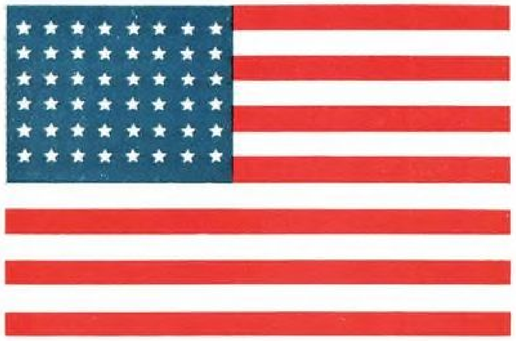
AVIATION WEEK

A McGRAW-HILL PUBLICATION

NOVEMBER 28, 1949



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Aviation Week

Volume 51 **November 28, 1949** **Number 22**

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Member of Associated Business Publications, Inc., and the Audit Bureau of Circulations

Aviation Week November 28, 1949 Vol. 51, No. 22

McGRAW-HILL PUBLISHING CO., Inc., James H. McGraw (1860-1948), Founder. Printed at 99-129 N. Broadway, Albany, N. Y. JAMES H. McGRAW, Jr., President; CURTIS W. McGRAW, Vice-President and Treasurer; EUGENE DUFFIELD, Senior Vice-President, Publications Division; NELSON BOND, Vice-President and Director of Advertising; JOSEPH A. GERARDI, Secretary; J. F. BLACKBURN, Jr., Vice-President and Director of Circulation . . . Published Weekly in U. S. A., price 50¢ a copy. 50¢ in Canada. Subscription rates—United States and possessions, $6 a year, $9 for 2 yr., $12 for 3 yr. Canada, $8 for 1 yr., $12 for 2 yr., $16 for 3 yr., payable in Canadian currency at par. Pan American countries, $10 for 1 yr., $16 for 2 yr., $20 for 3 yr. All other countries, $20 for 1 yr.; $30 for 2 yr.; $40 for 3 yr. Address all communications about subscriptions to Director of Circulation, 330 W. 42nd St., New York 18, N. Y. Please indicate position and company connection on all subscription orders. Allow at least ten days for change of address . . . Entered as second class matter, July 16, 1947, at Post Office, Albany, N. Y., under Act of March 3, 1879.

Atlantic Air Power—A Staff Report

The complicated machinery for building a common defense system for Atlantic Pact nations is slowly swinging into action. North Atlantic Council meeting in Washington during November gave top priority to special reports on defense strategy, production and financing. Special U. S. missions are on their way to London, Paris, Oslo, Copenhagen, Rome, Brussels and The Hague to administer the billion dollars in military aid voted by Congress. Next month the Atlantic Pact Defense Committee will hold its second meeting in Paris to map basic strategy for the defense of Western Europe against an eastern onslaught.

▶ Air Power Key—One of the prime requirements for eventual success of the strategy to be determined in Paris will be forging a keen cutting edge of air power. An on-the-spot survey of European air power early this fall indicated that this job is already under way and is not waiting on the results of top level conferences. There are three immediate problems on which visible progress has been made: rebuilding air defenses with jet fighters; providing an air power offensive for counter-attack; and forging air units flying a dozen flags into a single operating air force.

British aircraft factories have assumed the profitable job of building the jet fighter defense. Both de Havilland and Gloster are doing a brisk export business in Vampires and Meteors to Norway, Holland, Belgium, France and Denmark among the pact nations and to Switzerland and Sweden. De Havilland and Rolls Royce are also exporting Goblin, Derwent, Ghost and Nene turbojet engines to power these fighters. The British are giving this jet export business a higher priority than some of their own needs such as the re-equipping of Royal Air Force reserve and overseas squadrons. Most of the RAF reserve and some of the regular RAF squadrons overseas are still flying Spitfires.

It is the Vampire and Meteor that would form the backbone of any European fighter force, aided by the few groups of USAF F-80s and F-84s now in Europe. The British are showing little inclination to move into production on a new generation of swept-wing supersonic fighters. They are still concentrating on developing basic Vampire and Meteor designs for better speed, altitude and endurance. The Venom, latest of the Vampire line, and the Meteor VIII are just going into production and are not in service.

▶ Offense USAF Job—The problem of the air offensive will have to be solved almost entirely by the U. S. Air Force. The British have nothing but war-weary Lancasters and the newer Avro Lincoln bombers to pack a punch. Both are slow and short-legged night bombers. The Lincoln can carry a 14-ton bomb load and is being equipped with radar bombing gear but it cannot penetrate beyond Germany from British bases.

The twin-jet Canberra is a light bomber by USAF standards, is in limited production, and suffers from the chronic short legs of all jet warplanes. There is a family of larger, four-jet bombers all powered by the 7500-lb. thrust Rolls Royce Avon in the British experimental shops. If successful, they may eventually provide the RAF bomber command with a modern punch. In the meantime the plan is for USAF medium bomb groups training in England to leave their B-29s behind to help the RAF bridge the gap between the Lincoln and the super-jets. USAF groups will be re-equipped with Boeing B-50s on their return home.

▶ Third Air Division—Symbol of USAF offensive airpower in Europe is the Third Air Division, commanded by able, mustachioed Maj. Gen. Leon Johnson. Third Air Division is a headquarters on the edge of London that is a permanent link between USAF and the RAF and its satellites. Combat units of the division are based in Lincolnshire and rotate on three months' training duty from Strategic Air Command, now the first USAF B-50 group equipped with B-29 tankers for aerial refueling is on duty in England. Their range capabilities inject a new element into the traditional elements of European air power. Unseen but present in every calculation are the U. S.-based B-36 groups of Strategic Air Command, whose weight could be added to the European air equation in a matter of hours.

The problem of teamwork has been tackled in two sets of maneuvers over Britain—"Foil" in the summer and "Bulldog" this fall. British, Dutch and Belgian Meteors and British and French Vampires defended British industrial targets against day and night assaults by RAF Lincolns and USAF B-50s. Similarly British, French, Norwegian and USAF fighters participated in joint maneuvers offering air support for ground troops in Germany. Nobody concerned pretends that these maneuvers were anything more than a beginning on a vast and intricate problem.

▶ Future Problems—Among the major problems facing the future of Atlantic air power are: development of a modern jet night fighter force; development of new defensive weapons that can be produced cheaply and fast enough to counter the mass effect of any potential air offensive from the east; and development of trans-Atlantic air logistics to the point where reinforcements of all types can be rushed from the United States to Europe before action there reaches a decisive phase.

The night fighter problem is acute with only the plywood Mosquitoes of the RAF now available in Europe. The de Havilland DH-113 night-fighter version of the Vampire and the Lockheed F-94, night-fighting modification of the TF-80C are both in initial production stages. At this stage of the game, the Douglas Skyknight (F3D) being built for the Navy appears to be the most promising night fighter of the immediate future. It has made successful interceptions over 40,000 ft.; flown to 50,000 ft. altitude; has an endurance of several hours; it carries a relatively long-range airborne radar (18-20 miles); and has proved extremely maneuverable at altitude. The French are developing the twin Nene-powered SE-2410 as a night fighter.

The problem of meeting Russian mass in the air is equally acute as that of opposing the tremendous weight of their infantry and artillery on the ground. European observers point out that while the combined jet fighter forces of the Atlantic powers now have an edge over the Russian jet groups, the Russians have some 14,000 obsolescent piston-powered fighters and low level attack planes. According to optimistic estimates the Atlantic powers' jet force could handle the Russian jets plus perhaps half of the second line Red air fleet before succumbing to attrition. This would leave the remaining Russian second-line planes with a command of the air just as effective as if it were held with modern jets and just as disastrous to the Western ground forces.

▶ Need New Weapons—The problem here is to devise a new defensive air weapon that is more effective, cheaper and more easily mass-produced than a conventional jet fighter. Faced with a similar problem in 1945 the Germans turned to the ME 165 rocket interceptor. There is evidence that USAF, RAF and the French Armee del-Air are becoming more interested in this type of solution to the defense against air mass. The French have high hopes for the ramjet-powered Leduc 010 armed with 10 to 20 air-to-air rockets. The ramjet fighter would use a launching catapult designed to fit standard European railroad tracks and a rocket booster to attain operating speed for the ramjet. A belly skid would make any large grass field suitable for landing.

The French believe the operational simplicity, low cost and high performance make the ramjet fighter fit their purse as well as their defensive needs. There are indications that even the United States will find the manning of jet fighter groups with planes costing from $300,000 to $500,000 apiece too heavy a strain on the budget.

The need for trans-Atlantic cargo airlift capacity is so obvious when looking from the European shores that it is hard to understand the low priority assigned to it on this side. The Atlantic division of MATS, commanded by Brig. Gen. Archie J. Old, Jr., has made a beginning with the 30,000-lb. payloads lifted by the Douglas C-74 squadron across the Atlantic. The C-124A shows promise of continuing this development. However it is obvious that the bulk of trans-Atlantic airlift now available for an emergency is not well suited for airlifting divisions with artillery and tanks and air groups with their heavy ground equipment to bolster the Western European dike before it is engulfed.

In view of the mounting activity in building Atlantic air power the European nations involved find it hard to understand why our own air power is being cut back by the President and executive branch of the government, with the USAF already slashed from 60 operational groups to 48 and Naval air power undergoing a steady shrinkage.

AVIATION CALENDAR

Nov. 28-Dec. 2—70th annual meeting, American Society of Mechanical Engineers, Hotel Statler, New York, N. Y.

Nov. 29-30—Air Traffic Conference final meeting for 1949, sponsored by Air Transport Assn., Edgewater Beach Hotel, Chicago.

Nov. 30-Dec. 2—Annual meeting, Society for Experimental Stress Analysis, Hotel New Yorker, New York.

Nov. 30-Dec. 2—Kansas Airport and Aerial Spray Conference, Manhattan, Kansas.

Dec. 9-10—First Convertible Aircraft Congress, sponsored by Philadelphia chapter of IAS and American Helicopter Society, in Philadelphia.

Dec. 15-16—Air Transport Assn. board of directors annual meeting, Carlton Hotel, Washington, D. C.

Dec. 16-17—1949 national aviation meeting, organized by the National Aeronautical Assn., Hotel Statler, Washington, D. C.

Dec. 17—Institute of the Aeronautical Sciences 13th annual Wright Brothers lecture, U. S. Chamber of Commerce Building auditorium, Washington, D. C.

Dec. 31-Jan. 7, 1950—"Winter Wing-Ding," sponsored by the Mount Plymouth Hotel and Golf Club, Mt. Plymouth, Fla.

Jan. 11-12, 1950—Florida Flying Alligator Club's Annual Rituals & Frolics, Melbourne, Fla.

Jan. 13-15—All American Air Maneuvers, Miami.

Jan. 16-17—Miami-Havana Air Cruise for private planes, conducted by Florida Air Pilots' Assn.

Jan. 16-19—Plant Maintenance Show, sponsored by American Society of Mechanical Engineers and the Society for the Advancement of Management, Cleveland Auditorium, Cleveland.

Jan. 17-19—University of Illinois second annual Custom Spray Operators school, Urbana, Ill.

Jan. 23—IAS annual Honors Night dinner, Hotel Astor, New York, N. Y.

Jan. 23-26—IAS 18th annual meeting, technical sessions, Hotel Astor, New York, N. Y.

Jan. 24.—Ninth session, ICAO Council, Montreal.

Feb. 18-26—National Sportsmen's Show, Grand Central Palace, New York, N. Y.

Feb. 27-Mar. 3—Spring meeting, American Society for Testing Materials, Hotel William Penn, Pittsburgh.

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

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

PICTURE CREDITS

12, 13 (top)—Beech Aircraft Corp.; 15—Glenn L. Martin Co.; 24, 28—NACA.

NEWS DIGEST

DOMESTIC

National Aviation Trade Assn.'s new executive director, when Harry Meixell's contract expires Jan. 1, will be Charles Parker, formerly of Robinson Aviation and more recently of Aircraft Marketers of New England. Meixell had recommended a budget curtailment for NATA, and also recommended that his contract not be renewed. Both recommendations were voted. Arthur R. Currey, Galesburg, Ill., was elected president, succeeding Norman Larson, Burbank, who becomes chairman of the advisory committee.

Wright Aeronautical Corp. workers, members of two CIO locals representing 5700 production and white collar workers, last week voted to strike because of a snag in negotiations with the company. By mid-week Wright had not received termination notice, which usually must be given ten days before striking.

George Newbold, Clinton, Conn., died. He was a former member of the Institute of the Aeronautical Sciences and for years sales manager of Aviation Magazine.

More plane passengers than ship passengers left New York City for overseas points during October, according to the Port Collector. October air passengers totaled 24,351, compared with 21,749 by ship. Total for 1949 shows ships still leading with 475,650, compared to 403,084 by plane. Passenger arrivals by plane during October totaled 27,190, compared with 49,738 by ship.

An Air Force C-74 Globemaster flew to England with 103 passengers, largest number ever to fly the Atlantic in a heavier-than-air craft. This same Globemaster had previously set a performance record of 240-hr. utilization in September and was a veteran of the Berlin Airlift, where it had delivered 225,000 lb. of coal in one day.

Meteor Air Transport DC-3 crashed into a Detroit house, killing one occupant of the building and the two crew members. The craft was bound from Teterboro, N. J., its home base, to Detroit with a load of Christmas merchandise. Meteor holds a letter of registration as a large irregular carrier.

Air Force will get one-fourth of the graduates from the U. S. Military and Naval Academies in 1950. This year the allocation was based on 40 percent from West Point and 7 percent from Annapolis. In 1948, the Air Force received all of its Academy-trained officers from West Point.

Military Air Transport Service will transfer VR-3, one of three Navy Squadrons assigned to MATS from Patuxent River, Md., to NAS, Moffett Field, Calif. Reduction of facilities and reassignment of units under present curtailed Air Force and Navy programs is cited as reason. Transfer is scheduled to start Dec. 1 and will be completed by year's end.

FINANCIAL

Beech Aircraft Corp., for the fiscal year ended Sept. 30, 1949, reported net income of $922,089 on net sales of $20,582,043. Export business totaled $4,393,764, compared with $3,883,805 for the company's 1948 fiscal year. Current assets at Sept. 30 were $8,537,441; current liabilities $2,288,009. Backlog as of Oct. 1 was approximately $13 million, composed principally of contracts for rebuilding and overhauling Beechcrafts for the Navy, spare parts for the government, and aircraft which have been sold to individuals and foreign governments.

Grumman Aircraft Engineering Corp. reported sales of approximately $18,710,000 during the quarter ended Sept. 30, 1949, compared with $10,180,000 during the preceding three months.

INTERNATIONAL

Avro Canada's Orenda turbojet has completed unofficial endurance run of more than 750 hr. without major rebuild or overhaul. Run included these schedules: 150-hr. U. S. endurance test; 25-hr. British Ministry special category test; 150-hr. RCAF-type test; 50-hr. Canadian preliminary flight rating test; 150-hr. British Ministry service-type test; 50-hr. U. S. preliminary flight rating test; and approximately 175 hr. of miscellaneous trials, including performance runs to simulate engine flight conditions, acceleration tests, and endurance runs to measure consumptions. All tests were at design rating of engine. Only routine inspection and maintenance were employed and only significant replacements were flame tubes after 300 and 600 hr. and 6 nozzle guide vanes accidently damaged. Endurance trial was within 8½ months of engine's initial running.

BOAC is using pressurized Argonauts (DC-4Ms) to replace York, Skymaster and Lancastrian aircraft on several routes. Argonauts are already in operation between Britain, Hong Kong and Tokyo.

WHO'S WHERE

Changes

► **New Appointments**—General Electric has made these changes in its Apparatus department: **Neil Currie, Jr.,** from manager of manufacturing to administrative assistant to the general manager; **Ernest E. Johnson,** from manager of engineering to manager of engineering, Large Apparatus divisions; **Carl A. Salmonsen,** from manager, Aircraft Gas Turbine divisions, to manager of manufacturing, Large Apparatus divisions; **Byron A. Case,** from assistant to manager of engineering, to manager of engineering, Small Apparatus divisions; **Frank T. Lewis,** from manager of manufacturing, Aeronautic and Ordnance Systems divisions, to manager of manufacturing, Small Apparatus divisions; **Clarence H. Linder,** from assistant manager of manufacturing to assistant to the general manager; **C. W. LaPierre,** from assistant manager, Aircraft Gas Turbine divisions, to manager, Aircraft Gas Turbine divisions.

James O'Connor has been made cargo representative in Chicago for KLM Royal Dutch Airlines, replacing **Eloise Preli,** now New York cargo representative. . . **William B. Birren** resigned as director of service and parts for Wright Aeronautical Corp. and is now assistant to the president of Grand Central Airport Co., Glendale, Calif.

► **New Sales Shifts**—Minneapolis-Honeywell Regulator Co. has made these changes in its sales staff; **Kent L. Wilson** is now manager of the newly-formed manufacturers' division, to assist **A. H. Lockrae,** vp-heating controls division; **T. S. Carley,** formerly Detroit branch manager, succeeds Wilson as head of the Honeywell-Brown office in Dallas; **Karl Schick** has become sales manager of the company's gas controls division; **J. A. Depuy,** formerly branch manager of the sales staff in Cincinnati, is now manager of the Detroit office; **Jack Richardson,** formerly manager of the industrial division's sales in Detroit, now becomes Cincinnati branch manager; **James Dunlap,** formerly in Toledo, is now industrial sales manager in Detroit; and **Harry Merkel,** formerly in Pittsburgh, is now in Toledo in charge of industrial sales.

► **Retirement—Fred W. Marschner,** administrative assistant to the general manager of the New Departure division, General Motors Corp., plans to retire this week after 35 years service with the firm.

Elections and Honors

► **New Elections**—C. C. Pearson, Glenn L. Martin Co. president and general manager, and a director of the company, has been elected a director of the Baltimore National Bank. . . Parker Appliance Co. has elected **C. H. Wagner, Jr.,** treasurer, and **E. L. Dumas,** comptroller, replacing **O. P. Bereit,** who resigned as treasurer-comptroller.

► **New Honor—Richard White,** manager of TWA's electronic engineering, has been named chairman of the International Air Transportation Assn. Radio Aids Technical Group.

INDUSTRY OBSERVER

► **Lycoming is making a comeback in the small aircraft powerplant field with its geared 260-hp. engine. It has been test flying for some time in a Ryan Navion which may be prototype of the 1951 production Navion, and is credited with increasing the four-placer's speed to 170 mph. Two of the new geared Lycoming engines are also used as powerplants for the new Beech Twin Bonanza.**

► Navy will unveil three new sweptwing jet fighters during 1950: The Grumman F10F; the McDonnell F3H; and the Douglas F4D. All are designed as supersonic carrier-based interceptors. New attack planes will include the Douglas A2D powered by an Allison T-40 turboprop rated at 5500 hp. and the North American A2J powered by two of the same engines. Both planes are developments from the AD and AJ series now in production for the Navy.

► **Swedish Aircraft Co. (SAAB) says it is in production on an order for 500 of its sweptwing jet fighter, the SAAB-29. It is powered by the British de Havilland 5000-lb.-thrust Ghost turbojet built under license in Sweden. SAAB claims a design top speed of 665 mph. for the fighter.**

► Aero Medical Assn. is studying the problem of toxic gases in aircrew compartments of airplanes in an effort to set up concentration limits from the physiological standpoint by determining how much bodily impairment of the crew members can be considered safely allowable.

► **A supercharged 285-hp. Continental engine may become an important factor in rescue planes and helicopters for military services. Supercharging will improve performance at high altitudes in mountain country where many air crashes occur. The new engine has already been installed in a small Bell helicopter, the G-15. A modification of the Convair L-13 liaison planes owned by the Army Field Forces with new powerplant also is being considered. L-12s currently are powered with a 245-hp. Lycoming engine. First 146 of the L-13s are soon to be modified for winter operation to conform to the later L-13Bs.**

► Air Force has modified its procurement contract for Sikorsky H-5 helicopters, and will use the funds for the last 10 H-5Hs to buy 5 of the new larger Sikorsky H-19s, from which the new Feederliner S-55 is being developed. This contract change may give Sikorsky an edge in the Air Force rescue helicopter competition (AVIATION WEEK, Nov. 21), since various versions of the H-19 with 600- and 800-hp. enignes are the company's entries in this competition.

► **Breaking the official world speed record of 670.9 mph. is now routine at North American Aviation, Inc., company sources report. Every one of the 250 F-86As delivered by NAA to the Air Force has equalled or cracked the mark unofficially as part of its routine acceptance flight tests. The official record is held by an F-86A.**

► Republic F-84 Thunderjet fighters are being turned over to Air National Guard units to replace the Republic F-47s now in service. First-line USAF fighter groups are now being equipped with North American F-86As.

► **Vickers-Armstrong Ltd. expect to have the first Viscount 700 turboprop transport flying by the middle of next summer. This is the enlarged production version of the Viscount, designed for 40-53 passengers with block ranges of up to 1000 mi. at a cruising speed of 316 mph. at 25,000 ft. The Viscount 700 will be powered by four Rolls-Royce new model Dart turboprops rated at 1400 hp. equivalent shaft horsepower.**

► CAA has experimented with an oscillating forward warning light in the nose of a DC-3, designed to provide a continuous in-flight warning to other aircraft. The 8-10,000 candlepower beam oscillates 60 deg. either side of forward to produce a blinking warning to other aircraft within a distance of 12 mi. The light is actually visible for 18-20 mi. United Air Lines is awaiting receipt of equipment for conducting its own tests on the device. The idea is similar to that used on railroad locomotives, although the latter light describes a "figure 8" in its motion.

► **Evaluation tests comparing the British transverse bar (Calvert) approach light system, and the Airline Pilots Assn. center-line system with the CAA-approved slope line standard system, have been ordered at the Landing Aids Experimental Station at Arcata in an effort to get international agreement on an ICAO standard for high intensity approach lights. A single line of slope line lights using the ALPA center line idea is also being installed at the CAA test station at Indianapolis.**

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AVIATION WEEK

Nov. 28, 1949

BEECH AIRCRAFT CORP'S Model 50 Twin Bonanza has been successfully flight tested and will sell for about $30,000.

New Two-Engine Lightplane Market Ahead

With models already developed, four firms are readying all-out 1950 sales campaigns.

By Alexander McSurely

Prospects for new and virtually untapped military and civil markets for small twin-engine airplanes are stimulating a new wave of twin-engine plane development with four competitors already grooming their entries for a 1950 sales free-for-all.

• **Beech Aircraft Corp.** last week moved into an initial lead in the competition after successful test flights of the new Twin Bonanza Beech Model 50 at Wichita.

• **Piper Aircraft Corp.,** only other major manufacturer known to be grooming an entry in the small twin-engine field, hopes to fly its new tractor version of the Baumann Brigadier in January at Lock Haven, Pa.

Two other less-established competitors in the same field are:

• **Baumann Aircraft Corp.,** now building a production Model 290 pusher Brigadier, with essentially similar airframe to the No. 1 Brigadier sold to Piper. New production model is expected to fly in July.

• **Aero Design and Engineering Corp.,** which is pushing its Aero Commander (AVIATION WEEK, July 11) through certification in Culver City, and hopes to put it into production at Oklahoma City.

An AVIATION WEEK survey of other principal manufacturers produced the following reports:

• **Cessna Aircraft Co.,** is not building and does not contemplate building at this time a twin-engine airplane. (Unofficial reports were that Cessna had a high-wing twin-engine all-metal five-or-six place plane in early design stage.)

• **Ryan Aeronautical Co.,** has no plans for multi-engine plane for spring market. (Unofficial reports were that Ryan had made engineering studies of a Twin Navion along parallel lines to the Twin Bonanza, but had not committed company even to prototype construction.)

• **Aeronca Aircraft Corp.,** Middletown, Ohio, does not intend to produce a twin-engine plane this year. Considered buying Aero Commander, but decided against it.

• **Engineering & Research Corp.,** does not intend to revive the Ercoach, twin-engine, five-place, all-metal prototype design of Fred Weick, nearly completed but never flown.

• **Texas Engineering and Manufacturing Co.,** has no plans for a twin-engine plane for 1950.

Three markets are seen for the small twin-engine planes: for executive transport, for replacements of single-engine planes and other makeshift arrangements on small feederlines, and for military personnel transport use.

Super Navion

Instead of going into the twin-engine competition, Ryan Aeronautical Co. is announcing a new higher-powered Super Navion for 1950, as a companion line to its continuing production of the de luxe Navion as the principal model.

Main difference will be in the 260 hp. Lycoming GO-435-C2 engine, which gives the plane improved performance quoted as: 170 mph. cruising speed; 1250 ft./min. rate of climb; 400 ft. takeoff run, and 770 ft. to clear a 50 ft. obstacle from a standing start; normal range 640 mi., or maximum economy range of 900 mi. Slow flying and good landing characteristics of the plane have not been altered as a result of the higher power, the company states.

The Navion Super 260 will sell for less than $14,000 completely equipped. Presumably the de luxe 205 hp. Continental-powered Navion will continue at $10,965. Deposits for the Super 260 are now being accepted by Ryan distributors with first deliveries scheduled in March.

Externally the two planes are closely similar except for different paint and finishes.

CONVENTIONAL SINGLE TAILFIN on Twin Bonanza replaces V-tail of smaller Bonanza. Craft is rated for 180 mph. cruising speed.

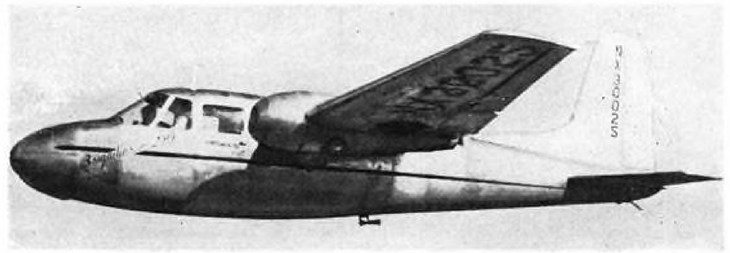
► **Military Competition**—Army Field Forces is making preliminary arrangements for a competition to supply small twin-engine transports to speed its personnel movements. First tip-off to this requirement was given last May at a Wichita lightplane engineering meeting, by AFF representatives. Competition is expected to be held early next Spring.

The only twin-engine personnel transport currently available to the services is the twin-engine Beech Model 18, which is also the most popular executive transport. The new forthcoming planes however are smaller, cost less than half as much as the Model 18, and have much smaller powerplants, with resulting operational economy. These planes also would have some Navy and Air Force market prospects.

Generally speaking, the design problem in the new twin-engine field is to provide a good twin-engine plane with cruising speed in the 150-200 mph. range, capable of hauling at least five persons, with good single-engine performance and acceptable under instrument flight conditions.

► **Twin Bonanza Flies**—Chief test pilot Vern Carstens took the six-place Twin Bonanza off the Beech Airport at Wichita at 70 mph. with a 500 ft. takeoff run, carrying a 4450 lb. load. Landing at the same speed required only a little more runway. Once he got the plane up to 200 mph. over the field on a downwind leg at only 2700 rpm. The plane is rated for a 180 mph. cruising speed at 1000-mi. range.

Plane is powered with two GO-435 Lycoming 260 hp. engines, turning Beech propellers. Powerplants were described as "prototypes." Walter H. Beech, company president, said the Twin Bonanza would have a good single-engine ceiling under full gross weight conditions.



BAUMANN BRIGADIER uses pusher engines; Piper plans a tractor version of this plane.

AERO COMMANDER is undergoing CAA tests; results will decide financing arrangements.

► **$30,000 Pricetag**—Present estimates indicate a price of $30,000 will be set for the plane, with first deliveries to commercial customers in the early fall of 1950.

Originally planned to use as many parts of the single-engine Bonanza as possible, the Twin Bonanza has been scaled up to a point where the outer wing panels and cabin controls are about all that can be used interchangeably with those of the single-engine plane. The Twin uses the conventional single tailfin arrangement instead of the V-tail which the smaller plane has used. Tail surfaces of the Twin appear to be similar and perhaps interchangeable with those of the Mentor, Beech tandem trainer version of the Bonanza.

► **Geared Engine**—Twin Bonanza wingspan is approximately the same as that for the older Twin Beech Model 18 (around 45 ft.). The geared Lycoming engines develop 260 hp. for takeoff at

3400 rpm. and maximum continuous power delivered by engines is 240 hp. at 3000 rpm.

Both front and rear seats hold three persons, and entry to rear seat is made by folding forward the right side of the front seatback, as in the Bonanza. Except for larger sizes, the Twin Bonanza appears to have used liberally the smaller Bonanza's design features throughout.

▶**Piper Entry**—Piper purchased the prototype Brigadier as a time-saving device, a company spokesman states, but is making extensive changes in it before marketing it.

Piper version of the Brigadier will use two 190 hp. Lycoming engines as replacements for the two Continental 125 hp. powerplants used in the prototype.

Modifications will include raising the wing, lengthening the tail, enlarging luggage compartment, and plane will be designed for 4200 lb. gross instead of 3500 lb. gross. It is expected to cruise at 165 mph.

▶**Simple Design**—Passenger comfort and load carrying, in combination with simple maintenance, will be goals of the Piper engineers. Design was sought after Piper structures engineers decided it well adapted to simple fabrication using flat sheet without much press work and with no compound curves. Piper will seek to use a simple gravity feed fuel system instead of a pressure system, and a simple landing gear retraction without underwing fairings, retracting wheels into nacelles.

As a result of this planning Piper has set a maximum price of $20,000 on its new twin-engine plane.

▶**Baumann Version**—Jack Baumann, president of Baumann Aircraft Corp., which originally developed the Brigadier, has announced that his first B-290 Brigadier will be flying by early next summer, and that he is pushing his CAA certification program. He will retain the pusher arrangement using two Continental C-145-2 engines, and Sensenich controllable pusher propellers. The larger powerplants are expected to give the following performance: cruising speed, 160 mph.; maximum range with standard tanks, 750 mi.; single engine ceiling with gross load, 7500 ft.; landing speed 55 mph.; sea level rate of climb 1250 ft./min.

Baumann plans to offer the plane in station wagon and ambulance versions as well as in a "plush" executive or passenger version.

▶**Aero Commander**—Prototype Aero Commander, with 190 hp. Lycoming engines, is soon to have larger 260 hp. GO-435 Lycoming engines installed. Arrangements to finance production of the airplane at Oklahoma City are contingent on its successful completion of CAA certification tests. T. R. Smith, president, stated to AVIATION WEEK that the Commander was shown to Aeronca and to Piper at their requests. Aeronca "wanted" the plane but was not "financially able to buy or produce the airplane," he stated. Aero Design would not consider releasing the design to Piper among so many varied other models of aircraft, Smith said.

Cruising speed of the Aero Commander is quoted at 181 mph. at 10,000 ft. with the 190 hp. engines, and 196 mph. at 10,000 ft. with the geared 260 hp. engines. Cabin is designed for conversion from five to seven persons, subject to CAA approval, and for certification at gross weights of 4500 to 5000 lb.

AF, Navy Disclose Large Contracts

Pratt & Whitney division of United Aircraft Corp. has received military contracts totalling $20 million during October for turbojet engines production and experimental development of its Wasp Major piston engine.

A $10,368,600 Navy contract calls for production of 264 J-48P-6 Turbo-Wasp engines rated at more than 6000 lb. static thrust for use in the Grumman F9F-5 Panther carrier-based fighter.

The J-48 is a Pratt & Whitney version of the Rolls Royce centrifugal-flow Tay engine which is essentially a larger and more powerful version of the British Nene. It is also scheduled for use in the U. S. Air Force XF-93 fighter now nearing completion by North American Aviation, Inc.

Second contract for $10,410,400 from the USAF is for development of a prototype R-4360-55C and a test program for this engine. The C series of the Wasp Major is a new version of the P&W VDT power plant using a redesigned General Electric supercharger that is expected to solve the high altitude cooling problems encountered by the earlier VDT version.

Other new large contracts recently awarded by Navy and the U. S. Air Force follow. The USAF listing includes contract date. Navy did not disclose contract date. These USAF contracts are in addition to the list which begins on page 18.

NAVY

Southwest Grease & Oil, Inc., Wichita, lubricant, various grades, 1,029,235 lb., $134,320.

Imperial Oil Co., Inc., Edgewater, N. J., lubricant, gear universal 117,060 gal., $67,334.

R. G. Le Tourneau, Inc., Peoria, mobile airplane crash crane, 6, $150,000 (approx.).

General Electric Co., Schenectady, N. Y., rotors (3); diaphragms (6 sets); turbines (3 sets); valves (40) $450,000 (approx.).

AiResearch Mfg. Co. division of Garrett Corp., Los Angeles, gas turbine air compressor unit, air turbine starters, motor actuated shut-off valves, 47, $535,968.

Bendix Aviation Corp. (Eclipse-Pioneer division), Teterboro, generators; voltage regulators; exciter controls and spare parts, 582, $149,788; starters, 340, $60,690.

Grumman Aircraft Eng. Corp., Bethpage, L. I., N. Y., parts necessary to convert government (Navy)-owned models JRF-4/5 airplanes to overhauled airplanes of the configuration "N" classification in accordance with the contractor's "specification for overhaul of JRF airplane," 20, $56,310.

AIR FORCE

AiResearch Mfg. Co., Los Angeles, refrigeration turbines, Sept. 14, 1949, $160,200.

Aeroflex Laboratories, Inc., Long Island, N. Y., type A-28 mounts, Oct. 13, 1949, $1,789,982.

Ansco division, General Aniline & Film Corp., Binghamton, N. Y., photographic film, Oct. 13, 1949, $1,134,469.

B. G. Corp., New York, aircraft spark plugs, Oct. 17, 1949, $422,220.

Beech Aircraft Corp., Wichita, tanks, 165 gal., droppable, Oct. 6, 1949, $174,977.

Bell & Howell Co., Chicago, silent bomb spotting motion picture aircraft camera, Oct. 12, 1949, $1,045,283.

Bellanca Aircraft Corp., New Castle, Del., recondition, pack and crate (30) T-6D aircraft, Oct. 19, 1949, $237,996.

Bendix Products division, Bendix Aviation Corp., South Bend, Ind., 24 x 16⅝-5 rotor braces, Oct. 10, 1949, $109,414.

Boeing Airplane Co., Seattle, services and materials to repair one (1) YC-97A aircraft, Oct. 28, 1949, $387,671.

Curtiss-Wright Corp. Propeller division, Caldwell, N. J., design, development, fabrication and delivery of 24 each model C748SP-A/1129-11C6-24 propeller assemblies, Oct. 27, 1949, $2,177,993.

Duffy Construction Corp., Cleveland, protection and maintenance of government aircraft plant No. 7, Cleveland, Sept. 21, 1949, $498,819.

Electric Storage Battery Co., Cleveland, battery, acft, storage, Oct. 10, 1949, $128,850; D-6A batteries, Oct. 25, 1949, $201,337.

Hycon Mfg. Co., Pasadena, type A-14 magazines, Oct. 6, 1949, $464,109.

General Electric Co., Schenectady, spare parts for turbo-super-chargers and turbo-regulators, Oct. 24, 1949, $150,000.

B. F. Goodrich Co., Akron, spare parts for C-47 and C-54 aircraft, Oct. 4, 1949, $681,449.

Goodyear Tire and Rubber Co., Akron, 26" x 6.6" wheels, brakes and spare parts, Sept. 1, 1949, $726,147.

Hoffman Radio Corp., Los Angeles, AN/APA-17 equipment, Oct. 28, 1949, $576,352.

International Business Corp., Dayton, tabulating equipment, accessories, Oct. 13, 1949, $740,000.

E. A. Kinsey Co., Cincinnati, lathes vertical turret and comm. lit. lathe, Oct. 21, 1949, $286,057.

Lockheed Aircraft Corp., Burbank, spare parts for C-121 aircraft, Oct. 11, 1949, $841,849.

Machine Products Co., Tulsa, protection, maintenance, repairs and utility services, Oct. 1, 1949, $278,198.

Massachusetts Institute of Technology, Cambridge, services—studies toward complete anaysis of response of aircraft to blast loading, Oct. 11, 1949, $200,000.

Minneapolis Honeywell Regulator Co., Minneapolis, overhaul tools and test equipment for type E-6 automatic pilot Aug. 9, 1949, $134,058.

Norton Co., Worcester, Mass., machine, grinding, and maintenance data, Oct. 25, 1949, $162,472.

Palmer Mfg. Co., Cleveland, oxygen servicing trailers, type E-3, Oct. 12, 1949, $106,175.

Pioneer Parachute Co., Manchester, Conn., parachute assemblies S-8 and B-12, Oct. 27, 1949, $147,191.

Republic Aviation Corp., Farmingdale, L. I., N. Y., special tooling development, Aug. 26, 1949, $125,262.

Sikorsky Aircraft division, United Aircraft Corp., Bridgeport, Conn., amphibious gear kit for retroactive installation on H-5F and H-5G helicopters, Oct. 14, 1949, $172,031.

Solar Aircraft Corp., San Diego, spare parts for the F-80 aircraft, Oct. 26, 1949, $194,420.

Kollsman Instrument division, Square D Co., Elmhurst, N. Y., altimeters, Oct. 11, 1949, $328,428.

Technicraft Corp., Kansas City, Mo., electrical tuner for radio compass, Oct. 12, 1949, $106,331.

Tumpane Co., Marietta, Ga., protection, maintenance, repairs and utilities, storage, recording and processing machine tools, Oct. 1, 1949, $758,613.

Why Strikes?

Report analyzes West Coast labor troubles. Lockheed cited.

Lockheed has never had a strike. Yet other major West Coast aircraft plants—Boeing, Consolidated Vultee, Douglas, North American and Ryan—have suffered long and bitter strikes over the same problems that were settled peacefully at Lockheed.

The National Planning Assn. in Washington set out to find out why. It gives its answer this week in a 100-page report.

The report attributes the favorable labor situation at Lockheed to the policies and leadership of both the management and the union, the International Assn. of Machinists.

▶**Labor Factors**—NPA says:

Lockheed has been progressive and flexible in its approach to bargaining; recognizes the dignity and desires of the workers; has accepted the union from the beginning; has provided a higher level of average hourly earnings and fringe benefits.

IAM is an old, established union; has not quarreled over private ownership; is not plagued internally by conflict between "left" and "right" as is the CIO; local union leadership is well trained.

▶**Problems Solved**—NPA does not imply that Lockheed and IAM don't have any trouble. The report, prepared by Clark Kerr and George Halverson of the University of California's Institute of Industrial Relations, points out that there have been 30,000 grievances and 25 arbitrations since the union entered Lockheed in 1937. Often the services of the War Labor Board and the U. S. Conciliation Service were necessary to settle disputes. Twice the union took a strike vote.

"This relationship shows how close parties can come to open warfare without having it," according to NPA. "It shows that strikes can be avoided in the face of very difficult problems."

▶**Peace Barriers**—The report cites four "barriers" to labor peace in West Coast aircraft plants:

- "Short-run financial insecurity of the companies.
- "Traditional managerial reluctance to bargain collectively.
- "Union insecurity resulting from militant rival unionism.
- "Large fluctuations in the magnitude of the industry's operations."

Among seven factors favorable to peaceful relations, the report cites the "ability of the companies, in the long run, to 'pass on' higher labor costs" and the government's policy, particularly during the war, of discouraging strikes in aircraft production.

The report is the sixth in a series on the causes of labor peace issued by NPA. Printed copies are available at $1 from NPA, 800 21st St., N.W., Washington 6, D.C.

Aeronca-Helioplane Deal Pending

Refinancing arrangements for Aeronca Aircraft Corp., Middletown, Ohio, negotiated last week, will put that company in the best financial position it has known in recent years, President John Lawler announced last week.

With completion of the new arrangements the company will show a surplus of $1,300,000 as compared to a deficit of $31,000 on July 31.

▶**Licensing Rights**—Meanwhile Lawler was conducting negotiations with Lynn Bollinger at Boston, Mass., for licensing rights for the forthcoming four-place, slow-flying, short-landing quiet Helioplane.

An Aeronca spokesman said that the company was very much interested in acquiring the rights, but had not signed a contract yet.

Prof. Bollinger told AVIATION WEEK that he and Prof. Otto Koppen, designer of the Helioplane, had conferred with Lawler and that further conference was scheduled but that no formal commitments had yet been made.

▶**Prototype Underway**—Bollinger said development of the four-place Helioplane was proceeding at the Norwood, Mass., base of Helio Corp., and that the prototype four-placer was expected to fly next spring. Meanwhile flight tests are continuing with the two-place 85 hp. Helioplane first flown last spring (AVIATION WEEK, May 16).

Bollinger said production facilities of Aeronca seemed well adapted for the Helioplane and that Lawler and Aeronca officials seemed agreeable to

DROGUE CHUTE FOR XB-51

Glenn L. Martin Co. XB-51 demonstrates the drogue parachute installation for decelerating the landing run. The chute is stowed at the base of the vertical fin and can be released by the pilot from a cockpit control. Combination of the drogue chute and JATO bottles, shown installed just aft of the fuselage insignia, are aimed at making the triple-jet bomber suitable for operation on small fields likely to be encountered in the ground troop support work for which the plane was designed.

his distribution philosophy of putting out a small test quantity of the radical new plane for thorough service testing before a large quantity production. Indications are that the deal is well on the way to completion.

► **Finance Plan**—Details of the Aeronca refinancing arrangement as disclosed by Lawler include:

• **Reconstruction Finance Corp.** has approved an additional $200,000 loan.

• **Certain "public-spirited" Middletown citizens** have obligated themselves to match the RFC loan.

• **Stockholders have approved** a new $400,000 issue of 5½% prior participating preferred stock.

• **Preferred creditors** with claims totalling approximately $1 million have agreed to accept approximately 200,000 shares of the 5½% new stock issue in compromise of their claims.

• **Aeronca had unfilled orders** as of Oct. 31 totalling $1.3 million, principally in Air Force and Army ordnance contracts.

• **One-third of the Aeronca** distributor organization placed firm orders with deposits for airplanes, totalling over $400,000, at a special regional meeting Nov. 15.

Biggest single step in the refinancing was seen as the compromise with preferred creditors, which in effect wrote off 80% of their claims and "had an extremely favorable reflection in the company's surplus," the company stated.

B-29s Grounded for Modification Work

U. S. Air Force last week grounded a large portion of its operational Boeing B-29 Superforts.

The grounding order affected:

• All B-29s being used for training by Strategic Air Command.

• All B-29s of the 19th Group stationed at Guam.

• All other B-29s that have not had their Wright R-3350 engines equipped with fuel injection and valve modifications or have been subjected to maximum altitude and take-off weights.

USAF currently has about 400 B-29s operational and informed sources estimated that about half of them would be affected by the grounding order. USAF has currently experienced an epidemic of operational losses among its B-29 groups but few if any of the crashes could be traced directly to engine trouble. The bombers have been undergoing unusually heavy wear in SAC and the 19th Group where they have been flying maximum-range missions that require extreme take-off weights and long periods at altitude.

► **Report Work**—Engine modernization has been carried out at Air Materiel Command's Oklahoma City depot with parts purchased from Wright Aeronautical Corp. Boeing's Wichita plant has done airframe and equipment modifications on the B-29s. The AMC depot overhaul system has been under severe criticism in Pentagon circles over its record during the Berlin Airlift when critical C-54 maintenance was jerked from the depots and given to civilian contractors. Military Air Transport Service reported that the civilian reconditioning of its C-54 fleet produced better work faster and at considerably less cost.

The Defense Department Management Committee, headed by Gen. Joseph T. McNarney, former AMC commander, has been considering reduction of the depot system as a means of effecting economy in the military budget and extending the practice of civilian contract overhauls for military aircraft.

► **Work Shift**—Originally the B-29 modernization program was scheduled for Boeing, Bell Aircraft Corp. and the Glenn L. Martin Co., but AMC shifted work scheduled for Bell and Martin to its depots on the grounds of "military security."

The B-29s are expected to remain grounded until technical inspection teams can inspect the heavily stressed aircraft and the engine modernization program can be completed.

Three Big Fields Bar Fighter Planes

Fighter-type aircraft, whether or not converted to civilian use, have been barred from using Washington National Airport, LaGuardia Field and New York International Airport.

This action, taken in Washington by the Civil Aeronautics Administration and in New York by the Port of New York Authority, followed the mid-air crash of an Eastern Air Lines DC-4 and a P-38 on Nov. 1 at Washington and subsequent reports of near collisions in that area. CAA modified an earlier order which would have kept all combat-type aircraft from Washington National Airport, including converted bombers used as transports by business concerns.

► **Navy-EAL Incident**—One of the latest reports on a "near miss" over the Washington area involved an Eastern Air Lines DC-3 and a twin-engine Navy Beechcraft. The Navy acknowledged the incident but said the EAL plane, bound from Richmond to Newark, was flying through the center of the restricted Dahlgren, Va., proving ground danger area—nine miles from the nearest authorized airway.

The Navy pilot, who was making practice bombing runs, said he flew near the airliner to identify it and get its registration number so that a complaint could be made to CAA.

NEW PUNCH FOR SABRE

North American's F-86A Sabre fighter is being fitted with new armament of eight 5-in. rockets shown here being test fired at Muroc Air Force Base. Standard armament is six .50-caliber machine guns mounted on both sides of the nose air intake. Later versions of the F-86 series will have a solid nose to house night fighting radar and flush air inlets on the side of the fuselage.

FINANCIAL

Stock Ownership By Officers-Directors

	Average Dollar Value Held (In $000)	Percentage Of Outstanding Shares Held
Aircraft Industry		
Martin	$6,761	25.92
Grumman	2,063	15.62
Lockheed	1,041	4.61
Boeing	174	0.80
Douglas	306	0.77
United	514	0.65
No. American	30	0.08
Curtiss-Wright	10	0.02
Republic	2	0.002
Air Transport Industry		
Eastern	$1,300	5.43
Northwest	260	1.32
Pan American	978	1.14
American	242	0.42
TWA	38	0.15
United	47	0.10

Survey Analyzes Aviation Group

Management's equity holdings appraised. Sustained aircraft industry and airline earnings seen.

An interesting appraisal of the aviation group is revealed in the current investment survey released by the Value Line, an investment advisory service. A new feature analyzes the stock ownership of the management of the companies and points out which of the competing units enjoy the backing of their management's own money.

This is a courageous undertaking. Corporate trends in recent years, making for broader distribution of ownership among many stockholders, have developed some managements with very nominal equity holdings and policies prone to overlook the real ownership interest.

► **Summary**—The Value Line has computed the trend of management-ownership from 1940 to the end of 1948 in terms of both average dollar value and percentage of outstanding shares for a selected group of companies.

These findings as of the 1948 year-end, are summarized in the box above.

An important qualification must be included with the above findings. This is the extent of holdings represented by nominees of substantial stockholders. Frequently, this determination is difficult to make. It is known, however, that the Hughes Tool Co. owns about 74 percent of the outstanding common stock of TWA and has a substantial interest in the airline's management.

► **Control Factor**—Nevertheless, the small percentage stock ownership through which managements can exert control of large corporate enterprises is particularly noteworthy. A test for control rarely develops. Hence, as long as a satisfactory record is maintained managements can, more or less, perpetuate themselves in office. The aircraft industry, however, has seen dissident groups successfully challenge the policies of two separate managements in recent times, causing their removal.

According to the Value Line computations, United Aircraft, for example, with total resources of more than $139 million, is controlled by a group owning an average of $514,000 of the company's securities. By the same token, Republic Aviation provides a more startling contrast, with more than $13.3 million in total assets controlled by a group owning, in the aggregate, stock worth an average of $2000.

Nearly all companies are reported to have showed a smaller officer-director ownership at the end of 1948 than at the close of 1940.

In reviewing the outlook for the aircraft builders, this investment advisory service declares that a high level of aircraft procurement seems assured with the final enactment of the fiscal 1950 military appropriations. Earnings of most aircraft manufacturers are expected to rise moderately in 1950. Aircraft usually require from one to three years for delivery in quantity after initial orders are placed. Operation of this time factor means that a considerable period must elapse before volume orders can be translated into earnings.

The impact of last year's orders was not felt in 1948 and although it will be reflected to some extent this year, the greatest improvement, according to the advisory service, will be shown in 1950 results. Similarly, orders placed this year, will primarily affect 1951 earnings.

► **Performance Varied**—Concluding its opinion on the aircraft builders, Value Line declares that performances of the individual companies will by no means be uniform, despite the generally favorable outlook for the industry. The degree of efficiency with which the various companies translate backlogs into sales and earnings will vary with the nature of their orders and the excellence of their management. Among companies expected to make favorable earnings showings in 1950 are Boeing, United Aircraft, Grumman and Lockheed.

Analyzing current developments in the airline group, the Value Line declares that profits of air carriers showing a high percentage of mail pay to total revenues should be regarded with some reserve. American and Eastern have consistently remained in the non-subsidized category. While United and TWA received special payments last year to assist them in their difficult financial situations, operations thus far in 1949 reveal a healthy recovery without benefit of mail pay. In fact, both of these carriers are reported receiving materially less mail pay than a year ago.

However, Value Line concludes that unless compensation for carrying the mail is reduced sharply in 1950, which they consider unlikely, a serious deterioration of the industry's profits is not anticipated. A good level of business activity and national income, coupled with such inducements as widespread adoption of air coach service, the 10 percent discount for military travel, and the family fare plan, is expected to sustain airline traffic at a high level.

(Ed. Note: *The opinions reviewed are those of the advisory service and not necessarily those of this writer. Neither the writer nor* AVIATION WEEK *stands sponsor to or endorses the advisory service indicated above.*) —**Selig Altschul**

AIR FORCE CONTRACTS

New Contracts Exceed $70 Million

GM division, North American lead in AMC awards for September, with bombing equipment largest item.

Air Materiel Command headquarters and Watson Laboratories entered into contracts worth $78,764,118 in September, with the largest single order to the AC Spark Plug division of General Motors Corp., $16,259,473 for bombing navigational computers.

Second largest single contract was for $8 million, to North American Aviation, Inc., for research and component development on guided missiles. Third largest single contract of the month was negotiated with Sperry Gyroscope Co., $6,279,372 for bombing navigational computers.

These orders put those companies one, two, three in volume of orders for September. AC's total was $17,328,887; NAA's, $8,685,342; and Sperry's $7,200,170.

▶ **Contract Breakdown**—During September, AMC negotiated 231 contracts worth $76,227,637 and let 127 contracts valued at $1,963,235 after formal advertising. Watson Lab, Red Bank, N. J., negotiated four contracts worth $13,587, and awarded two worth $2425 after advertising.

Complete list of September awards in excess of $1000 by AMC and Watson Lab follows, with the date being the estimated completion date of the contract:

More Than $100,000

AC Spark Plug division, General Motors Corp., Mich., spare parts and rental allowance for WAA plant, Oct., 1951, $1,069,414; bombing navigational computers and associated equipment, Sept., 1951, $16,259,473.

Bell Aircraft Corp., Buffalo, N. Y., no description or estimated completion date given, $3,655,799.

Bendix Products division, Bendix Aviation Corp., South Bend, Ind., spare wheels and brakes, Aug., 1950, $373,864.

Boeing Airplane Co., Seattle, Wash., spare parts for B-17, B-29, B-50, YC-97, and C-97 aircraft, June, 1950, $500,000; design development of 120 v. dc. electrical system, Aug., 1950, $293,856.

Civil Aeronautics Auth., Washington, D. C., AF share in Landing Aids Experiment Station, June, 1950, $200,000.

Consolidated Vultee Aircraft Corp., Fort Worth, Tex., incorporation of pod nacelles with jet engines, etc., Dec., 1949, $715,640.

Continental Motors Corp., Muskegon, Mich., engine packettes, power plant qualification tests and data, Aug., 1950, $276,711.

Cox-Stevens Aircraft Corp., Mineola, N. Y., aircraft weighing kits, Nov., 1949, $113,292.

Curtiss-Wright Airplane division, Curtiss-Wright Corp., Columbus, Ohio, spare parts for C-46 A-D, Nov., 1950, $1,213,831.

Curtiss-Wright Propeller division, Curtiss Wright Corp., Caldwell, N. J., machinery and related production equipment, July, 1950, $600,000.

Douglas Aircraft Co., Santa Monica Calif., miscellaneous services and supplies for the C-118 and C-54C aircraft, June, 1950, $150,000; data and flight testing, Dec., 1950, $3,280,107.

Duffy Construction Co., Cleveland, Ohio, maintenance protection, utilities and repair service to GAP No. 7, Cleveland, Ohio, Sept., 1949, $149,000.

Eclipse-Pioneer division, Bendix Aviation Corp., Teterboro, N. J., photo control system, Apr., 1950, $178,797.

Espey Mfg. Co., New York, N. Y., radio set AN-TRC-7B, Apr., 1950, $115,620.

Fairchild Aircraft division, Fairchild Engine and Airplane Corp., Hagerstown, Md., spare parts for C-82 and C-119 aircraft, June, 1950, $250,000.

Gaveco Laboratories Inc., New York, N. Y., exciter, type A-1, Dec., 1949, $142,090.

General Electric Co., Schenectady, N. Y., remote control turret systems and spare parts, Dec., 1951, $4,000,000; turbosuperchargers, Feb., 1951, $177,156; radio noise filter boxes, spare parts and data, Sept., 1950, $365,794.

General Electric Co., Syracuse, N. Y., gun directing radar sets and spare parts, Jan., 1951, $385,000.

General Mills Inc., Minneapolis, Minn., bombsights and associated equipment, June, 1951, $1,700,882.

Goodyear Aircraft Corp. division, Goodyear Tire and Rubber Co., Akron, Ohio, no description or completion date given, $656,553.

Graflex Inc., Rochester, N. Y., one model B-type K-41 aircraft camera, Mar. 1950, $153,538.

Hawthorn Co., Kansas City, Mo., release bomb rack type A-5, July, 1951, $159,341.

Hughes Aircraft Co., Culver City, Calif., no description or estimated completion date given, $3,174,132; overrun and flight tests, spare radomes, handbooks, Dec., 1949, $201,775.

Jack & Heintz Precision Inds., Cleveland, Ohio, direct cranking aircraft strater, adapter jaw, engineering and maintenance data, spare parts, Nov., 1950, $1,302,817.

Jumbo Steel Products Co., Azusa, Calif., Jumbo steel stand assemblies, Apr., 1950, $131,951.

Kaiser-Frazer Corp., Willow Run, Mich., storage services in Bohn Aluminum Plant, Adrian, Mich., Dec., 1949, $100,797.

Kollsman Instrument division, Square D Co., Elmhurst, N. Y., altimeters, June 1950, $131,973.

Lear Inc., Grand Rapids, Mich., F-5, autopilot, Oct., 1951, $1,417,617.

Lewyt Corp., Brooklyn, N. Y., signal generator TS-452-U, Feb., 1950, $124,800.

Lockheed Aircraft Corp., Burbank, Calif., spare parts for F-80 aircraft, June, 1950, $300,000.

Lockheed Aircraft Service, Inc., Burbank, Calif., cycle reconditioning of C-54 aircraft, Aug., 1949, $1,520,000.

North American Aviation Inc., Los Angeles, Calif., continuing study, research, and component development of guided missile, June, 1950, $8,000,000; spare parts for T-6, B-25, P-51, F-6, P-86, B-45, and P-82 aircraft, June, 1950, $520,000.

Northrop Aircraft Inc., Hawthorne, Calif., additional spare parts for YC-125A airplanes, Apr., 1950, $389,409.

Philco Corp., Philadelphia, Pa., services of technical representatives, June, 1950, $3,847,015.

RCA-Victor division, Camden, N. J., technical representatives, June, 1950, $180,208.

Raytheon Mfg. Co., Raytheon Production Corp., Waltham, Mass., radar set AN-APQ-27, Dec., 1950, $1,142,002.

Republic Aviation Corp., Farmingdale, N. Y., spare parts for F-47D, F-47N, YF-84A, C, D, and E, July, 1950, $106,226.

Sikorsky Aircraft division, United Aircraft Corp., Bridgeport, Conn., spare parts for H-5 aircraft, Feb., 1950, $292,232.

Sperry Gyroscope Co. division, Sperry Corp., Great Neck, N. Y., design, fabricate and supply one model radar set plus spare parts, engineering reports, test equipment, handbooks, data, no estimated completion date given, $889,700; A-1 bombing, navigational computers and associated equipment, Sept., 1951, $6,279,372.

Sundstrand Machine Tool Co., Rockford, Ill., constant-speed drives F-1A, Nov., 1950, $3,453,149.

Tumpane Co., Omaha, Neb., storage, recording and processing of machine tools, June, 1950, $266,149.

Univ. of Mich., Ann Arbor, Mich., research program on guided missile systems, Nov., 1950, $800,000.

Westinghouse Electric Corp., Essington, Pa., miscellaneous parts, assemblies, subassemblies or mock-ups, June, 1950, $100,000.

Wright Aeronautical Corp., Curtiss-Wright Corp., Wood-Ridge, N. J., engines, spare parts, tools, Jan., 1950, $1,275,745.

Yale and Towne Mfg. Co., Stamford, Conn., spare parts for pumps, Dec., 1949, $355,618.

$1000 to $100,000

Ace Drill Corp., Detroit, Mich., drill, twist, straight, Oct., 1949, $3584.

Acme Visible Records Inc., Cincinnati, Ohio, visible file cabinets, Oct., 1949, $2384; visible filing cabinets, Sept. 1949, $20,451.

Advance Equipment Co., Cincinnati, Ohio, chain spur gear hoist, Oct., 1949, $5073; filler assembly, Nov., 1949, $1042.

Aeromotive Equipment Corp., Kansas City, Mo., slaved gyro tester, Apr., 1950, $12,263; spare parts for components, July, 1949, $2717.

Aero Training Industries, Ypsilanti, Mich., type 0-58 trainer, Oct., 1949, $3956; type 0-58 trainer mock-up, Jan., 1950, $6181.

Aerojet Engineering Corp., Azusa, Calif., rocket refills, July, 1950, $7500; no description or estimated completion date given, $15,134.

Aeronautical Radio Inc., Washington, D. C., survey of airways in Alberquerque-Denver-Salt Lake City-Denver area and reports based thereon, Jan., 1950, $8000.

Aeroquip Corp., Jackson, Mich., rubber hose, Nov., 1949, $34,515.

Aircraft Products Co., Clifton Heights, Pa., tester, engineering data and pump assembly, Dec., 1949, $36,200.

Airesearch Mfg. Co., Garrett Corp., Los Calif., gaskets and screws, Mar., 1950, $2870.

Akeley Camera Inc., New York, N. Y., tester and engineering data, Nov., 1949, $19,875.

American Air Filter Co. Inc., Louisville, Ky., carburetor air filters, Apr., 1950, $3600.

American Auto Typewriter Co., Chicago, Ill., type 0-12 trainer, Nov. 1949, $2240; type U-166 trainer demonstrator, Nov., 1949, $8750; type T-1 terrain projector trainer, Nov., 1949, $44,280; type 0-12 trainer mock-up, Mar., 1950, $3335.

American Optical Co., Buffalo, N. Y., spare parts for photographic projectors, Dec., 1949, $6446; microscope, Oct., 1949, $1836.

American Phenolic Corp., Chicago, Ill., assemblies, sub-assemblies and spare parts, June, 1950, $2000; radio frequency cable, Nov., 1949, $3478.

American Pneumatic Tool Co., Los Angeles, Calif., pneumatic hammer and maintenance data, Sept., 1949, $7631.

American Surplus Co., Los Angeles, Calif., gun charger purchased from surplus to be modified, Oct., 1949, $2799.

American Time Products Inc., New York,

N. Y., bombsight tachometer calibration testing unit, Nov., 1949, $2000.

Ampco Metals Inc., Milwaukee, Wisc., rear no 50A shaft cones, Nov., 1949, $9900.

Anchor Rubber Co., Dayton, Ohio, rubber sheet, Nov., 1949, $3800.

Anderson Inc., Chicago, Ill., beam assembly, wrench assembly, Nov., 1949, $2378.

Antioch College, Yellow Springs, Ohio, continuation of research and analyses of data furnished by Aero-Medical Lab on current human engineering research projects Oct., 1950, $17,500.

Baird Associates Inc., Cambridge, Mass., maintenance service on one spectrophotometer model B, June 1950, $1080.

Barden Corp., Danbury, Conn., ball bearings, Dec., 1949, $85,500.

Bartky, Walter, Chicago, Ill., consultant services, June, 1950, $1500.

Battelle Memorial Inst., Columbus, Ohio, extension of jewel bearing group research program, Aug., 1950, $1700.

Bell Aircraft Corp., Niagara Falls, N. Y., modify five 5 VB-13 bomb tails to improve aerodynamic stability, Jan., 1950, $75,600.

Bendix Aviation Corp., Pacific division, North Hollywood, Calif., hydraulic tripod jacks, Mar., 1950, $1098; valves, June, 1950, $5000.

Bendix Products division, Bendix Aviation Corp., South Bend, Ind., spare parts for fuel injection systems, Jan., 1950, $9284; wheels and brakes, struts and spare parts, June, 1950, $20,000.

Bendix Radio division, Bendix Aviation Corp., Towson, Md., indicators, MN-42C, Nov., 1949, $22,498.

Berlin, Don R., St. Louis, Mo., consultant services, June, 1950, $1500.

Beseler, Charles Co., Newark, N. J., miscellaneous photographic equipment, Oct., 1949, $2098.

Boeing Airplane Co., Seattle, Wash., handbook revisions, and long range mission of B-50 airplane 47-163, Dec., 1949, $37,070; spare parts for YL-15, B-29, and B-50 aircraft, June, 1950, $25,000.

Bolee-Crane Co., Toledo, Ohio, bench type drill press, Oct., 1949, $4128.

Bollay, William, Downey, Calif., consultant services, June, 1950, $1500.

Booz, Allen and Hamilton, Chicago, Ill., interim missiles program study, Oct. 1949, $1500.

Bradbury, Dr. Norris E., Los Alamos, N. M., consultant services, June, 1950, $1500.

Brodie, Ralph N. Co., Oakland, Calif., meter fuel flow, 250 gpm valve flow control, Oct., 1949, $1232.

Buehrle, Phillip H. and Sons, Spotswood, N. J., antenna, test horn type in accordance with U. S. Air Force drawing list, Sept., 1949, (Watson Laboratories), $1173.

Buning, Charles Co. Inc., Chicago, Ill., navigation plotting machine, Sept., 1949, $1406.

Burton-Rodgers Inc., Cincinnati, Ohio, trainer, AN-T-1004, Nov., 1949, $4073; trainer type O-61, demonstrator, Jan., 1950, $11,797.

Cable and Wireless Ltd., London, Eng., custodial services, June, 1950, $3000.

California Research Corp., San Francisco, Calif., continuation of investigation, additional studies and reports on gas turbine engine fuel, June, 1950, $19,800.

Capital Sales Service Co., Washington, D. C., wardrobe racks, Nov., 1949, $29,673.

Cessna Aircraft Co., Wichita, Kans., spare spare parts for LC-126A, June, 1950, $2500.

Columbus Genl. Dept., U. S. Army, Columbus, Ohio, cotton duck, Sept., 1949, $21,172.

Cook Electric Co., Chicago, Ill., qualified engineers for the purpose of conducting calculating and wind tunnel test for evaluating parachute systems with special warhead V-2 rocket, Dec., 1949, $10,000.

Cox-Stevens Aircraft Corp., Mineola, N. Y., maintenance and repair to electric weighing kits, June, 1950, $35,000.

Crown Office Supply Co., Chicago, Ill., dictionary stands, Oct. 1949, $6370.

Curtiss-Wright Airplane division, Curtiss-Wright Corp., Columbus, Ohio, spare parts for C-46 aircraft, June, 1950, $50,000.

Danis, B. G. Co., Inc., Dayton, Ohio, increase in roof height of rocket test cell in building No. 79-D, Feb., 1950, $5575.

Davey Compressor Co., Kent, Ohio, compressor and maintenance data, Dec., 1949, $52,796; portable air compressor revision data, Dec., 1949, $39,400.

Dayton Aircraft Products Inc., Dayton, Ohio, 20 each, propeller dolly, transportation type C-1C, Feb., 1950, $22,137.

Delta Engineering Sales Co., Cincinnati, Ohio, hose-coupler fittings, Sept., 1949, $1609.

Denison Engineering Co., Columbus, Ohio, manifolding set, hydraulic jacking type E-104, Jan., 1950, $50,136.

Design Center Inc., Flushing, N. Y., trainer, type Q-1, Oct., 1949, $1184.

Design Fabricators Inc., Dayton, Ohio, demonstrator trainers, Jan., 1950, $3737.

Diamond Instrument Co., Wakefield, Mass., radio frequency plug, Nov., 1949, $4144.

Ditto Inc., Chicago, Ill., duplicating machines, Nov., 1949, $17,520.

Donovan, Allen F., Buffalo, N. Y., consultant services, June, 1950, $1500.

Douglas Aircraft Co., Long Beach, Calif., repair of integral fuel tanks on C-74 airplane 42-65410, Nov., 1949, $15,000.

Dow Chemical Co., Midland, Mich., research and development of a high-strength magnesium sheet alloy, Aug., 1950, $33,301.

Du Pont, E. I. De Nemours, Wilmington, Del., photo bromide proj. paper, Sept., 1949, $3976.

Duellman Electric Co., Dayton, Ohio, filler assembly, Dec., 1949, $12,026.

Dumont, Allen B. Labs. Inc., Clifton, N. J., cathode ray oscillograph, Dumont type, Sept., 1949, (Watson Laboratories), $3168.

Eagle Manufacturing Co., Wellsburg, W. Va., pump type oiler, Oct., 1949, $6506.

Eastman Kodak Co., Rochester, N. Y., photomechanical ortho film, Jan., 1950, $96,447; photographic film, Oct., 1949, $5763; photographic film, Oct., 1949, $1742; photographic film, Dec., 1949, $10,060; miscellaneous photographic equipment, Feb., 1950, $2153.

Eclipse-Pioneer division, Bendix Aviation Corp., Teterboro, N. J., amplifier transmitter for throttle actuator, Nov., 1949, $7863; yoke assemblies, Mar., 1950, $7473; oil pressure transmitters type P-1, Jan., 1950, $7564; manifold pressure indicators, type 0-16, June, 1950, $26,922; assemblies, subassemblies, and spare parts, June, 1950, $5000; spare parts for instruments July, 1951, $15,000; overhaul and maintenance parts for boost controls, June, 1950, $10,000; tester assembly and tester Mar., 1950, $59,663; oil pressure transmitters, type F-2 Feb., 1951, $38,969; oil pressure indicators, type B-19, July, 1950, $3529; oxygen mask valves, Nov., 1949, $1020.

Elcor Inc., Chicago, Ill., alternator assembly, type B-1, Nov., 1949, $79,565; spare parts for alternator, Oct., 1949, $36,053.

Electronic Brazing Co., Montclair, N. J., ignition harness testers, Nov., 1949, $56,895.

Elliott, Carleton R. Co., Dayton, Ohio, demonstrator trainers, Feb., 1950, $4046; demonstrator trainer, Jan., 1950, $6888.

Emerson Electric Mfg. Co., St. Louis, Mo., miscellaneous parts and/or assemblies of fire control system, type A-1, Oct., 1949, $25,000; no description or estimated completion date given, $8565.

Engelhard, Charles Inc., East Newark, N. J., tester assembly and engineering data, Dec., 1949, $16,938.

Farrand Optical Company, New York, N. Y., handbook data for Y-1 bombsight, May, 1950, $73,133.

Federal Aircraft Works, Minneapolis, Minn., wheel skis for the YC-125B airplanes, Nov., 1950, $55,000.

Federal Petroleum Corp., (Watson Laboratories), Newark, N. J., gasoline, Oct., 1949, $1506.

Federal Supply, Bureau of, Kansas City, Mo., miscellaneous furniture, Aug., 1949, $93,265.

Felsenthal G. and Sons, Chicago, Ill., trainer, AN-T-1003, Nov., 1949, $1264; mock-up trainers, Nov., 1949, $2311; demonstrator trainers, Jan., 1950, $6063.

Gaertner Scientific Corp., Chicago, Ill., design and construction of one special coordinate cathetometer, May, 1950, $4995.

Gaveco Laboratories Inc., New York, N. Y., voltage regulating exciters, Nov., 1949, $78,125.

General Aniline and Film, Binghamton, N. Y., photographic film, Dec., 1949, $3761.

General Electric Co., Bridgeport, Conn., electrically-heated cover for plasma bottles, Feb., 1950, $1684; clocks, Oct., 1949, $2570.

General Electric Co., Schenectady, N. Y., spare parts for drives, Jan., 1950, $54,555; modification of gyros to elinminate radio noise interference, Dec., 1949, $16,969; tachometer indicators, type E-28, Oct., 1950, $8702; frequency meter watt-varmeter voltmeter, spare parts, data, Jan., 1950, $35,188; relay generator, field control, engineering data, maintenance data, May, 1950, $7998; miscellaneous spare parts, assemblies and sub-assemblies, June, 1950, $25,000; spare parts for instruments, June, 1950, $10,000.

General Electric Co., Syracuse, N. Y., coil assembly, 50 each, Feb., 1950, $6040; factory familiarization training, Mar., 1950, $50,152; Electronics Dept., capacitor and insulator, June, 1950, $11,535.

General Radio Co., Cambridge, Mass, strobotac, Nov., 1949, $3042.

Gilfillan Bros. Inc., Los Angeles, Calif., technical services, Dec., 1949, $17,550.

Globe-Wernicke Co., Washington, D. C., bookcase sections, Oct., 1949, $1113; costumers, Nov. 1949, $3982.

Goodrich B. F. Co., Akron, Ohio, rubber sheet, Nov., 1949, $7191; deicer plug and sleeve, Dec., 1949, $2951; wheels, brakes and spare parts, June, 1950, $5000; rubber hose, Nov., 1949, $15,550; sponge rubber, Nov., 1949, $4840; rubber material, Nov., 1949, $7332.

Goodyear Tire and Rubber Co., Akron, Ohio, wheels and brakes, Mar., 1950, $16,012; wheels and brakes, parts, data, Mar., 1950, $21,926; rubber hose, Nov., 1949, $22,161; rubber hose, Nov., 1949, $2749; brake linings and brakes, May, 1950, $98,313; slotted and plain discs, June, 1950, $2737; spare parts for wheels and brakes, June 1950, $15,000; airplane casings and tubes, Oct. 1949, $65,770.

Gosiger, C. H. Machine Co., Dayton, Ohio, bench type drill press, Oct., 1949, $1136.

Graflex Inc., Rochester, N. Y., finger print cameras, Feb., 1950, $1170.

Grant Photo Products, Inc., Lakewood, Ohio, waterproof proj. photo paper, Oct. 1949, $7268.

Graybar Electric Co. Inc., Dayton, Ohio, electric soldering iron machine and tool assembly, Nov., 1949, $2030.

Grumman Aircraft Engineering Corp., Bethpage, N. Y., spare parts for SA-16 aircraft, June, 1950, $5000; factory familiarization training, Oct., 1949, $1636.

Hackensack Cable Corp., Hackensack, N. J., tow target cable, Jan., 1950, $44,012.

Halold Co., Rochester, N. Y., photocopy paper, Sept., 1949, $2295.

Hartman Electric Mfg. Co., Mansfield, Ohio, relay generator overvoltage engineering data, maintenance data, May 1950, $5911.

Heil Co., Milwaukee, Wis., procurement of spare parts for takeoff control assembly, Nov., 1949, $18,278.

Herman Mfg. Co., Lancaster, Ohio, bar assemblies and fork assemblies, Dec., 1949, $6136.

Hewitt Rubber of Buffalo division Hewitt-Robins Inc., Buffalo, N. Y., rubber hose, Nov., 1949, $2288.

Holmes, G. W. Co., Columbus, Ohio, cutaway trainer of aircraft engine and propeller, Dec., 1949, $29,167; demonstrator trainers, type U-171 and U-161, Nov., 1949, $19,440; mock-up and demonstrator trainers, Nov., 1949, $7437.

Houghton E. F. and Co., Philadelphia, Pa., spare parts for hydraulic jacks, Dec., 1949, $9800.

Hydropack, Los Angeles, Calif., rubber material, Nov. 1949, $1177.

Hydropress, Inc., New York, N. Y., maintenance inspection of heavy press equipment at Adrian, Mich., Dec., 1949, $48,535.

Imagineering Associates, Hollywood, Calif., demonstrator trainers, Jan., 1950, $6444.

Indiana University, Bloomington, Ind., determination limits within which operator behaves as a linear system in response to visual inputs, Oct., 1950, $30,250.

Indianapolis Varnish Co., Indianapolis, Ind., increased transportation charges and thinner cellulose nitrate, Sept., 1949, $2414.

Industrial Precision Prod. Co., Chicago, Ill., beam assembly-wrench assembly, Nov., 1949, $1856.

Industrial Precision Prod. Co., Chicago, Ill., vulcanizer assembly, Oct., 1949, $4600; holder assembly and tool assembly, Dec., 1949, $3718.

Jack & Heintz Precision Industries, Cleveland, Ohio, actuator assembly, Jan., 1950, $70,887; assemblies and sub-assemblies, June, 1950, $10,000.

Jackson Electric Instrument Co., Dayton, Ohio, tester and engineering data, Dec., 1949, $43,675.

Jayson-Bailey Co., Binghamton, N. Y., adapter assembly, Nov., 1949, $1817.

Kalitinsky, Dr. Andrew, Oak Ridge, Tenn., consultant, June, 1950, $1500.

Kay Rubber Co., New York, N. Y., rubber material, Nov., 1949, $12,462.

Kidde, Walter and Co. Inc., Belleville, N. J., cylinder and valves, June, 1950, $4965; fire extinguishers, June, 1950, $5000.

Kings Electronics Co., Brooklyn, N. Y., radio frequency adapter connector receptacle, Nov., 1949, $2200.

Koehler Aircraft Products, Dayton, Ohio, drain valves, Dec., 1949, $2630.

Kollsman Instrument division, Square D Co., Elmhurst, N. Y., manifold pressure transmitters, type L-1, Jan. 1950, $8575; assemblies and sub-assemblies, June, 1950, $10,000.

Krouse Testing Machine, Columbus, Ohio, repairing and modernizing two vibration testing machines, Dec., 1949, $1500.

Leach Relay Co., Los Angeles, Calif., relays, Oct., 1949, $2048.

Lewis Engineering Co., Naugatuck, Conn., indicators, type K-5, Mar., 1950, $9812.

Lieb-Jackson Co., Dayton, Ohio, by-pass piping system for 2 ft. x 2 ft. supersonic wind tunnel, Dec., 1949, $4590.

Lighting and Trans. Res. Inst., Minneapolis, Minn., services, continuation of research on radio interference fields in aircraft, Oct., 1950, $23,985; arresters, Feb., 1950, $1080.

Linde Air Products Co., New York, N. Y., liquid oxygen storage containers, June, 1950, $3850.

Linear Incorporated, Philadelphia, Pa., rubber material, Nov., 1949, $1174.

Link Aviation Devices Inc., division, J. V. W. and Co., Binghamton, N. Y., maintenance and repair services to Link trainers, July, 1950, $5000.

Liquidometer Corp., Long Island City, N. Y., spare parts for instruments, June, 1950, $10,000; tester and engineering data, June, 1950, $26,800.

Loewy Construction Co. Inc., New York, N. Y., retain custody of government-owned drawings pertaining to government heavy press equipment, decipher cross-index and translate same, June, 1950, $12,000.

Lord Mfg. Co., Erie, Pa., vibration insulator, Nov., 1949, $9321.

Louis-Allis Co., Milwaukee, Wis., electronic control, Nov., 1949, $1521.

Macelwane, Dr. James B., St. Louis, Mo., consultant services, June, 1950, $1500.

Machine Products Co., Wichita, Kans., maintenance, fire and guard protection GAP No. 13, Wichita, Kans., Sept., 1949, $31,391.

Magnaflux Corp., Chicago, Ill., demagnetizer assemblies and magnetic inspection machine, Jan., 1950, $44,520.

Management and Research Inc., Primos, Pa., trainers, type Q-64, Nov., 1949, $3960; mock-up trainers, Nov., 1949, $1579; demonstrator trainers, Jan., 1950, $11,570.

Manhattan Rubber division, Raybestos-Manhattan Incorporated, Passaic, N. J., rubber hose, Nov., 1949, $2993.

Mansfield and Green, Cleveland, Ohio, tester, Nov., 1949, $15,650.

Marion Screw Products Co., Marion, Ind., tester assembly, Nov., 1949, $6256.

Martin, Glenn L. Co., Baltimore, Md., bill of material for YSSM-A-1 guided missiles, Oct., 1949, $3362.

Marvel, A. Co., Caldwell, N. J., balancer assembly and maintenance data, Oct., 1949, $49,940.

Marvel - Schebler Carburetor division, Borg-Warner Corp., Flint, Mich., miscellaneous carburetor spare parts assemblies and sub-assemblies, June, 1950, $5000.

McColpin-Christie Corp. Ltd., Los Angeles, Calif., input rectifier, Nov., 1949, $1258.

McConnaughey Stationers Inc., Springfield, Ohio, drafting chairs, Nov., 1949, $4664.

McDonnell Aircraft Corp., St. Louis, Mo., flight tests with afterburners, Dec., 1949, $88,685; standard characteristics charts, Jan., 1950, $4989.

McQuay-Norris Mfg. Co., St. Louis, Mo., pressure switches, Oct., 1949, $1152.

Meyer, Charles A. Co., New York, N. Y., translations, June, 1950, $48,000.

Miami University, Oxford, Ohio, research on location discrimination, Jan., 1951, $4383.

Midwest Engr. Dev. Co. Inc., Kansas City, Mo., radar transmitter, Nov., 1949, $86,331.

Minneapolis Honeywell Regulator Co., Minneapolis, Minn., parts for B-4 regulator systems and repair work, June, 1952, $5000.

Monument Engineering Co., Indianapolis, Ind., tester, engineering data, maintenance data, Dec., 1949, $29,920.

Moody D. and Co., Tulsa, Okla., GE gun chargers purchased from surplus to be modified, Oct., 1949, $2400.

Nasco Inc., Cleveland, Ohio, tester, Sept., 1949, $6500.

Nash Engr. Co., South Norwalk, Conn., air compressor, June, 1950, $16,516.

Navy Department, Chief Bureau of Aeronautics, Washington, D. C., radar beacon AN-DPN-3, Sept., 1949, $4000.

Neal Machine and Tool Co., Lima, Ohio, beam assembly-wrench assembly; Mar., 1950, $1780.

New Departure division, General Motors Corp., Bristol, Conn., ball bearings, Dec., 1949, $14,400.

Nixon Nitration Works, Nixon, N. J., orange plastic sheet, Apr., 1950, $21,865.

North American Aviation Inc., Los Angeles, Calif., bracket tube wrench pliers, Jan., 1950, $35,862; items for B-45C airplanes, Oct., 1950, $12,965; relocate GF engine exhaust temperature thermocouple on 333 F-86 airplanes, Nov., 1950, $23,849; pilots ejection seat assemblies, Oct., 1949, $2666.

Northrop Aircraft Inc., Hawthorne, Calif., classified, June 1950, $54,296; standard aircraft characteristics charts and summary sheets for YC-125A and YC-125B aircraft, Nov., 1949, $3981.

Ohio State University, Columbus, Ohio, provide graduate courses of study, Sept., 1950, $80,900.

Ohio State University Research Foundation, Columbus, Ohio, additional services in form of investigation in cooling of electronic equipment, Dec., 1950, $53,683; research of infra-red detection, Dec., 1950, $26,400.

Optron Laboratory, Dayton, Ohio, services and materials in connection with preparation of glass plates, etc., June, 1950, $50,000.

Ordnance Bureau of Navy Department, Washington, D. C., drive, assembly fixture, turntable assembly testers, Oct., 1949, $2400.

Bureau of Navy Department, Washington, D. C., research and development of MX-770 ram jet power plants, Sept., 1950, $79,000.

Ordnance Department of the Army, Washington, D. C., develop and test various explosive-operated devices, Dec., 1949, $6350.

Otterbein Press, Dayton, Ohio, supply, printing, Aug., 1950, $10,000.

Pan-American Tool and Machine Corp., Dayton, Ohio, beam assembly-wrench assembly, Dec., 1949, $1193.

Paramount Rubber Co., Detroit, Mich., helmets, Dec., 1949, $33,176.

Patton Mfg. Co. Inc., Springfield, Ohio, beam assembly-wrench assembly, Nov., 1949, $1981.

Peerless Radio Distributors, Jamaica, N. Y., tube, type 3C45, Oct., 1949 (Watson Laboratories), $1253.

Pesco Products division, Borg-Warner Corp., Cleveland, Ohio, pump, spare parts, Apr., 1950, $9805; pump assembly, Dec., 1949, $1090; oil transfer pump, May 1950, $1500.

Phaostron Co., Pasadena, Calif., antennas, June, 1950, $1188.

Philadelphia Gen. Dep. Office QM, Philadelphia, Pa., cotton duck, Sept., 1949, $8730.

Philco Corp., Philadelphia, Pa., factory familiarization, Feb., 1950, $4800; modify and flight test radar set, Sept., 1950, $19,922.

Piper Aircraft Corp., Lock Haven, Pa., camera mount, Jan., 1950, $4810.

Pittsburgh Plate Glass Co., Pittsburgh, Pa., spare parts for B-29 aircraft, Apr., 1950, $53,062.

Polytechnic Res. and Dev. Co., Brooklyn, N. Y., signal generator, TS-602-U, Aug., 1950, $50,313; oscillator, external cavity rack-panel mounted for 7 to 11 KMC-SEC band, Dec. 1949, (Watson Laboratories), $1550.

Port Clinton Mfg. Co., Port Clinton, Ohio, beam assembly-wrench assembly, Nov., 1949, $8290.

Porter, Richard W., Schenectady, N. Y., consultant services, June, 1950, $1500.

Quaker Rubber Corp., Philadelphia, Pa., rubber sheet, Nov., 1949, $3510.

R-C Machine Co., Dayton, Ohio, modification of GE gun chargers, Feb., 1950, $2506.

Racon Electric Co., New York, N. Y., speaker mechanism, Oct., 1949, $5438.

Radioplane Co., Van Nuys, Calif., revise four each targets to include RPS-4 stabilization system, Sept., 1949, $6356.

Raytheon Mfg. Co., Raytheon Production Corp., Waltham, Mass., radar set AN-APQ-27, Dec., 1950.

Reconstruction Finance, Bantam, Conn., spares for seats, Nov., 1949, $2872; spares for seats, Nov., 1949, $3161.

Recordak Corp., New York, N. Y., photographic film, Oct., 1949, $7165.

Recordak Corp., Washington, D. C., photographic film, Oct., 1949, $1935.

Recknagel Machine Prod. Inc., Springfield, Ohio, fixture assembly, centering HSG gyro P-N 8003, special tools, Nov., 1949, $1865.

Reed Research Inc., Washington, D. C., spare parts for simulator for analyzing transient heat flow, Oct., 1949, $11,269.

Refrigeration Equipment Co., Dayton, Ohio, Freon-12 pumping system for wind tunnel refrigeration equipment, Jan., 1950, $13,176.

Remington Rand Inc., Dayton, Ohio, filing cabinets, Oct., 1949, $2289.

Republic Aviation Corp., Farmingdale, N. Y., spare parts for F-47D, F-47N, YF-84A, C, D, and E, July 1950, $25,000.

Reynolds Metals Co., Richmond, Va., reflector, RR-12-U, Dec., 1949, $11,620.

Rheem Mfg. Co., Lester, Pa., demonstrator trainer, type U-164, Jan., 1950, $8185.

Rockford Paint Mfg. Co., Rockford, Ill., enamel, Nov., 1941, $11,242.

Rocky Mountain Steel Products, Los Angeles, Calif., beam assembly-wrench assembly, $8318.

Rosenberg, H Z-Co., Buffalo, N. Y., drives, tail gun mount, azimuth and/or elevation, Oct., 1949, $10,934.

Roth Office Equipment, Dayton, Ohio, drafting stands, Dec., 1949, $2205.

Ryan Aeronautical Co., San Diego, Calif., spare parts for L-17 aircraft, July, 1950, $10,000.

Safeway Steel Products Inc., Milwaukee, Wis., style V multi-level service, Dec., 1949, $66,062.

Sangamo Electric Co., Springfield, Ill., capacitors, Nov., 1949, $2340.

Schuttig and Co. Inc., Washington, D. C., tester assembly, Nov., 1949, $5232.

Scintilla Magneto division, Bendix Aviation Corp., Sidney, N. Y., booster coils, Dec., 1949, $70,465; magneto and ignition harness spare parts and sub-assemblies, June, 1950, $50,000.

Selectar Industries Inc., Long Island, N. Y., radio frequency adapter connector receptacle, Nov., 1949, $1530.

Signal Officer, Washington, D. C., signal generator, TS-317-U, Oct., 1949, $9091.

Simpson Construction Co., Chicago, Ill., additional services and materials in connection with installation of plating room facilities, Oct., 1949, $2598.

Spencer Thermostat Co., Attleboro, Mass., assemblies, sub-assemblies, and spare parts, June, 1950, $2000.

Sperry Gyroscope Co. Inc. division, Sperry Corporation, Great Neck, N. Y., spare parts for instruments, June, 1950, $20,000; adapters and data, Mar., 1950, $5250; Zero reader installation in government-owned airplane, Sept., 1950, $5848.

Spicer Mfg. Co., Dana Corp., Toledo, Ohio, spares for F-1 truck tractors, Sept., 1949, $8439.

Standard Piezo Co., Carlisle, Pa., crystal units, Oct., 1949, $10,153.

Standard Rolling Mills Inc., Brooklyn, N. Y., additional work on reflector research,

Oct., 1949, $51,800.

Standard-Thomson Corp., Dayton, Ohio, pressurizing valves, Nov., 1949, $1560.

Stanford University, Palto Alto, Calif., research on the interrelations of brain metabolism and temperature regulation, Dec., 1950, $10,997.

Stewart, Homer J., Pasadena, Calif., consultant services, June 1950, $1500.

Stott, Charles G. Co. Inc., Washington, D. C., chairs, Nov., 1949, $12,351.

Surface Combustion Corp., Toledo, Ohio, heaters, June, 1950, $3000.

Sylvania Electric Products Inc., Flushing, N. Y., test program of the modified NRL pulse time telemetering system, Oct., 1949, $24,897.

Syracuse Gauge Mfg. Corp., Syracuse, N. Y., filler assembly, Jan., 1950, $5243.

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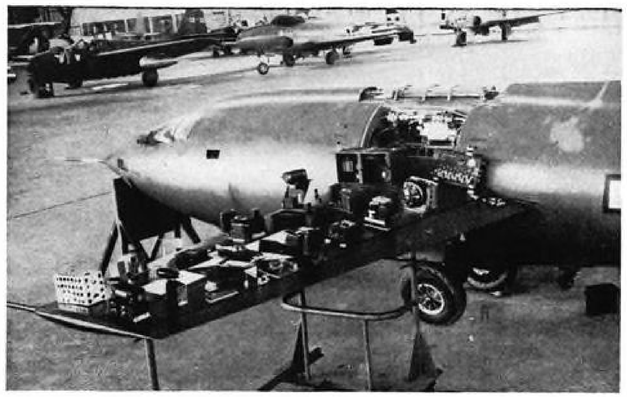

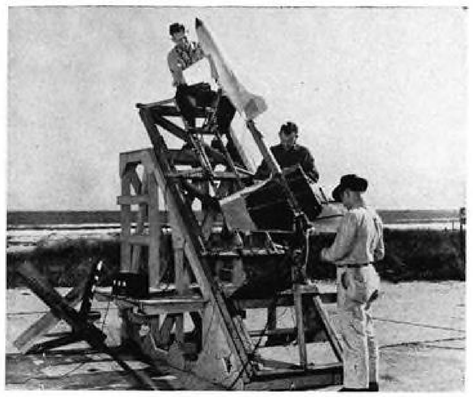

Wide variety of data recording and telemetering equipment carried in supersonic Bell X-1 (left). Craft was designed to carry approximately 500 lb. of research instrumentation. NACA research aircraft model (right) fitted with rocket booster, shown in preparation for launching, telemeters longitudinal and normal accelerations from which lift and drag data can be computed.

Report on Telemetering in Aero Research

New science, keyed to need for fast transmission of data, grows rapidly as basic tool in missile studies.

By Robert McLarren

The armed services of the U. S. have employed $8-10 million worth of special avionic equipment since V-J Day in their vast research programs on guided missiles and special piloted research aircraft.

Of this total, only about $2.5 million worth has been obtained by direct purchase from industry. Remainder has been fabricated on the spot because of the highly specialized characteristics desired of each particular piece of equipment. It is apparent that telemetering equipment will become an increasingly important factor in the aviation industry, provided various standard units can be devised applicable to a wide range of test conditions.

Here is a general summary of the field and an analysis of many of these conditions:

► **Research Instrumentation**—This is one of the pioneer avionic fields, dating back to World War I. Fundamental task this equipment performs is to provide a permanent record of the changes undergone by an aircraft in flight. Briefly, its purpose is to answer the question: "What happened?" regarding any function of the plane and its equipment. This question was usually answered by a test pilot, who made frequent entries during flight, in a log strapped to his knee. This method had obvious limitations.

One of the first instrumentations was a motion picture camera focused on the aircraft's instrument panel (or a duplicate panel mounted elsewhere in the airframe), which recorded changes in all readings with time throughout the flight. This method is still in use but, again, it has limitations—chiefly weight and complexity.

As pilotless aircraft became practical, instrumentation problems became acute. They were furthered rendered complex when pilotless aircraft and missile speeds and altitudes carried the equipment far beyond the range of accurate observation possible by either ground or air personnel.

► **Telemetering Mandatory**—It was to solve the basic problem of "measurements from a distance" that telemetering became a separate phase of the general avionic science.

There are two general situations in which telemetering systems are mandatory—when the aircraft is expendable, indicating that records made within the aircraft run the risk of destruction; and when data must be available instantaneously, such as to permit changes in the aircraft controls, power, etc. to prevent premature destruction. It is the first situation which characterizes instrumentation in pilotless aircraft and guided missiles, since in the great majority of cases they make only a single flight and are utterly destroyed on impact.

Many small pilotless aircraft are equipped with parachutes for a safe descent at the conclusion of the powered portion of the flight but such craft still run grave risks of destruction or loss through sinking in the ocean, coming down in inaccessible areas, malfunctioning of the parachute equipment, etc.

A typical telemetering problem, then, is one requiring the transmission of a variety of data in a very short space of time; certainty of safe, efficient operation; lightweight equipment; freedom from interruption due to violence of maneuver; freedom from atmospheric effects, such as temperature, moisture, low pressure, etc.; independence from high acceleration due to launching or maneuver; and freedom from vibration—all adding up to the ever-present demands of ruggedness, simplicity and dependability.

► **Telemeter's Job**—The telemeter must be able to measure an extremely wide variety of information quickly and accurately.

In a typical installation the following quantities are required for measurement and transmission: Aircraft attitude in roll, pitch and yaw; altitude and speed; movements of ailerons, rudders, elevators, flaps, spoilers, air brakes, etc.; acceleration of the aircraft in the longitudinal, lateral and vertical direc-

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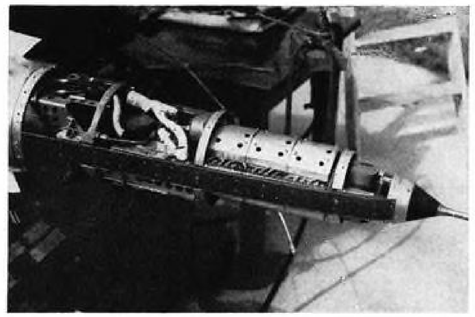


Eight channels of intelligence are held in this grouping (left) of airborne equipment mounted in closely restricted space of NACA 16-in. ramjet test vehicle. Exterior of telemeter housing serves as inner cone of diffusor. Carried aloft by F-82 (right), ramjet is released at 40,000 ft., data are transmitted to ground as vehicle attains speeds as high as Mach 2.4 during drop.

tions; structural loads on the aircraft components; air pressures about the aircraft wing, fuselage and empennage; control forces; atmospheric conditions such as temperature, humidity and pressure; operation of special equipment, such as homing devices, explosive charges; and powerplant conditions such as fuel-flow, exhaust pressures, and temperatures.

Because many of these quantities must be measured as often as 100 times per second, it is clear that the telemetering equipment often must provide readings as high as 2-3000 times per second. Each of these readings must be accurate, clearly distinguishable on the record and be arranged to permit comparison with a predetermined unit value.

Early types of telemeterng equipment used a single commutated channel with each value to be measured being determined by audio modulation frequency change, the change being made through variations in resistance values.

Although this method can accommodate a surprising number of values, an increase in the readings requires a decrease in time resolution so that additional readings are obtained at a cost of reduced accuracy.

When a large volume of information is required at high accuracy, a multichannel system is necessary.

▶ **Initial Screening**—First step in the design of a telemeter is the selection of the values to be measured. While this would appear fundamental, one of the common mistakes in early telemeter rigs was the use of all available sources of information on all tests, resulting in impairment of accuracy and the recording of much repetitive information of little or no value.

Only those types of information vital to the particular test projected should be selected. This permits a more careful selection of the range of values desired from each source and, therefore, greater accuracy.

▶ **Transducers**—Instruments used to supply the basic information for telemetering are standard aircraft instruments, such as airspeed, altimeter, gyro horizon, directional gyro, fuel pressure and similar indicators. Heart of the telemeter is the transducer, the device used to convert the mechanical energy of these instrument readings into electrical energy.

One of the simplest forms of transducer is a potentiometer, the instrument reading being used to vary the resistance and, therefore, generate a current. Strain gages can also be used to generate a current.

These systems are generally classified as generating transducers, which comprise a very broad family of methods. Included in this type are electron tubes and a wide range of piezoelectric, photoelectric, magnetic, thermoelectric and similar units.

A different approach to the problem is the modulating transducer, which uses a variable resistance, variable capacitance or variable inductance to modulate the carrier.

However, both types overlap to some degree, the generating transducer frequently being used as a modulator. With both types, the basic design problem is to create a unit that produces a usable output without the necessity for amplification. Many early transducers required considerable amplification that added weight, space and complexity to the system.

▶ **Calibration Factor**—It is vital to calibrate the various instruments with their respective transducers attached, since in many cases the transducer provides a slight drag on the instrument, impairing readings. A measurable drag can be transmitted to an instrument by a low-torque potentiometer, even though the latter has a torque measured in thousands of an ounce-inch.

A highly useful device for this purpose is a simple electromagnetic coil whose field is crossed by the field of a magnetic material. A widely-used material for this purpose is so-called "Mu metal," containing about 75 percent nickel, 4 percent copper and 1.5 percent chromium. This ferromagnetic alloy has an extremely high permeability (μ, from which it takes its name) and is used widely to reduce errors due to hysteresis.

Mu metal may be attached to the needle of an instrument, or mounted as a segment on a rotating shaft. Used in conjunction with a variable-reluctance transducer, in which the reluctance of a frequency-controlling inductance is varied with a motion, this arrangement has proved highly effective. The frequency-controlling inductance often is simply the tank coil of an audio oscillator, whose frequency is then varied by the position of the metal segment.

An effective tachometer can also be produced by placing a segment of Mu metal on the shaft, adjacent to which an E-coil is mounted. The frequency of the oscillator is varied over the desired range by a change of only a few thousandths of an inch in the transducer air gap. Such arrangements have proved highly satisfactory as transducers for accelerometers, airspeed indicators, altimeters, pressure gages or any position or displacement meter.

▶ **Response**—One of the critical design problems in all forms of avionic equipment is frequency response and this is true, of course, for telemetering equipment. Most end instruments in a telemetering set-up use mechanical motion in some form or other for their readings and this involves friction, inertia, damping and other losses in response time.

Sensitivity actually varies inversely as the square of the frequency, that is, a highly sensitive system is sluggish whereas a less-sensitive system usually has more rapid response. Therefore, there is no straight-forward solution to the problem of high-sensitivity, fast-response systems, since they are, in many respects, mutually exclusive. Tem-

perature-measuring instruments, for example, have notoriously slow response times. A flux-cutting coil is another example, for it requires time to establish clearly its initial and final conditions.

The transducer must, of course, have response times of equal magnitude to that of the end instrument to which it is attached. It is in this respect that variable-reluctance type transducers are vastly superior to potentiometer types, because of the former's fast response time. Progress in the transmission and reception phase of telemetering has far outstripped aircraft equipment in this respect and it is not unusual to see rigs employed in which highly-developed communication equipment is used with a potentiometer-type transducer which cannot give an intelligible response during rapid changes of quanitity.

► **Frequencies**—Telemeter transmission has previously used frequencies under 100mc., since the work is usually accomplished at remote testing stations near which there is no intereference.

Rapid expansion of commercial television, however, is causing a move to the ultra-high and, in some cases, the super-high frequencies. Considerable work is now being done in the 216-224 mc. band and some experimental work in the 2200-2300mc. range. However, operation in the shf bands involves so many difficulties as to render it impractical for routine test work.

► **Stability Problem**—As the foregoing would imply, conventional telemeter systems use frequency modulation transmission and reception. Either the carrier itself can be frequency modulated alone, or both the carrier and its subcarriers frequency modulated. In this system synchronizing circuits are not necessary, since discrimination between channels is a function of the subcarriers. FM telemeters are quite simple, use few parts, are lightweight, small in size and have a comparatively low power requirement.

The principal problem with this system is stability of the subcarrier oscillators. Since in a single, high-speed flight the test vehicle may pass through a considerable range of temperature, humidity, etc., this constitutes a substantial problem. Its importance is clear from the fact that a frequency drift appears on the record as a change in the quantity being measured and, obviously, has serious consequences.

One successful method of solving this problem is incorporation of a switching system in the receiver, which turns off the information being received for a few hundredths of a second. A frequency drift of the subcarrier is then apparent by a displacement of the recorded trace. This can then be accommodated by suitable correction factors in interpretation of the data.

Slender, needle-nose "spear," under test by Northrop Aircraft, is crowded with instruments to give instant telemetered readings of airspeed, yaw, angle of attack, temperature.

Subcarrier oscillators must have very low harmonic output, since higher harmonics create cross talk from the other subcarriers. Second harmonics are handled simply by selecting limit frequencies in each band whose second harmonics fall outside the range of the other channels. A low frequency deviation is required, usually less than ±10 percent.

The wave-form requirements of the modulated subcarrier are less exacting with this low deviation permitting a corresponding reduction in the pass band and in the modulating frequency of the data being sent. The receiver filters, used to separate the modulated subcarriers, are also limited to this low deviation either side of the center frequencies.

► **Displace Trace**—There is a variety of ways in which additional end instruments may be hooked in to a telemeter system. Additional subcarriers simply reduce the amount of power per channel, so that this method is satisfactory for highly local work only. Generally, the number of subcarriers is held to a minimum.

One suitable method for providing additional information is to use an incremental shift in the frequency of a subcarrier. For example, a single function (such as arming of the warhead, deflection of air brakes, and similar "one shot" actions on which information is required only once during a flight) may be made to displace the trace of a continuous function on the recorded data.

Since the continuous function may be indicated by a sinusoidal trace, a shift in its amplitude or trace position will not interfere with its frequency. In this manner the exact time of occurrence of a second function can be registered by the trace of the first without any effect on the first.

► **Part-Cycle Recording**—Another widely used system of "multiplexing" is time division of the subcarrier intelligence. In this system, a simple motor-driven switch is used to permit one function to be recorded for part of a cycle while a second function is recorded for the remainder of the cycle. This is actually only a refinement of the old commutator method. Usually, the cycle is divided into a long and a short interval, instead of exactly in half, so that the trace makes clear which of the two functions is being recorded.

It is obvious that this system of multiplexing is useful only for those functions which are not highly time dependent. As many as four end instruments may be used on a single subcarrier in this manner.

A variety of arrangements can be used in such a system. The switch can be located between the end instrument and the oscillator, such that two end instruments use a single oscillator. Another arrangement is to provide each end instrument with its own oscillator but place two oscillators on a single channel. Such multiplexing methods require careful discrimination in dwelling time and spacing on the trace.

► **Pulse-Position Modulation**—A second type of telemeter transmission is pulse-position modulation, which shows ex-

cellent promise for missile work because of its capacity to handle a theoretically infinite number of channels.

The pulses are of one-half to two microseconds duration and of high amplitude. Thus, the very long intervals between pulses can be used to provide additional pulses. During a given interval, each channel is sampled once and transmits a pulse created by modulation.

The amount of advancement or retardation of the pulse from its static position is determined by the amplitude and polarity of the input voltage at the instant the sample is taken.

Index to the large number of readings available from the pulse-position modulation system can be obtained by assuming that each channel occupies 10 deg. Since a synchronizing system must be used, a total of 35 channels (plus the synch) can be accommodated. If we assume a one-half microsecond pulse time and a sampling time of 10 microseconds, then the total samplings per second (including the synch) is 1/0.000360 or 2777.

Correct functioning of pulse-position modulation telemeters depends largely upon the accuracy of their timing circuits.

Phase doubling is, of course, used to give eight phase displacements from an original four, for example. The eighth channel is used for synchronizing pulses, leaving seven channels for intelligence transmission.

In this system it is necessary to introduce reference level markers to permit interpretation of the data. This requirement is eliminated in a slightly more complex system which separates transducer output from its oscillator output and uses them separately.

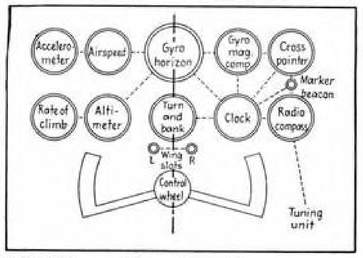
The transducer output is used to vary the time interval between the marker pulse and each channel at an audio rate.

Oscillator frequency output is used to modulate a channel whose pulse output is transmitted, received and demodulated to give the original transducer signal.

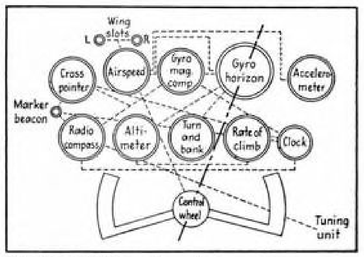
▶ **Accuracy**—Ground equipment consists of FM receivers, subcarrier filter equipment, audio discriminators and multichannel recording oscillographs. The latter include timing marks, control signals, etc., to establish reference positions for the data recorded.

In general, accuracies of the order of 0.5 to 3 percent are generally available with telemetered data, the accuracy depending upon the quantity being measured (for example, the former being common for flow rates, the latter for pressures).

Greater accuracy is easily obtained by more elaborate end instruments and transducers, but their added cost is usually not justified.



SIMPLE panel layout would replace . . .



CLUTTERED pattern in current use.

Easy-Reading Panel Plan Offered

Interim arrangement suggested to provide functional grouping for minimizing eye travel, mental confusion.

A new instrument panel arrangement, feasible for immediate adaption, and designed to fit the psychological and mechanical needs of the pilot, has been offered by a West Coast aircraft consultant to replace "outmoded" military types now in use.

The designer, Ralph H. Miner, engineer-pilot and AF reserve captain, is aware that "splendid results have been achieved" through an extensive instrument panel research program still being conducted by the military. But none of the new proposals resulting from this program can become effective immediately, since they call for several instruments, such as the Sperry Zero Reader, which are not yet in quantity production. Miner offers his panel (left sketch) as an advanced, interim design to fill this gap. All instruments in his layout are in common use today.

He states his arrangement is based on conclusive psychological research data with instruments "correlated to represent all flight conditions in optimum relationship to the pilots inherent response tendencies." Opinions of many other pilots and engineers are expressed in the design, he claims.

All instruments are placed in functional groupings and in order of importance to reduce eye travel and overlapping mental patterns (dotted lines).

To maintain the pilot's "basic concept of equilibrium" and because it is the "most constantly referred-to focus instrument, the gyro horizon is spotlighted in the position of greatest prominence on the panel centerline. The turn-and-bank indicator is located just below to preserve the equilibrium reference and furnish an immediate indication of gyro malfunction.

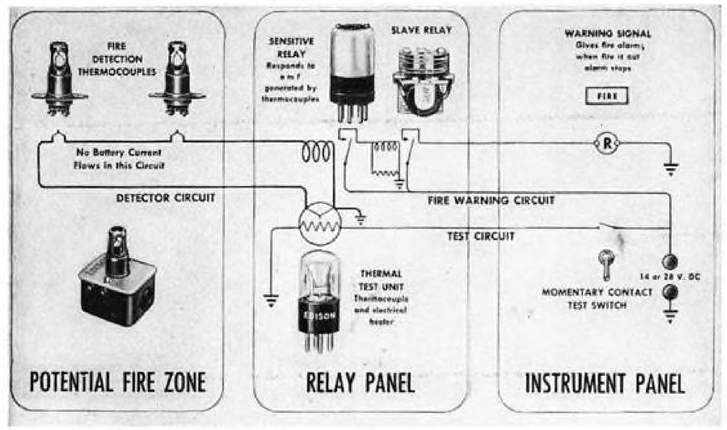
Next in importance are direction, airspeed and altitude indicators, grouped around the centerline, offering "direct individual integration" with gyro horizon and lending "positive definition to equilibrium."

The cross-pointer, marker beacon, radio compass, clock and gyro magnetic compass are positioned in a quick-reference cluster, with the clock as the "hub" for planning any type of instrument problem, in the most important position. These instruments are placed on the right side to tie in with the radio aid indicator tuning units.

The accelerometer and rate-of-climb indicators are positioned at the extreme left side of the panel, since they are lowest in the order of importance—based on percentage of reference during a flight. But they still are placed next to their only operationally related instruments.

Miner adds that the panel should be free of all protuberances such as flanges, screw heads, buttons, clips, and that the projected horizontal and vertical centerlines of the individual instruments should coincide with one another. Finally, the panel should be painted a dull-finish, horizon gray as a suitable background for the instruments.

He compares his design with the black-background panel (right sketch) of a type currently used by the Air Force. He claims "researchers unanimously agree that black . . . is undesirable" because of the floating effect this color gives to individual instruments. He points out the "unbalanced" gyro horizon (on offset centerline) disturbs the pilot's equilibrium and that the instrument layout as shown reduces his efficiency and safety by creating severely overlapping mental patterns and excessive eye travel.



Circuit hookup of Edison fire detector.

Evaluation Report

New Edison Installation for Capital

Airline equipping all DC-4s with thermocouple fire detectors after tests prove them nearly fool-proof.

Capital Airlines engineering department has decided to equip the airline's fleet of 23 DC-4 planes with Edison aircraft fire detection systems in the critical area immediately surrounding each engine.

Decision is aimed directly at the bugaboo of every airline—time lost through mechanical delay. For analysis of Capital's mechanical delay record in recent months shows that over 10 percent of all such delays is attributed to false fire alarms indicated by fire detectors.

▶**44 Units**—The new Edison installation will require seven of the thermocouple detectors strung like a chain of Christmas tree lights around the cowl ring of each engine and four thermocouples on each engine baffle, or 44 units for each plane. Total cost of the initial purchase is approximately $18,000. But it is anticipated that the airline will quickly pay off the cost of the new installation in time saved.

Replacement of the Wilcolater fire detector previously used at these locations does not extend to other parts of the airplane, where Wilcolater and Fenwal detectors will continue to be used. Only in the more critical Zone 1, where engine vibration has caused most of the false alarms, is the Edison replacement program being carried out. Sixty Wilcolater detectors and three Fenwal detectors will continue in use in each plane.

▶**Service Test**—A service test of the Edison detector system on Capital's No. 419 for 700 hr. of normal flying, over about 2½ months, preceded the decision to purchase. No trouble was reported in that test period. Meanwhile, Capital also had the benefit of additional service experience with the installation of Edison detectors on two leased DC-4s which it has rented from Northeast Airlines. The Edison installations on these two Northeast planes are older, and are beginning to require maintenance. But during the time the Northeast planes have been in use there have been only two failure-to-test reports, and no false alarms.

Initial installation of the Edison detectors involves approximately 85 man-hours per plane, and will be accomplished in the 8000-hr. major overhauls that are now being performed on the airline's DC-4s, and on the next 1000-hr. overhauls of planes which have already completed the 8000-hr. check.

▶**Temporary Installation**—In order to make the conversion as rapidly as possible, it has been decided to use specially-made adapter plates which will attach the Edison thermocouple unit to the mounting box, where the Wilcolater was attached to the cowl ring. This will make it possible for the Edison to use the wiring of the Wilcolater. This installation will be only temporary until the time of the next engine overhaul, when the system is completely dismantled anyhow. At that time the Wilcolater boxes will be eliminated, and the conventional open wiring system to the Edison detectors will replace it.

Capital expects to get additional Edison detector systems on Zone 1 of its new Super DC-3s when those are received next spring and summer.

▶**False Alarms**—Capital engineers expect the operating principle of the Edison will make the system virtually fool-proof against false alarms which have been such a headache previously.

Here's how it works:

Each detector unit produces an electric current when it is subject to a heat rise to 450 deg. F. or more. When the current reaches a sufficient strength (.004 amps.) it actuates a sensitive relay in the control box, shock-mounted on the radio rack in the pilot's compartment. The sensitive relay itself is connected with a more powerful slave relay which actuates the flasher unit alarm in the cockpit.

▶**Four Circuits**—Control box has four circuits, one for each engine, and four additional test thermocouple units. Current from the detector units has to go through these thermocouples also before the relays are actuated. The four thermocouples in the control box are mounted in glass sealed bulbs, and each unit includes in addition to the thermocouple a heater unit. Heater units are connected in parallel and are energized simultaneously by a test switch on the control panel.

As part of check test procedure, the pilot holds the test switch on for a maximum of 15 sec. This fires the heater units, creating increased temperature sufficient to develop current enough to actuate in turn the four sensitive relays, the four slave relays, and the four detector lights for the four engines. Since current developed must travel along the string of detectors and complete its circuit, any defect along the circuit would cause a failure-to-test.

▶**Less Vibration**—However, the provision of the test thermocouples in the control box effectively prevents a false alarm from one of the thermocouples in Zone 1, due to grounding the circuit. And the installation of the control for the system, away from the vibration conditions in Zone 1, makes for more trouble-free operation. Earlier trouble reports on the Wilcolaters in Zone 1 were traced and attributed to three principal causes:

• **Dirt and foreign matter** such as oil and water from the engine. Detectors later were sealed against this, but trouble

reports continued to be received.

- **Deformity** due to heat.
- **Vibration.**

The Wilcolater system operates the alarm signal if there is a ground at any place on the circuit, and it was this which led to most of the false alarms from the Zone 1 installations. However, the Capital engineers point out that the Wilcolater system is working well in other parts of the plane, and they expect to continue to use it.

The Edison thermocouples, unlike detectors of most other systems, have no contact points which can be fouled up by oil, dirt or corrosion, or which can be shaken together into contact by vibration.

Capital's new installation includes Edison relay control panel Type 117-64 and detector units of Type 35534-3.

For Servo Problems

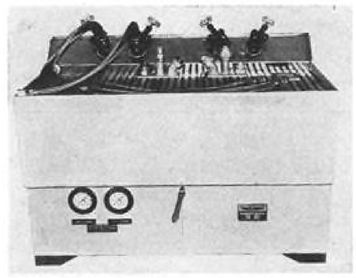
Servoscope, device for analyzing, testing and synthesizing servomechanisms, regulators or automatic control systems, by plotting phase and amplitude responses with respect to various signal frequencies generated by instrument, is made by **Servo Corp. of America,** New Hyde Park, N. Y.

Instrument accepts any carrier from 50 to 800 cps. without adjustment, modulates selected carrier with any envelope from .1 to 20 cps.

For measuring d.c. servomechanisms, either sinusoids or square waves are available between .1 to 20 cps. Thus, device becomes a sub-audio generator, useful for factory or lab testing of low-frequency cutoff and for aerodynamic studies.

Y-axis of oscilloscope used in conjunction with device may be switched conveniently back and forth between input and output phase of servomechanism under test. X-axis may be switched between electronic sweep output of Servoscope and unmodulated reference signal. In effect, this permits selection of either lateral or rotating pattern shift phase reading, accuracy 1 deg.

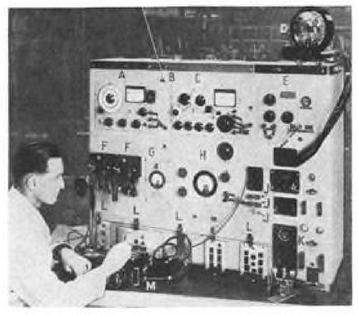
Unit operates on 115v. 60c. power.



Cleans Oil Coolers

Model 803-A oil cooler cleaner, offered by **Pacific Airmotive Corp.,** 2940 N. Hollywood Way, Burbank, Calif., is designed to circulate Turco Surjax, chemical compound specifically developed for safe and thorough removal of particular types of soil found in aircraft oil temperature regulators.

Equipment is powered by 2-hp. motor, driving 20-gpm. pump which provides pressures up to 80 psi. Also included is manually-operated, four-way valve which permits reversible flow of cleaning fluid. Special strainers are provided at the inlet and outlet valves from the coolers. Instrumentation includes 20-100 psi. gage to indicate pump and filter pressures.



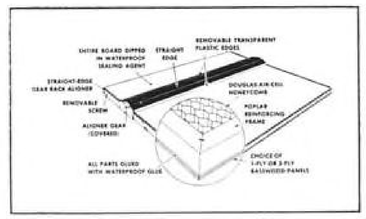
Radio Tester

To speed up and simplify aircraft radio testing, **Marconi's Wireless Telegraph Co. Ltd.,** Chelmsford, Essex, England, has developed Type OA.216 radio equipment tester.

Equipment is contained in steel cabinet measuring 4 x 3 x 1½ ft., and inclues beat frequency oscillator, output power meter, artificial aerials and special direction finder test set. At base of tester is row of standard back-plates corresponding to those on radio racks in aircraft. This feature enables radios to be removed from plane and quickly plugged into tester for checking under same circuit conditions existing in craft. Two boxes comprising plug-in sockets, volume control and switching arrangement are provided, but can be removed to permit installation of similar aircraft units for testing.

Lettered sections indicated on tester are: (A) Audio tester-beat frequency oscillator, (B) external aerial terminal, (C) signal generator, (D) loop aerial, (E) direction finder test set, (F) pilot's and operator's mixing box, (G) artificial aerial for transmitters, (H) output power meter, (J) artificial aerials for receivers, (K) voltage regulator, (L) instrument back plates, and (M) receiver under test.

Although tester has been specifically designed for Marconi Type AD.97/108/7092 radio equipment, it can be adapted for testing other types.



Drawing Board

Featherweight drawing board, offered by **Cal-Pan Corp.,** 1111 S. Fremont Ave., Alhambra, Calif., features Douglas Aircraft Co. Inc.'s honeycomb or air-cell construction and is stated to weigh only ⅓ as much as conventional boards.

To afford strength and resistance to warping, product has plywood surfaces bonded to framework and honeycomb, with wood grain running in different directions, and is available in sizes from 12 x 17 in. to 31 x 42 in. Straight edge and gear rack aligner are optional.

Picks Up Waste

All-purpose, heavy-duty sweepers, series 800, announced by **Willshire Power Sweeper Co.,** 4615 Alger St., Los Angeles 26, Calif., are designed for outdoor and indoor maintenance at factories and airports.

Stated to reduce cleaning and maintenance costs up to 75 percent, sweepers pick up sand, dust, nails, bolts, welding rod butts, paper, pop bottles, leaves and other debris. Machines have snowplow attachment and special guide wheels permit sweeping close to walls and machinery without marring or scraping.

Coming in two models, 36-in. sweeper is powered by 5-hp., 4-cycle, aircooled engine, while 48-in. size has 8-hp. engine. Units are built of heavy steel plate and equipped with "finger-tip" dual controls.

Comparative Air, Surface Fares*

		Rail Coach (New)	Air Coach	Rail First Class (New) Fare	Pullman	Total	First Class Air	(Per Person) Two On Family Plan
Washington–Chicago	OW	$25.91	$24.30	$34.50	$7.20	$41.70	$36.80	$27.60
	RT	$39.40	$48.60	$62.10	$14.40	$76.50	$70.00	$55.20
New York–Chicago	OW	$30.71	$29.60	$40.89	$7.75	$48.64	$44.10	$33.10
	RT	$46.75	$59.20	$73.60	$15.50	$89.10	$83.80	$66.20
Washington–Pittsburgh	OW	$10.05	$7.50	$13.34	$3.50	$16.84	$12.10	$9.10
	RT	$17.20	$15.00	$25.90	$7.00	$32.90	$23.00	$18.20

All the above exclusive of Federal tax. *OW (One Way); RT (Round Trip).* **Capital Airlines Figures.*

Airlines Helped by Rail Rate Rise

Some aircoach tariffs now below rail fare, giving air carriers better chance to capture more of travel market.

By Charles Adams

Domestic airlines may soon capture the bulk of first-class inter-city passenger traffic as a result of steadily-increasing railroad fares.

The railroads, which handled about 90 percent of the first-class common carrier passenger business via Pullman and parlor car as late as 1945, are expected to retain less than 60 percent of the traffic this year. Next year, the airlines hope to have very close to half of the first-class travel market.

▶ **Rate Decision**—Prospects for a continual decline in rail passenger business have been heightened by the Interstate Commerce Commission's recent decision granting 61 eastern railroads a 12.5 percent fare boost. This increase, the third since the war, brought basic rail coach fares east of the Mississippi and north of the Ohio and Potomac rivers to 3.375 cents a mile and parlor and sleeping car rates to 4.5 cents a mile (plus Pullman charges).

ICC was sharply split on granting the new fare hike. Of ten ICC commissioners voting, six favored the increase and four were opposed. The dissenters noted that the latest rate rise will put rail coach fares almost twice as high as bus fares and slightly above the air coach level between many points.

The time has come for the railroads to experiment with lower rather than higher fares, the dissenting commissioners declared.

▶ **Doubtful Benefit**—Some railroad executives are uncertain whether the new rate increase will boost revenues nearly $38 million annually, as has been estimated, or actually result in a revenue loss through accentuation of the post-war decline in their passenger business.

Whereas airline passenger traffic was up 15 percent in the first nine months of 1949, both first-class and coach rail passenger business was off sharply.

Airline penetration of the total first-class travel market increased from 11 percent in 1945 to 34.5 percent in 1948 and to over 40 percent in 1949. Total revenue passenger miles flown by the airlines soared from 1.4 billion in 1941 to 3.3 billion in 1945, 5.8 billion in 1948 and an estimated 6.5 billion this year.

By contrast, first-class rail inter-city passenger mileage rose from 9.2 billion in 1941 to 26.9 billion in 1945, and has since fallen to 11 billion in 1948 and an estimated 9.2 billion in 1949. Rail coach traffic jumped from 16.1 billion revenue passenger miles in 1941 to 59.4 billion in 1945, but then slid to 24.5 billion in 1948 and to an estimated 23 billion this year.

With a minimum of publicity, some crack train schedules have been canceled or consolidated with other trips as a result of falling patronage. Plans for buying new luxury passenger equipment have also been shelved by some railroads.

Bus travel went from 13.6 billion revenue passenger miles in 1941 to 26.9 billion in 1945 and has since fallen to about 23 billion.

Private automobiles have proved the greatest challenge to airlines, busses and railroads alike in the passenger field. In 1941, the common carriers handled only about 13.2 percent of all inter-city travel, with automobiles carrying the rest. During 1944, when wartime gas-rationing was in effect, the common carriers took care of 44 percent of the total passenger business, but this percentage dropped to 26.2 percent in 1946, 20.3 percent in 1947, 18 percent in 1948 and possibly only 15 or 16 percent this year.

▶ **Rates Compared**—Latest fare increase puts eastern rail rates about 44 percent above the level of June, 1946. Airline fare hikes have been much smaller.

Since 1941, airline fares (based on receipts per passenger mile) have risen from 5.01 cents to an estimated 5.8 cents this year—an increase of 15.7 percent. Bus fares have risen about 20 percent since 1941.

Under the new rates, one-way rail Pullman fare (with lower berth) from New York to Chicago will be $48.64 against $44.10 for regular airline flights. Rail coach tickets between the same two points will be $30.71 compared to $29.60 by air coach. Bus fare is $17.60.

▶ **TWA View**—Commenting on the rail fare raise, John H. Clemson, TWA general traffic manager, declared that "present transportation economics seem to be favoring the airplane as a low-cost carrier, with an added time-saving premium." TWA now operates New York-Chicago air coach service at a $29.60 fare.

Smaller trunk carriers, especially Capital Airlines, should also benefit from the higher rail fares. All American Airways, which operates entirely within the area of higher rail tariffs, hopes for improvement in its feeder traffic.

▶ **UAL Sees Gain**—United Air Lines President W. A. Patterson estimates that the scheduled domestic airlines will handle 46.5 percent of all first-class domestic travel in 1950, compared with 43.5 percent in 1949, even though the overall market probably will continue to decline. He said UAL's passenger business for all of 1949 will be up about 11 percent over 1948.

Patterson previously noted that whereas his company's costs have increased 86 percent since 1939, fares have risen very slightly. American Airlines said that if air fares had gone up in direct relation to costs since 1939, the average rate per passenger mile would be around 11 cents (instead of 5.8 cents).

Inter-city Passenger Traffic Volume

(BILLIONS OF REVENUE PASSENGER MILES)

Year	Air	1st Class Rail	Rail Coach	Bus	Auto
1941	1.4	9.2	16.1	13.6	264.3
1945	3.3	26.9	59.4	26.9	179.8
1946	5.9	19.8	39.0	25.6	253.6
1947	6.0	12.3	27.7	23.4	274.0
1948	5.8	11.0	24.5	23.0	293.2
1949* ...	6.5	9.2	23.0	23.0	301.4

* *Estimated*

(Air Transport Assn. figures)

Boots Rail Boost

Sen. Edwin Johnson (D., Colo.), chairman of the Senate Interstate and Foreign Commerce Committee, has strongly endorsed the stand of ICC Chairman Charles Mahaffie and three other commissioners who opposed further railroad passenger fare increases.

Johnson, whose committee is studying air and water, as well as rail transportation problems, termed the tariff boost "a horrible mistake." He said every time the carriers raise rates, revenues go down.

Commenting on speculation that the government might be asked to extend direct subsidies to the railroads, Johnson told AVIATION WEEK that such a move would have no chance of succeeding.

Report on Foreign Jet Transports

American's William Littlewood sees little prospect at this time of jets replacing Convairs on short hauls.

Only three of the many foreign turboprop and turbojet transport prototypes now under development offer immediately serious threats to U. S. commercial aviation prestige. This is the opinion of William Littlewood, American Airlines' vice president in charge of engineering.

▶ **Lists Best**—Reporting to the AA board of directors following his recent inspection trip to England, Littlewood named Great Britain's turboprop Vickers Viscount and turbojet de Havilland Comet and Canada's Avro C-102 Jetliner turbojet transport as the best in the foreign field. He said the fact that the U. S. has not seen fit to "freeze" its developments into a prototype aircraft reflects no discredit on this country—provided we don't wait too long.

▶ **Compares Costs**—Littlewood estimated that the direct operating cost of turbine-powered aircraft in medium-to-long-haul domestic service will be 25 to 35 percent higher per capacity seat-mile than presently operated transports. "And while indirect operating costs may not differ substantially from those now incurred, turbine-powered airplanes (with their higher price tag and large fuel consumption) cannot, in the immediate future, compete with present transports at the same passenger fare level."

The AA executive suggested that a small-scale operation of turbine-powered medium-to-long-haul transports may be feasible if extra fare is charged. He saw little prospect that turbine-powered aircraft would replace American's Convair-Liners on short-haul flights for some time to come "because the large proportion of operating time spent in maneuvering at low altitude would make use of turbine engines prohibitively costly."

▶ **Traffic Control**—According to Littlewood, air navigation and traffic control problems which only today are being worked out for conventional aircraft would be aggravated by faster, turbine-engined planes. "They cannot economically submit to traffic delays as they exist today. A jet-engined transport equivalent to the DC-6 would burn four times as much fuel per hour in a holding stack as does the DC-6.

"Thus substantial practical operation of turbine-engined planes must await introduction throughout the country of a new system of air traffic control precluding long traffic holds."

▶ **Major Problems**—To build a turbojet transport having about the same payload and range of the DC-6, but substantially higher speed, for extra-fare, luxury service, four major problems must be overcome, Littlewood declared.

• Development of commercially reliable turbine engines must be completed. "This may take three years of serious work with whole-hearted cooperation among engine and aircraft manufacturers, the airlines and the military agency presently sponsoring the engine selected for development. The engine work should be completed a year before the first production plane is flight tested."

• The aircraft itself must be developed so as to ensure that all necessary requirements are considered and that the final plane will be the best and most useful that can be built.

• An advance determination must be made on how the plane is to be operated—fuel reserves, navigation, traffic control, landing and takeoff standards.

• Fourth major problem is financing the entire project. "Cost of developing such a plane up to the point of production has been estimated at $20 million," Littlewood declared.

▶ **Federal Aid**—"Unless at least 100 planes are built, some form of government assistance will be necessary. It is essential that this government support—if given—be given freely in the interest of the airlines, and the contribution to national defense and no too-detailed nor restrictive governmental supervision of the program be required in return."

UAL Recommended For Hawaii Route

United Air Lines has been recommended for a new route between the West Coast and Hawaii.

In his report on the reopened Hawaiian route case, Civil Aeronautics Board Examiner Ralph Wiser has urged that Los Angeles be made a co-terminal with San Francisco on UAL's present service to Honolulu. He said that applications of Matson Navigation Co. and Pacific Overseas Airlines for Los Angeles-Hawaii links should be denied.

▶ **Split Decision**—United was certificated for the San Francisco-Honolulu run in competition with Pan American Airways in CAB's original Hawaiian route case decision of May, 1946. At that time, CAB was split on which carrier should compete with PAA between Los Angeles and Hawaii—two Board members favoring United and two favoring Hawaiian Airlines.

After examining the carrier's financial status and prospects for getting additional backing, Wiser found that Pacific Overseas Airlines is not "fit, willing and able" to conduct its proposed coach-type service between Los Angeles and Honolulu. In recommending against Matson, which operates surface vessels between the West Coast and Hawaii, Wiser noted that the carrier rested its case on evidence introduced in CAB's original hearing in 1944.

Matson's counsel said the company would not present new material because it had reached the conclusion that CAB would not grant a certificate to a steamship company no matter what the evidence showed.

First Star Routes

Post Office Department's proposal to grant contracts for air star mail routes between Charlevoix, Mich., and St. James, Mich., and between Honolulu and Kalaupapa, Molokai, T. H., has been approved by the Civil Aeronautics Board, which said the service will not interfere with certificated air transportation.

Slick's Garment Business Pays Off

Heavy Dallas-New York fashion traffic is one reason newly-certificated freight airline is currently in the black.

Slick Airways definitely has the ayes of Texas—especially its garment industry. Eastbound traffic from Dallas, which boasts an annual $67 million women's garment business, is one big reason the all-freight airline has been operating in the black since being certificated by the Civil Aeronautics Board three months ago.

Garment shipments from New York have always been big business for air-freighters (AVIATION WEEK, Nov. 7). One carrier has been transporting about 1 million dresses a month to the Southwest and West Coast. But manufacturers in those parts of the country have always found it tough to crack the New York market. Usual reason was that delivery took too long. Too, packing was expensive, and the retailer usually had to have the garments unpacked and pressed before they could be sold.

▶ **"Garment Airlift"**—So Slick, cooperating with the Texas manufacturers, is now running a "garment airlift," without which, says a Dallas fashion association, "we wouldn't be able to enter the New York and western markets." Using a specially devised garment bag, which eliminates packing and pressing-on-arrival, Slick offers overnight delivery from manufacturer to retailer—a combined service which competing forms of transportation find it hard to match.

Actual demonstration of this service was recently held at Newark Airport, where the Dallas Fashion Center held an advance showing of dresses for New York retailers. Models donned the garments as they were taken from the Slick bag, showing that no pressing was needed.

▶ **Good Business**—Sponsor of the demonstration was the New York Board of Trade, which indicated its hearty support of air freight. M. D. Griffith, general manager of the Board, said "we want to demonstrate that trade is a two-way business . . . The garments you see are made from textiles sold in New York and flown to Texas. In order to sell to Dallas we must also buy from Dallas. Earl Slick is making it easier for us to buy from Dallas, and that's good for New York business, as well as Dallas business."

In addition to Dallas, Slick serves 19 other cities on a schedule basis and 21 cities on a demand basis. Its certificate covers 14 additional cities, all of which are expected to be activated shortly.

Slick's ground crews at Newark, focal point for eastern seaboard traffic, have been showing some of the speedy handling of cargo which appeals to air shippers. While the average time to load 10,000 lb. into a C-46 is one hour, a six-man crew on occasion has unloaded 10,000 lb. and put on 11,000 lb. in 25 min. Production-line methods at the terminal also help to cut time in unloading from truck, sorting, and loading on aircraft. Perishables, such as foodstuffs, drugs and refrigerated commodities, are loaded into the C-46's belly compartment, which has a 1750-lb. capacity.

▶ **Flowers From Coast**—While Slick has been building up a steady Texas-New York-and-return business, it has not neglected the transcontinental market. Garments again are a big source of revenue, but the West Coast's flower industry is proving to be an enthusiastic air freight user and supporter.

Up until air freight, western flower growers could not expect their market to stretch past the Midwest because of the perishable nature of their commodity. Now, they say, using air freight to reach the eastern market has almost doubled business. Although Slick is handling a large volume of flower business, Flying Tiger Line did much of the pioneering in selling air freight to flower merchants.

Because of its comparatively good financial picture—the carrier turned the profit corner last summer—Slick has refused proposals from several scheduled lines which offered to buy out the freight carrier.

Earl Slick emphatically denied reports that he is seeking to dispose of Slick Airways. As a matter of act, the company, which flew 6,539,230 ton miles in the three months ended Oct. 31, has announced plans to buy six more C-46s.

By agreement with Pan American Airways, Scandanavian Airlines System, and Air France, Slick acts as a domestic carrier for the international airlines, picking up and delivering freight at the borders of the U. S.

Currently, the carrier has 975 employes, 105 of whom are pilots.

Italian Line Gets Grant From ECA

Economic Cooperation Administration procurement authorizations to foreign countries for commercial aircraft, engines, parts and equipment climbed well above the $60 million mark with a recent $4.5 million allotment to Linee Aeree Italiana.

The Italian carrier, which hopes to start regular service between Rome and New York early next year, asked for the money mainly for the purpose of financing the purchase of three four-engine U. S. aircraft.

LAI originally planned to buy DC-6s but may now acquire used Constellations because of their immediate availability.

Established in 1946, LAI is owned 40 percent by the Italian government, 40 percent by TWA and 20 percent by private Italian interests. It has been operating domestically in Italy since 1947 and now hopes to tap the heavy 1950 Holy Year travel between the U. S. and Rome.

The carrier has not yet asked the Civil Aeronautics Board for a U. S.-Rome foreign air carrier permit. However, CAB usually gives expeditious treatment to such requests when they are filed.

Through Sept. 30, ECA had made available about $60 million in aircraft procurement authorizations. The distribution (excluding the recent LAI grant) was: France $26.7 million; the Netherlands $27.8 million; Belgium $2.6 million; Italy $200,000; Greece $900,000; Denmark $800,000; Norway $900,000 and Ireland $100,000.

More Rules

CAB tightens its hold on nonskeds by checking secret tie-ups and ads.

Strict new federal regulations to prevent nonscheduled airlines from maintaining secret and illegal tie-ups for traffic generation purposes will become effective Dec. 10.

Citing a "substantial amount" of regular service and other unauthorized activity by large irregular carriers, the Civil Aeronautics Board said the unlawful operations frequently are conducted through ticket or travel agents. New curbs were originally proposed by CAB last April and are contained in amendments to Parts 291 and 292 of the Board's Economic Regulations.

► **Common Agreements**—According to CAB, the travel agent solicits business by representing to the public that he sells tickets by air between designated points on a regular or frequent basis. Several large irregular carriers, acting under common agreements with the ticket agencies, furnish transportation for groups of passengers assembled by the agencies.

This service, if conducted by the nonskeds individually, may meet the tests of irregularity, CAB conceded. "But collectively the operations in many instances have been both frequent and regular."

CAB said it has always considered such combined arrangements and operations a violation of the purpose and intent of the nonscheduled exemption. The Board declared that new and specific prohibitions against such activities are now being made for the purpose of clarification.

► **Ticket Rule**—As amended, the regulations will prohibit large nonskeds from carrying passengers to whom approved-type tickets have not been issued. Each ticket must contain the name and address of the carrier furnishing the service, name and address of the passenger, date of sale, date of flight, origin and destination points, and the fare actually paid.

To keep its letter of registration, an irregular carrier must reduce to writing all agreements pertaining to solicitation and generation of passenger traffic.

Payments to or from persons furnishing passengers must be made only on the basis of written bills or invoices containing specific information. Further, the nonskeds will be prohibited from entering into any arrangement or understanding with other air carriers if such an agreement would result in the holding out of transportation "which, if conducted by a single carrier, could take it out of the classification of an irregular carrier."

► **Board Warning**—Breach of any of these new conditions will constitute cause for revoking a nonsked's letter of registration and withdrawal of its operating authority, CAB warned.

In addition, nonskeds will be required to file with CAB specific information concerning services they conduct in cooperation with other irregular lines or with agencies handling arrangements for furnishing transportation by large irregular carriers. A copy of each advertisement, circular, pamphlet or other publicity material, and a copy of each announcement or notice issued by a large irregular carrier, must be submitted to CAB every three months along with the company's flight report.

Cargo Storage

Northwest Airlines will establish a chain of flexible refrigerated storage centers for perishable cargo at key points along its transcontinental system.

The refrigerated rooms, compartmentalized for storage at various temperatures as low as 12 degrees below zero, will each be capable of storing 6400 lb. of cargo at one time. They will have a 640 cubic foot minimum capacity.

SHORTLINES

► **Bonanza**—CAB has approved an agreement whereby TWA will transfer its operating rights between Phoenix, Ariz., and Las Vegas, Nev., to the feeder line. The Board, in awarding Bonanza a three-year certificate between Reno, Nev., and Phoenix last spring, said the franchise would not be issued until a satisfactory arrangement was made with TWA. Bonanza hopes to begin scheduled DC-3 service between Reno and Phoenix shortly.

► **CAB**—Member Harold A. Jones recently made a trip to Alaska to study the territory's air transportation needs and mail pay requirements of its certificated carriers.

► **Compania Mexicana de Aviacion**—First certificate authorizing a foreign repair agency to perform work on U. S. aircraft has been issued by the Civil Aeronautics Administration to CMA, a Pan American Airways affiliate based in Mexico City.

► **FAMA**—A CAB examiner has recommended that the Argentinean carrier be given a temporary foreign air carrier permit authorizing service between Buenos Aires and New York via Sao Paulo (or Rio de Janeiro), Belem, Trinidad, and Havana for six months.

► **Monarch**—Approval of a MAL-Arizona Airways merger has been recommended by CAB public counsel provided that Monarch activates all of Arizona's feeder route segments within six months after the deal gets final sanction from the Board. Public counsel also recommended that the merged company be given a connecting link between Gallup, N. Mex., and Winslow, Ariz. Monarch plans to acquire all of Arizona's outstanding capital stock.

► **National**—Has inaugurated scheduled daily cargo service between New York, Miami and Havana with C-46s. Flag stops will be made at Washington and other cities served by NAL to enplane 500 lb. or more of cargo.

► **Northeast**—Is trying to dispose of three DC-4s. Meanwhile, two of the ships have been leased to Capital Airlines for 60 days.

► **Northwest**—Has asked CAB permission to start coach service Dec. 1 between Portland, Seattle and Honolulu with 44-passenger DC-4s at a one-way fare of $120, compared with a regular rate of $160 via Stratocruiser equipment. Pan American Airways previously proposed a West Coast-Hawaii DC-4 coach operation starting at the same time. . . . Berths on NWA's new Stratocruiser flights to Honolulu are $25.

► **Pan American**—Has replaced its last DC-3 in Caribbean service with Convair equipment. Of 44 DC-3s PAA had on Latin American routes in 1945, only nine now remain—operating in Central America and Colombia where they can be used into small airports. None of the Latin American division's DC-3s was ever in an accident involving a passenger fatality, and they had carried about three million persons.

► **Pioneer**—Has proposed a special program of "air education flights." Starting Dec. 7 the company would carry groups of eight or more passengers between the ages of 8 and 19 years, including one adult leader or teacher, at fares of three cents a mile. Plan must be approved by CAB.

CAB SCHEDULE

Nov. 28—Hearing on transcontinental coach service. (Docket 3397 et al)

Dec. 5—Hearing in Western-Inland mail rate case. (Docket 2870)

Dec. 5—Oral argument in enforcement proceeding against Transocean Air Lines. (Docket 3244)

Dec. 6—Hearing on renewal of Trans-Texas Airways' feeder certificate. (Docket 3720)

Dec. 19—Hearing in Florida Airways mail rate case. (Docket 3695)

Jan. 4—Hearing in National Airlines route transfer case. (Docket 3500)

Jan. 9—Hearing in New York City area helicopter case. (Docket 946 et al)

Jan. 9—Hearing on air freight accumulation, asembly and distribution tariffs. (Docket 1705 et al)

Jan. 9—Hearing in Cuba-Florida foreign air carrier permit case. (Docket 3717 et al)

Jan. 16—Hearing on Nationwide Airlines' application for certificated routes in Michigan. (Docket 2832)

Feb. 6—Hearing in Colonial Airlines mail rate case. (Docket 2724)

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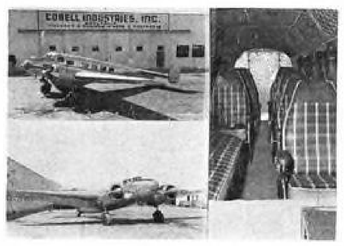

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PILOT WITH Airline Transport License, commercial, instrument, single-multi engine land ratings. 3500 hrs., seven years flying exp. with Navy and Airlines. Desires position as personal, executive or airline pilot, domestic or foreign. Age 28, single, free to travel, available now. PW-1491, Aviation Week.

AIRLINE TRANSPORT Pilot, 4800 hours, commercial pilot, single and multi engine land, instructor and instrument ratings. Ten years accident free flying as instructor, Army Pilot flying V.I.P. Personnel, Airline and Commercial Pilot. Desires position as personal or executive pilot. Any offer will be considered. Well educated, excellent references. PW-1503, Aviation Week.

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For Sale—35Z Bonanza
Serial D-2007—140 hours total Directional gyro —platinum spark plugs—all newest equipment —motorola aviagator with loop. Sacrifice quick sale $7985. FS-1525, Aviation Week.

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Cargo type aircraft, low airframe and engine times, 24-volt systems, P&W engines. Two airline type deluxe 21-passenger C-47 type airplanes. For further information, contact Harry C. Webb & Associates, Inc., Suite 707, Denrike Building, Washington, D. C.

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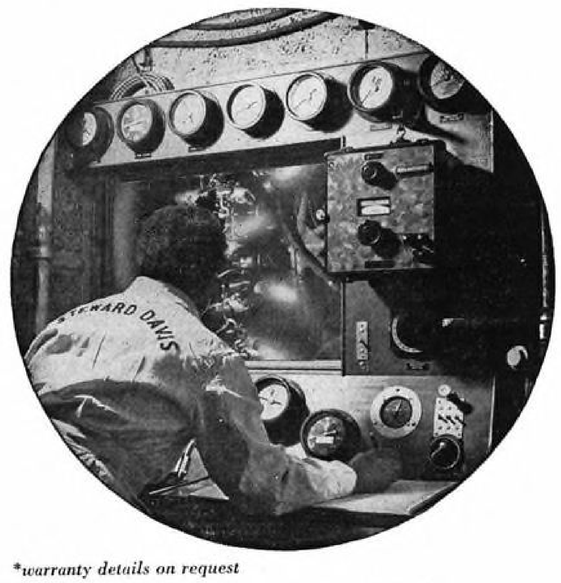

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STRICTLY PERSONAL

STRIKE STORY BY A SOCIETY EDITOR—Now that the Bell Aircraft strike is over we can release a "story" written about one of the riots by a local society page editor who saw the whole thing and was impressed enough to send her own version to her editor. It was forwarded to us by **George D. Ray**, chief of structures engineer, and goes like this:

"One of the most interesting soirees of the current autumnal season was held shortly after dawn Thursday at the Bell estate in the wooded fields and lanes just off the busy Niagara Falls Boulevard. The affair was highlighted by many impromptu meetings between deputy sheriffs wearing silver shields on their natty blue caps. Many waved wands garlanded with horse hair straps which they wore draped around their wrists.

"One of the outstanding matrons who was introduced to Mr. Arthur Muisiner during the morning was Mrs. Lavon Eagle, of the Edison St. Eagles. At the conclusion of the affair, Mr. Muisiner personally escorted the attractive guest to a Niagara County car. She later was introduced to County Judge John S. Marsh. Many of the guests were members of the Ladies' Auxiliary of the Bell union which is having a minor dispute with some of the company officials. Some of the Ladies' Auxiliary wore steel helmets while many carried ice-picks with which to make an impression.

"A noteworthy pair was Mr. and Mrs. Frank Yukowski, who arrived early and remained late at the soiree. He was attired in the fall garb of a workman which intrigued many of the spectators. She wore an overall dress of blue denim tastefully spotted with red paint and gray putty. A feature of her costume was her matron's staff of old English dock topped off with shiny spikes of steel.

"Cheerily chanting the refrain, 'sticks and stones can't break our bones,' a group of young ladies from Mr. Martin Gerber's New York School of the Ballet, gave a bonne touch to the frolic. Another popular chant was 'Which Side Are You On?', sung by Mr. Stanley Stypczynski, who explained he had to hurry off to court when urged to sing an encore."

* * *

HELP, HELP—This column, the sole concession this magazine makes to corn, exists entirely on contributions you readers send in. If you want better columns, please help. Send your whimsy to AVIATION WEEK, 330 West 42nd St., New York, N. Y. It's free; we charge you nothing.

* * *

CAL'S PACKAGED DIVORCE TOURS—Continental Air Lines' agile idea men in the publicity department come up with a "super-packaged one-day divorce tour" all for $200 from Denver. "With all attorney arrangements previously made with a prominent Juarez (Mexico) law firm through Continental's El Paso station manager, one leaves Denver at 7:45 a.m., arriving in El Paso at 1 p.m. He is whisked across the border via cab, and presto two hours later emerges at last like a butterfly from a cocoon—free. After proper celebration one boards the 5:20 p.m. flight back to Denver in comfort aboard the luxurious pressurized CAL Convair-Liner. Less than 16 hours." It's all quite legal, unless you ever want to go to New York State.

* * *

SUPER-COMMUTER—**Mrs. Marie Hall** of Long Beach, Cal., says **Husband Dick Hall**, first officer with Transocean Air Lines at Windsor Locks, Conn., is her nomination for champeen commuter. "He lives here but commutes to work in Windsor Locks." She says Dick has done this over a year and figures it's 2779 statute miles via the airway he uses, or 5458 miles to go to and from work. Who can beat it?

* * *

LET'S FLY TO THE RAIL FAIR—We liked an announcement Associated Aviation Underwriters' Chicago office mailed its customers nearby. **E. L. Stephenson**, Middle West manager, said it this way:

"There's a darn good show at the Railroad Fair on the Chicago lake front. The railroad's have spent $10,000,000 in honor of my great uncle George Stephenson who made the railroads possible by inventing the first locomotive. . . Why not fly in to see it and land at our lake front airport. . . There's nothing—except riding them—that builds confidence in the future like watching trains."

—R. H. W.

WHAT'S NEW

New Books

"General Kenney Reports," by George C. Kenney, a personal report based on the diary of the commanding general of the Allied Air Forces in the Southwest Pacific. It is stated that General Kenney also planned, designed and illustrated the book. Published by Duell, Sloan & Pearce, Inc. Price $4.50.

Technical Literature

"Brazing in Civil Aircraft," Airframe and Equipment engineering report No. 44, presents general data on brazing with emphasis on civil aircraft manufacture and repair. The report is intended as being a ready reference for manufacturers and repair stations. Available from Civil Aeronautics Administration, Publications Division, Aviation Information Office, Washington 25, D. C.

"Aeromagnetics in Exploration," and **"The Airborne Profile Recorder"** deal with new techniques used in survey or mineral and oil exploration services. Brochures are issued in form of file folders for containing additional follow-up bulletins. Write to Photographic Survey Corp., Ltd., Toronto, Canada.

"The Characteristics of Elastometers With Respect to Vibration in Aircraft" is an address by W. A. Keetch, senior product engineer, Lord Manufacturing Co., Erie, Pa., available free by writing the company.

Bulletin describing instruments for measuring and recording wind directions and velocities is available on request to W. & L. E. Gurley, Troy, N. Y.

"Method of Presentation of Data for Proposed Aircraft" has been revised by Air Transport Assn. of America. Report outlines standard methods of presenting aircraft data so that airlines will be facilitated in comparing airplanes. There have been revisions in the performance analysis and operational analysis section and the direct operating cost data. Operational analysis section, including direct operating cost data formulae, has been printed separately. Copies are available to company officials on request to engineering division of Air Transport Assn. of America, 1107 16th St., Washington 6, D. C.

"Wings for the Transit" is brochure explaining basic principles employed in producing aerial topographic maps. Obtainable from Lockwood, Kessler & Bartlett, Inc., 32 Court St., Brooklyn 2, N. Y.

ADVERTISERS INDEX

AVIATION WEEK
NOVEMBER 28, 1949

PROFESSIONAL SERVICES—
First issue of each month.

SEARCHLIGHT SECTION
(Classified Advertising)

EDITORIAL

Air Coaches & Foreign Policy

The air coach issue promises to stimulate as much controversy among trans-Atlantic carriers as it has among the major domestic airlines. But the implications of cheap international travel are greater.

Actually, of course, "coach" rates are inevitable on the main airways of the world. But the necessary and healthy open forum arguments of a democracy will be complicated, in the coming fight over mass air travel on international routes, by the added intricacies of conflicting foreign policies of the United States government and other countries.

Pan American Airways, which usually knows exactly what its long-term objectives are at any given moment, and is trying to reach them, has sought to force the North Atlantic air coach issue by proposing a one-way tourist fare of about $225 between New York and London for a six-month period. It was Pan American, also, which took the initiative a few years back in forcing trans-Atlantic fares down from a passenger rate which had been proposed by British Overseas Airways Corp., and adopted by the U. S. international carriers.

The Civil Aeronautics Board as usual is sitting unhappily and fully exposed to the crossfire of our own government in announcements of foreign policy, the governments of other nations, the International Air Transport Assn. and our own U. S. competitors of PAA. CAB has turned down PAA's latest proposal. The fighting will get hotter.

Our own Truman Administration must eventually, directly or inferentially, set forth our national policy on the subject for the CAB, and the record of this Administration to date presents no encouraging evidence that business efficiency and old-fashioned economics of a once rugged American individualism will primarily determine our international airways policies—at least, not without a lusty struggle on the part of U. S. business.

Despite the Administration's solicitude for our hard-pressed major European countries, most of whom are struggling to maintain their own subsidized airlines across the Atlantic, perhaps with our own taxpayers' money, it would appear that Pan American's main weapon in this campaign for lower trans-Atlantic passenger fares is to prove that such service would not add to its financial demands from the U. S. government.

If such service can be shown to be self-sustaining, at least, the American taxpayer could become exceedingly obnoxious in his queries.

If PAA, after a trial period of low-fare operation, could present cost and income figures that would be satisfying to the proper authorities, PAA would have a powerful answer to the loud expressions of doubt being heard about its "motives." And it would be able to offer another powerful argument to the Administration in encouraging mass tourist travel to a dollar-hungry Continent. Even with today's air fares there is evident an important travel trend from the steamship to the airplane on the Atlantic. Still lower air rates could start a record-breaking tourist crusade to the Old World.

The controversy, as it progresses, will also arouse again the suspicions of a few thoughtful aviation observers in this country who fear that the U. S.—by giving too great heed to other countries in the IATA and ICAO organizations—runs the risk of lowering our own technical and economic standards to the levels of others, rather than bringing our less fortunate neighbors up to our own proficiency.

This fight, although it may retard truly low-fare trans-Atlantic air travel for at least a year, will help clarify several vital differences of opinion within our own air transport industry, IATA and the CAB. But in the end, even in these early days of the American welfare state, we believe that the proponent who offers the soundest evidence for a business-like plan of least government subsidy will win out. The fireworks of the intervening battle will be something to watch. If Pan American sticks to its guns, and proves it can operate economically at lower fares, it and other low-fare, anti-subsidy spokesmen should win. Because on this basis, eventually, U. S. public opinion will demand that U. S. foreign policy be determined.

—ROBERT H. WOOD

Let's look at Beechcraft advantages BONANZA from the owner's viewpoint

You want speed . . .

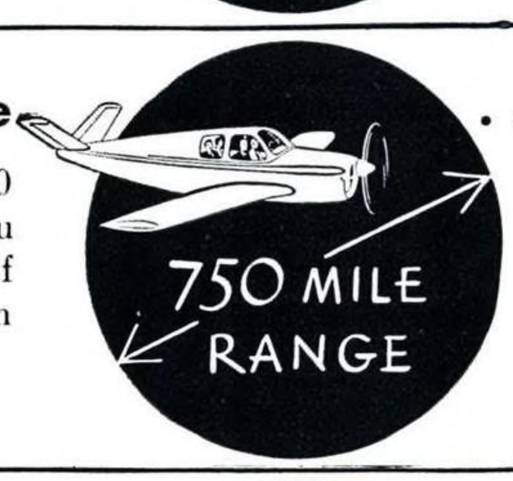
The Beechcraft Bonanza cruises at 170 miles per hour at 8,000 feet, using only 56% of engine's maximum rated take-off power. *No engine overload.* Top speed of 184 miles per hour at sea level. (Bonanza performance figures guaranteed.)

. . . but you want strength and ruggedness, too.

See how well the ship handles on short, rough fields. See that low, sturdy landing gear with wide tread and struts exclusively cross-braced. No pitching — because of nose gear position and long wheel base. Allows greater braking.

You want high performance

Your Beechcraft Bonanza has a range of 750 miles, a service ceiling of 17,100 feet. You get the extra speed with an extra margin of safety. Carries four people and more than 135 pounds of baggage.



. . . but you want economy, too.

Beechcraft Bonanza fuel consumption amounts to only 9½ gallons per hour at cruising speed. Because of lack of engine overload, there's less engine wear. Seat-mile cost reaches as low as 1¼ cents. Real savings!

You want safety . . .

Tough, sturdy framework gives you safety "plusses." Rated in *utility* category at *full gross weight*, with a limit flight load factor of 4.4 G's, the Beechcraft A35 Bonanza underwent radio controlled dive tests at 275 miles per hour, pulling out safely at 3 G's.

. . . but you want beauty and comfort, too.

Exclusive retractable step and limousine door let you enter and leave with ease; preserve feminine dignity! Room to spare for four in the handsome, *sound-proofed* cabin. Maximum 5-way visibility.

Add up all these features—and you have the reasons why the revolutionary Beechcraft Bonanza is a better buy. *See* it today! A note on your company letterhead will bring illustrated brochures describing the Beechcraft Bonanza's many *extra* advantages. Write to Beech Aircraft Corporation, Wichita, Kansas.

Compare these performance features

- Top speed, 184 mph
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- Service ceiling, 17,100 feet
- Fuel economy, 9½ gal. per hour

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- Exclusive retractable step
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- Luggage compartment accessible two ways

Beechcraft

BONANZA MODEL A35

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