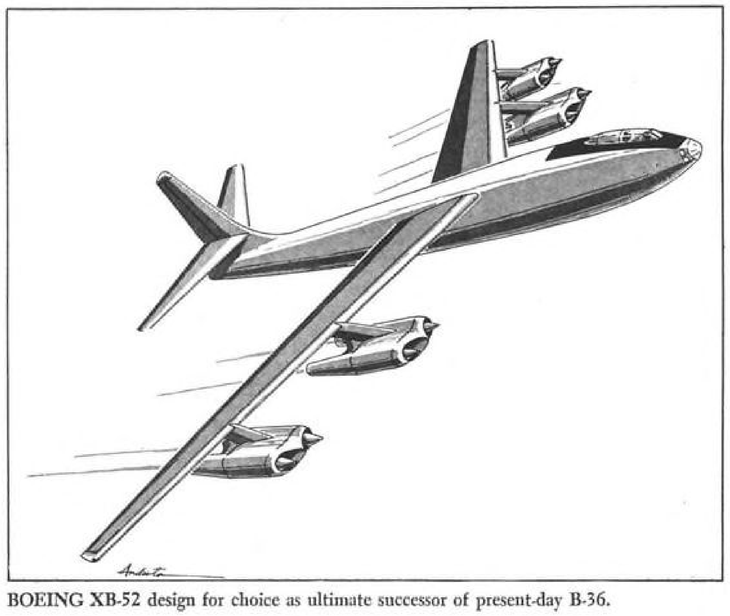
Officials of Consolidated-Vultee and Boeing are waiting anxiously this week while members of the Senior Officers Board weigh merits of the Boeing XB-52 versus the B-36F, a sweptwing version of the Convair B-36.

Timetables already set, dating phase-out of the present B-36 program, dictate that a successor to USAF's current "big stick" must be chosen soon. As a result, officials of both companies have made elaborate proposals the past three weeks to Air Force Under Secretary John A. McCone and members of the board for the coveted big-bomber contract.

Phase-out of the present very-heavy-bomber program places an operational total of more than 200 of the giant B-36 bombers with USAF. The big planes are now the backbone of this nation's long-range defense. They were designed to provide the nation with a strategic air arm capable of striking any target in the world from bases within continental U. S.



CONVAIR B-36F proposal, as visualized by Aviation Week artist, competes with . . .



BOEING XB-52 design for choice as ultimate successor of present-day B-36.

► **B-36 Concept**—The Joint Chiefs decided to hold to the B-36 as sledgehammer of their strategic defense through Jan. 1, 1955, because of the inability of current jet fighter craft to make a significant percentage of successful attacks on the bomber. Key to the present role of the B-36 is its performance at 40,000 ft. and above, and the subsequent shift in fighter-bomber battle into the tropopause, a boundary layer of the atmosphere that has not as yet been fully explored.

Six-engined B-36 performance with full equipment and 10,000-lb. bomb load is reported officially as 372 mph. True air speed jet pods added to B-36D models have upped the speed to 436 mph.

The proposed sweep back of the wing plus turboprop engine installation would up performance of the bomber to an expected 500 mph. This changes the present Mach limitation from 0.69 to 0.75. Eventual hope of USAF is to reach a 550-mph. speed at 55,000 ft.

► **Invulnerability**—Low wing-loading of the B-36 makes it possible for it to outmaneuver fighters with a higher wing-loading. Fighters' margin between top speed and stalling speed is extremely narrow at 40,000 ft. and restricts them to shallow 15-degree turns.

Rate of climb of present jet fighter types to 40,000 ft. is not fast enough

to allow them to intercept even the current B-36 before it reaches its target and drops bombs, tests have indicated. Early warning radar gives less than 30 minutes warning of a B-36 approach, while fighters take 36 minutes to reach 40,000 ft. after the alarm has been sounded. Even on days when B-36 contrails were clearly visible from the ground, jet fighters were unable to climb to 40,000 ft. in time to position themselves before the bomb drop.

Stature of the Strategic Air Force—from a weapons point of view—has been a matter of controversy. Navy critics decried the big bomber as virtually a sitting duck unable to protect itself from fighter attack. USAF, on the other hand, described the B-36 as practically un-reachable by effective fighter attack at altitudes above 40,000 ft., where it is designed to operate.

Controversy between the services reached a climax a year ago with Congress calling for an official airing of USAF's strategic air defense program. Evaluation of the B-36 by the Joint Weapons Systems Evaluation Board followed the congressional hearing. Although findings of the board were never made public it apparently justified USAF's procurement in that field. Indicative of that fact was the earmarking of funds out of fiscal 1951 budget for procurement of nearly 60 more B-36 bombers.

▶**Turbojet or Turboprop?**—Ex-officio chairman of the Senior Officers Board McCone, in making ultimate decision as to the successor of the B-36, is actually making a major choice between turbojet and turboprop powerplant developments.

Development status of the turbojet and the turboprop engines, despite the fact that most U. S. experience has been with the jet, are currently about the same. Military thinking, based on McCone and Senior Officers Board decision, is that the next 18 months will cast the die as to the immediate future development of one or the other in the big engine field.

Engine manufacturers confirm this view in part, but point out that the chief delaying factor in the development of the turboprop engine is the status of the supersonic propeller and engine controls.

Propeller manufacturers are hard at work on their design and engineering difficulties, and expect that small-scale production will be underway in time to meet test schedules of the forthcoming XB-52 and sweptwing B-36F. Three propeller manufacturers competing in this field are:

- Aeroproducts div., General Motors Corp.
- Curtiss-Wright Corp.
- Hamilton Standard div., United Aircraft Corp.

Engine manufacturers concerned in development of the long range bomber are:

- Curtiss-Wright Corp.
- General Electric Corp.
- Pratt & Whitney div., United Aircraft Corp.
- Allison div., General Motors Corp.
- Westinghouse Corp.

Turboprop engines currently in flight test in U. S. are: Allison T-38 and T-40, developing 2750 and 5500 shp., respectively; and Pratt & Whitney T-34, developing 5700 shp. In the same power range is the British-engineered Bristol coupled Proteus, with 6400 shp. Recent licensing rights for U. S. manufacture acquired by Curtiss-Wright place the company in the competition for B-36F or XB-52 turboprop engine contracts. There may be other powerplants not yet disclosed, figuring in the studies, also.

▶**Boeing XB-52**—In appearance, the Boeing bid for the big-bomber contract greatly resembles the present six-jet-engined B-47 in production. Though somewhat smaller in size than the present Convair B-36, the XB-52 is designed to meet the same strategic bomber requirement capability of carrying 10,000 lb. 10,000 mi. Powerplants are eight jet engines slung, two in a pod, in pairs under each wing. Wings and tail are swept back at a 35-degree angle.

Crew complement is reported to be nine, including relief personnel for long-distance missions. Design specifications of both turbojet and turboprop versions of the XB-52 give it a slight edge in speed over the proposed B-36F. Speed of the XB-52 will approach 600 mph. Two were ordered by USAF for delivery in 1952, but delivery schedules have been stepped up and reports are that the turbojet version will be in flight test late next year.

Boeing has gone ahead with a semi-tooling up program for production with its own financing. This was despite a re-examination of the strategic concept by USAF early this year. USAF was forced to shelve its immediate plans for the B-36 successor because of enforced economies, the relative progress of turbojet and turboprop development and a general worsening of the international scene.

▶**Convair B-36F**—Familiar configuration of the current production B-36 changes greatly in Consolidated-Vultee's sweptwing big bomber bid. Overall dimensions remain substantially the same, but both wings and tail are swept back. Tail empennage is raised and given low dihedral. Current production B-36 has no dihedral in its lateral surfaces.

Engines in both versions—turbojet and turboprop—are slung in nacelles below the wing. Turboprop configuration includes provisions for six engines slung in single pods, three under each wing. A secondary proposal by Convair is for a 12-jet version of the sweptwing configuration. This proposal places the engines slung two in a pod, three pods under each wing.

Convair's top priority proposal is its turboprop version. Engines most discussed and in present operational test are the Pratt & Whitney T-34 developing 5700 shp.; Allison T-40 developing 5500 shp.; and the Bristol coupled Proteus developing 6400 shp.

But Pentagon sources say Convair proposals suggest use of turboprop engines with a much higher shaft horse power rating than those currently in operational test. Several companies (Pratt & Whitney, Allison, Westinghouse and General Electric) have been developing bigger, more powerful engines which are yet to be announced.

Design performance figures of the Convair sweptwing configuration call for a bomber capable of carrying 10,000 lb. 10,000 mi. at 550 mph. and at an altitude of 55,000 ft. Crew complement remains the same, 11, plus a four-man relief crew.

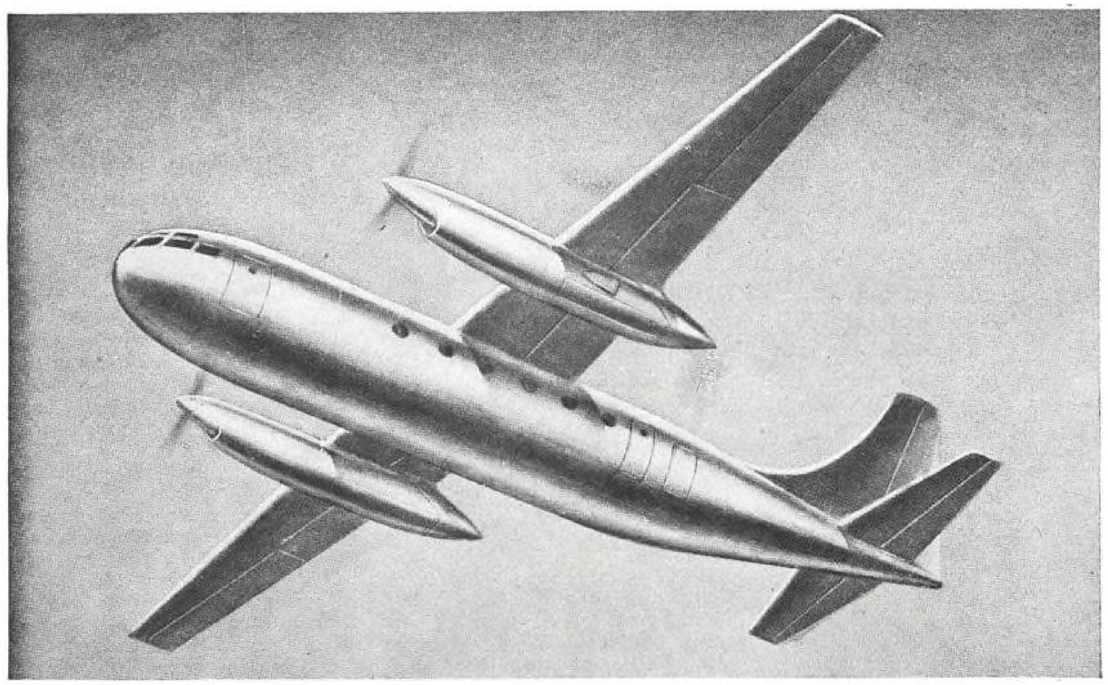
▶**Facilities**—Major factor likely to affect the impending decision as to successor of the current big bomber is facilities for manufacture. Phase-out of the current B-36 series will place Ft. Worth Consolidated-Vultee facilities, among the largest in the country, in need of new plane business. Boeing, on the other hand is heavily committed to production of the B-47 at Wichita, Kan., and to commercial and military production of the Stratocruiser at its Seattle plant.

If Boeing comes out winner in the bomber division with the B-52, its production would have to be handled in other facilities.

▶**Economy of B-36F**—If all factors of proposed design performance of both planes remain relatively equal, chances for USAF giving the go-ahead to Convair are very high. Much of Convair's present B-36 tooling can be readily adapted to the sweptwing configuration.

Another factor exerting considerable influence on Air Force thinking is that the present B-36 is already proven equipment. Because of this factor, static and flight test procedures can be quickly accelerated and major production accomplished in less time than in the case of the XB-52.

Additional and vital factor which will figure in decision to build either the XB-52 or the B-36F is that of cost per unit of equipment. Last available estimates placed the cost of the B-36 at approximately $4.7 million. Initial cost of the XB-52 has been estimated at $7.5 million each plus tooling for quantity production.



BOEING 498-4, proposed short-haul airliner, mounts Allison T-38 turboprops cleanly, has extra-large flap and aileron chord.

Boeing Offers New Turboprop Feederliner

24-passenger craft to use Rolls - Royce Darts or Allison T-38s.

By Alexander McSurely

A new 24-passenger turboprop airliner for local service routes is virtually ready to be built by Boeing Airplane Co.—if the customers, domestic and foreign, want to buy it, and if more urgent military airplane requirements do not block the project.

Boeing has completed preliminary design work on two powerplant versions of the airplane:

- **Model 498** which would use two Rolls-Royce Dart RDA 3 engines rated at 1400 shaft hp. each.
- **Model 498-4** which would use two Allison T-38 turboprop engines rated at 2750 shaft hp. each.

Except for the differences caused by engine installations, the two models are identical twins. The basic plane is a high-wing design with powerplants suspended beneath the wings in pod-like installations similar to the jet engine nacelles of the Boeing B-47 bomber.

Special attention is given to details for ease in handling passengers and cargo efficiently. Tricycle landing gear puts the cargo door of the plane at truckbed height. Passenger door has built-in steps to eliminate need for a wheeled ramp or steps.

Passenger seats are arranged four abreast, in six rows, following feeder operators' requirements (see page 52) for a new local service plane to replace the old workhorse of the airways, the Douglas DC-3.

▶**Pressurized Cabin**—Cabin is pressurized and plane is designed to take advantage of high altitudes up around the 30,000 to 35,000-ft. levels for medium distances. The Allison version will cruise at 350 mph., at 35,000 ft. at 30,000 lb. gross weight. The Dart version would have a 255-mph. cruising speed at 30,000 ft. at 26,500 lb. gross.

The Boeing design does not quite meet the U. S. feeder requirements for

Boeing Feederliner Operating Estimates

Trip length and alt.	BLOCK SPEED: Model 498 (Dart engines)	BLOCK SPEED: Model 498-4 (Allison T-38)	PAYLOAD: Model 498 (Dart engines)	PAYLOAD: Model 498-4 (Allison T-38)
65 mi., 5000 ft.*	160 mph.	...	6000 lb.	6600 lb.
100 mi., 5000 ft.	187	220 mph.	6000	6600
200 mi., 10,000 ft.	210	260	6000	6600
400 mi., 20,000 ft.	228	290	5300	6600
600 mi., 30,000 ft.	227	310	4700	6200
1400 mi., 35,000 ft.	...	330	....	3500

	OPERATING COST Per Plane Mile		OPERATING COST Per Ton Mile	
65 mi., 5000 ft.*	60 cents	..	20 cents	..
100 mi., 5000 ft.	50	55 cents	17	18 cents
200 mi., 10,000 ft.	43	50	15	14
400 mi., 20,000 ft.	39	42	15	12
600 mi., 30,000 ft.	37	38	17	12
1400 mi., 35,000 ft.	..	34	11	20

* Average trip length selected by Feeder Airlines Assn.

short field operations, except in one condition. Feeder airlines have asked for a plane that will operate from 3300-ft. runway field. If reverse pitch propeller braking is used with the Allison version, the Boeing designers expect that the 498-4 would meet this requirement. However without reverse thrust, the Allison version would need a 4250-ft. field length and the Dart version would require a 3850-ft. field length.

Incorporation of the turboprops instead of conventional piston engines may give some feeder airlines pause as there has been no U.S. airline operational experience yet with turboprops, and only very little flight time in any turboprop airplanes on this side of the Atlantic.

However, several British transports, notably the Viscount, have already piled up considerable operational experience with turboprops, and soon three Allison turboprop-powered planes in this country should provide considerable additional operating data. These are the Convair Turboliner, the Convair XP5Y flying boat, and the Douglas XA2D Navy attack fighter.

Boeing went to turboprops for its new designs because of two factors:

- **Vibration-free** passenger comfort.
- **Potentially superior** performance and operating economy.

Actually the 498 designs are Boeing's first announced commercial venture into the turboprop-powered field, although the company is understood to have design studies for turboprop versions of both the B-47 six-jet medium bomber, and the XB-52 eight-jet intercontinental bomber, being developed as a successor to the B-36.

► **Developed From 417**—History of the new Boeing preliminary design goes back to an earlier plane, the Boeing 417, developed as a first postwar design attempt at a DC-3 replacement. It was never completed. But like many another experimental design it was one in a series of continuing developments. Subsequent design studies finally evolved into the Model 498 airplanes, which Boeing is now ready to build, under the conditions previously mentioned.

A factor in production of the plane undoubtedly will be the extent to which government sponsorship of development of a local service or feeder airliner is provided. Hearings of the Senate Committee on Interstate and Foreign Commerce have clearly indicated a strong congressional interest in developing a suitable plane for feeder routes. It is logically contended that a new airplane specially designed for such work, taking advantage of modern design techniques and advancements in the 20 years since the Douglas DC-3 was first developed, might well make the difference between a profit and a loss to many a marginal feeder operation. Next step in this line of reasoning is that to develop such a plane through a federally subsidized development program is certainly more economical than to pay out continuing subsidies for marginal operations which continue to use outmoded equipment.

► **No Price Yet**—Boeing has not yet put a price on its new local service airliner, and price of course depends on quantities of orders primarily. But it is reasonable to assume that the Seattle manufacturer will not move forward toward actually cutting metal and building a prototype, until it is assured a reasonable financial backing to make the project at least a good risk.

It is unlikely that this would come from the struggling feeders themselves, in a period when they do not have funds needed for such a development investment.

It is probable that if the Boeing 498 or something like it is to be produced, government funds will have to be provided.

CAA's current testing program, which Congress approved early this fall, and which provides for funds to test prototype aircraft, could not begin to finance such a prototype. (Total funds available are only $12.5 million to be provided over a 5-year period.)

Best chance remaining is for appropriation of some additional funds to develop the plane as a commercial prototype, or perhaps in a military version as a light personnel and cargo transport, where it obviously could serve quite a useful purpose. With Congress waking up to the importance of air transport, such appropriations may not be as far away as they appeared earlier in the year. The advent of more new congressmen with a leaning toward budget slashing, still remains a formidable obstacle to any such commercial development. If USAF or Navy should decide, on the other hand, that they needed such a plane, it could be thrown into development quite speedily.

► **Basic Data**—Basic data for the two Boeing versions follows. Where figures for both are available, those for the Dart-powered model are first. Figures for the Allison-powered Model 498-4 are in parentheses.

- Design takeoff gross weight, 26,500 lb. (31,500 lb.).
- Design landing gross weight, 25,150 lb. (30,000 lb.).
- Weight empty, 16,190 lb. (19,930 lb.).
- Useful load, 10,310 lb. (11,570 lb.).
- Payload at 300-mi. range, 6160 lb.
- Payload at 600-mi. range, (6200 lb.).
- Cargo, 1600 lb. (1600 lb.).
- Maximum speed at altitude, 287 mph. (380 mph.).
- Cruise speed at altitude, 255 mph. (350 mph.).
- Rate of climb at sea level takeoff gross weight, 1430 fpm. (3260 fpm.).
- Wingspan, 86 ft. 8 in. for both models.
- Length, 66 ft. 8 in. for both.
- Height, 22 ft. 6 in. for both.

Civilian Aluminum Cutback Ordered

To bolster war industry supplies of aluminum, National Production Authority last week ordered a cut-back of 35 percent in use of aluminum for civilian products, effective Jan. 1.

In view of the fact that the order materially reduces commercial use of the metal for civilian consumption, organized labor is up in arms over the prospect of the resulting unemployment problem.

Economists predict an immediate temporary shortage as large users of aluminum increase purchases between now and the end of the year. The ruling does not affect users purchasing less than 1000 lb. annually.

Aluminum used for maintenance, repair and operating supplies is not curtailed. The order, however, does require that aluminum inventories may not exceed a 60-day supply or a practicable working inventory, whichever is less.

Total supply of aluminum available on a current annual basis in the U. S. is a little over a million tons. Non-military consumption of aluminum has been at a rate equal to the entire supply, it was pointed out.

In justifying the order, NPA Administrator William H. Harrison declared, "in the final analysis, the order (M-7) does not take aluminum away from non-military users—defense needs do that. Upwards of 30 percent of the total available aluminum supply is directly needed for the already authorized defense program."

NACA Entitled to DO Priorities

National Advisory Committee for Aeronautics last week won permission of the National Production Authority to use DO priority ratings to get quick delivery of the materials and equipment it orders for use in the national defense.

With virtually all the work of NACA's two aeronautical laboratories and engine laboratory and its guided missiles research base concentrated on high priority basic research work for Air Force and Navy, its entitlement to DO priorities was not disputed by NPA.

But an NPA spokesman said that since NACA's budget was included in a separate category from the Defense Department budget, it was necessary to make a separate directive entitling it to the DO status.

LOOK MA, NO HANDS could be the title of these photos showing HO3S-1 (left) and XHJP-1 (right) being flown by automatic controls.

Automatic Pilots Developed for Helicopters

All-weather and night-time operation of helicopters are a step closer with development of two automatic pilots for rotor-craft. They are the work of:

- **Sperry Gyroscope Co.**
- **Naval Instruments Laboratory.**

The new devices are expected to increase the utility of copters, previously limited by the difficulty in maintaining stability. The copter pilot now has complete automatically stabilized control in any flying attitude. Blind flying and instrument let-downs in zero weather are now made possible.

Pilot fatigue should be greatly reduced. Until now a helicopter pilot has had to "fly" his craft constantly, using both feet and both hands to handle the many helicopter controls. With the auto pilots, the craft can be automatically controlled throughout their speed ranges, in maneuvers, and while hovering, according to Navy spokesmen.

► **Navy Version**—First tests were made at the Naval Air Materiel Center, Philadelphia, in a Sikorsky HO3S-1 single-rotor helicopter. The automatic pilot aboard the HO3S-1 was developed by the Naval Instruments Laboratory.

Current tests with the automatic pilot installed aboard a twin-rotored Piasecki XHJP-1 (prototype of Navy's production HUP-1) are being made at Piasecki's Morton, Pa., plant. Several successful flights have already been made, according to company spokesman, and the HUP-1 will be the first Navy production copter to be equipped with the automatic controls.

The XHJP-1 flying with the Sperry automatic pilot is also a test bed prototype for several proposed XH-16 component developments. The XH-16, under development for Air Force, has been scheduled for first test flight sometime early in 1952 (AVIATION WEEK Aug. 28).

P&W Needs 10,000 More Workers

Helicopters and television advertising, along with more conventional newspaper and radio ads, are being used in an intensive labor recruiting drive throughout New England started by Pratt & Whitney division of United Aircraft, to add 10,000 new workers in the coming year. Early in November, total Pratt & Whitney employment stood at 17,500.

Earlier increases in employment this year have already created a very tight supply of skilled and semi-skilled workers in the immediate Greater Hartford, Conn., area, forcing the engine manufacturer's labor recruiting teams to fan out through Maine, Vermont, New Hampshire and Massachusetts. Flight demonstrations with the helicopter, and free copter rides to job applicants are used in the campaign.

The plant is now working two full shifts and a third part-time shift.

NWA Inspecting Its 2-0-2 Fleet

Northwest Airlines is making a complete fleet inspection of its Martin 2-0-2s after their second fatal crash in a month.

But President Croil Hunter hastens to point out: "I would like it clearly understood that there is no evidence or any reason to believe that structural deficiencies contributed to our recent accidents. However, this extra inspection is to assure the company and the public that there are no structural deficiencies in the plane."

Northwest is maintaining most Martin 2-0-2 schedules by using Stratocruisers and DC-4s. As each 2-0-2 is checked, it goes back in service. Meanwhile, the unchecked 2-0-2s stay grounded, awaiting their turns.

Glenn L. Martin representatives say they know Northwest feels it must make this inspection, even though evidence is that the accidents were probably not the fault of the plane.

One 2-0-2 struck a ridge on the Continental Divide while letting down on an instrument approach to Butte, Mont., Nov. 7, killing all 22 persons aboard. Location of the crash indicates the plane was low and off the proper instrument approach course.

The other recent Northwest 2-0-2 crash occurred Oct. 13 on a routine pilot check flight, killing all six persons aboard. The right propeller was found in the 8-degree reverse-pitch position. The plane went into a steep spiral during maneuvers and never recovered.

PRODUCTION

Aircraft Labor

Technicians getting hard to find, production line worker supply ample.

The manpower situation is tighter in the aircraft industry than in any other principal U. S. industry as a result of stepped-up military plane orders.

In June—pre-Korea—the aircraft industry employed 256,400 and contemplated no immediate expansion.

By September, employment increased 13.5 percent to 291,000.

By next January, aircraft jobs are expected to rise another 13.5 percent. And by next March, another 4.5 percent on top of that.

That is the picture the U. S. Employment Service has gotten from reports from 64 aircraft and parts plants, which provide 87 percent of the industry's jobs.

Already the major aircraft plants are up against shortages in skilled and technical employes needed for the augmented program.

This is reported by Robert C. Goodwin, new Director of Defense Manpower, whose office is making a special manpower study in the aircraft industry at the request of the Pentagon.

The study will show where the aircraft industry is today on manpower, where it is going, and what steps will be necessary to alleviate the labor supply problem.

▶**Technicians Needed**—Needed most in aircraft production, Goodwin said, are engineers and other technical employes, tool and diemakers, machinists and instrument men. Ford, he said, needs 30,000 employes for aircraft engines in Chicago.

First step of Goodwin's office is to find out if the needed skills exist. If they do, then the U. S. Employment Service, which Goodwin heads, will consider ways of getting them to the places where they are needed most. In the last war, voluntary transfers of employes from one employer to another were negotiated by USES with the cooperation of employers and unions. This is being considered again, but Goodwin points out it will be more difficult now because of the spread of pension plans.

If the needed skills don't exist, then the task becomes one of breaking down the jobs—diluting the skills required—and special training, according to Goodwin. In-plant training will be stepped up, he said, with the government educating employes in training techniques. They, in turn, will do the actual training in the plant. Something like the World War II training-within-industry is envisioned.

Because production workers' supply is not yet a real problem in aircraft, Goodwin is opposed to mass recruitment of workers for aircraft at this time. New workers should be brought into the labor force only as fast as they are needed and can be placed in aircraft jobs, he feels.

The government has its eyes on bringing back into aircraft the more than 1,700,000 who left after the war. Peak wartime aircraft employment was 2,000,000, compared with present employment of less than 300,000. Most of the "missing" are women.

Hartford, Conn., and Wichita, Kan., are major aircraft centers in a list of 51 "A" areas having a tight labor supply with less than 3 percent unemployment. Seattle and Fort Worth are among "B" areas with slight labor surplus of less than 5 percent. New York, Los Angeles and San Diego are classified as "B" areas with moderate labor surplus of less than 7 percent.

Here is the employment expansion that took place and is contemplated in those areas·

	Percent (Actual) July-Sept.	Percent (Contemplated) Sept.-Jan.
Los Angeles....	8.0	10.8
San Diego.....	31.3	25.5
Seattle	12.9	12.3
Hartford	4.0	N.A.
New York.....	8.5	16.3
Fort Worth....	8.5	8.7
Wichita	21.3	28.5

N.A. Not available.

PRODUCTION BRIEFING

▶**Pacific Airmotive Corp.** has been awarded a USAF contract to reactivate, modify and overhaul a large number of four-engine transports. The work will be handled at PAC's newly acquired $2-million airport near Chino and Ontario, Calif. PAC estimates that at least 1000 additional employes will be needed immediately. This contract brings the firm's backlog to over $15 million.

▶**Solar Aircraft** has split its engineering organization into two divisions to meet increasing pressure for development. W. C. Heath has been placed in charge of aircraft products and P. A. Pitt is chief engineer for the development section. The firm has also sold its Redwood Products division, which handled furniture, to the John Hancock Mfg. Co.

▶**Kaman Aircraft Corp.,** Windsor Locks, Conn., has gotten a new Navy production contract, this one for HTK-1 trainer copters, boosting the company's military backlog to over $2 million.

▶**Krupp Forge Co.,** Chicago, has started a second shift to handle output of critical castings for defense uses including jet engines.

USAF Invitations

Bid openings are 20-30 days after approximate issue dates shown in the following bid proposals. Bid sets containing specifications for items to be procured will be sent to qualified applicants who state bid invitation number.

One bid set will be available for examination without obligation by prospective bidders, after bid publication date, at each of the seven AMC procurement field offices. This will enable firms to see specifications before writing or telegraphing for their own bid sets.

Procurement field office locations: Boston Army Base, Boston 10, Mass.; Government Aircraft Plant No. 4, Ft. Worth 1, Tex.; 39 S. LaSalle St., Chicago 3; Wright-Patterson AFB, Dayton, Ohio; West Warren and Longo Aves., Detroit 32; 155 W. Washington Blvd., Los Angeles; 67 Broad St., N. Y. 4.

INVITATIONS

Connectors, plug and receptacle, 1-6 items, bid invitation No. 51-839, issue date 26 Oct., delivery complete within 30 days.

Adapter assembly, 1-9 items, bid invitation No. 51-840, issue date 26 Oct., delivery 50 per cent within 60 days, completed within 90 days thereafter.

Capacitors, 1-20 items, bid invitation, No. 51-842, issue date 26 Oct., delivery within 120 days.

Indicators, calcium chloride, oxygen cartridge, 1-3 items, bid invitation No. 51-843, issue date 26 Oct., delivery within 150 days.

Drills, 1-160 items, bid invitation No. 51-822, issue date 23 Oct., delivery starting within 60 days and complete in 180 days thereafter.

Solder, lead, 1-8 items, bid invitation No. 51-826, issue date 23 Oct., delivery within 90 days.

Screws, 1-100 items, bid invitation No. 51-828, issue date 23 Oct., delivery 50 per cent within 60 days and complete within 120 days.

Cap assembly, 1-4 items, bid invitation No. 51-832, issue date 23 Oct., delivery within 75 days.

Capacitors, 1-10 items, bid invitation No. 51-835, issue date 23 Oct., delivery within 120 days.

Gloves, 1-4 items, bid invitation No. 51-829, issue date 23 Oct., delivery starting date 120 days, complete 150 days thereafter.

Flexible ducts, 1-3 items, bid invitation No. 51-830, issue date 23 Oct., delivery within 120 days.

Dolly assemblies, 1-8 items, bid invitation No. 51-831, issue date 23 Oct., delivery complete within 90 days.

Aluminum alloy, 1-46 items, bid invitation No. 51-837, issue date 23 Oct., delivery within 90 days.

Bushings, 1-34 items, bid invitation No. 51-838, issue date 23 Oct., delivery 30 percent within 45 days, delivery to be completed within 90 days.

OBD: Its Errors, Coverage, Reliability

Air navigation system analyzed for typical omni facility locations.

By David A. Anderton

How good is omni?

The final answer depends on several years of flight operations with the omni-bearing-distance system, which should give enough data to allow a statistical analysis.

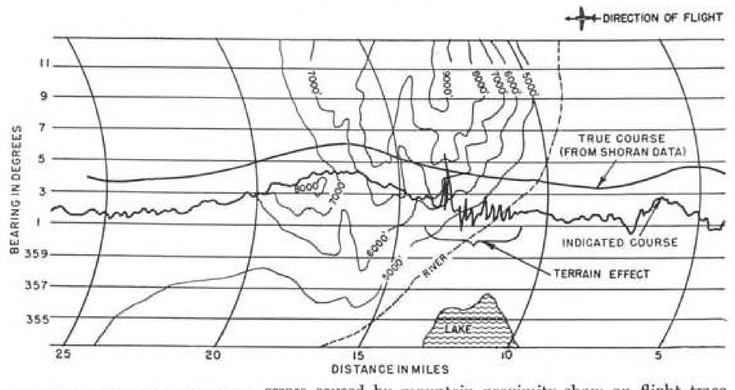
But in the meantime, the first step in system evaluation has been completed by Airborne Instruments Laboratory, Mineola, N. Y., and a group of associated workers.

Some time back, the Air Force had undertaken the job of preliminary testing of the omni system at Indianapolis, Ind., with the assistance of the Navy, Civil Aeronautics Administration and Air Transport Assn. When these test results were analyzed by the Air Navigation Development Board, it was concluded that there was a need for a much more extensive series of tests under controlled conditions.

ANDB formed a committee of military and civil agencies to outline the basic problems and approaches. This committee suggested that the job should be done by an impartial group, entirely free of any military or civil connections. Airborne got the assignment.

This led eventually to the "Summary Report on Evaluation of Omni-Bearing-Distance System of Air Navigation," just issued by AIL.

C-47 WINGTIP points to mountain cluster on outbound evaluation flight from Ogden, Utah OBD station. Plane's course is traced below.



TERRAIN EFFECT errors caused by mountain proximity show on flight trace as abrupt swings from true path, are averaged by plane.

▶ **Four Objectives**—The basic test program was set up to obtain evaluations of the present-state performance and the future possibilities of the omni-system. And the program involved four phases:

- **System errors**—overall and component—were to be measured for the VOR (VHF Visual Omnidirectional Range), DME (UHF Distance-Measuring Equipment) and Course Line Computer;
- **Coverage** of VOR and DME was to be determined;
- **Terrain effects** on overall system accuracy were to be evaluated;
- **Reliability** of the various equipments was to be determined.

Major emphasis was to be placed on tests of VOR, which was a fully commissioned facility. The Course Line Computer was to be given the least attention, since only one preliminary model was then available. (But that situation is now changing—see AVIATION WEEK's story on Pictorial Computer in Oct. 23, 1950 issue.)

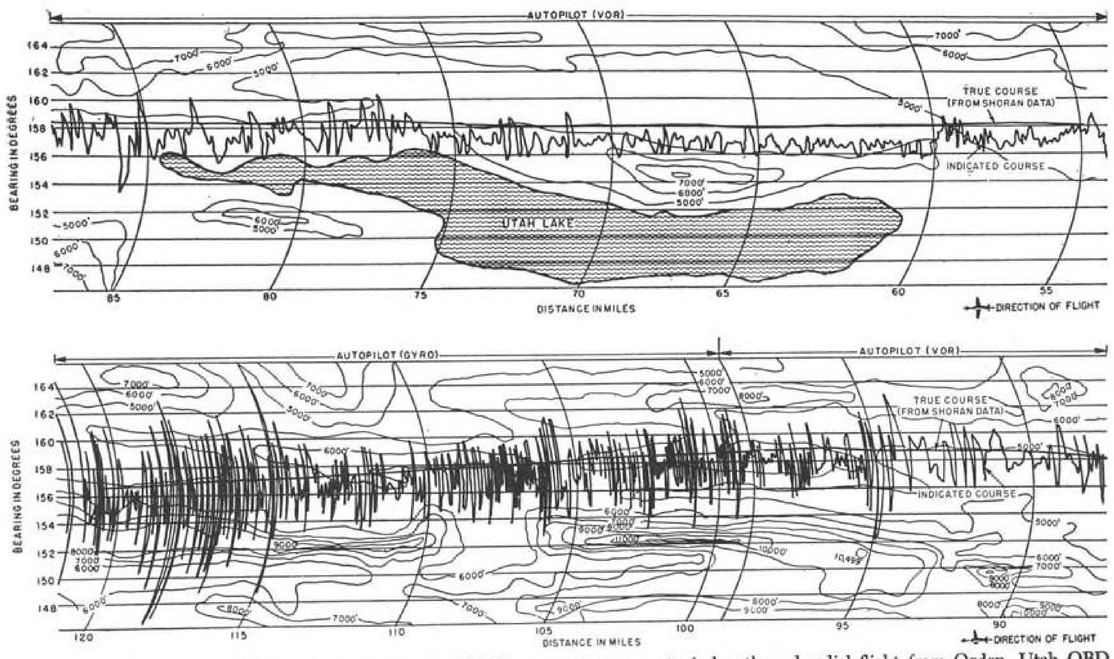
▶ **Three Locations**—It took six months to gather the necessary data—six months of calendar time, 300 hr. of flight time and 55,000 individual measurements—at three stations chosen for their differing topography:

- **Patuxent River, Md.** Flat country with Chesapeake Bay and the Patuxent and Potomac Rivers, with the station at 35 ft. above mean sea level.
- **Philipsburg, Pa.** Mountainous terrain about 30 mi. from Altoona, with the station on a hilltop at 2440 ft.
- **Ogden, Utah.** The station at 4222 ft., backed by a long string of mountain peaks crowding 10,000 ft. and facing out over the waters of Great Salt Lake.

Most of the test flights were made in an Air Force C-47; a few flights at high altitude were made with an AF B-17. And for additional checking, some flight tests were made with a Piper Clipper and a Beech Bonanza.

Four Shoran ground stations were used during the flight test program for accurate position fixes on the aircraft. As a typical example, spacing of the Shoran stations were on the order of 40 mi. from the omni stations.

▶ **No Easy Presentation**—Getting data to do the job is not particularly difficult—but presenting it for evaluation is something else again. Prime difficulty is that magnitude and rate of change of



PATH TRACE of C-47 aircraft shows sample of VOR aggregate error on typical outbound radial flight from Ogden, Utah OBD facility. Data were selected to point up effects on overall flight accuracy of very large terrain effect errors. True course flown by plane has average deviation of only 1.2 deg. from desired aircraft heading of 156 deg.

some of the omni system errors are functions of aircraft position and attitude, topography and equipment condition.

These errors may either add or subtract, presenting an entangled final error. So the performance of any installation cannot be defined in terms of a single number with any meaning.

The magnitude of the job precludes any simple paragraph or sentence which says that the overall system errors are thus and so. Any comprehensive analysis of results is lengthy—it has to be.

The important thing is to get the answers to four questions:

- **What are the errors?**
- **How big are they?**
- **How do they affect flight paths?**
- **How may they be reduced?**

► **Errors, By Definition**—Since most of the effort in Airborne's program centered around the evaluation of the commissioned VOR facilities, the results are a little top-heavy in that department.

VOR aggregate error is the difference between the actual magnetic bearing of the aircraft with respect to a ground station minus the bearing given by the VOR equipment. And it is made up of five primary, and a number of secondary grouped errors:

- **Ground station error** attributable to the particular characteristics of the VOR transmitter, goniometer, antenna and counterpoise system, the structure of the antenna enclosure and some other minor station characteristics.
- **Site effect error** associated with particular topographical features in the immediate vicinity of the site—features such as fences, power lines or buildings.
- **Terrain effect error** produced by reflection of signals during flights close to mountainous terrain or in VOR "shadow" areas produced by such terrain.
- **Attitude effect errors** associated with bearing indications which vary with aircraft attitude or heading.
- **Receiver errors** caused by failure of the receiver to translate the input signal accurately into a bearing indication.

DME aggregate error is composed only of ground and airborne equipment component errors, because there are no effects comparable to site, terrain and attitude errors on DME accuracy.

► **Error Magnitude**—All through any consideration of the physical magnitude of these errors, it must be remembered that the figures quoted are for three particular stations which were considered typical. Other stations can and may have different values for the error signals or they may have different total spread or arithmetic sign.

Ground station error was least at the Philipsburg site, with Ogden and Patuxent following in that order. Total spreads in angular measurement were 3.1, 4.4 and 5.0 deg., respectively.

Site effect error was smallest at Patuxent, and Ogden and Philipsburg were of comparable magnitude. At Patuxent, the error pattern was a rapid and irregular variation, largest near the horizontal line-of-sight—an error attributed to a pattern of trees, buildings and hangars near the site. Philipsburg and Ogden both showed slow, large-amplitude error patterns typical of fences around the station. And power lines produced a low-angle scalloping error variation at Philipsburg, but only in one angular sector.

Amplitude of site errors were as high as 2.5 deg. (in the case of the fence-produced error) but in general, they were below 1.0 deg.

► **Terrain Errors**—At Patuxent, terrain effect errors were negligible, which is hardly surprising—there is no rough terrain at Patuxent. At Philipsburg, the topography was such that only short-duration, isolated disturbances resulted. Ogden showed the greatest terrain effect errors, with amplitudes as much as 5 deg.

Attitude effect errors are, of course, influenced by the installation in the particular aircraft being flown. For these data, errors are those of a vertical fin antenna on a C-47. In practically all cases, total error spread was less than 2 deg.

Errors for the airborne receiver used (Collins 51R-2) were not greater than 1.0 deg., after proper alignment.

DME error was demonstrated on several runs to fall within plus or minus 0.2 mi. on slant range out to the distance limits of the airborne indicator—100 mi.

► **Influence on Flight**—All the errors considered above total to the aggregate error incorporated into the bearing indication supplied by the equipment. Whether or not the airplane responds to these error signals is a function of the time constants of the equipments and the aircraft.

As an example, site, terrain and attitude effect errors generally are of very short period. It is possible, and with the C-47 it worked out that way, that the aircraft just can't respond to a left turn signal (produced by one of these errors) before it gets another signal to turn right.

Consequently, it is the long period ground and receiver errors that produce the largest effects on the airplane flight path. All the other components of error tend to be averaged out by the time constant of the airplane's response.

So, it can be said that the flight accuracy using the OBD system is principally determined by the ground station and receiver errors.

But the other errors can't be ignored. In their presence:

- The problems of pilot interpretation of bearing indication are increased;
- An objectionable, rough ride can result from the attempts of an aircraft to respond to the rapidly varying error signals;
- Flight accuracy is affected when the site error appears as a slow, periodic variation, or when the average terrain error is not zero;
- Circumstances arise where there is no change in bearing information with aircraft position, or there is a change but with reversed sign, thus handicapping an autopilot-controlled flight.

Again, it is impossible to say that the omni system has a final aggregate error of X degrees. But for one typical flight at Ogden, where there were normal site errors plus very large terrain errors, the aircraft flew at an intended heading of 156 deg. Over a distance of 120 mi., and despite instantaneous aggregate error spread of as much as 15 deg., the flight path lay in an angular sector between 155.7 and 159.0 deg. And the average aircraft displacement from the desired course was 1.2 deg.

► **Error Reduction**—After the errors are defined, measured and assessed, the logical next step is to reduce or eliminate them.

In the case of ground and receiver errors, this can be done by careful alignment and maintenance of the equipments. Ground station error is more advantageously improved because it is the larger of the two. But it remains as primarily a problem of alignment, and ground antenna redesign promises further improvement.

Although site effects are not too worrisome (because of the averaging tendencies of the airplane in flight) they can be reduced. CAA is working on this by lowering the antenna counterpoise and by identifying the sources of errors (fences, for example) and eliminating them.

► **Moving Mountains**—Terrain is something else. You can't move mountains, so the next best thing is to avoid them. But—flights have to be made in mountainous terrain. Fortunately, when the C-47 was flying at minimum instrument altitudes, no large terrain errors were found—except close to a mountain or within a shadow area caused by a mountain. Even then, terrain effect errors were quite symmetrical about the indicated course, and the airplane tended to fly the average value.

Aircraft attitude errors respond to treatment also. VOR is a horizontally polarized wave form, but it is possible to get radiation energy which is vertically polarized. Such radiations carry erroneous bearing indications. But with careful equipment design, attitude errors can be brought to a lower value.

► **Coverage Results**—Although error determination was the main objective of the omni evaluation, assessment of coverage and reliability is no less important.

VOR coverage was a function of the topography, as could be expected. Philipsburg, with its hilltop site, provided the best of the three locations; at Ogden, coverage was reduced as much as 50 percent at minimum altitudes because of the mountainous terrain. At all sites, the coverage with the 51R-2 receiver exceeded radio line-of-sight by at least 10 percent.

DME coverage, on the other hand, was related closely to the optical line-of-sight. It was possible to get ranges in excess of the indicator limits of 100 mi., although in all cases, DME tracking range was less than the maximum range of usable VOR signal.

DME is also sensitive to antenna radiation pattern; in some flights, signals were lost in portions of offset orbits made at standard rate turn (3 deg. per sec.) in the normal coverage area.

► **Cone of Ambiguity**—Above any VOR station there exists an inverted cone of ambiguous signal indications. In this cone, the to-from and cross-pointer indicators swing violently and the omni bearing indicator spins.

Width of this mixed-signal zone depends on altitude, because of the geometry of the cone. Included angles at the vertex were measured, and varied from 70 to 90 deg. In the 90 deg. cone, an aircraft would fly a distance equal to twice its altitude through the ambiguous region.

► **High-Altitude Effects**—The B-17 flights at high altitudes determined that there were no significant differences from low-altitude characteristics in VOR signals.

At the same time, tests were made to determine the VOR interference fringe between two stations operating at the same frequency. The interference region is defined as the area where neither station has positive control of the bearing indication. This results in receiving data with no relation to the true aircraft position.

Flights were made at 20,000 to 30,000 ft. between Allentown, Pa., and Raleigh, N. C.—383 mi. apart. These flights determined that there was an interference region 60 mi. across, displaced 12 mi. toward Raleigh from the point midway between the stations. The region seemed to be independent of altitude.

One of the things which plague scientific testing showed in these tests. The two facilities were originally chosen because CAA had run some earlier tests over the same route, and Airborne wanted to be able to compare flight data. Unfortunately, during the period between the two sets of runs, three barns had been built near the Raleigh site. Their presence affected the test data permitting direct comparison.

Voice and identification signals were good within normal service areas of the facilities, even in the cone of ambiguity at high altitudes.

► **Equipment Performance** — VOR ground equipment showed excellent stability and reliability. No measurements were lost because of failures, and standby equipment was used only infrequently.

After a short shakedown period, the airborne 51R-2 receiver was stable and reliable. Only one in-flight substitution of equipment was necessary during the entire flight test program of 300 hr.

DME ground station gear also performed reliably and well. But the airborne units had numbers of tube failures which put the interrogator-responder units out of service frequently. Operation of the units was not reliable above 20,000 ft.

► **Afterthoughts**—Now, all this gives some insight into the accuracies and vagaries of the OBD system. And it should be well-realized that there is no broad, sweeping statement which sufficiently evaluates the system.

There is one remaining bothersome point that needs to be brought out from behind the pile of data.

What do 4-deg. bearing errors mean in a polar coordinate system?

They result in potential off-course displacements of less than a mile when 10 mi. from the facility—but 3½ mi. when 50 mi. away, and 7 mi. when you're 100 mi. out. The result is not narrow airlanes.

Whether or not these tolerances are acceptable for future air navigation and traffic control systems remains for the operational experts to decide.

Footnote

Evaluation of the omni system was a cooperative venture, with overall responsibility for project conduct resting upon Airborne Instruments Laboratory. Air Navigation Development Board was the sponsoring agency, and the Civil Aeronautics Administration made some special installations in DME and incorporated the latest modifications in VOR. On the service side, the U. S. Air Force lent the C-47 and B-17 aircraft, the flight personnel, a large portion of the equipment, and transportation for the equipment; the U. S. Navy provided at Patuxent living, office and lab space, tracking and other equipment and the OBD facility.

Shoran equipment was supplied and operated by Aero Service Corp., whose personnel also evaluated the multitudinous Shoran data.

The summary report was written by AIL staff members W. R. Rambo, J. S. Prichard, D. P. Duffy and R. C. Wheeler. AVIATION WEEK acknowledges the cooperation of AIL, and particularly Messrs. Rambo and Prichard for their assistance in making available the material for this article.

Dual Tunnel Teams Instruction, Research

New facility for school use has Mach range from 0.4 to 4.0.

Given: The inadequacies in transonic and supersonic aerodynamic research facilities and a lack of technically trained personnel.

To find: Some means to help overcome these inadequacies.

One solution: A reliable, flexible windtunnel facility which can be used for instruction or for basic research in high-speed aerodynamics.

That solution has been supplied by the National Advisory Committee for Aeronautics working in cooperation with the Office of Naval Research. This team has designed, constructed and tested a unit which NACA's experience has shown to be a suitable solution to the given problem.

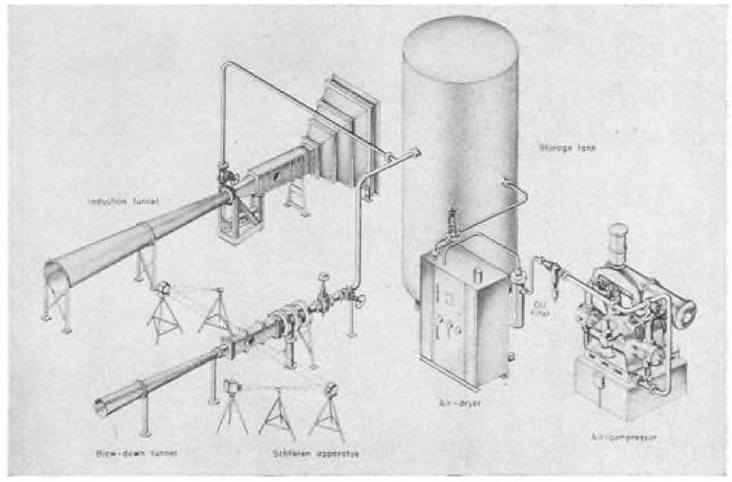
► **In Anticipation**—The program of development of this facility was begun in anticipation of the problems to be faced by educational institutions participating in the Unitary Plan for procurement of high-speed research facilities. The plan, formulated by NACA, the Air Force and the Navy, calls for the erection of aerodynamic research equipment facilities in educational institutions.

Basic description of the unit has been published in NACA Tech. Note 2189, titled "The Development and Performance of Two Small Tunnels Capable of Intermittent Operation at Mach Numbers between 0.4 and 4.0." Authors of the note are Walter F. Lindsey and William L. Chew, both of whom are on the staff of Langley Aeronautical Laboratory.

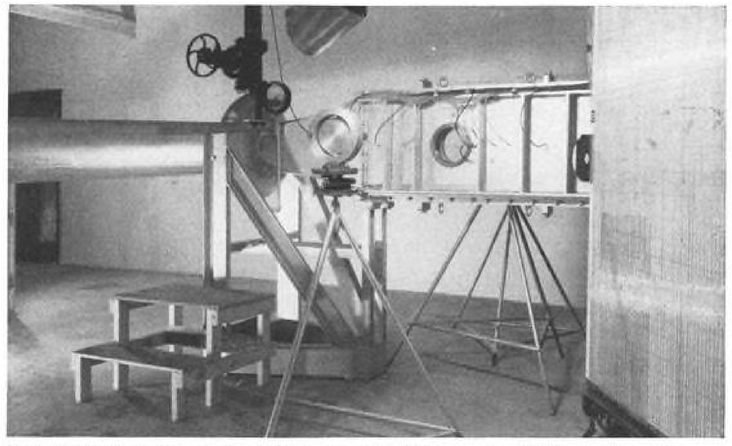
When the unit had passed the preliminary performance tests, it was turned over to the United States Naval Academy at Annapolis for student instruction and high-speed research.

► **Design Problems**—First step in NACA's program was the establishment of a set of design specifications. To be useful, any windtunnel would have to have:

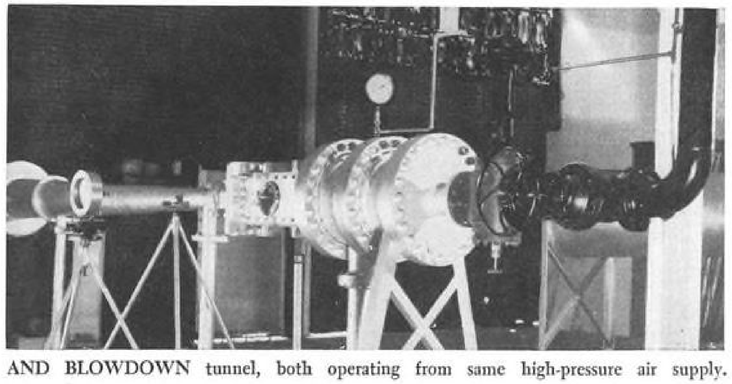
- Low initial and operating costs ,out of respect to the low research budgets of educational institutions;
- Large Mach number range, for testing flexibility;
- Long test run duration, to get maximum amounts of data;
- Minimum time between tests, to maintain high utilization;



NACA TUNNELS: Package development suggested by Unitary Plan provides for . . .



INDUCTION tunnel, with performance capabilities up to Mach number 1.4 . . .



AND BLOWDOWN tunnel, both operating from same high-pressure air supply.

• Size to permit testing a reasonably large model.

Having fixed these tentative requirements in mind, the next step was to consider the type of windtunnel that would meet these needs.

Broadly speaking, there are two types of high-speed tunnels. Continuous tunnels, as implied, can operate continuously; intermittent tunnels can only test between long periods of inactivity, used to store energy.

Because of these differences in the methods of operation, there is also a great difference in the amounts of power required to run the two types. For the size of tunnels that NACA was considering, power requirements for continuous operation were ten times those for intermittent. And power costs money—to install and to buy. The first design choice then was an intermittent tunnel.

► **Suck or Blow?**—But with intermittent operation, there are two possible schemes. The evacuation system uses upstream air at atmospheric pressure and sucks it through the test section into an evacuated tank. The compression system is just the reverse—air is forced from a high-pressure storage tank through the test section and discharged to the atmosphere.

NACA, after comparing the two, found that the compression system had advantages over the evacuation system of comparable cost. For instance, at supersonic speeds, the compression system gives:

• Higher test Reynolds number;
• Controllable stagnation pressure to vary the test Reynolds number;
• Minimum-sized air drying equipment;
• Modification possibilities accruing from the atmospheric discharge, which permits studies of ducts or combustion.

In the subsonic and transonic speed ranges, it is possible to add an induction tunnel to the compression system. This tunnel is powered by a high-energy discharge from the compression system storage tank, and the discharge is used to aspirate additional air through the test section. In this way, a two- to four-fold increase in air flow and tunnel size is possible. It has the disadvantage that dry air is best for operation, and with only a dry driving jet, the humidity level in the tunnel is going to be pretty close to that of the ambient atmosphere which is okay in Denver, rough in Baltimore.

(NACA suggests that a room enclose the induction tunnel so that recirculation and mixing of the primary driving stream and secondary aspirated stream be possible.)

There is another disadvantage to the compression system, and that is that the test section stagnation pressure decreases during a run. Generally the rate of change is low enough to be re-

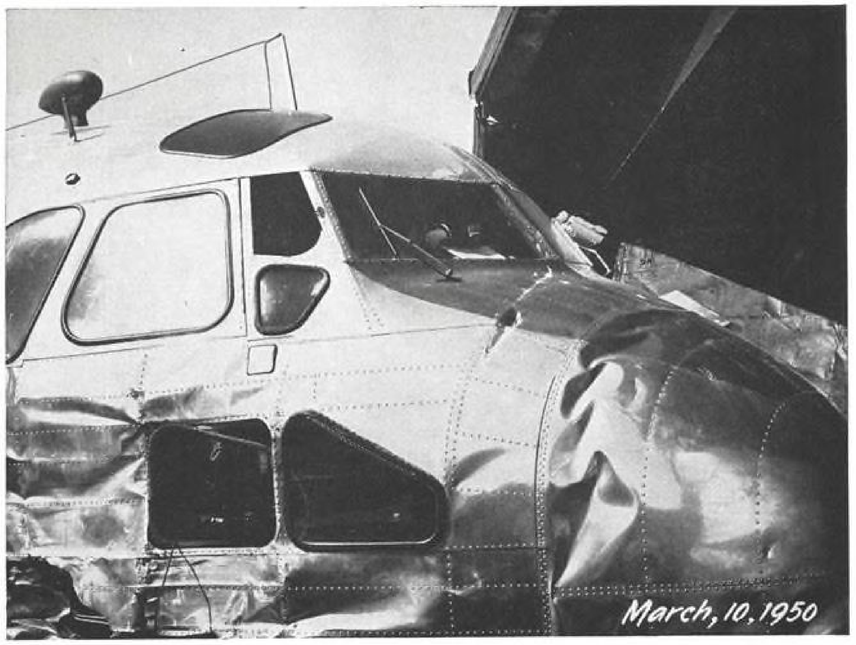


Photo shows nose of XC-123 after it had torn out a section of cyclone fence, uprooted a 20 inch apple tree and nosed through the concrete block wall of a garage. Sturdy tubing construction in the nose withstood the severe impacts with little damage to the aircraft.

RUGGED TUBE CONSTRUCTION *Pays Off In Accident To* CHASE XC-123 TRANSPORT

Showing apple tree stump uprooted by XC-123 compared in size to a six foot man

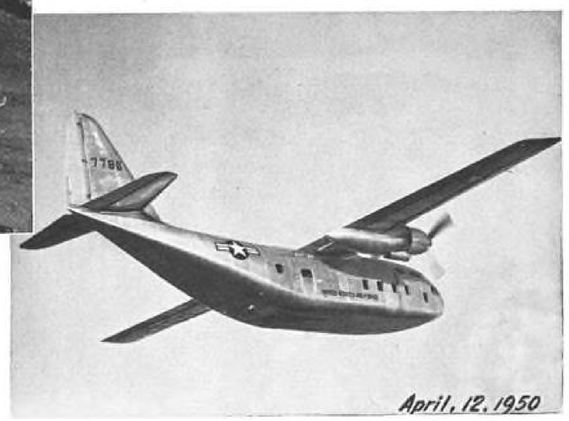


Photo left, shows XC-123 back in flight on April 12 following repairs.

• While moving the XC-123 on March 10, the plane got out of control. The giant transport roared across a field, tore out a section of cyclone fence, uprooted a 20 inch apple tree stump, splintered the roof on one garage building, and nosed through the concrete wall of a second garage.

Despite the force of the impact, the occupants climbed out of the cockpit uninjured and the construction of the plane stood up just as the designer and Armed Forces men estimated it would stand up under severe landing shocks in a combat situation—irrefutable proof of rugged design and sturdy tube construction. Tubing was furnished by SERVICE STEEL CO.

Repair work commenced on the 17th of March. By April 12th—repairs were completed and the next day the XC-123 roared down the runway and into the air—ready to appear in Exercise Swarmer. Rugged construction had paid off. Service Steel is proud that they furnished the rugged tubing for the XC-123.

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corded by commercial instruments.

NACA chose the compression system as their final recommendation, because advantages outweighed disadvantages. And they had enough experience with the system to have some ideas of its adaptability and operational costs.

► **Facility Described**—Briefly, then, the windtunnel package that NACA developed consisted of two tunnels and their ancillary equipment. For Mach numbers from about 0.4 up to 1.4, an induction tunnel is used. It has a test section 4 x 16 in. For supersonic Mach numbers up to about 4.0, a blowdown (compression system) tunnel is available, with a test section size of 4 x 4 in.

Dry compressed air for the tunnels is stored at 300 psi. in a 2000-cu.ft. tank. A 150-hp. Sullivan reciprocating air compressor is used for pumping.

Test run durations of as long as 400 sec. can be made (depending, of course, on the stagnation pressures maintained) at half-hour intervals.

Minimum size for pressure distribution test models is 2 in. chord and 4 in. span.

► **Some Details**—The working pressure of 300 psi. means that the compressor must operate at a compression ratio of 20, using atmospheric air intake. Pumping capacity of the compressor was found to be 600 cfm.

Storage tank turned out to be about 35 ft. long by 9 ft. diameter. It weighed 34 tons.

A commercially available air dryer was employed to keep the dew point at —40 deg. A reactivation period of 8 hours was specified to permit operation on alternate days.

An adsorbing oil filter was found desirable to remove the oil generally found in the discharge air from a compressor. The filter chosen had a capacity of 600 cfm of free air at the 300 psi. working pressure.

► **Induction Flow Scheme**—Ambient air enters the upstream cone and passes through a 5½ x 9-ft. 30-mesh screen for flow smoothing. It is accelerated in this entrance cone to a rectangular 4 x 26-in. passage at the nozzle. Solid aluminum alloy blocks are used to form the contours of the nozzle inlet, test section and diffuser. Downstream of the nozzle is a transition cone which increases the flow area uniformly from a 4- x 21½-in. rectangle at the nozzle block ends to a 13.4-in. diameter passage at the induction nozzle.

Induction nozzle is a torus, and encircles the air passage. The outer periphery of the tunnel air passage receives the high-pressure air from the tank. Downstream of the induction nozzle there is a diffuser with a 4½-deg. included angle.

► **Blowdown Details**—The pressurized,

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engineering has become food for discussion even among laymen in this highly technical age. So this advertising also highlights the manner in which Martin *systems engineering* is meeting the challenge of tremendously complicated air power needs. Today, the Martin engineering staff is designing aircraft and missiles as integrated air-borne systems, not merely as flying vehicles. Martin design work embodies electronic flight and navigational controls and military armament or passenger facilities, as well as airframe and power plant. And the complete development of the aircraft or missile is so scheduled that the end product represents a completely coordinated system.

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dry air from the storage tank flows through the test section of the tunnel. A gate valve controls the primary flow, and an automatic pressure-regulating valve maintains constant stagnation pressure. Just upstream of the nozzle section there is a settling chamber with screens for flow smoothing and a transition section. Nozzle blocks form the test section contours, as in the induction tunnel. Downstream of the test section is a transition piece which takes the air from its 4 x 4-in. square to a 5½-in. circle. This transition is followed by a diffuser with a 3½-deg. total included angle.

► **Overall Performance**—Tests and operation of the induction tunnel showed that the flow in the subsonic test section was reasonably uniform and not critically affected by room air humidity. But at low supersonic speeds condensation effects were pronounced during high humidity conditions. It was suggested then that the induction tunnel be installed in a room which acts as a return passage. As a consequence, relative humidity levels of 20 percent or less could be attained, and the tunnel could be operated at Mach numbers around 1.2 with no condensation.

In the blowdown tunnel, tests served to confirm the design of the various nozzles and the uniformity of the velocity distribution. There were some small streamwise pressure gradients found in two of the nozzles—Mach 2.8 and 4.1—which can be eliminated by locating the second minimum farther downstream.

► **Cost Appears High**—NACA was asked about the relative cost of the tunnel facility, which is an item of obvious importance to anyone who would like to buy one. They pieced together some information and came up with a rather-staggering estimate of $250,000, which would include the instrumentation, engineering and housing.

But now, the engineering work has been done, and presumably housing for such tunnels could be made available in existing buildings (a room of 54,000 cu.ft. contains NACA's prototype tunnel and is not crowded). So—tunnel cost could be materially reduced.

Assuming that building a 54,000-cu.ft. building could be done for somewhere around $50,000, and assessing the engineering work at the round figure of $100,000, simple subtraction places the tangible hardware cost of the tunnel at about $100,000. This still seems high, but for the money, one can get a tunnel facility which is extremely flexible, can be used for student instruction or basic research (which brings a fairly high return to colleges now), and which needs no long shakedown period for debugging.

At that rate, this NACA windtunnel package is a bargain.

Titanium Data

Studies show favorable properties. Two AMC projects underway.

Air Force researchers are stepping up their studies of titanium to establish its structural potential for aircraft applications.

Interest of the Engineering Division of AMC's Materials Laboratory has been sharpened because it has found that 40 percent in weight saving can be achieved by substituting titanium for stainless steel, gage for gage. It estimates that in one particular very heavy bombardment plane, 2000 lb. of weight could be saved if titanium were used for certain applications.

Although discovered almost 160 years ago, the metal has only recently emerged from obscurity. But metal refining progress and the need for other high-strength, high-temperature materials have now focused the research spotlight on it.

▶ **Development Pushed**—AMC's Materials Laboratory has teamed with Battelle Memorial Institute and other AF contractors to produce a large number of experimental titanium alloys. The Central Air Documents Office's Technical Data Digest reports that some of these alloys have a tensile strength ranging as high as 200,000 psi.

According to CADO, non-structural components—ducts, fittings, firewalls—already are in production. And wing and fuselage sections are being studied experimentally. It reports that the Engineering Division's Aircraft Lab have begun two research and development projects:

- Design of a complete wing for a supersonic missile, to achieve a high-temperature-resistant structure of titanium alloy.
- Design and construction of a complete aft fuselage section for a jet fighter, to replace all corrosion-resistant steel alloys with titanium alloys. This fabrication will utilize titanium forgings and rivets as well as sheet.

This work will provide valuable experience in establishing design criteria, fabrication techniques and service-test data.

▶ **Properties Favorable**—The Materials Lab's Metallurgical Branch has checked the properties of titanium and its alloys against steel and aluminum and magnesium alloys.

Here is what CADO reports:

- Yield and ultimate tensile strengths of unalloyed titanium at room temperature are superior to magnesium and aluminum alloys, carbon steels and annealed 18-8 stainless steel. Only heat-treated alloy steel and cold-worked stainless steel show greater strength than unalloyed titanium. Only heat-treated steel is similar in strength to a high-strength titanium alloy.
- On a strength-weight basis cold-worked titanium and the titanium alloys are equal or superior to the best of the other materials.
- Comparison of elastic buckling of slender and wide columns on a strength-weight basis indicates that titanium is superior to steel, but inferior to aluminum and magnesium alloys.
- Titanium has a useful creep strength at temperatures as high as 1000 F., whereas aluminum and magnesium alloys do not have useful load-carrying ability above 600 F. Titanium is stronger at 800 F. than aluminum or magnesium alloy at 400 F.

Creep data for titanium containing small but undetermined amounts of carbon, oxygen, nitrogen and tungsten disclose properties that are intermediate between those of the best aluminum alloys and steel.

The Engineering Division Aircraft Lab's Dale H. Black holds that the limit of the metal's applicability depends largely on its working and handling characteristics. Experiments have shown the following characteristics in these operations:

▶ **Bending and Forming**—Annealed, .020 to .070-in.-thick titanium sheet will take a twice thickness minimum bend radius. Brake-forming of the metal appears practicable.

However, considerable development work is necessary to establish procedures for drawing, cupping, spinning, die- and hammer-forming, and extruding.

▶ **Machinability**—Initial investigations indicate that machining of titanium is similar to that for austenitic stainless steel.

▶ **Forging**—The commercially pure metal is readily forgeable in the 1600-1800 F. range.

▶ **Annealing**—This can be satisfactorily accomplished with commercially pure metal by heat-treating in air for one hour at 1300 F.

Exposure to 800 F. for 1000 hours will remove the metal's cold-work properties. Like other metals, shorter times at higher temperatures also will remove the cold-work.

▶ **Welding**—Spot, seam, and inert arc welding to other pieces of the metal is readily done.

Other methods of welding (or brazing or soldering) have not yet been adapted for titanium.

Also, no data appear available for welding the metal to other common structural materials.

The Air Force is stressing its efforts to insure availability of the metal for aircraft use.

Need is indicated, AF engineers say, for a simple, inexpensive and rapid method for producing titanium from the basic ores.

Presently the Bureau of Mines is using the Kroll method—now considered most practical for large scale operations—of magnesium reduction of titanium tetrachloride for producing ductile titanium. Metal reduced by this process is reported to give purity as high as 99.8 percent.

The most pure and ductile titanium is now produced by the iodide process. Here, crude titanium of fairly high purity is refined by exposing it to iodine in an evacuated chamber, giving volatile iodides which are decomposed on heated filament, forming a titanium rod.

Ingots of 125 lb. and 24-in.-wide by 7-ft. long sheets are now being produced by one manufacturer. Sheet price is about $20 per pound. Large-scale production may price ingots at about $1 per pound.

Although immediate use of titanium now is centered on substitution for stainless steel, CADO says, it is expected that further research will give titanium alloys having higher strength, better characteristics, with wide use in supersonic plane structures and missiles.

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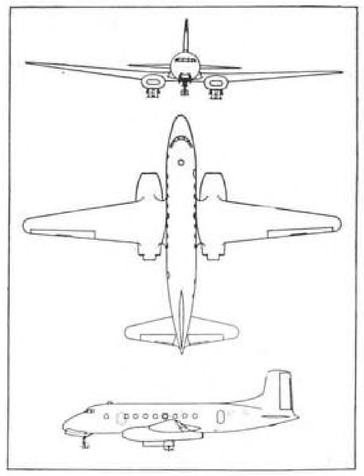
Ashton Reports for Altitude Duty

Avro to build six pressurized, Nene-engined research craft under contract with Ministry of Supply.

Britain's Hawker Siddeley Group is transferring a main share of its high-speed, high-altitude research from fighter-size craft to a new, four-jet flying lab specifically designed for the job.

The new plane is the Avro Ashton, the only aircraft of its type now flying in Britain. It will be put through its high-flying paces to resolve operational problems for guidance of future design trends of the engine- and aircraft-building Group companies—Hawker, Gloster, Avro, Armstrong Whitworth, Avro Canada and Armstrong Siddeley—particularly in the bomber and airliner field.

First flown in August, and exhibited publicly for the first time at the recent Society of British Aircraft Constructors' Farmborough show, the Ashton is big enough to accommodate all the instruments required and has a pressurized cabin for long, comfortable flights.



Maximum differential cabin pressure is 8.2 psi., so that at 40,000 ft. there is an internal atmospheric pressure equivalent to that at 8000 ft.

► **Fuselage**—This structure is divided into five sections: Nose, front center section, center, rear center and tailcone. Length is 89 ft. 7 in.

Except for the nose section forward of the cockpit, the fuselage has a circular cross-section with 11-ft. maximum diameter.

Makeup is a conventional structure of frames and stringers.

► **Wing**—The low-placed airfoil has a span of 120 ft. and tapers sharply towards the tips. Construction is three-panel makeup—center section and two outer panels.

Approximations show the root chord to be about 16 ft., tip chord 5 ft. Dihedral is about 4½ deg.

The outer panels each house four flexible fuel cells. There is a cross-feed system to permit all four engines to be supplied from tanks in either panel.

► **Engines**—Two nacelles accommodate the four jet powerplants—two twin Rolls-Royce Nenes.

At the front of each nacelle is a large detachable cowling forming a common air intake for the side-by-side engines. Separating the two powerplants is a longitudinal fireproof diaphragm attached to the firewall. The individual exhaust cones pass under the rear spar.

► **Gearing**—There is a lateral, universal connection from each engine gearcase hooking into a single driveshaft beginning at the forward end of the separating diaphragm and running aft to an accessories gearbox on the rear face of the firewall. With this arrangement, if one of each pair of engines fails, the other supplies sufficient power to drive the accessories.

Starboard gearbox drives two cabin superchargers, two hydraulic pumps. Port gearbox drives similar units plus two compressors used to charge a pair of storage cylinders supplying air for operation of main wheel brakes, for hydraulic reservoir and windshield deicing tank pressurization, and water delivery to crew's toilet.

Each gearbox has its independent oil system, with the sump integral with the component. In addition to the normal gearbox oil supply, a separate reservoir is located at the forward end of the longitudinal driveshaft.

► **Landing Gear**—Each unit of the tricycle landing gear has twin wheels, each strut retracting forward. Nose gear is housed in an unpressurized compartment, the main gear in the engine nacelles.

Nose gear strut utilizes the liquid-spring principle (Dowty), while main gear strut uses air-oil action.

Nose wheel is steerable to maximum angle of 35 deg. on each side. Beyond this range, the gear casters up to 180 deg. on each side.

► **Actuating Systems**—Hydraulic power is used for landing gear actuation (up only), flap operation and nosegear steering.

Pushbutton switches control gear retraction. Gear extension is by gravity, only the up-locks being released by hydraulic pressure. An emergency, ground-charged air system will release the up-locks and assist in initial extension if the hydraulic system fails.

The six positions of the flaps are controlled by a lever-operated drum switch. The emergency air system also can be used to operate the flaps if the hydraulic system fails.

► **Deicing**—Air pressure is used for fluid delivery to windshield sprays.

Wing leading edge deicing employs the principle of porous metal inserts, multi-cell pump and ice-detector head.

Bronze Alloy for B-47 Counterweights

B-47B Stratojets coming off Boeing's Wichita lines are being equipped with rudder and elevator counterweights made of Revere Copper and Brass Inc.'s architectural bronze alloy 283.

Switch was made from steel because this material would have required shifting the Flux Gate compass from an ideal location.

Revere's non-magnetic material is furnished in extrusions with cross-sections closely approximating the shape of the finished part.

Revere reports that savings in machining time more than offsets the initial increased cost of the bronze. Net savings, it says, "were great enough to promote" the use of the bronze for counterweights where magnetic effect is not a factor.

Wayne Students Build Supersonic Tunnel

Students at Wayne University, Detroit, Mich., have designed and built their own intermittent supersonic wind-tunnel. Undertaken as a regular study project, the tunnel is of the blowdown type and is capable of Mach numbers up to about four.

Flow cycle is conventional, from a compressor through filters and driers to a storage tank, then through the test section. Discharge is to atmosphere.

A pressure-regulating valve is placed in the circuit just upstream of the test section, to keep the pressure constant before expansion.

Blowdown time is limited to about 20 sec. at Mach 3.

Test section size is 1.5 x 2.67 in., an area of 4.0 sq. in. The speed range on the tunnel is in the area from Mach 1.4 to 4.0.

Tunnel will be used for basic research as well as educational instruction. Wayne University says that this is one of few such facilities in the country.

Remote Control for Safer Test Flying

AMC and Lear developing more precise video monitored radio control.

By George L. Christian

Grand Rapids, Mich.—"Arm-chair test flying" is in the offing. Odd as it may seem to be sitting on the ground while wringing out a supersonic jet, it will be possible when the Aircraft Remote Flight Control System grows from its current teething stage to maturity. Remote flight testing from a "mother" plane will also be feasible.

Test pilots of the future can thank Paul W. Nosker at Wright Field for a major contribution toward flight testing experimental aircraft through monitored remote control, and also for having been instrumental in pushing through a contract for the development of such a system. Nosker is unit chief, Equipment Laboratory, Air Materiel Command.

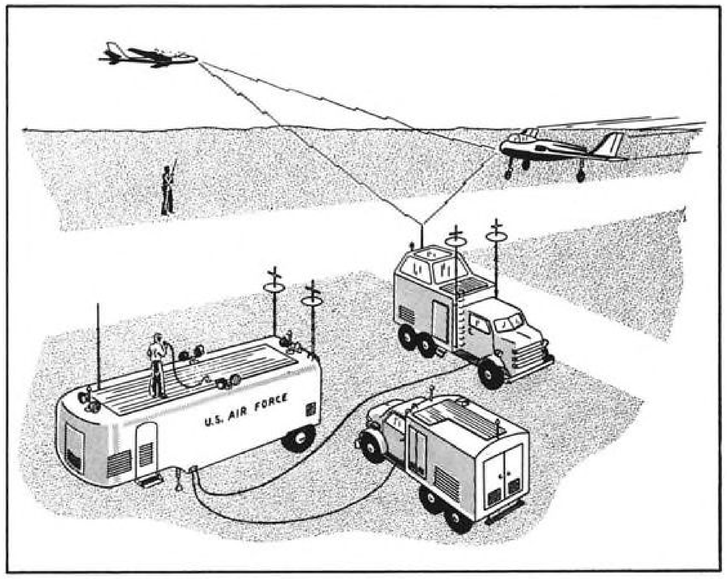
Remote Flight Control is being developed by engineers of AMC's Equipment Lab and Electronics subdivision and Lear, Inc., of Grand Rapids.

▶**Since World War I**—Remote control of aircraft is nothing new. As far back as 1919 Morris M. Titterington, then a research engineer of the Sperry Gyroscope Co., startled delegates to the second Pan-American Aeronautical Congress meeting in Atlantic City by revealing some of the experiments made during World War I in the development of nonmanual controlled aircraft.

Problems involved in remote control are apparent with the realization that in 1919 Titterington said ". . . the French government had developed air torpedoes controlled by radio from other planes several miles away." Solutions are near only now, 31 years later.

In 1919, the purpose of remote control was destruction. Now, the Remote Flight Control System's prime purpose is to save test pilots and aircraft, Richard M. Mock, president of Lear, told AVIATION WEEK.

▶**Versatility**—A tremendous advantage will be the possibility of wrenching the drone through high acceleration maneuvers where the limiting factor will be the structural integrity of the aircraft, not the physical stamina of the pilot. Flights in the transonic and supersonic speed regions may also be accomplished with this system.



REMOTE Flight System in final form. Drone is landing. In foreground are three mobile ground units. One observer stands on roof of lab, another on runway with walkie talkie.

Actual flight testing has begun. J. P. Brown, Lear project engineer and pilot in charge of the Remote Flight Control System showed AVIATION WEEK every detail of the project at the Lear hanger, Grand Rapids Airport. Included was an hour-long demonstration of remote control flight.

He pointed out how television receivers enabled the pilot of the drone plane to see the horizon and instrument panel, though the craft might be miles distant, and thus control the drone almost as precisely as though he were at the controls.

Brown cited these differences between the Remote Flight Control System and previous methods:

• **Previous systems** maneuvered the drone by an "on-off" or "beep" type of radio control. This did not permit direct operation of the drone's stick and rudder for conventional flying by a remote pilot. The "on-off" radio was used through an automatic pilot to vary the attitude of the drone at a constant rate as long as the beep switch for roll or pitch was actuated.

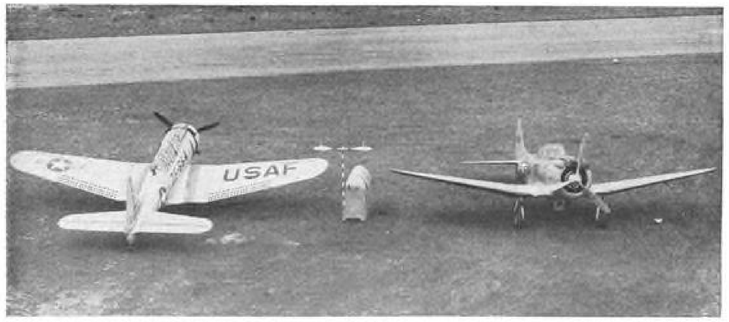
Leveling the drone or assuming a precise attitude was difficult. The drone had a tendency to overshoot the desired attitude, resulting in considerable jockeying of the control. Also, only one rate of change of attitude was possible.

• **The new system** actuates the controls of the drone in a continuously-proportional method. The displacement of control in the command cockpit is faithfully duplicated by the corresponding control in the drone. However fast or slow the command control is displaced, the drone control duplicates the movement within the limits of the high-velocity servos used.

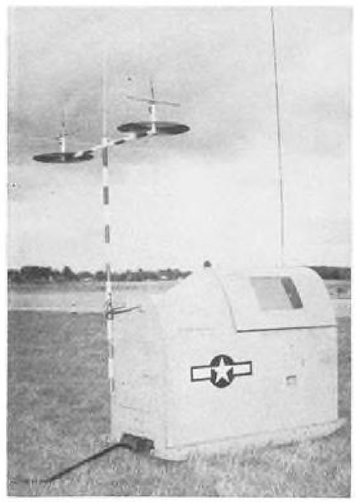
• **The new system** is the first to include such complete facilities for controlling the drone, recording every facet of activity aboard the aircraft, and yet being completely self-contained and mobile. This elaborate system will permit flight testing to be done with a degree of thoroughness heretofore impossible.

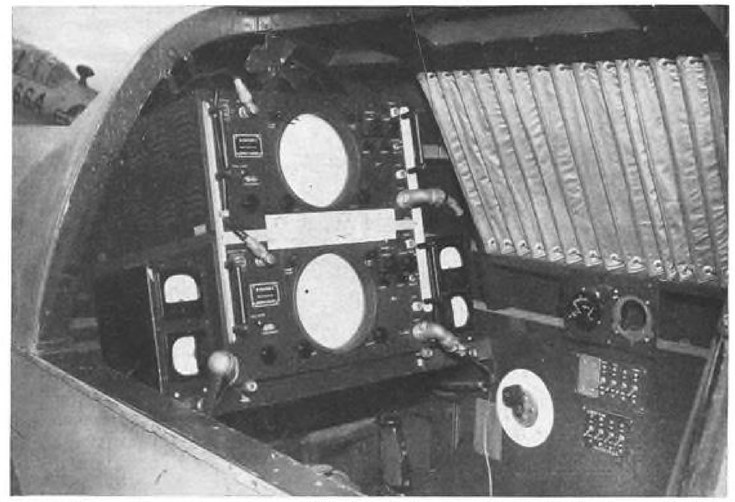
▶**Pilot Model**—Still brand new, the Aircraft Remote Flight Control System now is made up of a ground control station which looks like an overgrown Link trainer plus two aircraft.

The ground structure houses a cockpit complete with all the controls for the drone plane: stick, rudder pedals, throttles, flap and gear controls, etc. In lieu of an instrument panel, the drone pilot is confronted with two television screens. The upper one shows him the horizon, the lower reflects instrument panel activity aboard the drone. An intercom is provided for



MOTHER & DRONE A-24s. Note horizon video camera under belly of drone (right). Test ground control unit is between planes. Right photo: drone control cockpit in mother ship. Upper television screens in pilot's line of sight monitor main video receivers (lower pair).





COMPACT test ground control station mounts transmitting and receiving antennas (right). Interior view of unit (left). Upper television receiver shows ground remote control pilot the horizon, lower set the drone's instrument panel. Other controls are under throttle.

continuous communication between the ground remote control pilot, the remote control pilot in the mother plane and the drone safety pilot.

To date, a safety pilot has ridden in the drone and taken over manually when necessary. Attached to the ground control station are the transmitting and receiving antennas necessary for control.

Completing the present equipment are two A-24s, obsolete Douglas Dauntless SBDs, one the mother, the other the drone.

The mother A-24 is flown from the front cockpit. The rear seat is practically identical to the ground control station, with two bulky video receivers in the small cockpit. From here too, a pilot may put the drone through its paces.

The other A-24 carries a normal front cockpit where the safety pilot rides. The rear office is a maze of black boxes, hydraulic controls, television equipment trained on brightly lighted instruments and other gear stowed into every available square inch of space. The horizon video camera is contained in a streamlined housing on the belly of the drone aircraft.

This installation has not proved satisfactory because engine oil blows back and obscures the lens. It will be a relatively simple matter to relocate this unit.

▶**Search for Data**—With this rudimentary equipment, (even the GFP television is obsolete) Lear pilots J. P. Brown, Ed Conklin and L. C. Leith have conducted almost 20 hours of remote control flight to demonstrate principles of operation and obtain test data pertinent to construction of the final Remote Flight Control System.

They point out that flying the drone from the ground station, with only television to monitor the plane's attitude, presents problems of coordination and timing.

But flying the drone from the mother plane is even harder.

The pilots find it difficult to disassociate their actions from the motion of the mother plane which might be banking to the right while the drone was turning left, for instance. Seat-of-the-pants reactions are hard to overrule. They expect practice to eliminate that problem.

▶**How It Works**—A flight demonstration for this writer gave convincing evidence that Lear engineers and pilots are well along in their efforts to make the Remote Flight System practical. Even more convincing was a half-hour try at flying the drone from the ground station.

Leith took the drone off and when at about 5000 ft. and a few miles from the field radioed back to Conklin who was at the ground controls that he was ready to synchronize, or trim the ship with the ground controls. This was done in a few minutes with special knobs, one for each flight axis.

On this particular flight both video receivers displayed the instrument panel, the horizon circuit being temporarily out of service.

"You've got it," said Leith, and Conklin took over. Listening in on a spare head set, the conversation from safety pilot to control pilot sounded something like the soft, even patter coming from a good GCA controller. "We're three miles north of the field,

heading south-east, flying straight and level at 200 indicated. Now making a well-coordinated turn to the left, you're smooth today. Nice climb, but leave us not stall . . ."

Having memorized the instruments as they appeared on the video set (unlabeled and specially arranged against a white background to facilitate televising) the writer exchanged places with Conklin.

A slight movement of the stick to the left resulted, after a brief delay, in a rather ragged left bank of the drone. "Slippin' a little," said Leith. To level the ship out, you had to neutralize the controls somewhat before the gyro indicated that the drone was level; there was a definite and noticeable time lag between movement of a given control and indicated response on the video screen.

This resulted in sloppy and indecisive flying for a novice. But Brown asserted that the full-fledged system would embody control circuits with reactions ten times as fast as those on the current equipment.

After half an hour of remote flying the drone, simple, coordinated turns became relatively feasible, and straight and level flight could be accomplished. Leith then took over and brought the drone in for a manually controlled landing.

▶ **Final Model**—The three-unit ground power supply and control vehicles, parked by the Lear hangar, are nearing completion. All are sound-proofed, insulated and air conditioned with standard Tropic Air bus-type air conditioning units. An interior temperature of 70 deg. will be maintained in any type of climate varying from equatorial to arctic.

The Control Station is mounted on a six-wheel truck chassis. The "green house," occupying the upper rear section of the truck, contains complete dual control cockpit equipment. It is from here that the drones will be controlled.

Both pilot and copilot will have dual video receivers, one showing the horizon, the other the instrument panel. A complete pedestal between the pilots will mount 14 proportional positioning controls for such requirements as throttle or propeller, plus 18 switching controls for such "on-off" operations as the landing gear, flaps or oil cooler shutters.

The large glass enclosure housing the pilots gives them an unobstructed view of the drone, allowing them to fly it by visual direct-line-of-sight as long as it is within view. Provisions are also made to operate the drone through a Type F-5 autopilot, developed by Lear, and now in production for USAF jet aircraft. The pilot may, at any time, transfer control of the drone from his stick and rudder pedals to the F-5 which

FINAL model ground control station will . . .

be used in conjunction with power unit . . .

and complete laboratory in demi-trailer.

he controls through a "formation stick" or automatic pilot controller.

Thus the remote control pilots have two methods of handling the drone: by direct, proportional control or by autopilot. And they have two ways of checking on the drone's progress: by direct-line-of-sight or by televised horizon and instrument panel.

In the forward part of the Control Station is an engineer's station where all radio controls and the power supply will be constantly monitored. The slightest defection in frequency or voltage could result in control positioning inaccuracy.

Foreseeing the possibility of radio signal failure, provisions have been made automatically to switch the drone to a pre-set course and level flight attitude should such an eventuality arise. Simultaneously, all other proportional controls can be made to assume pre-set positions. When radio signals return to strength, remote control again takes over.

The second van-type truck serves as the power source. Crammed into its body is a B-8 generator capable of delivering 28 kw. at 240 v. 60 cycles, single and three phase. In the rear of the unit are several powered reels which store the hundreds of feet of cable used to interconnect the three units while operating remote control flights.

Power Unit, as it is called, furnishes all the power required for the whole system, making it completely independent of outside power sources.

▶ **Nerve Center**—The Laboratory Unit is housed in a semi-trailer and is the nerve and recording center of the system.

In the radio and recording room, engineers will receive and record all communications, television and telemetering from the drone, the mother aircraft, and other ground units. (Provisions have been made for three remote observers using "walkie-talkie" radio sets.)

The communications will be recorded on Lear wire recorders, the television by movie cameras and the telemetering on photo strip paper by means of an oscillograph.

Next to the recording room is a small dark room where the recording film may be processed without delay. The room is complete in every detail—even to providing dryers and constant water temperature control.

Squeezed into the rear of the trailer is a repair shop complete with lathe, drill press, and equipment necessary for instrument and electronic overhaul, including compressed air and an adequate water supply.

On top of the unit are the collapsible antennas, four flood lights, four loud speakers and an observer's platform. Jack boxes are provided so that those on the roof may talk with engineers inside the trailer. All three units may be packed up and moved at a moment's notice.

▶ **Target Date**—Brown said Lear hopes to deliver the completed system to the Air Force in 1951, under a contract calling for the following:

- **The prototype test** (pilot model) system.
- **The three-vehicle ground** control and power units.
- **One bomber mother** and drone, flight tested for 50 hr.
- **One fighter mother** and drone, flight tested for 50 hr.
- **A third mother-drone combination,** of equipment (not installed) to be delivered to Wright Field for laboratory test work.

Amount of the contract was undisclosed.

Development of the Aircraft Remote Flight Control System comes appropriately during the twentieth anniversary of Lear, Inc. W. P. Lear, chairman of the board and director of research and development is the company's guiding genius. His success may be gauged by comparing the $8,750,000 1949 backlog to the $18,000,000 figure for 1950.

NEW AVIATION PRODUCTS

Cell-Lighted Airway

A powerful, new obstruction light or beacon which operates entirely on dry-cell batteries reportedly has been installed by Bonanza Airlines to mark the carrier's Reno-Las Vegas route. Important advantage of this light is that it can be located at will in remote areas without the need for bringing in costly electrical lines for power.

The unit, which produces 90 red flashes per minute, was developed by Light Products, Inc. The firm says that at recent tests supervised by the Civil Aeronautics Administration and witnessed by representatives of several airlines, the beacon could be seen 20 miles away. Bonanza has purchased three of the lights and installed them at ten-mile intervals under supervision and approval of CAA's Air Carrier division, it says.

Besides its use as a route marker, the beacon can serve as an obstruction light on mountains, hills and buildings.

The unit has four lamps, each covering 90 degrees. Lights are controlled by an automatic day-and-night selenium switch and powered by two, specially-designed "Power-Pak" dry cell batteries rated at a minimum life of one year. The swivel-mounted heads are adjustable and 12-in. dimpled plastic lenses are designed to give wide angle diffusion without sacrificing visibility.

The heavy-gage steel container is waterproof and weighs about 50 lbs. without batteries. Models also are available with one, two or three lamps. Maker's address: 4070 Commercial Center, Beverly Hill, Calif.

Relay for Planes

Hart Mfg. Co is marketing a new miniature, four-pole, double-throw relay for aircraft designed to withstand shocks up to 50 Gs. It is hermetically sealed to operate through temperatures ranging from —85F. to 392 F.

The unit weighs 3.5 oz. and displaces 1.5 cu. in. It is sealed with a dry, inert gas, pressure filled, and has variable mounting arrangements. It will take an overload of 12 amps, 28 v. d.c. for 20 seconds.

The company says many variations are possible in the basic specifications for voltage, amperage, number of poles and temperatures.

This unit has contact ratings of 2 amps., 28 v. d.c.; 2 amps., 115v. a.c. 400c.; coil resistance 300 and 150 ohms; coil voltage 28 v. d.c. with 0.1 amp. Existing terminals call for soldered connections, but plug-in terminals are available. Address: 110 Bartholomew Ave., Hartford, Conn.

Better Jet Joints

The use of stainless steel for higher temperature applications in jet engines is promised through better joining of stainless by an improved "Nicrobraz" brazing material.

The developer, Wall Colmonoy Corp., says the joint of a stainless steel assembly brazed with Nicobraz now possesses equal strength at 2000 F. plus better corrosion and oxidation resistance than the parent metal. Test also show new Nicrobraz joints have a higher re-remelting point of 2600 F., compared to 1850 F. for original Nicrobraz, the firm adds.

Other tests showed that the tensile strength of a butt-brazed super alloy specimen was 120,000 psi. at room temperature–about 90 percent that of parent metal strength. At 2000 F., the tensile strength was 99.8 percent that of the parent metal. The company says the next best brazing material of all those tested produced a joint only 35 percent the tensile strength of the parent metal at 1600 F.

Nicrobraz alloy can be used to braze 300 and 400 stainless steel, Inconel, S-590, Monel, alloy, tool and carbon steels and special stainless products. Address: 19345 John R St., Detroit 3, Mich.

GE's New Silicone

General Electric says it has developed a new silicone rubber compound that makes possible easier molding of this type rubber into parts with highly improved mechanical and thermal properties.

As a result of these improved characteristics, GE sees many new uses for this material in diaphragms, boots, sleeves, belting, hose, mountings and similar parts.

The new material, 81223 compound, is outstanding for its ease in processing, engineers say. Many parts can be fabricated from it without prolonged oven cure and it has "excellent molding and extrusion properties after only a five-minute warm-up," according to GE.

Since its hot tear strength is high, parts with undercuts can be removed easily from molds, and being neutral in color, stock can be colored as desired by individual fabricators.

Other important advantages of the compound listed by the firm, are its high tensile strength, high elongation, excellent electrical properties and serviceability over a wide range of temperatures, from -85 to 550 F. Address: Chemical Dept., General Electric Co., Pittsfield, Mass.

ALSO ON THE MARKET

Socket-head wrenches combined conveniently in five popular sizes in a single tool, fold like pocket knives into sturdy handle. Handle gives added leverage; wrenches can be removed and replaced separately when worn down. Made by H. D. Hunter Co., 4476 Union Pacific Ave., Los Angeles, Calif.

A sensitizer, new accessory for Amprobe snap-on volt-ammeter, is designed to increase tenfold the sensitivity of the volt-ammeter. It makes it easier to take low-current readings and broadens the low-current range of the Amprobe. Made by Pyramid Instrument Corp., 49 Howard St., New York 13, N. Y.

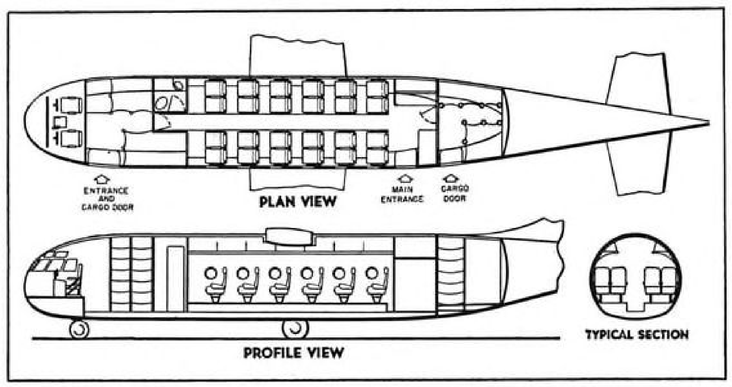
Sparkplug wrench for aircraft grips plug during removal or installation, minimizing chances of dropping and damaging parts. Tool is designed to speed plug changes, cut maintenance costs. Made by Gabb Mfg. Co., division of E. Horton and Son Co., Windsor Locks, Conn.

Triplet magnifier for shop inspection consists of three elements cemented to form composite lens. Chromatic and spherical aberrations are supposed to be fully corrected in this 10-power magnifier. Made by Buhl Optical Co., 1009 Beech Ave., Pittsburgh 12, Pa.

Feederline Specifications for 'Ideal' Plane

DE HAVILLAND DOVE has advantage of availability, but is smaller than "ideal." And . . .

SUPER DC-3, while also available, may be too big for feederlines' needs. Proposed . . .



BOEING 498, with capacity for 24 passengers, comes closer to shorthaul specifications.

Shorthaul operators ask 5250-lb. payload, 350-mi. range in new designs.

By F. Lee Moore

New specifications for the shorthaul plane of 1955 have been drawn by U. S. feeder airlines. Their tentative requirements for this as-yet-unbuilt plane include:

- **Payload minimum,** 5250 lb.
- **Seating capacity,** 24 passengers.
- **Cargo bin capacity,** 1500 lb.
- **Combination load** of 20 passengers with 25 lb. baggage each, plus 1500 lb. cargo.
- **3300-ft. single-runway** airfield operation. Many towns served by feeders cannot afford longer runways.
- **Provision for turbine** engines as replacements for piston engines powering the feederliner.

Representatives from seven feederlines—All American Airways, Continental Air Lines, Empire Air Lines, Piedmont Airlines, Robinson Airlines, Southern Airways and Trans-Texas Airways—Air Transport Assn., and Ray & Ray (feeder consultants) have so far agreed on the broad outlines. ATA engineer A. W. Dallas last week sent the proposed requirements to all feeder operators for further modifications and suggestions.

▶ **Beginnings**—They first met in Washington last May 22 to consider the characteristics of a feederline airplane. Results of their first deliberations were circulated for further study. Then seven of the feeders met again Oct. 19 further to peg the problem. Now the specifications of what they want are pinned down.

The seven feeders not present at the last meeting are sending comments this week. They are Bonanza Air Lines, Frontier, Hawaiian Airlines, Lake Central, Pioneer Airlines, Southwest, and Trans-Pacific Airlines.

▶ **Purpose of Plan**—When all the feederlines have agreed to specifications, they will ask manufacturers to make trial applications to actual designs. And ATA will try to get Congress to pass a new prototype bill to develop the needed feederline equipment.

Among other features the feeder operators would like to see in their proposed plan:

- **Four abreast** seating arrangement, to simplify weight and balance operation.
- **Baggage racks** laid out for carry-on storage by passenger, as in the Convair-Liner.
- **Cargo-handling ease** and economy. Cargo compartment should be next to the cabin, so the flight attendant can watch the loading of both passengers and cargo, and can enter the cargo bin during flight; loading floor must be waist high or less—low enough to handle from ground level without lifts or ladders; cargo door opening should be at floor level; overall cargo door dimensions should be about 48 in. high and 36 in. wide.
- **Refueling** should require only one man.
- **Maintenance simplicity** and parts interchangeability should get extremely careful designer attention.
- **Range should be 350 mi.,** including five intermediate stops with 200 mi. plus 45 min. reserve at 60-percent METO power. Increased tankage of 50 percent more than the 350-mi. range should be provided so feeders could get extra range with reduced payload.
- **Air refrigeration** is more of a must for feeders than other type operations. The planes seldom fly high enough to cool off, and they aren't on the ground long enough to use ground cooling equipment.

The feeders think air conditioning is an essential need for their prospective plane—but costs may be prohibitive. Heating and ventilation are, of course, required. Heating for cargo bin is specified also, but not humidity control.

- **Anti-icing** must be thermal, or by other improved methods.
- **Pressurization** is considered important, but only "if it can be obtained without undue economic penalty."

These requirements leave three big questions to the designer—powerplant, operating costs and speed.

- **Powerplant.** Favored right now by the feeders is the 9-cylinder, single-row Wright 1475-hp. 959C9HE1, with piston displacement of 1820 cu. in. Provision for later replacement by turboprop is desired.
- **Operating costs and speed** will depend on results of designing a plane around the other specifications.

The feeders want the highest cruising speed consistent with economy. Small improvements in block speeds mean a lot in feederline operation.

But designing a plane that will get out of a 3300-ft. runway cross wind, using only one of its two piston engines, will probably call for big wings—reducing speed potential. Another drag component is inherent in the feeder request for four-abreast passenger seating.

▶ Are They Practical?—First query by

some people looking at these feeder specifications is: "Why 24 passengers? Average load factor on feeder DC-3s in the comparatively good month of August ran only 37½ percent, and that's figured on a 21-passenger capacity."

• **Average load** of eight passengers carried on DC-3s by feeders in August includes all DC-3 flights—every day, good hours and bad, good runs and bad. A feeder flight averaging eight passengers might start out with 16 passengers at the home port, and reach the end of the line practically empty. So present capacity requirements might be figured around 16 passengers.

• **Peak load traffic** may be very heavy. Either the carrier loses that business, or he flies the equipment to take care of it, even during off days. Carriers reject the idea of holding smaller-capacity planes in reserve. They prefer flying a large plane around three-quarters empty during off days, as it requires less initial capital outlay, less pilots, less maintenance, they say.

• **Growth of feeder traffic** might be 50 percent, between now and the 1955-60 period. If a 16-seat plane were needed now, the plane bought in 1955 for use in 1955-65 ought to have capacity to seat 50 percent more.

• **Service is the primary reason** for feeders' existence. They are heavily subsidized because national policy considers them a worth-while investment. Skimping on equipment to save money now brings up the point that under pure economics most of the feeder-lines would not exist at all. So the feeders feel that they should try to get adequate equipment for potential future needs.

► **Other Planes Available?**—The feeders are really asking replacement of their standard plane of today—the DC-3. It operates now only under a Civil Aeronautics Administration waiver of modern airworthiness specifications.

There is no exact replacement of the obsolete DC-3 now available. But the 31-passenger Douglas Super DC-3 (AVIATION WEEK Oct. 9), the 11-passenger de Havilland Dove and the 11-passenger Percival Prince are possibilities for immediate feeder procurement.

► **On the Drawing Board**—There is at least one DC-3 replacement on the drawing board—the Boeing 498 Local Service Airliner. It fits nicely into the operating specifications proposed by the feeders (see page 15).

But it is turboprop-powered, and the feeders ask for piston engines. The Boeing 498 probably would not be certificated until 1954, and Boeing feels that turboprops by then will be the thing to build into a brand new design like this.

Other companies as well as Boeing designed DC-3 replacements, or feeder planes back in 1946, but demand failed to materialize for any of them. Some of them were: Boeing 417, Douglas DC-9, Lockheed Saturn 75.

► **Market Changed**—A Lockheed survey at that time showed there was a potential world demand for about 300 of its 14-passenger Saturns. De Havilland has captured most of the foreign demand with its 11-passenger (maximum) Dove, of which it has sold over 200. The Prince has started coming off the line in England now. A couple of U. S. feeders are showing interest in it.

But foreign planes have not sold in the U. S., although a new sales effort is in the offing for the Dove (AVIATION WEEK Oct. 30). Wiggins Airways President Joseph Garside is negotiating to buy perhaps two Doves now—three more later if he likes them. Right now, the Dove appears the best immediately available feeder for moderate-sized feeder load factors. For heavy traffic the Super DC-3 seems best.

► **Who Will Build?**—The problem of the feeders, if they want their idealized feeder plane in 1955, is this: alone they offer a very thin market for the manufacturer. Boeing, for instance, estimates engineering and tooling cost of getting its Model 498 ready for production might run around $20-30 million.

They hope to be able to get cooperation of commercial, engine and military interests on a strictly commercial basis. Failing this, Boeing says it might try to get in on some kind of federal-assistance prototype program, but prefers greatly the straight commercial bargain-risk deal if possible.

New Policy?

CAA coming around to pilots' way of thinking on approach lights.

The Civil Aeronautics Administration is expected to do another flip-flop on approach light policy, and land right where most other interested parties have stood for several years.

Sometime next month pilots landing at Newark Airport will start using a single-row centerline system such as has long been advocated by the Air Line Pilots Assn. and the Air Transport Assn. CAA has had the system installed, nominally as a test. It is not supposed to represent any change in CAA's policy of installing slope line fixtures in a single row on the lefthand side of the approach lane (AVIATION WEEK May 22). But informed observers think this is the CAA pattern of the future.

Here's what has happened:

► **IATA Reversal**—The last two weeks in October, the Flight Technical Working Group of the International Air Transport Assn. met in Montreal to restudy the approach light situation. Sitting in on the sessions, in addition to members of the group, were representatives of CAA, ALPA, ATA, the International Civil Aviation Organization and others with a stake in the outcome. After a thorough review of all approach light systems, the group decided to recommend the single-row centerline system.

At the moment, IATA's policy is that any one of several approach light configurations is acceptable, and at last spring's technical meeting in Asbury Park, N. J., IATA members were inclined to follow the lead of CAA in the matter. Now, the recommendation of the working group will go to IATA's Operations Subcommittee, then to the Technical Committee and, if approved, be transmitted to ICAO for consideration.

In the opinion of several persons who attended the working group's meetings, approval by all those bodies will be forthcoming.

► **CAA's "Out"**—This will give CAA an "out" on its own insistence on the lefthand row. CAA people who observed the working committee's deliberations seemed well-satisfied at the results. If the recommendation becomes ICAO policy, CAA then will be able to yield gracefully, with the explanation that the U. S. will have to go along with the system desired by the majority of the member nations of ICAO.

Such a reversal will be applauded by ATA and ALPA, the two most interested U. S. groups. Actually, ATA all along has been more in accord with ALPA's thoughts on approach lighting than is generally the case on technical matters involving pilots and airlines.

And for several years ALPA has had its own committee flight testing approach light systems both here and abroad. The pilots' group has insisted that what the pilots want is a single-row center line system, with a cross bar 1000 ft. from the threshold to provide distance indication. And that is what now is being installed at Newark.

► **Background**—CAA, too, tested all systems, and finally standardized on the slope line, which was a creation of its own engineers. This uses a funnel-like pattern with the narrow end at the runway threshold. It was criticized on many counts by the pilots, but CAA finally gave up on it for a different reason: Seldom was the terrain near an airport suitable for installation of the slope line.

Then, CAA switched to using the slope line lights mounted horizontally, instead of on an angle, in a straight line along the lefthand side of the approach lane. This configuration has always been favored by the military.

Nonsked Plea

Irregulars ask CAB for liberalized exemptions; pledge strict policing.

Civil Aeronautics Board members are mulling over their tough "nonsked problem" after a tense hearing of the nonskeds' plea for a more liberalized exemption order.

At the special hearing, the nonskeds and their Air Coach Transport Assn. showed a new personality. Formerly they made demands for freedom to fly almost at will. Now they have asked CAB: "What can we do to stay in business?"

The five Board members at the hearing leaned forward in their chairs to hear every nonsked word—then leaned over backward before speaking. They are making sure to give fair hearings and fair thought to the knotty nonsked problem. Chairman Delos Rentzel closed the hearing by saying, "I can assure you that I for one have an open mind in this matter."

► **The Problem**—The problem is this: The Board says a "large irregular" carrier may not fly more than three round-

trips a month between any pair of certain major cities, and still claim exemption as an "irregular." But the carriers say, "We cannot make money on that."

The Board presented its 3-trips-a-month yardstick for non-scheduled operations between certain big cities in its Draft Release No. 43 on May 25 of this year. This is a proposed regulation defining the scope of operations of large irregular carriers.

As the nonskeds apply for their individual exemptions, CAB grants exemption to worthy operators, and requires that they stick to the limits outlined in Draft Release No. 43.

Air Coach Transport Assn. proposed "an alternative plan" to Draft Release 43's regulations. CAB members had told the coach group that they were anxious to have a look at any plan the nonskeds could work out to provide organized, irregular service without merely skimming the cream from scheduled coach service to the certificated lines. They are studying the ACTA plan now.

▶ **Nonsked Plan**—Air Coach Transport Assn., representing the large irregular carriers, asks CAB for a stay of execution of the Board's individual exemption denials under Draft Release 43 until decision on the Transcontinental Coach Case, in which several irregulars are applying for permits to operate like the air cargo operators.

Here is the broad outline of what ACTA asks CAB:

- **Temporary exemptions** issued nonskeds should be only for long enough to allow the Board to pass on several applications for certificates.
- **Certificates should recognize** each carrier as a demand-type carrier offering second-class low-cost service.
- **Regulations** should be directed at restricting carriers to their type of operation for the route awarded.
- **Routes awarded** should be on an area basis, as with air cargo routes.

▶ **Nonsked Limits**—The proposal of ACTA that CAB recognize a definite classification and certification of second-class air coach service goes on to suggest certain regulations that would limit the proposed "bus service" of the air. Here are some ACTA suggestions on how certain large irregulars could be regulated to give such bus service:

- **High load factors** should be required, by regulation, before a flight would be allowed to depart. For example, says ACTA, failure to have a 75-percent load factor could prevent the dispatch of a trip out of New York City to the West Coast. But while one air carrier's passengers may not be sufficient to make up the required load, turning those passengers over to another air carrier may fill out another flight.
- **No arrival time** or departure time dependability could be offered.
- **High-density seating** might be required.
- **No air mail subsidies** will be available for these second-class coach operators.
- **Quantity service** "should be encouraged within limitations, restricting the type of service offered. Surface transportation offers various income groups various types of service—Pullman, rail coach, and bus. In general, the bus patron puts price ahead of comfort, speed, and convenience . . . . Who would deny the patron—the public to be served—the right to choose his own mode of transportation?"
- **Public protection** from unsafe or unfair practices would be guarded by Air Coach Transport Assn. ACTA coordinator offices are already set up in New York, Miami, and Los Angeles. ACTA approval of a carrier will be based upon adherence to a strict code of ethics to protect passengers from the time they read or hear advertisements until they are deposited at their destination.
- **Agency advertising** of service by nameless carriers "who offer the highest commissions" will be eliminated. (ACTA has already parted company with Columbia Aircoach Agency and the Flying Irishman Agency.)

ACTA asks CAB to grant additional time for the industry to "engage in self-discipline with the help of the Board, and to work out a more detailed plan with the Board."

The Board may reach a decision on this request any day. The Board has gone on public record stating that there is a definite place for the large irregular carriers. It does not want "to put them out of the business." The problem is to allow scope for the best of them to stay in business, yet still limit them to "irregular" operation.

Light up the Sky

Eastern Air Lines claims it now has the largest neon sign in the world.

The mammoth sign—200 ft. long and 90 ft. high—shines atop the Palisades, reminding New Yorkers across the Hudson River that Miami is much warmer than Gotham in the winter. Letters 20 ft. high will flash Miami's temperature once a minute.

Capt. Eddie Rickenbacker, EAL president and general manager, estimates that 30 million automobile passengers will pass the sign every month, and that over a million and one-half people live within reading distance. The sign will cost $2.5 million over a ten-year period.

SHORTLINES

► **Aer Lingus**—The Irish airline won the Cumberbatch Trophy "for its outstanding record of reliability and safety" from the British Guild of Air Pilots and Navigators. . . . Company has seven officials here in U. S. to study American Airlines cost-reducing techniques.

► **Air Transport Assn.**—Has inaugurated a city terminal service for Washington air freight and international air express. This central handling is to meet growing volume of air cargo.

► **All American Airways**—Feeder carried 15,590 passengers in October, 89 percent over October, 1949.

► **American Airlines**—October traffic was second highest of any month in history—180,739,000 passenger miles. Record of this June was 181,623,408. . . . Company will spend almost $250,000 next year promoting air travel to Mexico. . . . Company offers, with Pan American, an 11-day cruise to the Hawaiian Islands costing $613.50 from New York.

► **British Overseas Airways**—Is forming a special "Princess unit at its seaplane base in Hythe, England, to introduce service by the 105-passenger Princess flying boat. Routes for the new plane aren't announced yet.

► **California Eastern Airways**—Shows a net pre-tax profit for the nine-months to Sept. 30 of $251,597. This has helped the company pay off its last unsecured creditor. Final $155,126 payment allowed stockholders this month to take back full control and possession of the company.

► **Capital Airlines**—Carrier has been turned down by the Supreme Court in its try for Court of Claims review of its petition for retroactive mail pay. . . . Company received a plaque from the Washington Board of Trade commending it for inaugurating the first scheduled air coach service Nov. 4, 1948.

► **Colonial Airlines**—Company offers a new ski-plane package tour—New York-Montreal, $65 for 4 days.

► **Eastern Air Lines**—Company has filed with CAB to serve Paducah, Ky., on its St. Louis-Nashville route. Chicago & Southern Airlines serves Paducah on Memphis-Evansville run.

► **Florida Airways**—Feeder failed to get requested post-certificate-expiration mail pay from CAB. When the feeder's certificate was not renewed, CAB says it would have had no right to claim later profits of the line, and likewise, the line has no claim to mail pay for flights made after certificate expired. CAB did give the company $40,664 mail compensation for its last two week's certificated operation.

► **Flying Tiger Line**—Company reports a net profit for the July-September quarter of $608,000 after taxes, or 80 cents a share. Gross revenue of $3,500,000 compares with only $4,964,168 for the entire previous fiscal year (ending June 30).

► **Iberia**—The Spanish airline has CAB permission for service between Spain and San Juan, P. R., via Caracas, Venezuela, and service between Spain and Ciudad Trujillo, Dominican Republic via Miami and Havana. Company plans to use DC-4s.

► **Mid-Continent Airlines**—Company reports a net profit of $23,735 for September, compared with $35,797 a year ago.

► **National Airlines**—Company has set up a European sales district, under William J. Peabody.

► **Ozark Air Lines**—Plans to start operating St. Louis-Memphis part of Route 107 this week, with stops at Dyersburg, Tenn., Paducah, Ky., Cape Girardeau, Mo., Jackson, Tenn., and Jonesboro, Ark. . . . Company has filed airport notices for service to airports on Tulsa-Kansas City and Tulsa-St. Louis runs starting about Dec. 12.

► **Pacific Northern Airlines**—Company flew 1,259,000 revenue passenger miles in September, 67 percent over year ago. Alaska-Seattle flights for the Alaska fishing industry added 470,000 "special service" revenue passenger miles.

► **Pan American World Airways**—International carrier plans service to Bremen, Germany, starting about Dec. 1. . . . Company is ordered by Venezuela to make an intermediate stop at Curacao, on the New York-Caracas run, formerly nonstop. . . . Carrier has signed a five-year contract with Venezuela, by which PanAm will continue exempt from airport fees at the five airports which it turned over to the government for 14 million bolivars. This price has reportedly been about half paid back to PanAm in the form of free airport use. . . . Company is getting $315,982 more from CAB for mail service given Latin America from March, 1944-August, 1945. . . . Recent speed records are: Stratocruiser, Trinidad-Rio de Janeiro, in 9 hr. 26 min. for 2850 mi.;

DC-6, Panama-Miami, 4 hr. 5 min. for 1141 mi.; Stratocruiser, Montevideo-Rio de Janeiro, 3 hr. 27 min. for 1150 mi.

► **Pan American-Grace Airways**—Has completed negotiations with Peru to provide Lima Airport with the first instrument landing system in South America. Company will lend Peru the money and will supervise the installation at total estimated cost of $180,000. All airlines may use the system when it is finished.

► **Pioneer Air Lines**—Reports a net profit of $72,875 for the first nine months, compared with an adjusted net of $484,714 a year ago. Although net profit declined 14 percent, mail pay declined 23 percent. Load factor of 42.05 percent compares with 34.07 percent load factor for nine months 1949.

► **Tasman Empire Airways**—Company is flying three weekly roundtrips between Wellington, New Zealand, and Sydney, Australia, this month, using Solent flying boats. Step-up to five flights from Dec. 10 to Christmas is planned, dropping back to four flights thereafter to March. . . . Service by 4-engine landplanes from Christchurch, N. Z., to Melbourne, Australia, should get underway next month, if construction at Harewood Airfield, Christchurch, is completed on time.

► **United Air Lines**—Officials attribute company's October all-time high of 4,948,196 air cargo ton miles partly to fall buying volume and increased industrial activity. Estimated revenue passenger miles, excluding military contract operations, were 143,524,103—six percent under September but 18 percent over year ago. . . . Company has prepared a new slide-film and booklet —"Modern Flight"—explaining flight methods and electronic equipment that give airline dependability. This is for showing to high school students. The 35 slides and lecture are available on a free loan basis for educators.

► **Western Airlines**—Company plans to build a new terminal building at Portland Airport. Company has shared terminal facilities with Northwest Airlines since starting Portland service three years ago. . . . Western has started a three-months promotional campaign urging cold-country people to head for the sunshine available on Western routes. . . . Net profit the third quarter was $474,026 compared with $309,257 a year ago. Nine-months net of $662,136 is double year-ago earnings of $349,194. Third-quarter revenues of $4,170,763 yielded post-depreciation operating profit of $888,521.

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EDITORIAL

Publicity for USAF Contracts

The Air Force soon will resume issuing lists of its contracts to AVIATION WEEK, according to Under Secretary John McCone.

Letters to us from our readers have been asking why we discontinued publishing Air Force contract awards, when it was this magazine that had been responsible for making negotiated contract listings available to the press for the first time during Secretary Symington's administration.

Shortly after the Korean outbreak, the Air Force clamped a tight censorship on all negotiated contracts it was making with industry, regardless of the materials ordered. The new censorship applied not only to AVIATION WEEK, to whom it sent its more detailed list, but to the rest of the nation's press.

No distinction was made between such items as office equipment and "sensitive" contracts which could in some way be described as security material. All publicity was banned. Previously, some confidential items bearing on security had always been removed before the lists were given to the press.

Apparently AVIATION WEEK was the only publication to make formal note of the unfairness of this complete blackout of contract information.

In our letter to Secretary Finletter we went on record as protesting this action, pointing out:

"We are fully cognizant of the importance of preserving the national security. But we doubt that this sweeping action is necessary for security. Thousands of items bought by the Air Force with the people's money give no clue to any potential enemy, we believe. If it is deemed that they do, then the public should be prepared for a radically new philosophy of what will and will not, hereafter, be judged information affecting national security. An Air Force policy of secrecy in connection with its negotiated contracts seems to us to present potential dangers to the American taxpayers, and to the Air Force itself. In the latter case, it seems to us that a sweeping censorship of information on how the Air Force conducts its business and spends its money can lead only to distrust of the Air Force and wild rumors that, once started, become most difficult to put down."

To the credit of Secretary Finletter and Under Secretary McCone, this drastic secrecy on contracts will be removed, not only for AVIATION WEEK but, obviously, for the rest of the nation's press too.

Mr. McCone in his reply to AVIATION WEEK, says:

This is in reply to your letter of Sept. 18 in which you brought to my attention certain aspects of the Air Force's policy covering the release of contract award information.

I have gone into the matter with Gen. Sory Smith and his public relations people and, as a result, I believe I can give you a clearer picture of the whole situation.

Distribution of the "Blue Book" containing official contract information was temporarily suspended immediately after the outbreak of the Korean hostilities. This action was only one of several restrictive measures placed into effect temporarily pending a re-evaluation of the increased requirement for security measures in the public information field.

I feel certain that we are in fundamental agreement that the best interests of the country are served when, in doubtful instances, information of potential value to an enemy is not released until such time as its proper status with respect to classification can be determined.

In this case, I am pleased to report that it has been determined that contract award information may continue to be released and that henceforth will be available here in the Pentagon to representatives of your Washington office on a weekly basis.

It goes without saying, I believe, that the Air Force action in temporarily suspending distribution of this information is in no wise indicative of a desire to impose censorship nor to foster any new philosophy in the field of information. It was nothing more than a precautionary measure taken by those individuals who must, in the final analysis, bear the responsibility for safeguarding the security of official information.

I trust, however, that the arrangements now in effect will be satisfactory to you.

It was good of you to bring the matter of the contract data to my attention. Should additional problems in this connection arise in the future, I know that Gen. Smith will be pleased to assist you in any way he can.

AVIATION WEEK will resume publishing summaries of Air Force negotiated contracts as soon as they start reaching us from the Pentagon or Wright Field.

We commend Messrs. Finletter and McCone on this prompt action.

—Robert H. Wood

Allison "501" Turbo-Prop engines fit in nacelles of present commercial transports.

A new kind of Air Travel is in the making

New Navy engine— soon to undergo first tests in civilian transport—promises smoother, faster, quieter, more pleasant air travel

WITHIN a short time the first American commercial airliner powered by turbine engines will be delivered to the Allison Division of General Motors.

The power plants in this Convair are the new Allison Model "501" Turbo-Props—commercial version of the Navy T38 engine. They are geared to new-type propellers especially designed and built for high-engine-power characteristics by the Aeroproducts Division of General Motors.

The "501" is lighter, smaller, smoother and quieter than any other propeller-type engine of equal horsepower. It develops 2,750 horsepower and weighs only 1,250 pounds!

As soon as this experimental Turbo-Prop transport is received, General Motors-Allison engineers will start putting it through a comprehensive series of flight tests.

In cooperation with the airlines it will be flown under all types of operating conditions—in all kinds of weather. It will be given the works, checked and rechecked many times over, until all its performance characteristics are definitely evaluated.

Such an all-out test program may take a year or more. But it will be well worth it, in view of the fact that present military experience indicates that Turbo-Prop power should bring the following benefits to commercial aviation:

Smoother, quieter operation—for more comfortable travel; also lower maintenance and overhaul costs.

Ability to use low-cost, low-octane fuels, without increased consumption.

Faster speed – up to maximum limit permitted by airframe design.

Very low engine weight—less than half —increasing range or pay load.

Much improved take-off and climb—permitting use of shorter runways, with greater safety and better schedules.

Usable in present aircraft – no costly modifications in changing over to turbine power.

When General Motors is satisfied with its tests of these engines and they are approved for commercial use by the C.A.A., it will be possible to convert present airliners to smoother turbine power without further delay – giving America very high-speed, low-cost, regular airline service.

The development of the Allison Turbo-Prop engine, America's first axial flow propeller-type turbine engine, together with Aeroproducts Propellers, is another example of General Motors progress—and who serves progress, serves the nation.

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