AVIATION WEEK

DEC. 26, 1949

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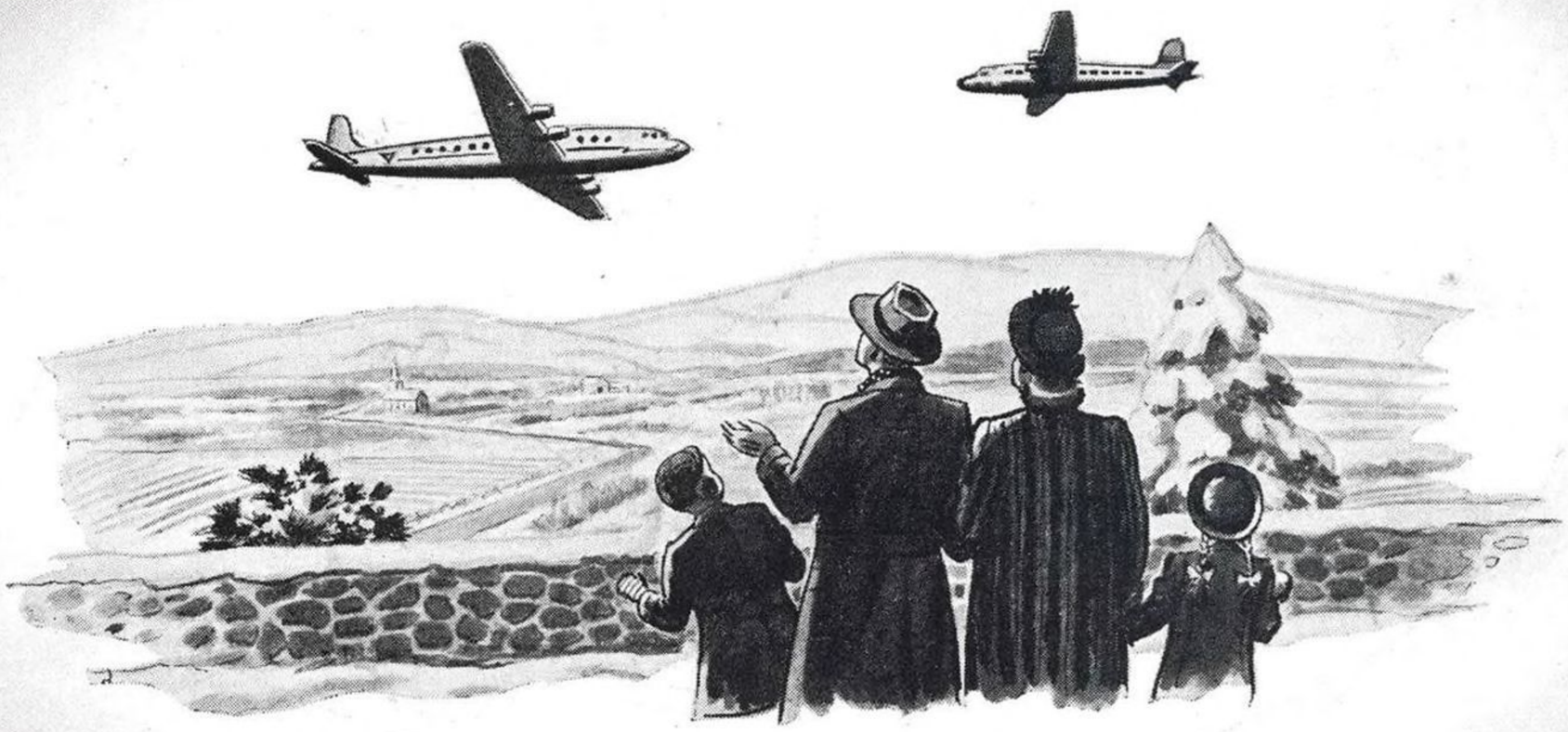
Sentinels of Peace



"A just and lasting peace among ourselves and with all nations"

—ABRAHAM LINCOLN

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WHO'S WHERE

Changes

► **New Appointments**—Otis E. Kline has been named executive asst. to United Air Lines President W. A. Patterson, and will act as liaison between the president's office and all departments of the company. . . . **Ross Willmot** is public information officer for A. V. Roe Canada Ltd., at Malton, Ontario. He will handle public relations on Avro's jet developments. . . . **Paul Grotts** has joined Durham Aircraft Service, Inc. as technical adviser to the sales staff.

Airborne Accessories Corp. appointed **William R. Hopkins** director of engineering at its Hillside, N. J., plant. . . . **Kenneth H. Jacobs** has been appointed supervisor of the applied mechanics dept.'s propulsion section, at the Armour Research Foundation of Illinois Institute of Technology.

Edward V. Trapani has been named Constellation project engineer at Lockheed Aircraft Corp. He had been asst. project engineer on the Constellation since 1939.

► **Retiring—Dr. Zay Jefferies**, vice president of the General Electric Co. in charge of the chemical department, will retire Dec. 31.

► **Sales Shifts**—Trans World Airline has named **J. N. Martin** general sales manager for the Atlantic region, succeeding **W. F. McGrath**, now executive vice president of the American Society of Travel Agents. TWA also named **J. D. Harrigan** as Chicago district sales manager. He was formerly passenger sales manager for the New York district.

American Air Export and Import Co., Miami Springs, Fla., named **James Korth** as sales manager. . . . **Raymond S. Colley** is now sales manager of Rivnuts and Rivnuts Tools at B. F. Goodrich Co. . . . **Robert Schott** is now business manager of Aviation Operations magazine, replacing **Joseph Mehr**, resigned, who will continue with the magazine on a consultant basis.

► **New Post**—A. V. Roe Canada Ltd. has appointed **J. H. Berry** to the newly-created post of director of manufacturing. He will be responsible for coordination and direction of gas turbine and aircraft manufacturing activities.

► **Resigned—William A. Van Dusen** has resigned as consultant to Curtiss-Wright Corp. and has moved his offices, which were in the C-W headquarters in N. Y. C. Van Dusen had been acting for the former management of C-W and remains available for consultation by the new management.

► **Douglas Expansion**—Increased sales and service activity in South and Central America by Douglas Aircraft Co. has sent two service reps on field trips. **C. B. Cort** is traveling through Brazil, Argentina, Uruguay and Chile; **C. J. Brunton** is touring Venezuela, Colombia, Ecuador, Peru, Bolivia, Panama, Costa Rica, Honduras and Guatemala. Both will visit operators of Douglas aircraft.

INDUSTRY OBSERVER

► **ECA has approved a French government proposal to buy approximately 50 Pratt & Whitney R-2800 engines from the Glenn L. Martin Co. for $2.3 million. The engines have been in the Martin inventory as excess, and were originally ordered for Martin 2-0-2 airliner sales which did not jell. The French bargain deal has been pending for sometime, and has little relation to Martin's other sales campaign to sell 30 revised model 2-0-2s to Eastern Airlines. Revised specifications for Eastern call for another and slightly more powerful model of the R-2800 to be installed in the revised 2-0-2s.**

► Former Shell Oil Co. butadiene plant at Torrence, Calif., is expected to be reactivated as a combustion research center. Huge spherical storage tanks may be converted into evacuated chambers for airflow in ramjet studies.

► **Allison division of General Motors Corp. has the production contract to supply turbojets for the Northrop Scorpion F-89A twin-jet night fighter. They will be the Allison J-35-21 rated at over 5000 lb. thrust. USAF had erroneously listed the General Electric J-47 turbojet as the production powerplant for the F-89A, instead of the Allison powerplant.**

► Cessna Aircraft Corp. is flight testing a new prototype to be entered in Air Force liaison competition. Plane is a single-engine high-wing strut-braced all-metal craft which Wichita observers say has excellent takeoff and climb performance. Plane appears to have been developed from the Cessna 170 four-placer, except that the fuselage is thicker and belly hangs lower.

► **Despite interest by the Air Force and Naval Aviation in the convertaplane, only actual project now under way is a private venture of M. A. Guerrieri, New Castle, Del. Guerrieri has formed Transcendental Aircraft Co., consisting of himself and two mechanics, and is building a convertaplane in a hangar opposite Bellanca Aircraft Corp. The design features twin rotors, mounted laterally, which swing forward in flight to become propellers. He has no customers, either military or civilian, but is going ahead with construction purely as a hobby.**

► U.S. Bureau of Standards in 1951 will build a radio propagation research laboratory on a 210-acre site at Boulder, Colo. with laboratory facilities costing about $4.5 million and staffed by 200-300 scientists. Major research program of the laboratory will be a study of the ionosphere and properties of aircraft navigation and communications frequencies between 30 and 30,000 megacycles.

► **Navy has towed its new target glider at an altitude of more than 35,000 ft. and at speeds in excess of 450 mph. It was developed by Chance Vought division, United Aircraft Corp., which has produced a service test group of 45 for flight test and evaluation. The 24-ft. span glider is all-metal to aid radar reflection. A drag parachute to permit stopping within 200 ft. in landing is tripped automatically upon contact with the runway.**

► A Swiss industrial powerplant firm, Brown, Boveri & Co., Baden, Switzerland, is seeking to market "packaged" wind tunnels to U.S. research facilities. Components when assembled would provide complete wind tunnel test facilities, offering speeds of Mach 2.6 and Mach 4, the manufacturer reports.

► **Philippines Air Force has ordered one 145 hp. TEMCO T-35 Buckaroo military type trainer for evaluation purposes, and the manufacturer is optimistic that the tests will be followed by a quantity production order. Production T-35 version has numerous changes from the prototype development of the commercial two-place Swift, including fuselage contour changes, three-piece jettisonable canopy, new controllable constant-speed automatic propeller, new design wing; and instrumentation, lighting and equipment arranged to meet USAF trainer requirements. First production trainer is scheduled for completion early in January.**

► Sale of de Havilland Vampire jet fighter to Venezuelan Air Force makes the 12th country to purchase the British jet fighter. Vampire is powered by the Goblin jet engine which is rated at 3500 lb. thrust, and approved by British for 600 hr. operations between overhauls.

AVIATION CALENDAR

Jan. 9-13—Annual meeting and engineering display, Society of Automotive Engineers, Hotel Book-Cadillac, Detroit.
Jan. 10-27—Fourth annual Air Transportation Institute, conducted by American University in cooperation with CAA and ATA, Washington, D. C.
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—38th annual dinner of the Traffic Club of Philadelphia, Benjamin Franklin Hotel, Philadelphia.
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. 24—Fifth annual flight propulsion meeting, sponsored by the Institute of the Aeronautical Sciences, Carter Hotel, Cleveland.
Mar. 28-31—National Plastics Exposition, sponsored by Society of the Plastics Industry, Navy Pier, Chicago.
Apr. 4-6—Engineering and Maintenance conference, Air Transport Assn., Hotel Continental, Kansas City.
Apr. 4-8—National Production Exposition, sponsored by the Chicago Technical Societies Council, Stevens Hotel, Chicago.
Apr. 16-20—Annual business meeting, American Assn. of Airport Executives, Neil House Hotel, Columbus, Ohio.
Apr. 17-19—1950 aeronautic meeting, Society of Automotive Engineers, Hotel Statler, New York City.
May 5-6—Midwestern conference on fluid dynamics and the national meeting of the American Physical Society, fluid dynamics division, University of Illinois, Urbana.
June 26-30—53rd annual meeting, American Society for Testing Materials, ninth exhibit of testing apparatus and related equipment, Chalfonte-Haddon Hall, Atlantic City, N. J.

PICTURE CREDITS

11—Boeing Airplane Co.; 12—NME; 13, 14—Mcraw-Hill World News; 25—National Bureau of Standards.

NEWS DIGEST

DOMESTIC

TWA has filed suit against Pan American Airways for an injunction to restrain permanently PAA's charter operations between the U. S. and Rome. Complaint points out that TWA is the only lawfully certificated U. S. airline between the two points, and alleges PAA's service, scheduled to begin last week, is without authority under the Civil Aeronautics Act. PAA had been granted CAB permission to conduct flights to Rome, in conjunction with Felix Roma, a non-profit Catholic travel group (AVIATION WEEK, Dec. 19). TWA says PAA has solicited parish clergy, urging them to sell transportation to Rome via Pan American.

Aeronca Aircraft Corp. workers, members of an independent union at the Middletown, Ohio, plant, have offered to buy $50,000 worth of common stock to aid in a refinancing program for the company. Stock would be paid for by payroll deduction. No immediate response came from company officials.

Personal aircraft exports of four-placers and under during November totaled 21, valued at $87,035, according to the Aircraft Industries Assn. This compares with 37 planes valued at $201,902 for the previous month. Nine companies reported.

Harold C. Stuart, assistant secretary of the Air Force, has been named as an Air Force member of the Research and Development Board, replacing Arthur S. Barrows, USAF undersecretary. Barrows asked to be released from the R&D assignment because he is a member of the Munitions Board.

Elbridge F. Bacon, assistant chief engineer of AC Spark Plug division of General Motors, died Dec. 15 after an illness of several weeks. He was 51 years old.

A PAA Stratocruiser claimed a new trans-Atlantic record from New York to Shannon, Eire, of 7 hr. 49 min., representing an average speed of 395 mph. for the 2670 miles. Former record was 8 hr. 25 min., held by a BOAC Constellation. It was set in 1946.

Civil Aeronautics Board late last week planned to start hearings on the Capital Airlines DC-3 accident near Washington National Airport, Dec. 12. Fatalities from the mishap rose to six with the death of two more injured passengers.

U. S. Court of Appeals for the District of Columbia upheld CAB's action in revoking the license of former American Airlines pilot Charles R. Sisto for operating a plane in a careless and reckless manner. Sisto was captain of the AA DC-4 which executed half of an outside loop near Mt. Riley, N. Mex., on Oct. 8, 1947, after he had engaged the gust lock mechanism.

FINANCIAL

Northrop Aircraft, Inc. reported net profit of $404,600 for the quarter ended Oct. 31, 1949, compared with a net profit of $111,577 for the corresponding period last year.

Lockheed Aircraft Corp. backlog at the close of 1949 will total about $230 million, $185 million of which is in military contracts. Robert Gross, president, reported the company sold 42 Constellations to major airlines during 1949. Aircraft deliveries during 1949 were valued at more than $115 million.

INTERNATIONAL

Cia. Mexicana de Aviacion has purchased three Douglas DC-6s at a cost of $2,990,000, for probable service between Los Angeles, Mexico City and Havana, Cuba.

Former Maj. Gen. Claire Chennault and Whiting Willauer reportedly bought the Chinese Nationalist government's interest in two civil airlines, including planes and equipment, and have asked protection of the property from Chinese Communist forces. The two airlines are China National Aviation Corp. and Central Air Transport Corp. Chennault and Willauer already own Civil Air Transport.

A Sabena Airlines DC-3 crashed and burned at Aulnay-Sous-Bois, near Paris, killing all eight passengers. One of the passengers was Foster White, assistant to the vice president of United Aircraft Export Corp.

IATA Clearing House air traffic transactions for the first 10 months of 1949 totaled $134,497,000, as against $96,928,000 for the same period last year. September and October turnover, calculated at pre-devaluation rates of exchange, was $31,267,000, an increase of 9.7 percent over the $28,513,000 worth of interline accounts handled during the same period last year.

Colombia is holding off on a new air agreement with the U. S. until it gets some of its own problems ironed out first, according to Capt. Ernesto Recaman, new general manager of Lansa Airline. The problems, according to Recaman, are solution of the administration of air mail, now in the hands of Avianca, nationalization of radio communications and just distribution of subsidies.

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COLLINS: How to tell what CAA wants?

BEALL: By making it a partner in the deal.

WELLS: So engineering is minor problem.

Boeing Wants CAA to Lead Jet Program

But agency head prefers partnership with military rather than sole responsibility.

(This is the first of a series of articles on U. S. jet transport development problems. These articles were prepared by AVIATION WEEK *Editor Robert H. Wood and News Editor Robert Hotz after interviewing key executives and engineers of the leading Pacific Coast transport manufacturers.)*

SEATTLE—Boeing Airplane Co. believes a simple solution to jet transport development problems lies in making the Civil Aeronautics Administration responsible for technical and financial administration of a jet transport prototype program.

Boeing spokesman Wellwood Beall, vice-president for sales and engineering, told AVIATION WEEK that the Boeing plan included the following steps:

• **Industry and governmental approval** for CAA to assume technical and financial responsibility for the jet prototype program.

• **A special appropriation** for the prototype program added to the CAA's fiscal 1951 budget.

• **A CAA-sponsored competition** for jet transport designs in the various categories suggested by the airlines as offering the best commercial operational possibilities.

• **CAA to award contracts** to the two top designs in each category for the building of two prototypes by each winning manufacturer.

• **Airlines or other operators** could obtain the desired quantity of jet transport types of their choice either by buying directly from the manufacturer or by leasing from the CAA, which would also have authority to award production contracts to manufacturers. Airlines would pay CAA for their leases on the basis of the revenue ton miles actually flown by the lessee.

Beall pointed out that Aircraft Industries Assn. has already advocated use of an existing federal agency to monitor jet prototype development rather than adding to the federal bureaucracy by creating a new agency. The Johnson-Kennedy bill introduced during the 81st Congress proposed to create a federal air cargo development corporation with a working capital of $250 million in federal funds, employing a permanent staff of at least nine $10,000-a-year-or-more politically-appointed directors.

▶ **Civilians Preferred**—Use of a civilian agency rather than the military services is more logical, according to Beall, because primary users of jet transports will be the commercial airlines. Transports built for economical airline operations can always be used for military purposes, but transports built for military requirements cannot be operated

ATA Stand

The certificated airlines have seconded the Aircraft Industries Assn.'s request for government aid in developing new transport aircraft.

At its annual meeting this month, the Air Transport Assn.'s board of directors adopted a resolution calling for federal participation in providing:

• **Jet-powered transports,** either of the turboprop or pure-jet type, or both;

• **A high-efficiency cargo plane;**

• **A small transport** especially designed for feeder service.

ATA recommended that responsibility for the government's interest in the prototype program be assigned primarily to the Air Force and the scheduled airlines represent the civilian interest.

As a further step, ATA urged that the regular air carriers participate with the USAF in a program providing experience in scheduled operation of jet aircraft. ATA said cooperation between the airlines and USAF in producing and operating jet transports is natural because they compose the team which provides air transportation in wartime.

at a profit by the airlines, he contends.

Neither U. S. Air Force nor the Navy are interested in using any of their funds for jet transport development. Since the recent fiscal 1950 budget cuts imposed by Defense Secretary Louis Johnson, both USAF and Navy are concentrating their remaining funds on combat aircraft. There is apprehension that any military development of jet transports would be at the direct expense of combat plane requirements.

▶**CAA Partnership**—CAA must be a virtual partner in any jet transport development program, Beall believes, due to the certification problem alone. He cites Boeing's experience with the Stratocruiser, as a case in point. It took 200 hours of flying time, two years, and cost Boeing hundreds of thousands of dollars to get CAA certification of the plane after it had already been approved by USAF as a military transport. Boeing credits much of the loss it has taken on the commercial Stratocruiser project to its interminable wrangling and delays with CAA over changing certification requirements.

"Unless CAA sits in on jet transport development from the beginning, sets firm certification requirements and assumes some responsibility for not making arbitrary changes without notice, no private manufacturer can afford to gamble on building a jet transport even if he now had the money to do so," Beall said.

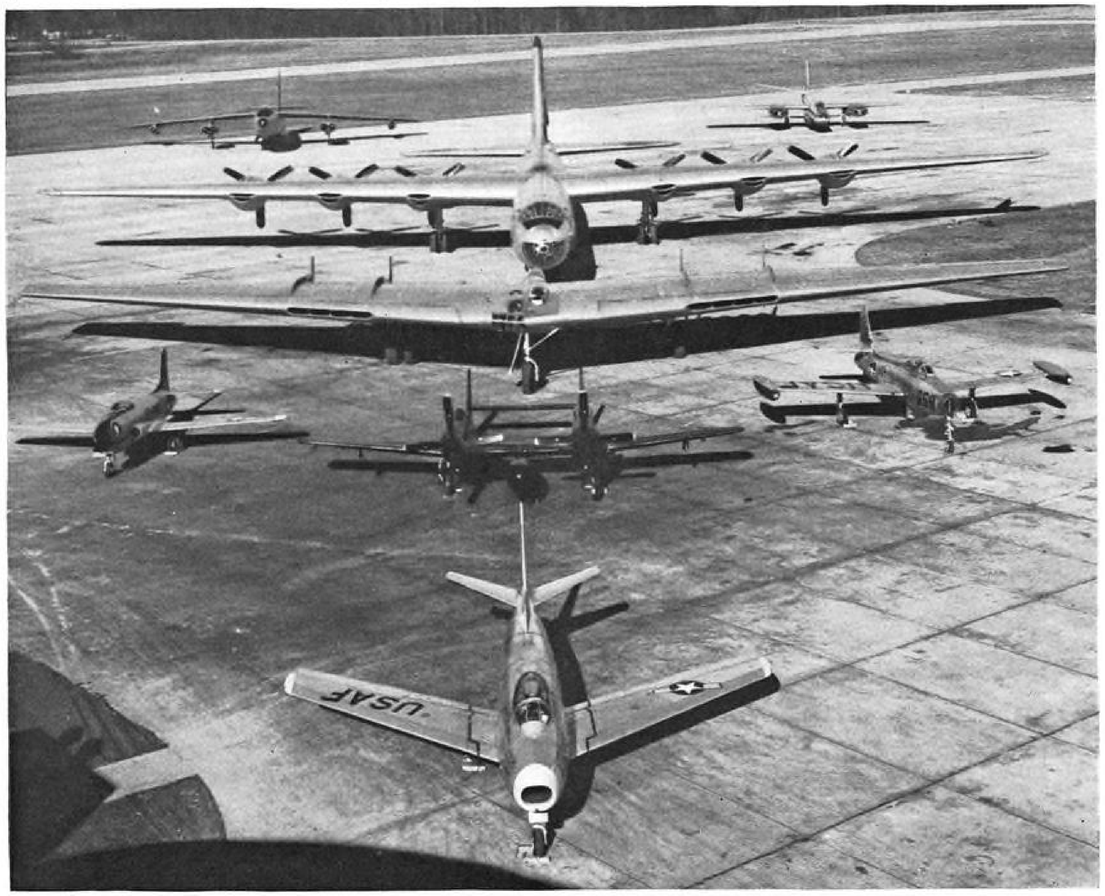
Beall said that with the CAA dependent on early certification of a jet liner to begin leasing operations to airlines and on a high rate of aircraft utilization by the airlines to recoup its investment, the aircraft manufacturer would get more sympathetic treatment from CAA in his efforts to build an economical and reliable commercial jetliner.

Contacted in Washington, CAA Administrator Delos W. Rentzel said the Boeing proposal took him by surprise.

"We are of course willing to do whatever we can to help," he told AVIATION WEEK. "But there is a question of what is the most logical group to carry out the jet transport development program. I believe there must be a cooperative effort by both civil and military groups.

"As you know, we have been working within the Air Coordinating Committee to overcome objections of airlines and manufacturers to prototype legislation.

"If this (Beall's program) is what the industry wants, we are willing to carry it out. But I personally would suggest that a using agency (such as the Military Air Transport Service) would be a more logical agency to handle the program than CAA. I'd like to give the subject more thought, but offhand I think CAA would prefer to be a partner in the program rather than the agency with primary responsibility for developing and leasing jet transports. CAA will be glad to cooperate with both civil and military groups in drawing up specifications, engineering, conducting tests, providing necessary traffic control and better airport facilities, in certification, etc."



USAF FAMILY PORTRAIT

Unusual photo shows most of USAF's top fighter and bomber types gathered for a "family portrait" at Andrews Air Force Base, Md. From front to rear, left to right, planes are: North American F-86 Sabre, holder of the world's official speed record (670.981 mph.); Lockheed F-80 Shooting Star; North American F-82 Twin Mustang night fighter; Republic F-84 Thunderjet; Northrop XB-49 Flying Wing; Convair B-36 intercontinental bomber; Boeing B-47 Stratojet, and North American B-45 Tornado. The B-49 is not included in present AF procurement plans. Absent from photo are such stalwarts as the Boeing B-29 and B-50, and newcomers like the Lockheed F-90, McDonnell F-88, and Northrop twin-jet F-89.

▶**Collins on Sales**—Fred B. Collins, Boeing vice-president for sales, points out that it would be impossible to conclude a firm contract with an airline for a jet transport at present because no manufacturer has any clear idea as to what CAA would require for certification on a number of key points in jet transport design.

Among these items on which CAA must express itself before designers can proceed are:

- One engine out performance
- En route cruising requirements
- Fuel location—i.e. whether CAA will permit jet fuel to be carried in the fuselage of a transport plane.
- Passenger location in relation to turbine wheel positions.
- Fuel reserve requirements
- Passenger and crew oxygen requirements at the 40,000 ft. level where most jet planes cruise most efficiently.

Collins believes that U. S. airlines will be in the market for a jet transport in from three to five years when most of the airlines will have amortized the bulk of their present equipment investments. Best market for the jet transport, according to Collins will probably be a jet liner that will be suitable for both trans-Atlantic and trans-continental operations.

▶**Wells on Engineering**—Boeing vice-president for engineering Ed Wells believes engineering a jet transport represents a relatively minor problem compared with the political and financial problems involved.

"All of the high-speed flight research conducted during the past two years on military aircraft has provided a good reservoir of basic data for engineering a jet transport," Wells said.

Wells pointed out that while the same basic problems were involved in the design of high-speed multi-jet bombers and commercial jet airliners they had to be solved in different ways. Boeing made a study of a four-jet transport version of the B-47, six-jet bomber (AVIATION WEEK, Oct. 10), but concluded that it was not feasible and has begun a new series of jet transport design studies starting from scratch.

▶**Lighter Structure**—Continuing on the technical side, Maynard Pennell, chief of Boeing's preliminary design department, believes that one of the principal differences between jet bomber and jet transport design is the range required for economical transport operations.

Jet transport designers still face the problem of determining the exact size and power of the future jet engines around which they must design their airframe, according to Pennell. He believes that jet transports will use axial-flow type engines because of the lower specific fuel consumption and lower drag possibilities they offer in comparison to the centrifugal-flow type used on the British Comet and Canadian Avro Jetliner.

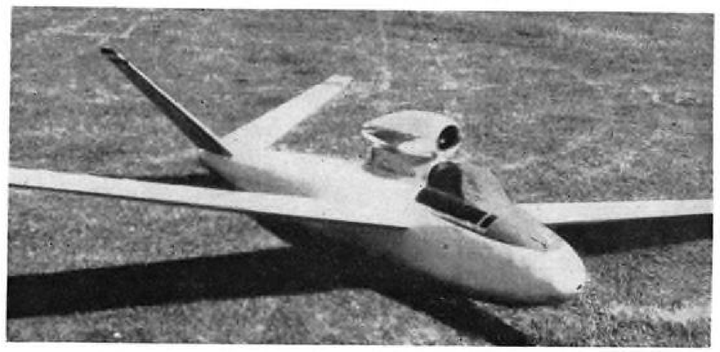
▶**Slowing Plane**—Another jet transport design problem is in slowing the plane during its approach. To solve this problem the designer must "dirty up" the basically clean configuration developed for jet types through the use of spoilers, air brakes, a drogue parachute for emergency use and possibly eventually reverse JATO.

Forum Announces Record Awards

Presentation of national and international flight record certificates for 13 records attained in 1949, concluded the National Aviation Forum in Washington last week.

Roger Wolfe Kahn, NAA contest chairman, presented the following certificates for NAA and Federation Internationale Aeronautique:

- International helicopter maximum speed record, 129.522 mph., and international helicopter speed record for 100 kilometers, 122.749 mph., in Sikorsky S-52-1: Harold E. Thompson, Sikorsky Aircraft division of United Aircraft, Air Cooled Motors, Inc.
- International helicopter altitude record, 21,220 ft. in S-52-1: Captain H. D. Gaddis, Sikorsky Aircraft division, Air Cooled Motors, Inc.
- International lightplane distance record, 2406.906 mi., and international lightplane distance record, 4957.240 mi., in Beech Bonanza: the late William P. Odom, Beech Aircraft Corp., Continental Motors Corp.
- International single-seat glider altitude record, 33,500 ft. in Ross-Stephens Zanonia: John Robinson.
- National single-seat glider record for altitude gained, 24,200 ft. in Ross-Stephens Zanonia: John Robinson.
- National multi-seat glider record for altitude gained, 14,800 ft. in Briegleb BG8: William G. Briegleb.
- National single-seat glider distance record to pre-determined goal, 227.152 mi. in Schweizer 1-23: E. J. Reeves, Schweizer Aircraft Corp.
- National transcontinental solo record, 5 hr., 5 sec. in F-51: Joe DeBona, North American Aviation, Packard Motor Car Corp.
- National west-east transcontinental record for commercial aircraft, 6 hr., 17 min., 39.4 sec. in Constellation: Eastern Airlines, Lockheed Aircraft Corp., Wright Aeronautical Corp.
- National intercity record, San Francisco to Washington, D. C., 6 hr., 22 min., 25.4 sec. in a Stratocruiser: Pan American Airways, Boeing Airplane Co., Pratt & Whitney division.
- National intercity record, Chicago to Miami, 3 hr., 21 min., 53 sec. in a DC-6: Delta Airlines, Douglas Aircraft Corp., Pratt & Whitney.
- National intercity record, San Francisco to Los Angeles, 49 min., 2 sec. in an F-51: Paul Mantz, North American Aviation, Packard Motor Car Corp.
- National lightplane altitude record for first category, 26,138 feet in a Piper Cub: Mrs. Mildred Zimmerman, Piper Aircraft Corp., Continental Motors Corp.



FRENCH J-P SAILPLANE

Slated to be demonstrated at the coming Miami Air Races, Jan. 1950, is this unique Fouga CM-18-R.13 Cyclone one-place sailplane powered by a 225-lb. static thrust Turbomeca TR 011 jet unit. Craft has climbed to 25,000 ft. in a recent test; at 16,000 ft. the Cyclone is said to have recorded a rate of climb of 8.2 fps., and speeds of about 190 mph. in level flight. Four of the craft are being constructed; the third and fourth models are to have provision for retracting the turbojet into the fuselage during flight. The Turbomeca TR 011 is stated to have completed a 150-hr. duration test under following conditions: 15 hr. at 225 lb. static thrust, 75 hr. at 178 lb. thrust, and the remaining 60 hr. at approximately 125 lb. thrust.

Forum Question: To Be or Not to Be?

Sparse attendance at National Aviation Forum in Washington last week, has caused National Aeronautic Assn., sponsor of the forum and of the previous national aviation clinics, to reexamine its plans.

A committee headed by Frederick C. Crawford, president of Thompson Products, and vice-president of NAA, has been asked to study the future of NAA and recommend whether it shall continue or dissolve.

R. M. Phelps, NAA executive vice-president, will continue to serve, and is preparing a report for committee action, following a meeting in February. Other committee members are Eugene E. Wilson, NAA chairman of the board; William Anderson, Pennsylvania aeronautics director; Robert Ramspeck, Air Transport Assn. executive vice-president; Paul Vance, St. Louis, and Roger Wolfe Kahn, NAA contest chairman. Louis Leverone, NAA president, and William Enyart, Federation Aeronautique Internationale president are ex-officio members.

▶**Attendance Wanes**—Controversial nature of the clinics and their 1949 successor, the forum, appeared the cause of diminishing attendance from year to year, since the third clinic which reached a high point of 1300 registrants at Oklahoma City in 1945, including 768 out-of-town visitors.

This year's forum registrations included only 104 persons.

Analysis of the dwindling support of the annual "hair-shirt" sessions indicates a growing sensitiveness on the part of the larger manufacturers and established airlines to the critical attitudes of small operators and other segments of industry who are fighting for survival with no holds barred.

▶**Panel Session**—High point of the 1949 forum was a panel discussion at which the question of government subsidy of aeronautical research and of airline operation was viewed from various angles.

Sample viewpoints:

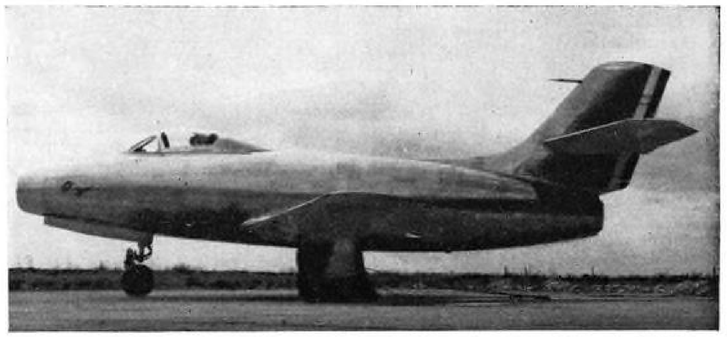
• **Joe Garside**, Wiggins Airways: The government should do one of two things: Get out of our business, or help us out of the rut we are in. The New England operator credited the federal government's war training program, war surplus airplane sales and veterans flight training as major contributions to the downfall of small aviation business, and discussed, without personal recommendation, the NASAO recommendation for a national aviation council to handle research and development for light planes.

• **Eugene E. Wilson**, former United Aircraft president: Called for a determination of what is subsidy and what is not. Wilson called for the non-subsidized segment of the airlines to declare their independence and then seek to free themselves from federal restrictions growing out of regulation of the subsidy problem.

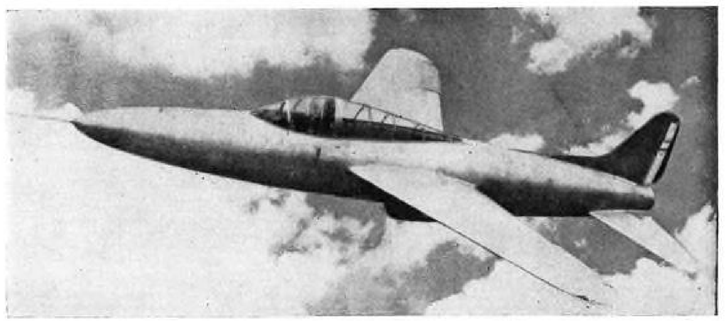
• **J. Carroll Cone**, Pan American Airways vice-president: Said that despite air coach possibilities in international travel, which had increased for Pan Am 400 percent since inauguration in Sept. 1948, he did not expect it to cut into the de luxe air travel market.

• **Joseph J. O'Connell, Jr.**, CAB chairman: Called for separation of mail pay from subsidy, to give airline management "additional incentive to act like businessmen and to create a more efficient air transport system."

• **James W. Austin**, Capitol Airlines' vice-president, traffic: Asserted that the 14 million airline tickets sold this year were bought by from 3 to 5 million riders, and called for additional efforts in safety and airline ticket pricing to win additional public acceptance for air transportation.



DASSAULT MD-450 fighter will succeed Vampire; in production will be paired with . . .



SO 6020, likely choice as all-weather fighter, as backbone of France's interceptor force.

How Long Could France Fight?

A new plan would reorganize its aircraft industry to provide an air defense of two weeks—after five years.

By Boyd France

(McGraw-Hill World News)

PARIS—France is getting set to build a fighter force within the framework of the Atlantic Pact capable of defending French skies for at least two weeks.

It will be a short-lived force, but it still will take five years to get it ready. And to do this, the entire French aircraft industry will have to be reorganized. The Minister of National Defense has drafted a five-year plan soon to be submitted to the National Assembly.

The plan will:

• **Define** the size and kind of air force France can afford.

• **Outline** the characteristics of an aviation industry needed to build and maintain this air force.

• **Make possible** a long-term flow of production and research effort, instead of the spasmodic, year-to-year work currently being accomplished.

Hard core of this air force will be about 1000 first-line fighters. Relatively small numbers of transports, trainers, and special-purpose planes will make up the rest. Most of the models will be culled from the postwar jumble of prototypes, but a few will be built from the drawing board up.

All this, if it is to be accomplished within the five-year timetable, will mean that France's nationalized aircraft industry will be mercilessly overhauled. Nine plants will be closed or converted to other types of production. What remains will be concentrated and reorganized.

▶**Basic Types Planned**—The reorganization is keyed to the size and kind of air force France proposes to build. On the preliminary blueprints, the air force will be composed of 12 basic types of craft:

• **Interceptor fighter**—Current choice is Dassault MD 450, although the French are considering manufacture of some Vampires as a stopgap measure until the 450s start coming off assembly lines. At full strength, the air force will have roughly 1000 Dassaults on active duty.

• **All-weather fighter**—Only a few hundred will be built, and odds are they will be SO 6020s.

• **Medium transport**—Almost certainly, this will be the Nord 2500, first test flown successfully in September. About 200 will be ordered.

• **Light transport**—Air force has already ordered 295 Dassault MD 315s, but may buy some SO 95s until the 315s get into production.

• **Trainer and liaison plane**—The two-place Nord 1221 is slated for this job.

• **Intermediate trainer**—This probably will be the low-wing all-metal Morane 472.

• **Artillery observation plane**—The Morane 500 is the selection.

• **Long distance seaplane**—No prototype yet. Few production craft will be ordered.

• **Carrier-based torpedo-bomber**—No prototype designed yet.

• **Amphibious sea rescue plane**—This will be the Nord 1400, two prototypes already have been built.

• **Light amphibian**—Forty SCAN 30s have been ordered. This is the Grumman Widgeon, built under license, powered by two Mathis 8 G 20 engines developing 196 hp. at takeoff.

• **Fast liaison plane**—The Nord 1100 has been chosen.

To power these planes, France has the Atar 101 turbojet, still in the testing stage, and the SNECMA 14 U piston engine. But France will continue to put Nenes made under license in its jets until the Atar is on the assembly line. And although production will continue on the SNECMA, the French are almost resigned to adopt as their principal engine Pratt & Whitneys or Bristols made under license.

▶**Production Coordinated**—All these tentative decisions will have strong effects on manufacturing. Already, the four nationalized aircraft companies—S.N. Nord, S.N. Centre, S.N. Sud-Quest and S.N. Sud-Est—have been cut to three by the liquidation of S.N. Centre. And factories which are better fitted for non-aviation production, or which are inefficient, are to be weeded out of the other three companies.

▶**Appropriations**—The reorganization plan currently is based on the somewhat optimistic assumption that the air force and navy will have about $86 million a year to spend on aircraft. It would mean the combined air forces would have to receive a total appropriation of about $375 million, as against last year's $240 million.

France's economy-minded Minister of Finance Maurice Petsche has made no provision for increased defense spending in his proposed 1950 budget, but the yearly budget battle has yet to be fought. If the extra francs can't be squeezed out for national defense, France's nationalized aviation industry will have to be cut back even further than now planned. Some sources say a 10 percent reduction in the total air forces' appropriation would result in about a 20 percent cutback in the activity of the nationalized aircraft industries.

1950 Preview: More Weight, Less Planes

U. S. aircraft production in terms of airframe weight will be increased during 1950, with the increase expected to amount to approximately 2 million pounds overall, Aircraft Industries Assn. predicted in a year-end summary and new year forecast last week. This will include an expected 3 million pounds military airframe increase and a drop of about 1 million pounds in civil aircraft deliveries.

The estimate was based on full utilization of funds approved by the Budget Bureau for fiscal 1950 USAF budget, and not taking into consideration cuts imposed by Defense Secretary Louis Johnson below the 48-group $1.4 billion budget.

▶**More Weight, Less Planes**—Increase anticipated is based principally on expectations for deliveries from orders based in 1949 fiscal year with heavier aircraft coming off production lines. Unit deliveries are not expected to increase and may even decrease.

Reductions in funds because of decisions by President Truman and Secretary Johnson are not expected to bring about accompanying contractions in production and employment in the aircraft industry until later in 1950.

Sales volume for 1949 for all airframe, engine and propeller companies was estimated by AIA at $1.7 billion. Profit estimates are uncertain because of renegotiation, but it was estimated that profit before renegotiation for most companies would be slightly higher than in 1948.

Military aircraft production for calendar year 1949 is expected to reach 28,000,000 airframe pounds as compared with 25,100,000 in 1948, the AIA summary estimates. Production was expected to exceed the 1948 unit production of 2200-2400 planes by two or three hundred planes.

Airline transport aircraft production in 1949 will amount to less than 120 units plus an additional 45 smaller twin-engine executive planes. This compares with about 260 transports and executive twin-engine planes in 1948 and 280 in 1947.

The aircraft industry employed approximately 218,000 people during 1949—168,000 in airframe plants, 41,000 in engine plants, and about 8500 in propeller plants.

Unified Transport Program Asked

A more unified federal program for regulating and promoting the various types of transportation has been suggested to President Truman by Secretary of Commerce Charles Sawyer.

Couching his recommendations in mild language, Sawyer observed that some of the $1 billion spent by the federal government on promoting transportation may be aiding sea and aircarriers at the expense of railroads, which are also essential to national defense. He said that at times the Interstate Commerce Commission, Civil Aeronautics Board and Maritime Commission work at cross purposes in regulating their particular group of carriers.

▶**Waste Seen**—As a result, shippers and passengers don't always use the more economical form of transportation; and the cost burden is borne partly by the taxpayer. One of Sawyer's most positive recommendations was that subsidies to any common carrier should be clearly tagged as such and not hidden in the guise of mail payments.

The Commerce secretary declared that the federal government should undertake as soon as possible a study aimed at assessing user charges for transportation facilities provided at public expense.

▶**Subsidy Problem**—Sawyer said one important issue to be faced is whether present circumstances justify continuation of separate treatment for air transportation as set forth in the Civil Aeronautics Act of 1938. He urged investigation of the charge that the present system of air mail subsidies places a premium on inefficiency and penalizes the efficient carrier.

The report stated that if another type

of carirer or a different carrier of the same type can perform a service at a profit it is entitled to the business, and carriers which are being protected should restrict themselves to operations in which they have a clear economic advantage. "Services which no longer can be furnished at a profit should be abandoned."

▶ **Contract Carriers**—Sawyer took a dim view of CAB's efforts to extend its jurisdiction over contract carriers. He said that since contract carriers operate without a subsidy, efforts to restrict the scope or the pricing of their operations would tend to destroy the effectiveness of these services in furnishing a comparison with the efficiency of subsidized carriers.

"Extension of regulatory controls in this field might also discourage the development of new and useful enterprises," the Commerce secretary declared.

Airports Declining

Existing airports are closing as fast as or faster than new ones are being built, according to a recent CAA study.

This is despite the fact that long-range aviation forecasters call for many more U. S. airports to serve all sections of the nation adequately, and the CAA-admininstered federal airport construction program continues to finance new airport construction.

In the first six months of 1949 there were 224 airports abandoned, while in the calendar year 1948 the number closed was 319. A net increase in the total number of airports of all types at the end of 1948 was 655, due to opening of nearly 1000 new fields, but the net increase for the first half of 1949 had shrunk to only 29 airports, CAA reports, and there are indications that the last half of the year's totals will show a net shrinkage.

CAA analysts explain the paradox this way:

• **Land value** has increased in many sections so that land owners who have leased airports are converting the land to more profitable uses—for farming, apartments, etc.

• **Commercial airports** operated by private capital for public use, for remuneration, represented 60.2 percent of all airports closed in the 18-month period surveyed, with a total of 327 fields shut down. Poor management, poor location, unfavorable lease arrangements, the postwar slump in lightplane sales, and the rapid expansion and equally rapid curtailment of the GI aviation flight training program are all factors in the commercial fields' closing. (Of commercial fields abandoned in the first six months of 1949 approximately 71 percent were on leased land.)

• **Decrease in military airports** was attributed to the reduction in aircraft and personnel of the services after the war, while decreases in CAA intermediate fields, and those operated by other government services, was seen as due to establishment of comparable or better facilities nearby operated by municipalities. A similar reason probably accounted for closing of a large number of the 92 private airports shut down during the period surveyed.

RTCA Gets Award

The Radio Technical Commission for Aeronautics was awarded the Collier Trophy for 1949 for the work of its Special Committee No. 31 which drew up the basic plans for an all-weather electronic airways system.

The RTCA program which is now in the initial phases of implementation calls for an expenditure of $1.5 billion for electronic navigation and traffic control equipment during the next 10 years. It involves a joint effort by the Civil Aeronautics Administration, the U. S. Air Force and Navy in developing, installing and operating the all-weather airways system.

Formal presentation of the trophy to RTCA officials will be made at the White House by President Truman on Jan. 10. The Collier Trophy committee was headed by Louis Leverone, president of the National Aeronautic Assn.

The RTCA SC 31 report was handled in two phases headed by Col. Joseph Duckworth of the Air Force and Capt. A. S. Born of the Navy. Milton W. Arnold, vice-president of the Air Transport Assn. was also a key figure in the committee proceedings. RTCA is a voluntary organization composed of representatives of military and civil aviation agencies, radio manufacturers, airlines management and pilots and private pilots.

Symington Retorts On Seattle Protests

Seattle's continued protests against an Air Force decision to transfer some Boeing Airplane Co. manufacturing to Wichita, Kan., has brought a "Quiet, Please" suggestion from Air Force Secretary W. Stuart Symington. In a letter to Senator Warren G. Magnuson of Washington, he said:

"As you know, most of this agitation resulted from various people in and out of Boeing subsequently protesting against an agreement, made over a year ago, to build the B-47 bomber at Wichita, Kan., leaving for production in Seattle the B-50, C-97 and the new B-52. There never has been any plan to take any additional business out of Seattle, let alone close the Boeing plant in Seattle. In fact, as a result of my recent visit to Seattle, arrangements were made to give additional business to Boeing. Nevertheless, criticism of Air Force policies by various people in your locality has not lessened, rather it would seem to have increased.

"I do not see how such criticism on the part of these people can help what they say they are for, because naturally the Air Force is becoming increasingly regretful of such continuing unfair attacks which are not based on the truth."

Symington also declared untrue a charge made at Spokane, Wash., that the Air Force is shipping aluminum from Spokane to Texas for stockpiling, and then back to Seattle when needed.

Prototype for the XB-52 is under construction at Boeing's Seattle plant. With Stratocruiser production virtually completed and C-97 orders less than had been expected, Boeing's payroll is on the way down, now being about 19,000 level as compared to a peak of 25,000. The downward trend in employment is expected to continue throughout next year and into 1951.

Power Expansion Sought for AEDC

Tennessee Valley Authority will go to Congress in January for funds to build a $37 million steam electric generating plant to provide additional power for the new USAF Air Engineering Development Center near Tullahoma, Tenn. (AVIATION WEEK, Nov. 21).

Besides supplying power for wind tunnels and other test facilities at AEDC, the new TVA plant will also provide additional power for the Atomic Energy Commission's Oak Ridge, Tenn., facility at off-peak hours when other power demands are reduced.

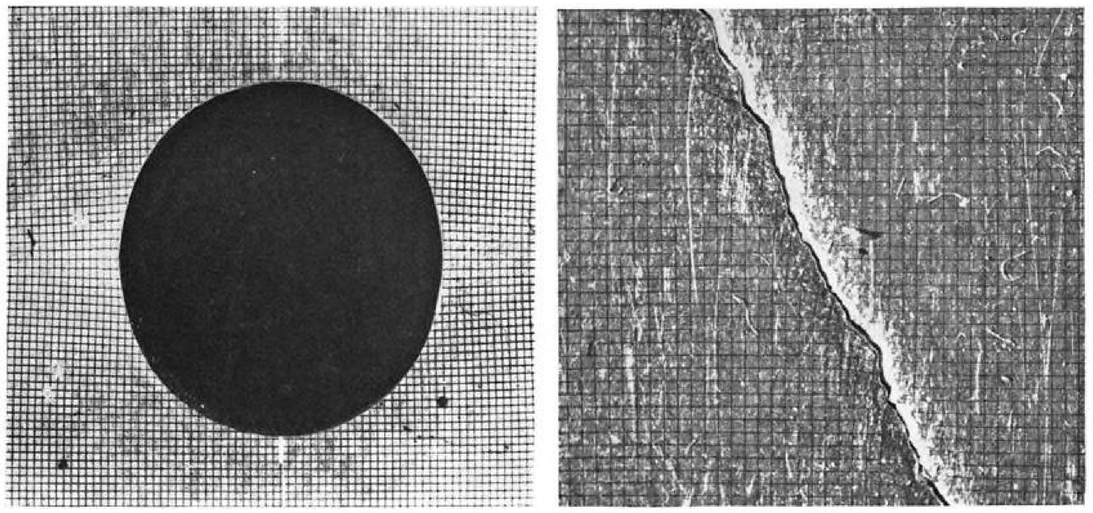
The new Widow's Creek steam plant will be constructed on the Tennessee River at the closest point to the Tullahoma AEDC site, four miles south of Bridgeport, Ala., and 29 mi. southwest of Chattanooga, Tenn. Plans call for two 125,000 kw. turbo generators.

TVA expects little congressional opposition to construction of the new plant, because of its strategic purpose in aiding atomic production and air research.

Tip Transport

(McGraw-Hill World News)

South African scientists and engineers have developed a method of transporting radioactive isotopes cheaply in the wing-tips of South African Airways DC-4s operating between Johannesburg and London. The technique eliminates the heavy lead casings previously found necessary to protect plane crews and freight against radiation.



Appearance of grid on metal test specimen (left) just prior to tension failure reveals localized elongations around 0.4-in. hole and demonstrates possibility of technique in investigating structural discontinuities resulting in excess stresses. Magnified view (right) of ¼-in. high-strength aluminum specimen, with grid revealing localized elongations in vicinity of failure.

New Photo-Grid Method for Sheet Studies

Procedure gives greater accuracy in judging effects of forming action on high-strength aluminum alloy.

An improved photo-grid technique for determining elongation of sheet metal has been developed at the National Bureau of Standards to overcome difficulties involved in other methods and provide a more reliable procedure for establishing the behavior of sheet during forming.

In addition, the technique is proving useful in the investigation of plastic deformation in the vicinity of holes and in studies of other structural discontinuities that result in excessive stresses.

▶ **Formability Interest**—The new development is important because interest in the formability of sheet has increased greatly with the use of higher strength materials in aircraft, since improvement in strength frequently is accompanied by a reduction in material ductility.

Amount of elongation in a 2-in. length—a detail usually found in sheet metal specifications—is not a reliable guide for predicting formability, because the elongation may not be distributed uniformly, and frequently may be confined to an extremely small area.

It has been suggested that the elongation over a gage length equal to the length of the bend or even approaching zero, corresponding to reduction in area, should provide a better basis for predicting sheet metal formability. Since accurate determination of reduction in area is difficult for thin sheet, most attention has been directed to the measurement of elongation over short gage lengths.

A marked advance in the technique of measuring elongation over short gage lengths followed the development of a photo-grid process by G. A. Brewer and R. B. Glassco, for ruling gage marks on test specimens. In that process, a negative is made from cross-section paper or a photoengraver's glass screen. The surface of the specimen is sensitized with bichromated photoengraving glue, exposed in contact with the negative, and rinsed with water. It is then dipped in dye to color the glue, which has been rendered insoluble by the exposure.

▶ **New Grid Makeup**—When the Bureau initiated its project, under sponsorship of the National Advisory Committee for Aeronautics, to obtain stress-strain and elongation data for high-strength aluminum alloy sheet used in aircraft, an accurate grid having spacings of about .01 in. was desired.

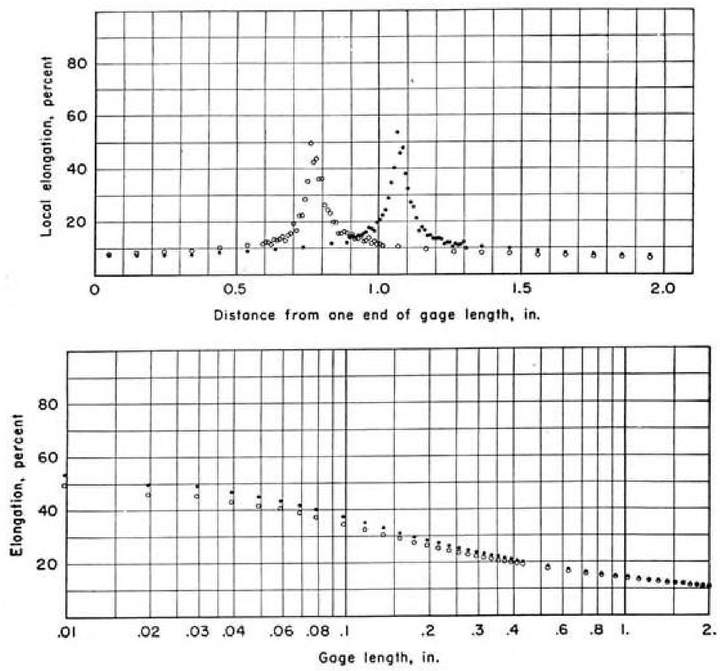
It was found that existing grids were not suitable for accurate work, because of excessive width of lines, inaccurate spacing or lack of line sharpness, when examined at high magnification.

To meet this problem, a master grid -2.07×2.16 in. overall—was prepared by ruling the grid in wax on plate glass, etching the lines in the glass, and filling them with lead sulfide. The lines are about .015mm. wide and are spaced nominally .25mm. apart.

A careful study of a negative obtained from the master grid by contact printing indicated that in the middle portion, where the lines are most accurate and where measurements are taken at each line, the spacing was within ± 1 percent of the nominal value.

In the past, investigators have experienced much difficulty in obtaining consistently satisfactory lines by using photoengraving glue. Specifically, the lines are not clean-cut, and the time needed for exposure is quite variable. However, lines of excellent quality were obtained at the Bureau, with the product known as cold top enamel.

▶ **Specimens Printed**—Here is the procedure developed by the Bureau's photographic technology section for printing lines on tensile specimens: Thoroughly cleaned of grease and other foreign matter and wiped with alcohol or ace-



Graphs obtained using new grid technique. Curves (top) show local elongation measured on two 75S-T sheet specimens loaded in tension in direction of rolling. Peak values of about 50 percent were in fracture vicinity, elsewhere elongation was 10 percent or less. Curves, bottom, show elongation for various gage lengths. Elongation, measure of formability, usually is taken over 2-in. gage length. Actually, in many cases, forming occurs over much shorter length, for which elongation, as shown, is greater.

tone, the specimen is mounted on a whirler and coated with a small amount of cold top enamel. The whirler is then run at about 500 rpm. for 10 min., or until the enamel on the strip is dry.

The sensitized specimen is removed from the whirler and printed in contact with the film negative of the grid in a vacuum frame. A 4-min. exposure at about 12 in. from an EH-4 mercury flood lamp has generally proved satisfactory.

However, the time of the exposure is affected by the relative humidity—the enamel becoming less sensitive with higher humidity. Also, the sensitized specimen should be exposed and developed immediately, since it will keep but a short time.

► **Developing**—The image is developed by immersing the specimen in agitated cold top developer (purple shade preferred) for about 20 to 40 sec. A dye incorporated in the developer makes the image on the metal visible. After developing, the specimen is quickly rinsed for a few seconds in two baths of alcohol (95 percent) and immediately dried in air. The sensitizing and developing should be done in a dark room illuminated for ordinary photographic work.

Since the film negative does not maintain its dimensions during processing and during changes in relative humidity and temperature, a length equal to 50 or 100 spaces near the middle of the gage length of the specimen is measured to determine the average grid spacing.

Measurements before and after test are made with a toolmakers' microscope under a 50 to 100 magnification reading to .001mm.

CV Uses Forging To Minimize Parts

A new method of constructing main beams used in fighter aircraft, which eliminates many factory operations previously required and promises large savings in production time and money, has been developed by Chance Vought Aircraft division of United Aircraft Corp., Dallas, Texas.

In place of the conventional, but costly, procedure of building up these structures with scores of individually fabricated parts which are riveted together, CV now quickly shapes out a main beam in the machine shop—from a single, large forging.

These forgings—said to be some of the largest ever produced in the U. S.—are 75ST aluminum alloy and are pressed from 120-in. round bars, 6½ in. in diameter. They are specially made for Chance Vought on a new 18,000-ton press at the Wyman Gordon Co. in Worcester, Mass.

Weighing 325 lb. before machining, the forgings are formed on two steel die blocks, each 21,000 lb.

At CV, the forgings are placed on a 36 × 168-in. Cincinnati Vertical Hydrotel machine equipped with tooling expressly designed to profile the main beam. While a hydraulically operated tracing unit moves around the outlines of a pattern, the big miller automatically performs 90 percent of the total machine operations on the beam in a fraction of the time formerly spent by machinists on individual parts of a built-up structure.

CV points out that many workers formerly engaged in assembling and riveting main beams have been released for other duties. Indirect labor has been reduced by eliminating work orders and records carried for each of the many parts making up the old beam. And stock chasers, who formerly had to track down dozens of details, now have only one large part to handle.

Fixed Tip-Tanks Emptied Quickly

Latest design wrinkle in auxiliary fuel tanks is the use of a permanent wingtip installation on the Grumman F9F Panther, Navy jet carrier fighter. Instead of jettisoning the tanks, either upon exhaustion of fuel or in emergency, high-flow dump valves empty them in just 40 sec.

A variety of reasons has been advanced for the use of fixed wingtip tanks. Their cost of about $800 each is an important economic reason. Danger to people on the ground is a safety reason. A very good aerodynamic reason exists, however, in that end-plate effect of the tanks increases the effective aspect ratio of the wing.

The fast-emptying feature is obtained by opening a check valve in the tank nose, and dynamic air pressure does the rest, forcing the fuel out the dump valve. Airspeed must be at least 200 mph. to insure this fast action.

First public demonstration of the dumping equipment was at the 1949 National Air Races. The Navy "Blue Angels" acrobatic team dumped colored liquid from their tanks to create a picturesque red, white and blue trail during maneuvers. New McDonnell F2H-2 Banshee fighter also incorporates fixed wingtip tanks.

Convertaplane Interest Grows Fast

Experts convene to exchange design philosophies on convertible aircraft configurations. Optimism is note.

By Robert McLarren

Although it has been only a little more than 18 months since the first detailed analysis of the convertaplane was published (AVIATION WEEK, April 12, 1948), interest in this unusual new type aircraft has grown so rapidly that nearly 250 engineers attended the First Convertible Aircraft Congress in Philadelphia, on Dec. 9.

This meeting was organized by E. Burke Wilford, gyroplane pioneer and sparkplug of the convertaplane, and was sponsored jointly by the Philadelphia sections of the Institute of the Aeronautical Sciences and the American Helicopter Society.

The convertaplane is currently in the stage that immediately preceeds the birth of a new kind of transportation—discussion of its form. Once this important question is decided, the enthusiasm of the Congress left no doubt that the first true convertaplane will become a reality.

No one doubts that a tremendous amount of technical work remains to be accomplished before a successful convertaplane is flown, but the increasingly high caliber of personnel concentrating their attention on the new type is indicative of its nearness.

► **Early Form**—The convertaplane is not without precedent in the aeronautical field. Amiable, venerable George Herrick, president, Convertoplane Corp., showed interesting historical motion pictures of the first aircraft in history to change its form in mid-air.

The Herrick Convertoplane made its first flight Nov. 6, 1931 at Niles, Mich. It was a light, single-seat tractor design of cantilever biplane form. Upper wing of the combination, upon release of its locking mechanism, rotated about its pylon to create a gyroplane configuration, which permitted slow landing. This historic aircraft was designed by Ralph H. McClarren and flown by George Townson, both of whom received awards at the Congress.

The status problem of the convertaplane, then, becomes one of definition. Assuredly George Herrick deserves full historic credit for the convertaplane but it is equally true that the craft which rises vertically from the ground as a helicopter and flies level as a fixed-wing aircraft has not yet flown and that is the technical problem defined by the true convertible aircraft.

► **Hohenemser Approach**—Position of the convertaplane in the aircraft spectrum was clearly outlined by Dr. K. Hohenemser, chief aerodynamicist, Helicopter Division, McDonnell Aircraft Corp.

He made clear the aerodynamic limitation to the forward speed of the helicopter created by stalling of the retreating blade, and, to a lesser extent, compressibility losses on the advancing blade.

Since these considerations indicate that the helicopter is characteristically incapable of high speed (existing official helicopter speed record is 129.616 mph. held by Sikorsky S-52; Piasecki XHJP-1 has hit 131 mph. unofficially), it follows that its vertical takeoff feature must be combined with fixed wing design for high-speed level flight.

Hohenemser isolated μ, advance ratio, (aircraft speed/rotor tip speed) as a major criterion in the ability of a helicopter to fly fast horizontally. Pointing out that current types exhibit an advance ratio of 0.3 to 0.35, he showed how increased advance ratio can be obtained through the use of low values of $C_T\sigma$, aerodynamic blade loading.

One obvious solution to this problem is speeding up the rotor, but Hohenemser pointed out the futility of this because of increasing compressibility losses above a tip speed of about 550 mph. He concluded, therefore, that the only practical means of reducing the aerodynamic blade loading and, therefore, obtaining higher advance ratios, is to unload the rotor onto a fixed wing.

His studies indicate that a wing having an area of only 6 percent of the rotor disk area and a C_L of 0.6 would raise the permissable advance ratio to 0.5 and higher at a value of $C_T\sigma = 0.8$. His studies also indicate that low aerodynamic blade loadings greatly simplify the problem of attaining advance ratios well above 0.5, since the values of lift and drag coefficient tend to become constant above this figure.

He believes that the addition of a small fixed wing to the helicopter would permit it to operate efficiently in the 150-250 mph. speed bracket. At these speeds, his calculations indicate that, since the rotor drag would be such a small part of the total drag, it would be unnecessary to add the complexity of rotor retracting means as well as risk the reduced condition of safety created thereby.

In general, then, he proposes an "interim" type between the helicopter and the convertaplane.

► **Leonard's Study**—Lloyd Leonard, former National Advisory Committee for Aeronautics engineer, and one of the earliest serious students of convertaplane problems, presented a study of the true convertaplane, that is, an aircraft which rises vertically as a helicopter, heels over in mid-air and flies level using its rotor as a propeller.

Leonard showed the basic instability of the conventional convertaplane in which the rotor is mounted atop the fuselage and tail fins below. He demonstrated the well-known side-force effect of a yawed propeller and showed how a destabilizing couple is created by the tail fins.

He concludes that the only inherently stable combination is one in which the C. G. of the craft is above the rotor, and explained that model tests had borne out this theory.

Leonard examined the classic convertaplane problem—relative efficiency of blades used as a rotor and as a propeller. He explained that there was no magical way in which a single set of blades could be made equally efficient as rotor (for vertical flight) and propeller (for horizontal flight). He presented an elaborate chart showing that convertaplane designers cannot expect an efficiency of more than 60-65 percent in either mode of operation.

He also concluded that three-bladed rotors would be required to permit a smooth transition from hovering to horizontal flight, whereas two-bladed rotors would require conversion of their operation from rotor to propeller prior to the roll-over to horizontal flight. Leonard also presented studies of jet and propeller-driven rotors.

► **Flettner Heard**—One of the distinguished speakers at the Congress was Dr. Anton Flettner, renowned inventor of the trim tab (AVIATION WEEK, Sept. 12, 1949), the rotor ship and a pioneer in the rotary aircraft field, who has now turned his attention to the problem of the convertaplane. He has formed his own company in this country to pursue such developments.

Dr. Flettner sees the convertaplane, at least in this stage of the game, as fundamentally a fixed-wing aircraft with auxiliary rotor for vertical lift. Consequently, he developed a "boom principle" in which booms are attached to a fixed wing aircraft. Rotors are mounted on the ends of these booms. The aircraft is lifted vertically by the rotors, after which the rotors are aligned with the booms in a minimum-drag position and the flight proceeds as a conventional fixed-wing aircraft. He believes the drag of such booms will be inconsequential.

► **Applied to "Packet"**—For example, Dr. Flettner presented a suggested adaption of his principle to the Fairchild "Packet" to which a single, thin boom is attached to each outer wing panel at the aileron inboard end. His calculations indicate that a 40,000-lb. gross weight could be lifted by four 50-ft. rotors having a 2840-sq. ft. disk area with a disk loading of slightly more than 14 lb./sq. ft. (compared to 2-4 lb./sq. ft. for conventional helicopters).

This is a graphic illustration of his belief that the key to the convertaplane is high-powered, highly-loaded rotors, such rotors being small and producing low drag in the stowed position, as a consequence.

His "boom principle" was derived as a result of his conviction that rotor downwash must be clear of the fixed surfaces of the aircraft.

► **Power Means**—Demonstrating his famed inventiveness, Dr. Flettner then turned to consideration of power means for such boom-mounted rotors and presented an imposing array of various methods through the use of which the light weight and high power of the gas turbine could be used. He believes that a wide variety of gas turbine sizes, powers and weights will be available, shortly, to offer the designer a wide choice for his purpose.

He feels that gear-shifting will be required for such highly-loaded rotors since their speed would have to be increased two or three times in the transition from propeller to rotor operation. As a design principle, he believes that the power loading of the craft as a fixed-wing aircraft must be the same as the craft as a helicopter.

Pointing out that the vertical lift portion of the flight would have a duration of only a few seconds, he believes that the rocket might prove useful and presented a sketch of a "rocket turbine" in which the rocket jet impinges on the blades of a turbine wheel.

He also examined liquid rockets mounted at the rotor tips, with their fuel contained in the hub, pointing out that centrifugal force would make pumping equipment unnecessary for fuel delivery to the tips.

He presented a study of the Packet using rocket-powered rotors, and concluded that the 40,000-lb. craft could be lifted with only 14,000 lb. rocket thrust using 600 lb. of fuel for 6 sec.

► **"Pancake" Designer**—Charles Zimmerman, noted inventor of the "flying pancake" and successful advocate of low aspect ratio planforms, recounted his many years of experiments leading to the development of the well-known Vought V-173, flying scale model of the Vought XF5U-1. This odd craft was actually a convertaplane in reverse—it took off as a conventional fixed-wing aircraft but converted to near-

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hovering flight in mid-air.

Zimmerman began private experiments with this design in 1936, using rubber-powered models. He later graduated to small electric motors and ultimately produced the final configuration of the V-173/XF5U in model form.

He resigned from the NACA in the late '30s to devote full time to the project and became a consultant to United Aircraft Corp. during the life of the V-173/XF5U development. He has now returned to the NACA, where he is continuing his convertaplane studies.

Zimmerman believes that a propeller/rotor may obtain efficiencies in the 65-85 percent range. This may be achieved by the use of fairly high pitch, of the order of 10 deg., to obtain a maximum efficiency. He believes that this efficiency may be controlled, to some extent, by the proper selection of the diameter, since excessive diameter results in excessive blade profile drag.

He revealed that the full-scale model could not fly slower than about 50 mph., because the propellers were too small when used as rotors to support the weight of the plane. His calculations indicated that 3800 hp. is required to slow to 60 mph. or less, and this power was not available in the V-173/XF5U configuration.

In the matter of two-speed gearing, Zimmerman is of the opinion that a gear-shift is not required in the 0-250 mph. range, is desirable in the 250-400 mph. range and is essential if speeds above 400 mph. are to be obtained by rotors functioning as propellers in horizontal flight.

He is convinced that a convertaplane can be built that closely approaches the conventional fixed-wing aircraft in cruising speed and economy, but warns that good engineering of the details is essential to success of the configuration. In his view, the problem is to design a propeller that can act as a rotor when required.

► **Views of Navy Men**—Because it is to the Navy that convertaplane designers look for immediate support, the paper of Lt. Cmdr. William Knapp, VOS design desk, Navy Bureau of Aeronautics, held intense interest for those in attendance.

However, Knapp threw discouragingly cold water on the proceedings by holding that the convertaplane would be required to match existing combat and service craft in performance, while possessing the additional advantage of vertical takeoff and landing.

While insisting that these views were his own and not those of the Navy Department, it would seem that they are also those of the Bureau in which he serves, because of the support of his opinion by Rear Adm. C. M. Bolster, assistant chief for Research and Development. Admiral Bolster said: "If somebody can come up with an aircraft that can do what our present aircraft can do and still takeoff vertically, then the Navy will be interested."

Cmdr. Knapp held that the military convertaplane would have to be basically a high-performance fixed wing aircraft capable of performing the mission for which it was designed, such as fighter, attack, etc. He did not feel that the ability to actually hover was essential, but held that a takeoff and landing speed of 20 knots or less would be satisfactory.

He did suggest the potentialities of a successful convertaplane in rendering the current aircraft carrier obsolete, since this type of plane could be operated from cruisers, destroyers, tankers, etc.

Because the carrier task force is the current determinant of sea warfare, Cmdr. Knapp intimated that a successful convertaplane would revolutionize sea warfare itself.

However, it was apparent that if Cmdr. Knapp's views are shared by BuAer, the Navy is waiting until the advantages of the convertaplane are actually demonstrated before taking an active role in its development.

► **Bell Technician Demonstrates**—Robert L. Lichten, Bell Aircraft Corp., presented a model demonstration and motion pictures that removed all shadow of a doubt that a rotor undergoes any difficulty in transition to a propeller in flight.

He presented the theoretical basis of the problem by showing how the airflow is down through the rotor in forward flight as a fixed-wing aircraft and up through the rotor in autorotation as a helicopter or gyroplane.

There exists, obviously, some speed at which the airflow through the blades is zero. In the vicinity of this speed there is a decelerating torque on the rotor and the aerodynamic problem is the question of whether this decelerating torque is strong enough to slow the rotor down to autorotation speed.

By the use of a small, motor-driven fan and a model rig, Lichten demonstrated this problem and revealed that no undue difficulty is experienced in this respect.

Lichten also showed motion pictures of famed helicopter "idea man" Arthur Young performing model flight experiments with a rudimentary convertaplane in 1944. The device was a 48-in. span wing and a 39-in. rotor mounted on the end of an 18-ft. pole, which served as a control-line for the model. The rotor was driven at a tip speed of 250 fps. by a 220v. converted drill motor.

Young repeatedly caused the model to rise vertically, hover, roll over into high-speed level flight, heel over to hover and settle gently as a helicopter.

► **Pithy Opinion**—In one of the most profound analyses of the relationship between the public and flying, Roland Rohlfs, ace test pilot and altitude record holder of the post World War I period and now Personal Flying Specialist of CAA Region 1, assessed the possibilities of the convertaplane breaking the bonds of the present restricted market for private aircraft.

He presented a philosophical discussion of the private flying problem, that explained in only a few sentences the whole myriad complexity of the present status of personal flying. In brief, he believes that flying enthusiasts have simply asked the average citizen to do something he has neither the inclination nor the natural ability to do—fly his own airplane.

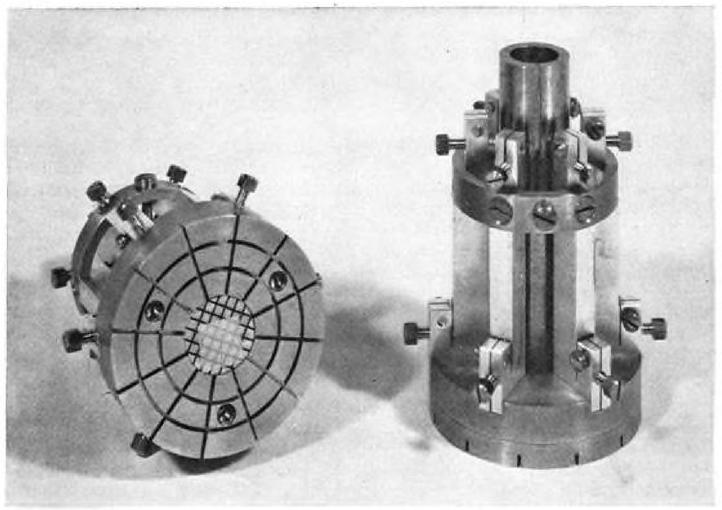
Rohlfs believes that the stagnation of private flying can be attributed to the natural fear of leaving the ground and to a lack of utility of the vehicle. He pointed out that the average businessman can more easily afford the price of a new personal aircraft than he can the time it takes to learn to operate it!

He believes that the normal "nervous tension" of the average person upon leaving the ground can be overcome only by presenting him with a method that has an essential "naturalness" to it. If the convertaplane can approach such naturalness much more closely than has the airplane and the helicopter, then it certainly can break the logjam of private flying.

Rohlfs drew up a score card for the convertaplane and gave it a "plus" on the counts of safety and utility over existing aircraft. He gave it both a plus and minus on the counts of noise and reliability, the first contingent upon a reduction of ramjet/pulsejet noise, and the second pending a demonstration. He gave it a minus score on counts of stability, power required, maintenance and ease of handling. He believes that his score sheet shows the convertaplane a type worth developing and believes it can be done.

However, he sagely warned enthusiasts that producing a vehicle that "does a trick" is not enough but that it must meet public taste and desire and recognize natural public limitations.

Other papers included an exhaustive classification of conceivable convertaplane configurations, by Viscount Louis de Monge de Franeau, Consultant, Pennsylvania Aircraft Syndicate, Ltd.; and a discussion of the well-known Doman semi-rigid rotor, prepared by Glidden Doman, president, Doman Helicopter Corp. and delivered by Giles N. Montgomery, Doman engineer.



Tall plunger apparatus devised to eliminate limiting factors of conventional lapping equipment in production of very thin quartz crystals for radio application. Modification of "inkwell" model, unit has bearing point screws to replace close-fitting bore. Slots in uprights permit transverse screws to lock bearing point screws in position.

Thin Crystal Problem Solved

High frequencies demand plates as thin as .001 in. Researchers at last have found how to make them.

The need for very thin quartz crystal oscillator plates having fundamental frequencies up to 100 megacycles or even higher, is highlighted by increasing interest in high frequencies for radio communication.

Because usual crystal grinding methods and machinery proved inadequate for producing plates of the required thinness researchers L. T. Sogn and W. J. Howard conducted equipment studies at the National Bureau of Standards to modify conventional techniques, and have come up with a satisfactory answer.

The improved equipment, capable of producing .001-in.-thick quartz crystals with a high degree of parallelism and flatness, can also be used for grinding equally thin wafers from a variety of other materials. A promising application, for example, is the production of extremely thin dielectric plates for miniature radio condensers.

► **Limitations**—In crystals whose fundamental frequency is in the higher range, the thickness of the quartz plate determines the frequency. Since the frequency is inversely proportional to the thickness, the higher the frequency the thinner the crystal must be.

Thus, a crystal with a fundamental frequency of 100mc. is about .001 in. thick. Moreover, its surfaces must be parallel within a few millionths of an inch. To manufacture such crystals, it has been necessary to modify the usual lapping procedures and to design equipment suitable to the modification.

Ordinarily, crystals are carried in a planetary path between two abrasive-charged lapping plates by a thin apertured disk called a nest. Nests thinner than .005 in. do not have the strength required to carry the crystals. Because the nest must be thinner than the crystals to permit their abrasion, crystals produced by this method have maximum fundamental frequencies of about 20mc.

► **Solutions Applied**—Initial problem, therefore, was to make crystal thickness independent of nest thickness. The solution involved various replacements for the customary top lapping plate and related changes in the design of the nest.

In the first modification, the crystals were cemented individually to small steel blocks that were used in place of the top plate to supply lapping pressure. A conventional nest carried the cemented units over the lower lap. Because of difficulties inherent in this method of mounting, the crystals became wedge-shaped.

Next, crystals were lapped, using the same equipment with the pressure blocks resting freely on the crystals. This process, however, did not correct contour defects, and the rate of lapping had to be reduced to prevent the blocks from being separated from the crystals in the process.

To permit faster lapping with some control of the relative movements of the block and crystal, both were closely confined in an accurately machined opening of a small steel plate. When this assembly was carried by the nest through the lapping operation, abrasives that worked into the narrow clearance between the block and plate caused binding.

For this reason the plate opening was enlarged, and the pressure block was centered by means of an apertured zinc sheet cemented to the top side of the retaining plate, thus eliminating binding and permitting the crystal to move laterally with respect to its pressure block. Although crystals lapped this way were wedge-shaped, experience that led to more successful models was gained.

► **Parallelism Factor**—The wedge-shaped crystals emphasized the need for designs that would assure parallelism. The attack on this phase of the problem resulted in three variations of a model in which small blocks were rigidly attached to a lapped ring. The assembled blocks were trued against the lap until they were coplanar and parallel to the lap so that wedged crystals could be corrected by parallelism.

To prevent uneven abrasion caused by the adhesion between the crystals and the blocks, the surfaces of the latter were broken up by the use of cross-channels.

In the first apparatus of this type, pentagonal blocks fitted into pentagonal nest openings. In the second variation, cylindrical plugs were used, and the nest was eliminated by using a close-fitting collar around each plug to confine its crystal and by using spokes to drive the ring directly.

The third variation was similar to the first, except that round rather than pentagonal plugs and holes were used. Its nest was thicker and channeled to reduce sticking.

Of these three forms, the nestless type was least satisfactory, chiefly because its excessive weight caused breakage. The third variation gave better results than the first because the plugs and holes were a more precise fit. Consequently, crystals produced with the

Another satisfactory lapping apparatus is the "inkwell" model. Four assembled units are shown ready to be driven over lap.

round plugs had less pronounced rims.

Deviations from parallelism in crystals produced by both lapping units were radial rather than wedge-like. The rims accounted for most of the deviation, which was shown not to exceed .00004 in.

► **Two Lapping Units**—Because of the difficulty in removing the ring and handling very thin crystals, a lapping method that permits much easier inspection of individual crystals has been evolved.

The new apparatus employed is an improved form of the square block and cell method and exists in two slightly different models—the "inkwell" and the tall plunger.

The inkwell type has a conical exterior and is essentially a keyed and closely fitting plunger and cylinder. The crystal is attached to the plunger by a drop of oil. The unit is then inverted and placed on the lapping plate. The crystal is thus confined between the piston and plate by the cylinder walls. A nest drives a number of such units over the lapping plate.

The tall plunger model differs mainly in having a taller piston sliding on bearing screws by which the amount of wobble can be controlled to a precise degree.

Crystals have been lapped at the Bureau to .001 in. with both these models. Breakage is almost nonexistent, and the surfaces are quite flat and parallel.

Limiting thickness for this equipment is not yet known, since the difficulties of handling and properly measuring such crystals impose many new problems that remain to be solved.

Generator Control

A simplified 28v. aircraft generator control system, in which numerous units are packaged in one installation to reduce ground maintenance time, has been developed by General Electric Co., Schenectady.

Designed so that only main current carrying items of equipment must be located in generator main power circuit adjacent to the main bus, system has control relays located in drawout-type panel which is shock mounted and enclosed to protect relays from humidity, salt spray, sand, and vibration. This panel is connected with current carrying units by small control cables.

In main generator line are two 250 mv. shunts providing indication for differential current fault protection, a contactor by which generator is switched on and off the line under normal operating conditions, and a reverse current circuit breaker to back up contactor in interrupting high current faults and extreme overvoltages.

Faulted generator is both disconnected and de-energized until fault is removed. Manual or electric reclosing may be provided. The trip-free circuit breaker and field relay assure that malfunctioning generators are not manually kept in system.

AIR FORCE CONTRACTS

October Total Hits $¾-Billion

Convair tops list with B-36D award for $40 million. Boeing gets $11 million experimental plane contract.

Contracts totaling more than three-quarters of a billion dollars awarded by Air Materiel Command headquarters in October indicate that Air Force fiscal 1950 procurement is getting into high gear.

Fixed price contracts let during the month numbered 364 and added up to a whopping $713,630,050. In the preceding month, 296 fixed price contracts totaled only $16,700,258 (AVIATION WEEK, Nov. 28). All told, AMC during the month awarded 484 contracts with a value of $826,655,816.

In addition, during October, Watson Laboratories, Red Bank, N. J., let 12 contracts totaling $70,797, and Cambridge (Mass.) Research Laboratories gave out 18 awards valued at $170,308.

Greatest number of AMC contracts, 329, was negotiated, and only 128 (totaling $3,832,021) were entered into after formal advertising. AMC placed 223 contracts valued at $8,283,888 with small businesses (which are defined as those employing less than 500 persons). Another interesting feature of AMC's October procurement actions was the size of cost-plus-fixed-fee contracts—34, totaling $67,525,040. In September, CPFF contracts numbered 22, but with a value of only $22,985,562.

At Watson, eight contracts valued at $62,877 were negotiated, and four, aggregating $7920 were entered into after advertising. Six contracts worth $14,512 went to small businesses. Cambridge negotiated six contracts totaling $140,522, and let 12 worth $29,786 after advertising. Eight awards valued at $33,363 were granted small businesses.

► **Convair Tops**—At the top of the list of AMC awards in October was Consolidated Vultee Aircraft Corp. which was given five contracts or letters of intent, adding up to $46,757,533. Convair's total was boosted by a single contract for $40,677,053 covering an undisclosed number of B-36YAs, Bs and YBs to be modified to B-36Ds. A CPFF contract, this actually was entered into in August, although only being issued in October. Work is scheduled for completion by July, 1951.

Other major item in Convair's awards was a $5,214,753 contract for 12 T-29A navigational trainers, along with spare parts, tools, data, flight testing, etc. This is scheduled for completion in April, 1951.

► **Boeing Next**—Second largest contractor during October was Boeing Airplane Co., which received five awards totaling $11,741,648, largest of which was for $11,007,123, and covered "confidential experimental airplanes." It is a CPFF contract.

$100,000 and Over

Aeroflex Laboratories Inc., Long Island, N. Y., type A-28 mounts, Oct., 1950, $1,789,-982.

Airborne Instruments Laboratory Inc., Mineola, N. Y., spare parts for AN-GPA-7A, Jan., 1950, $120,000.

Airesearch Mfg. Co., Garrett Corp., Los Angeles, Calif., refrigeration turbines, Feb., 1950, $160,200.

Allison division General Motors Corp., Indianapolis, Ind., aircraft engine spare parts used in F-82 aircraft, June, 1950, $106,016.

Allison division, General Motors Corp., Indianapolis, Ind., maintenance and overhaul parts for J-35 jet engines, June, 1951, $3,000,000; spare parts for J-33-A-23 turbojet engines, Apr., 1951, $1,459,436.

Ansco General Analine Film Corp., Binghampton, N. Y., photographic film, Mar. 1950, $1,134,469.

AVCO Mfg. Corp., Williamsport, Pa., 70 additional type B-10 power plants, Sept., 1950, $553,800.

BG Corp., New York, N. Y., aircraft spark plugs, Mar. 1950, $422,220.

Beech Aircraft Corp., Wichita, Kan., tanks, Jan., 1950, $174,977.

Bell & Howell Co., Chicago, Ill., silent bomb spotting motion picture aircraft camera, Sept., 1951, $1,045,283.

Bell Aircraft Corp., Buffalo, N. Y., no description or estimated completion date given, $873,360.

Bellanca Aircraft Corp., New Castle, Del., recondition, pack and crate 30 T-6D aircraft, Jan., 1950, $237,996.

Bendix Products division, Bendix Aviation Corp., South Bend, Ind., rotor brakes, July, 1950, $109,414.

Boeing Airplane Co., Seattle, Wash., services and materials to repair one YC-97A aircraft, Mar., 1950, $387,671; confidential experimental airplanes, no estimated completion date given, $11,007,123; rearrangement and rewiring of AN-APQ-24 navigational and bombing radar equipment in eight FY 1947 airplanes, Nov., 1949, $274,-100.

Boston University, Boston, Mass., services—reserach studies, design and fabrication of prototype camera, Nov., 1950, $465,715.

Bureau of Federal Supply, Cleveland, Ohio, filing cabinets, Jan., 1950, $230,054; office equipment and furniture, Mar., 1950, $363,955.

California Institute of Technology, Pasadena, Calif., services for continuation of research on supersonic ram jet problems, Jan., 1951, $150,000.

Consolidated Vultee Aircraft Corp., Fort Worth, Tex., B-36D airplanes, modification of B-36A and B and YB airplanes, July, 1951, $40,677,053; 2 mobile training units, Mar., 1950, $831,729.

Consolidated Vultee Aircraft Corp., San Diego, Calif., spare parts, data, special tools and ground handling equipment and flight testing, Apr., 1951, $5,214,753.

Curtiss-Wright Propeller division, Curtiss-Wright Corp., Caldwell, N. J., design, development, fabrication and delivery of 24 each model C748SP-A-1129-11C6-24 propeller assemblies, Feb., 1951, $2,177,993.

National Bureau of Standards, Department of Commerce, Washington, D. C., research in optics, June, 1950, $150,000.

Douglas Aircraft Co. Inc., Santa Monica, Calif., no description or estimated completion date given, $1,729,079; maintenance spare parts for C-74 and B-26 aircraft, Nov., 1949, $143,929; maintenance spare parts for C-47, C-54, C-117, and C-118 type aircraft, Nov., 1949, $359,914.

Duffy Construction Co., Cleveland, Ohio, protection, maintenance at government aircraft plant No. 7, Cleveland, Ohio, June, 1950, $498,819.

Eastman Kodak Co., Rochester, N. Y., Y-1 periscope bombsights and type B-1 desiccators, Apr., 1951, $712,341.

Electric Storage Battery Co., Cleveland, Ohio, aircraft storage battery, Apr., 1950, $128,850; D-6A batteries, Apr., 1950, $201,-337.

Emerson Electric Mfg. Co., St. Louis, Mo., flexible bomber tail defense fire control, type A-2, Feb., 1950, $2,900,000.

Fairchild Aircraft division, Fairchild Engine and Airplane Corp., Hagerstown, Md., research and development MX821, June, 1950, $5,760,000.

Falk, Walter E.—Books, Cincinnati, Ohio, commercial books, periodicals and related items, June, 1950, $100,000.

Flight Refueling Ltd., Little Hampton, England, classified modification, Apr., 1950, $150,000.

General Electric Co., Schenectady, N. Y., spare parts for turbosuperchargers and turboregulators, June, 1950, $150,000; turbosupercharger spare parts, July, 1950, $118,545.

Gibbs Mfg. and Research Corp., Janesville, Wis., servo amplifier AM-APA-52 and mounting MT-APA-52, May, 1950, $190,604.

Goodrich, B. F. Co., Akron, Ohio, spare parts for C-47 and C-54 aircraft, Mar., 1950, $681,449; 56 x 16 in. wheels and brakes, Mar., 1950, $185,762.

Goodyear Tire and Rubber Co., Inc., Akron, Ohio, 26 x 66 in. wheels, brakes, and spare parts, May, 1951, $726,147.

Hoffman Radio Corp., Los Angeles, Calif., equipment, July, 1950, $576,352.

Hughes Aircraft Co. division of Hughes Tool Co., Houston, Tex., engineering and a portion of manufacturing necessary to convert the XH-17 ground test rig into a flyable test article, Sept., 1950, $490,653.

Hycon Mfg. Co., Pasadena, Calif., type A-14 magazines, Mar., 1950, $464,109.

International Business Machines, Dayton, Ohio, tabulating equipment accessories and devices, June, 1950, $740,000.

Kinsey, E. A., Company, Inc., Cincinnati, Ohio, vertical turret lathe and comm. lit. lathe, Mar., 1950, $286,057.

Kollsman Instrument division, Square D Co., Elmhurst, N. Y., altimeters, July, 1950, $328,428.

Lockheed Aircraft Corp., Burbank, Calif., spare parts for C-121 aircraft, Mar., 1950, $841,849.

Machine Products Co., Tulsa, Okla., protection, maintenance, repairs and utility services, June, 1950, $278,198.

Massachusetts Institute of Technology, Cambridge, Mass., services—studies toward complete analysis of response of aircraft to elastic loading, Feb., 1951, $200,000; research and development services, Sept., 1950, $2,700,000.

Mine Safety Appliances Co., Pittsburgh, Pa., oxygen mask, type A-13A, Jan., 1950, $101,000.

Minneapolis Honeywell Regulator Co., Minneapolis, Minn., 18 overhaul tools and test equipment for Type E-16 automatic pilot, June, 1950, $134,058.

Northrop Aircraft Inc., Hawthorne, Calif., no description or estimated completion date given, $3,906,855.

Norton Co., Worcester, Mass., machine

grinding and maintenance data, May, 1950, $162,472.

Ohio State University Research Foundation, Columbus, Ohio, additional data concerning the application of liquid hydrogen as an aircraft engine fuel, Oct., 1950, $100,000.

Philco Corp., Philadelphia, Pa., domestic technical representative services, June, 1950, $111,669.

Pioneer Parachute Co., Inc., Cheney Bros., Manchester, Conn. parachute assemblies S-8 and B-12, May 1950, $147,191.

Pratt and Whitney Aircraft division, United Aircraft Corp., Hartford, Conn., prototype R-4360-55C series engines and 150 qualification tests and reports, Feb., 1951, $10,414,400.

Remington Rand, Inc., Dayton, Ohio, insulated filing cabinets, Dec., 1949, $128,259.

Republic Aviation Corp., Farmingdale, N. Y., tooling development using universal optical positioner, Dec., 1950, $125,262; extension of flight test program and design and installation of hydraulic boost in elevator control system, June, 1950, $279,394.

Ryan Aeronautical Co., San Diego, Calif., no description or estimated completion date given, $181,916.

Safeway Steel Products, Inc., Milwaukee, style V multi-level service stands, Mar., 1950, $359,900.

Shaw-Walker Co., Dayton, Ohio, insulated filing cabinets, Dec., 1949, $128,129.

Sikorsky Aircraft division, United Aircraft Corp., Bridgeport, Conn., amphibious gear kit for retroactive installation on H-5F and H-5G helicopters, Apr., 1950, $172,031.

Solar Aircraft Co., San Diego, Calif., spare parts for the F-80 aircraft, June, 1950, $194,420.

Sperry Gyroscope Co., Inc., division Sperry Corp., Great Neck, N. Y., no description or estimated completion date given, $1,115,041.

Steel Products Engrg. Co., Springfield, Ohio, bomb hoist and spares, Mar., 1950, $539,960.

Technicraft Corp., Kansas City, Mo., electrical tuner for radio compass AN-ARN-6, May, 1950, $106,331.

Tumpane Co., Marietta, Ga., protection, maintenance, repairs and utilities, storage, recording and processing machine tools, June, 1950, $758,613.

United Mfg. Co., division, United Advertising Corp., New Haven, Conn., test stand, engineering data and maintenance data, Feb., 1950, $150,008.

U. S. Bureau of Mines, Washington, D. C., investigation and development of zirconium and zirconium alloys, July, 1951, $112,000.

University of Texas, Austin, Tex., research to analyze aircraft fire control systems, Oct., 1950, $258,912.

Western Electric Co., New York, N. Y., radar set, Sept., 1950, $2,280,135.

Wright Areonautical Corp., Curtiss-Wright Corp., Wood-Ridge, N. J., R-1820-101 engines and spare parts, July, 1950, $1,946,880.

$1000 to $100,000

AC Spark Plug division, General Motors Corp., Flint, Mich., spark plugs, Dec., 1949, $7000; tester assembly, Feb., 1950, $10,100; components for K-14B gunsights, Feb., 1950, $1836.

Adams Mfg. and Engineering Co., Huntington Park, Calif., adjustable pliers, Jan., 1950, $2700.

Addressograph, Dayton, Ohio, services and materials for repair of four model 1250 multilith machines, Dec., 1949, $2400.

Adel Precision Products Corp., Burbank, Calif., valves, July, 1950, $7030; valves, Dec., 1949, $26,279.

Aeroflex Laboratories Inc., Long Island, N. Y., additional development of A-31 mount, Jan., 1950, $12,000; tester and maintenance data, Nov., 1949, $1610; type A-1 vertical reference units, Nov., 1949, $27,800.

Aerojet Engineering Corp., Azusa, Calif., additional work on rocket thrust test stands, June, 1951, $26,663.

Aerological Research division, American Institute, Pasadena, Calif., evaluation of meteorological forecasting aids by means of placing various basic parameters forming the bases for forecasting aids on an objective basis either graphically, etc., Oct., 1949 (Watson Lab.), $24,961.

Aermotive Equipment Corp., Kansas City, Mo., clutch assembly, Nov., 1949, $1170.

Aeroproducts division, General Motors Corp., Dayton, propeller spare parts, Jan., 1950, $17,127; propellers rework of 5 ea. A542F-D1 and AL542F-D1, Jan., 1950, $8859.

Aeroquip Corp., Jackson, Mich., aircraft hardware, Jan., 1950, $20,523; aircraft hardware, Jan., 1950, $5920.

Air Associates Inc., Teterboro, N. J., aircraft hardware, Feb., 1950, $2358; O-ring gaskets, Apr., 1950, $35,253.

Air Reduction Sales Co., New York, oxygen gas, breathing, June, 1951, $8114.

Airborne-Instruments Laboratory Inc., Mineola, N. Y., technician services, June, 1950, $16,625.

Aircooled Motors Inc., Syracuse, N. Y., spare parts for 0-335-3, 0-425-9 engines and E5A and E5B auxiliary power plants installed in H-13, L-13, and B-36 aircraft, June, 1950, $10,000.

Aircraft Fittings Co., Cleveland, aircraft hardware, Jan., 1950, $5128.

Aircraft Hardware Mfg. Co., Inc., Bronx, N. Y., aircraft hardware, Jan., 1950, $1337; aircraft hardware, Jan., 1950, $2147.

Aircraft Products Co., Clifton Heights, Pa., pump assembly and maintenance data, Feb., 1950, $1900.

Aircraft Radio Corp., Boonton, N. J., transformer arc No. 6308, Jan., 1950, $1650.

AiResearch Mfg. Co., Garrett Corp., Los Angeles, Calif., oil coolers and parts, June, 1950, $15,000; factory familiarization training, Mar., 1950, $11,582.

Airequipment Co., Burbank, fuselage maintenance dolly, Mar., 1950, $9815; type B-2 aircraft maintenance stand assembly, Jan., 1950, $92,450; type B-1 aircraft maintenance stand assembly, Jan., 1950, $75,105.

Akeley Camera Inc., New York, tester assembly, Nov., 1949, $1069.

Alar Products Inc., Cleveland, spare parts for type AN6010-1 oxygen regulator, Jan., 1950, $19,258.

American Chain division, American Chain-Cable Co., Detroit, aircraft hardware, Jan., 1950, $1748; aircraft hardware, Feb., 1950, $1043.

American Chronoscope Corp., Mt. Vernon, N. Y., chronoscope adapter pick-up light source circuit diagrams, Nov., 1949, $3320.

American Pad and Textile Co., Greenfield, Ohio, life preserver-tapacto, Dec., 1949, $1044.

American Paper Goods Co., Kensington, Conn., envelopes, Dec., 1949, $2855.

American Seating Co., Grand Rapids, Mich., folding chairs, Nov., 1949, $11,001.

Ampro Corp., Chicago, spare parts for photographic equipment, June, 1950, $3264; spare parts for photo equipment, July, 1950, $2410.

Andrews-Alderfer Processing Co., Akron, Ohio, cylinder CO2, Jan., 1950, $16,006.

Andrews, P. L., Corp., Brooklyn, N. Y., envelopes, Dec., 1949, $19,721.

Anti-Corrosive Metal Products, Castleton, N. Y., aircraft hardware, Jan., 1950, $1271.

Armour Research Foundation, Chicago, research in silicon and silicon alloys, Oct., 1950, $47,092; research for determination of compressive bearing and near properties of non-ferrous structural sheet materials at elevated temperature, Oct., 1950, $21,922; development of phase diagrams of the titanium-molybdenum titanium-columbium and titanium-silicon alloy systems, Oct., 1950, $68,636.

New Awards

These contracts in excess of $100,000 were signed by the U. S. Air Force during November. Contracts with an October date signify date on which letter of intent was awarded, followed by a contract in November.

American Gas Accumulator Co., Elizabeth, N. J., lamp assembly and engineering data, Nov. 2, 1949, $130,016.

Bendix Products division, Bendix Aviation Corp., South Bend., Ind., carburetors and spare parts, Oct. 21, 1949, $865,855.

Breeze Corp., Newark, N. J., hose clamps AN 737, Nov. 16, 1949, $142,440.

Champion Spark Plug Co., Toledo, Ohio, spark plugs, type R-375-1, Oct. 18, 1949, $359,625.

Cleveland Pneumatic Tool Co., Cleveland, spare parts required for maintenance of all types USAF aircraft, Oct. 3, 1949, $100,000.

Curtiss-Wright Propeller, Curtiss-Wright Corp., Caldwell, N. J., miscellaneous spare parts, assemblies and sub-assemblies for contractor manufactured propellers for stock replenishment, Oct 21, 1949, $145,000.

Curtiss-Wright Propeller, Curtiss Wright Corp., Caldwell, N. J., propeller equipment for B-50 aircraft, Oct. 27, 1949, $401,424.

Eastman Kodak Co., Rochester, N. Y., manufacture, supply or acquisition of facilities, including machinery and production equipment, Nov. 16, 1949, $200,000.

Eclipse Pioneer, Bendix Aviation Corp., Teterboro, N. J., generators (aircraft) regulators, voltage, 115V a.c.; spare parts, Nov. 4, 1949, $225,264.

Fairchild Camera & Instrument Co., Jamaica, N. Y., cone assembly for K-17C camera, Nov. 1, 1949, $194,963.

Federal Motor Truck Co., Detroit, spare parts for C-2 and F-1 truck tractors, Nov. 18, 1949, $102,123.

Gisholt Machine Co., Madison, Wis., machine, dynetric balancing, Oct. 17, 1949, $432,674.

Ideal Clamp Mfg. Co., Brooklyn, N. Y., hose clamps AN 737, Nov. 16, 1949, $132,075.

Minneapolis Honeywell Regulator Co., Minneapolis, E-6 autopilot components, Nov. 25, 1949, $344,111.

North American Aviation Inc., Los Angeles, rebuilding 330 T-6 aircraft in accordance with N.A.A., Inc., report No. NA49-737—Engineering drawings and data, Nov. 18, 1949, $3,989,503.

Norton Co., Worcester, Mass., machine, grinding, Nov. 15, 1949, $218,555.

Packard Electric division, General Motors Corp., Warren, Ohio, cable, Nov. 28, 1949, $124,466.

Pesco Products, Borg-Warner Corp., Bedford, Ohio, spare parts for fuel pumps, Oct. 11, 1949, $163,908.

Thompson M. I. Co., Los Angeles, fabric, quilted fibre glass insulation, Nov. 25, 1949, $124,466.

Wellington Sears Co., New York, mercerized cotton cloth, Nov. 23, 1949, $312,622.

Aro Equipment Corp., Bryan, Ohio, air pumps, Feb., 1950, $3450; air pump, June, 1950, $4600.

Aviation Maintenance Corp., Van Nuys, Calif., substitution of aircraft to be reconditioned, Jan., 1950, $1638.

Baldes, Edward J., Rochester, Minn., consultant services, June, 1950, $1500.

Barber-Colmen Co., Rockford, Ill., manifold., thermister elements, Nov., 1949, $3530.

Barco Mfg. Co., Chicago, swivel joint, Jan., 1950, $6480.

Battelle Memorial Institute, Columbus, Ohio, research on rectifiers, Mar., 1951, $28,802; research on titanium and tungsten alloys, Oct., 1950, $21,400; research-mechanical property tests on ceramic bodies, Oct., 1950, $39,910; research on heat resisting alloy sheet, Oct., 1951, $15,002; research on conducting materials for resistors, Mar., 1951, $21,137, research on substitutes for zinc and cadmium, Sept., 1950, $21,646.

Beaver Valley Painting, Ambridge, Pa., painting of 2 ft. x 2 ft. wind tunnel, Nov., 1949, $1998.

Beech Aircraft Corp., Wichita, spare parts for C-45, T-7, and T-11 aircraft, June, 1950, $50,000.

Bell and Howell Co., Chicago, miscellaneous photo equipment, Dec., 1949, $1431; capacitors, Dec., 1949, $1080.

Bell Aircraft Corp., Niagara Falls, N. Y., spare parts for YH-12, 13, 13A, H-13B aircraft, June 1950, $25,000.

Bendix Aviation Corp., Pacific division, North Hollywood, Calif., control valves, Feb., 1950, $2598; valve assembly, Jan., 1950, $1501.

Bendix Aviation Corp., Red Bank division, Red Bank, N. J., technical data covering dynamotor assembly, Nov., 1949, $1051.

Bendix Products Appliances Inc., division, Bendix Aviation Corp., South Bend, Ind., miscellaneous strut assemblies and aircraft components, struts and brackets, June, 1950, $50,000.

Bendix Radio, Baltimore, terminal board assemblies, Feb., 1950, $1433.

Beseler, Charles Co., Newark, N. J., miscellaneous photo spare parts, Dec., 1949, $7844.

Binks Mfg. Co., Chicago, cleaner-engine spray type, Dec., 1949, $1741.

Blumenthal, Sidney and Co., New York, synthetic fur, June, 1950, $6000.

Boeing Airplane Co., Seattle, Wash., field engineer services pertaining to modification of Boeing Aircraft, June, 1950, $36,396; inspection service and maintenance of B-50 airplane 46-603 by contractor for 30 days while AMC flight crews conduct flight tests to secure cruise data for pilots handbook, Nov., 1949, $36,358.

Booz, Allen and Hamilton, Chicago, Ill., no description or estimated completion date given, $28,000.

Borg, George W., Corp., Gibbs division, Delavan, Wis., synthetic fur, June, 1950, $23,650.

Boston University, Boston, Mass., research on immersion hypothermia, Aug., 1950, $10,262.

Bowser-Morner Laboratory, Dayton, tests and test reports of materials submitted by analysis division, June, 1950, $2000; testing of fuels and lubricants for materials laboratory, June, 1950, $5000.

Bronk, Detley W., Baltimore, consultant services, June, 1950, $1500.

Bronson, Homer D., Co., Beacon, Conn., hinges, Dec., 1949, $1615.

Browning Bros. Inc., New York, cover, propeller governor drive P-N AN 5025-1, Jan., 1950, $1644.

Brujac Electronic Corp., New York, oscilloscope cathode ray tektronix type 512, Jan., 1950 (Cambridge Lab.), $1900.

Burdett Oxygen Co., Cleveland, oxygen gas, breathing, June, 1951, $5857.

Burns Bros., Belmar, N. J., fuel oil No. 2, Oct., 1949 (Watson Lab.), $1365.

Bury Compressor Co., Erie, Pa., compressor and maintenance data, Jan., 1950, $39,200.

Capital Sales Service Co., Washington, D. C., wardrobe racks, Dec., 1949, $41,288.

Chandler Evans division, Niles Bement Pond Co., Hartford, Conn., pump spare parts, Apr., 1950, $12,522.

Chase Aircraft Co., Inc., Trenton, N. J., loading mock-up of YC-122C cargo floor and loading and lashing brochure, Sept., 1950, $19,040.

Cincinnati Milling Grind Co., Cincinnati, milling machine and data, Jan., 1950, $33,870; machine tools and data, Nov., 1949, $22,675.

Clary Multiplier Corp., Los Angeles, aircraft hardware, Jan., 1950, $3411.

Clayton Mfg. Co., Rosemead, Calif., cleaner vapor pressure spray rinse, Mar., 1950, $35,605.

Collins Radio Co., Cedar Rapids, Iowa, radio set Collins type 51R-2, Jan., 1950, $4215; equipment VHF navigation Collins type 51R-1, Nov., 1949 (Watson Lab.), $7931.

Columbus Production Mfg. Co., Columbus, Ohio, aircraft hardware, Jan., 1950, $1807.

Commercial Envelope Corp., Baltimore, envelopes, Dec., 1949, $12,730.

Conray Products, New York, gum arabic, Dec., 1949, $2124.

Consolidated Engrg. Corp., Pasadena, Calif., magazine record, Mar., 1950, $3023.

Consolidated Vultee Aircraft Corp., Fort Worth, Tex., additional cable assembly for bomb-rack auxiliary crew member, install lighting in trailing edges of wing, special training for 51 civilian employes, July, 1951, $13,998; rework repair modification or overhaul of GFP components furnished to contractor, Dec., 1949, $20,000.

Continental Elastic Corp., New Bedford, Mass., experimental webbing, Nov., 1949, $1600.

Continental Motors Corp., Muskegon, Mich., spare parts for 0-190-1, 0-205-1, and 0-470-7 engines installed in L-16A, L-16B, and L-17 aircraft, June, 1950, $10,000.

Cook Research Laboratory, Chicago, repair and maintenance to Cook types 599-2024, 599-2496, and D1-2 magnetic-tape recorders, June, 1950, $3000.

Cornell Aeronautical Laboratory, Inc., Buffalo, N. Y., research and development of a suitable non-rigid tow target, Dec., 1950, $41,836.

Curtiss-Wright Propeller division, Curtiss-Wright Corp., Caldwell, N. J., installation and spare propeller control parts for C-112 airplanes, May 1950, $9457; miscellaneous small tools, Dec., 1950, $54,173.

Danis, B. G., Co., Dayton, repair subfloor and provide additional wood block flooring, Dec., 1949, $5515.

Dayton Aircraft Products Inc., Dayton, case tester instrument field, Oct., 1949, $5853.

Department of Interior, Geological division, Washington, D. C., Aleutian volcano investigation program, June, 1950, $20,000.

Deutsch Co., Los Angeles, aircraft hardware, Jan., 1950, $6621; aircraft hardware, Jan., 1950, $3956.

Devry Corp., Chicago, miscellaneous photographic equipment, Nov., 1949, $2875.

Dial Machine Tool Co., Detroit, special bombsight tools, Dec., 1949, $2156.

Distillation Products Inc., Rochester, N. Y., tube exhaust system includes a VMF 80 fractionating 3-stage diffusion pump, etc., Dec., 1949 (Cambridge Lab.), $1738.

Draper, Charles S., Cambridge, Mass., consultant services, June, 1950, $1500.

Dumont, Allen B., Laboratories, Inc., Clifton, N. J., oscilloscope cathode ray, Dumont type, Oct., 1949 (Cambridge Lab.), $2013; cathode ray oscilloscope, Dumont type, Oct., 1949 (Cambridge Lab.), $1705.

Du Pont de Nemours, E. I., New York, plastic sheet cellulose acetate base, Apr., 1950, $9600.

Duffy Construction Co., Cleveland, component parts for engine test stand, Dec., 1949, $6370.

Dye Oxygen Co., Phoenix, Ariz., breathing oxygen, June, 1951, $8067.

Eastern Rotocraft Co., Willow Grove, Pa., tie-down device, June, 1950, $2580.

Eastman Kodak Co., Rochester, N. Y., photographic film, Nov., 1949, $15,460; plastic sheet-cellulose acetate colorless, Jan., 1950, $25,958; photographic film, Jan., 1950, $31,562; spare parts for photographic equipment, Dec., 1949, $1896.

Eav-Tex Co., Havertown, Pa., plastic sheet-cellulose acetate colorless, Jan., 1950, $4991.

Eclipse-Pioneer division, Bendix Aviation Corp., Teterboro, N. J., torque pressure indicators and transmitters, Feb., 1950, $16,513; maintenance parts for G-18 starter, Mar., 1950, $20,550; tester assemblies tester fuel flowmeter, Apr., 1950, $82,342; fuel pressure indicators type C-28, Mar., 1951, $22,192; stand assembly high range, Apr., 1950, $7694; pressure demand oxygen regulators, May, 1950, $47,487; fuel pressure transmitters type E-5, Mar., 1951, $44,473; oil pressure indicators type B-18, June, 1951, $10,618; relief valves, June, 1950, $1706.

Elcor Inc., Chicago, modification kits for alternators, Dec., 1949, $21,313.

Elastic Stop Nut Corp. of America, Union, N. J., nuts, Jan., 1950, $46,793.

Electric Sprayit Co., Sheboygan, Wis., tester assembly and revision data, Dec., 1949, $2599.

Electronic Transformer Co., New York, filter reactor single winding electronics, Feb., 1950, $1193.

Elliott Co., Jeannette, Pa., twin oil strainers, Jan., 1950, $2568.

Emeco Corp., Hanover, Pa., chairs, Jan., 1950, $27,552.

Fafnir Bearing Co., New Britain, Conn., machine testing antifriction bearings, July, 1950, $3850.

Fairchild Aircraft division, Fairchild Engine and Airplane Corp., Hagerstown, Md., loading and lashing handbook C-119B airplane, Mar., 1950, $57,835.

Fairchild Camera-Instrument, Jamaica, N. Y., drawings for Zenith cameras, Feb., 1950, $2404; periscope, Mar., 1950, $66,363; dial assembly, Jan., 1950, $3382.

Farwest Trading Co., Seattle, Wash., drives tail gun mount azimuth and elevation, Aug., 1949, $1726.

Federal Telecommunications Laboratories, Nutley, N. J., one each radar antenna for use with radar set AN-FPS-2, Oct., 1949 (Watson Lab.), $5898; slotted line coaxial FTL-30A, Nov., 1949 (Cambridge Lab.), $2940.

Felsenthal G., and Sons, Chicago, computers, Dec., 1949, $1542.

Fenwall Inc., Ashland, Mass., fire detector switch assembly, Jan., 1950, $49,476.

Foote Mineral Co., Phila., Pa., zirconium and hafnium research, Oct., 1950, $91,347.

Gabb Mfg. Co., E. Horton and Son Co., East Hartford, Conn., indicator piston position and maintenance data, Feb., 1950, $3974.

Gadgets Inc., Dayton, testers and maintenance data, Apr., 1950, $4910.

Gannon, Russell R., Co., Norwood, Ohio, container assembly, Jan., 1950, $15,460.

Gardonyi, Eugene, Co., New York, locate identify prepare for shipment pack and deliver to port for shipment to U. S. 1-80000 MKG hammer 1 63000 MKG hammer and related equipment, Jan., 1950, $17,246.

Garrett, George K., Inc., Phila., Pa., aircraft hardware, Feb., 1950, $3493.

Garvey Fountain Brush-Ink, St. Louis, Mo., stencil ink, Dec., 1949, $2103.

General Controls Co., Glendale, Calif., valves, Jan., 1950, $7029, valve, Jan., 1950, $2122.

General Electric Co., Dayton, O., generator aircraft engine driven, June, 1950, $11,540; generator aircraft engine driven 200 amp. engineering data, Feb., 1950, $44,700; block receptacle and relay, Dec., 1949, $2120.

General Electric Co., Schenectady, N. Y., supplies and services on projects MX809 and MX893, June, 1950, $27,000; engineering study service and data, May, 1951, $3600; engineering tools manufacturing and installation of streamlined dome, June, 1950, $88,836; repair inspect and functionally test B-50 fire control equipment, June, 1950, $15,000; barometric valves, Feb., 1951, $25,055; voltmeters, frequency meters, varmeters, Mar., 1950, $9393; perform additional testing of B-36 turrets incorporating 50 calibre guns in lieu of 20mm guns, Aug., 1950, $5563.

General Electric Co., Syracuse, N. Y., field engineering services, Dec., 1949, $9571; spark gap contact, Jan., 1950, $3225.

General Electric X-Ray Corp., Milwaukee, Wis., machine-X-ray, Jan., 1950, $15,560.

General Paper Goods Mfg. Co., Brooklyn, N. Y., envelopes, Dec., 1949, $5244.

General Radio Co., Cambridge, Mass., strobotac range 600 to 14,400 rpm., Dec.,

1949, $1375; impedance measuring circuit twin-T General Radio type 821A, Apr., 1950 (Cambridge Lab.), $1185; standard frequency secondary radio type 1100-AQ code-exact, Oct., 1949 (Cambridge Lab.), $1590.

General Tire and Rubber Co., Akron, Ohio, casings aircraft, Dec., 1949, $15,807.

Gengelbach, Werner K., Wright-Patterson Air Force Base, Ohio, scientific consultation, no estimated completion date given, $5526.

Gilfillan Bros., Inc., Los Angeles, Calif., waveguides (four contracts), Apr., 1950, $8755.

Gisholt Machine Co., Madison, Wis., dynetric balancing machine for supercharger, June, 1950, $15,253.

Goodrich, B. F. Co., Akron, Ohio, spare parts for C-46 aircraft, Dec., 1949, $46,039; nose wheels, July, 1950, $20,647; fuel cell fittings, Feb., 1950, $28,863; spare parts for miscellaneous aircraft, June, 1950, $5000.

Goodyear Tire and Rubber Co., Inc., Akron, Ohio, fuel cell fittings, May, 1950, $6501; brake discs, July, 1950, $18,692; wheel assemblies, Mar., 1950, $7220; wheel bearing closures, Jan., 1950, $2047; casings and tubes, June, 1950, $1909.

Goshen Rubber and Mfg. Co., Goshen, Ind., grommets, Jan., 1950, $1506.

Gosiger, C. H., Machine Co., Dayton, Ohio, portable grinder, Nov., 1949, $1244; magnetic polishing lathe, Nov., 1949, $1592.

Graflex, Inc., Rochester, N. Y., Graflex cameras, Dec., 1949, $10,611.

Grand Central Airport Co., Glendale, Calif., B-36A bomb release trainer, Feb., 1950, $1898.

Grant Photo Products, Inc., Lakewood, Ohio, photographic film, Jan., 1950, $1663.

Greer Hydraulics, Inc., Brooklyn, N. Y., test stand gear boxes, Feb., 1950, $14,825; tester assembly, tool engineering and maintenance data, B-36 project, Feb., 1950, $36,155; assembly stand, tool engineering and maintenance data, Dec., 1949, $6650; aircraft tester, engineering and maintenance data, Feb., 1950, $44,900; test stand, Jan., 1950, $50,540; assembly stand and sample copy of comm. lit., Dec., 1949, $14,970.

Hackensack Cable Corp., Hackensack, N. J., aircraft hardware, Jan., 1950, $1044; cable, Jan., 1950, $16,635.

Hadley, Robert M., Co., Los Angeles, Calif., transformer, Dec., 1949, $1744.

Haloid Co., Rochester, N. Y., photographic film, Jan., 1950, $8174.

Harding Devices Co., Dallas, Tex., gaskets, Dec., 1949, $1138.

Hartzell Industries, Inc., Piqua, Ohio, development of magnesium propeller blades 9 ft. in diameter or less, Oct. 1950, $22,038.

Hawthorne, William R., Cambridge, Mass., consultant services, June, 1950, $1500.

Hazeltine Electronics Corp., Little Neck, N. Y., field engineering services, June, 1950, $7650.

Hess, Inc., Perth Amboy, N. J., kerosene, Oct., 1949, (Watson Lab.), $1020.

Hewitt Rubber of Buffalo, division of Hewitt Robins, Inc., Buffalo, N. Y., gasoline hose, Nov., 1949, $2229.

Hobart Brothers Co., Troy, Ohio, welder and maintenance data, Jan., 1950, $9200.

Hoff, Nicholas J., Brooklyn, N. Y., consultant services, June, 1950, $1500.

Hoffman Radio Corp., Los Angeles, Calif., radio set AN-URC-4, Sept., 1950, $39,214.

Hollis, Ernest V., Jr., Arlington, Va., manuscript report, $3000.

Hollingshead, R. M., Corp., Camden, N. J., 11,310 gal. protective coating, Jan., 1950, $29,955.

Holmes Projector Co., Chicago, spare parts for photographic equipment, Dec., 1949, $17,959.

Houghton, Henry G., Cambridge, Mass., consultant services, June, 1950, $1500.

Hughes Aircraft Co., Culver City, Calif., $7011.

Hughes-Simonson Engineering Co., Dayton, Ohio, labor and materials for maintenance and repair of atmospheric conditioning equipt., June, 1950, $15,000; installation of government-furnished 250-volt d.c. switchgear assembly, bldg. 18, area B, Dec., 1949, $4096.

Hughes Tool Co., Hughes Aircraft Co., Culver City, Calif., factory familiarization training, Feb., 1951, $84,316.

Hydropress, Inc., New York, pumps and motors for 5500-ton press at Canton drop forge, Canton, Ohio, Mar., 1950, $71,632; supervision of unloading and identifying heavy press equipt. at N. Y. POE, Oct., 1949, $7999.

Ideal Clamp Mfg. Co., Inc., Brooklyn, N. Y. aircraft hardware, Jan., 1950, $16,373.

Independent Engineering, Fallon, Ill., Collins type expansion engine and liquid pump, Dec., 1949, $3006.

Inland Equipment Co., Nashville, Tenn., tester assembly and maintenance data, Feb., 1950, $1500.

International Latex Corp., Dover, Del., helmet, Dec., 1949, $51,500.

J. O. Mfg. Co., South Gate, Calif., shield, Nov., 1949, $2476.

Jack & Heintz Precision Industries, Cleveland, Ohio, direct cranking type K-1 aircraft starter, Feb., 1950, $98,000; spare parts for accessory power plants, June, 1950, $50,000.

Jackson, Keene S., Pasadena, Calif., components for K-14B gunsights, Nov., 1949, $7789, spare parts for maintenance stock, Jan., 1950, $5619.

Jam Handy Organization, Inc., Detroit, Mich., 35mm type G-1 projectors, June, 1950, $56,654; vu graft slides, Nov., 1949, $4570.

Jerome Engineering Co., Worcester, Mass., gun charger, Apr., 1950, $17,374.

Johnson, Gerald C., Associates, New York, N. Y., helmet test shells, Mar., 1950, $9417.

Jones and Lamson Machine Co., Springfield, Vt., comparator-optical bench type universal stage screw, Dec., 1949, $2058.

Jumbo Steel Products Co., Azusa, Calif., connecting platforms, Jan., 1950, $78,308; bomb hoist dolly assembly, type H-1, spare parts and data, June, 1950, $26,733; pressurized cabin leakage tester and maintenance data, Jan., 1950, $66,500.

Justrite Mfg. Co., Chicago, five-gal. gasoline can spring cap, Dec., 1949, $2129.

Kaplan, Joseph, Los Angeles, consultant services, June, 1950, $1500.

Kelek Co., Brookline, Mass., light-timing and engineering and maintenance data, Feb., 1950, $3631.

Kennedy, D. S. and Co., No. Scituate, Mass., cellular lens and frame, Sept., 1950, (Cambridge Lab.), $1840.

Kentucky Research Foundation, Lexington, Ky., continuation of research on gas turbine screens, Mar., 1950, $7000.

Kimball-Johnson Co., Inc., Watertown, Mass., services and material necessary to insulate MPS-3, Dec., 1949 (Cambridge Lab), $4680.

Kinsey, E. A. Co., Inc., Cincinnati, Ohio, drill press and data, Jan., 1950, $22,137.

Kollsman Instrument, division of Square D Co., Elmhurst, N. Y., Machmeters, May, 1950, $35,700; tachometer indicator, Jan., 1951, $79,298; pressure type altimeter, Apr., 1950, $13,597.

Lamb Electric Co., Kent, Ohio, electrical spare parts, June, 1950, $5000.

Lavoie Laboratories, Morganville, N. J., generators, pulse 35 to 14,000 pulses per second, internally generated, Dec., 1949 (Cambridge Lab), $2475.

Leboeuf, George H. Co., Dayton, Ohio, irreversible mechanism for the F-80 plane-aileron control system, Feb., 1950, $3559.

Leland Electric Co., Dayton, Ohio, rotary inverters, June, 1950, $3014.

Lewis Engineering Co., Naugatuck, Conn., temperature indicators, Dec., 1950, $22,587; cold junction thermocouple circuit compensator, Feb., 1950, $2207.

Linde Air Products Co., New York, N. Y., oxygen, breathing, June, 1951, $44,747.

Line Material Co., East Stroudsburg, Pa., lens and receptacles, Dec., 1949, $1819.

Linear, Inc., Philadelphia, hydraulic packing, Feb., 1950, $14,278.

Liquidometer Corp., Long Island City, N. Y., tester and maintenance data, Mar., 1950, $1325; electric oil gage tank unit, May, 1950, $3961.

Lockheed Aircraft Corp., Burbank, Calif., pilot seats for F-80C aircraft, Jan., 1950, $3311.

Lovelace, W. Randolph II, Albuquerque, N. M., consultant services, June, 1950, $1500.

Lycoming, division of AVCO Mfg. Corp., Williamsport, Pa., spare parts for 0-290-7 engine used in L-15 aircraft, June, 1950, $25,000.

M B Mfg. Co., Inc., New Haven, Conn., drive coils and repair work, Nov., 1949, $1924.

Machinery Welder Corp., St. Louis, Mo., sheet metal brake, Apr., 1950, $59,837.

Magnavox Co., Fort Wayne, Ind., spare parts for photographic equipment, Dec., 1949, $9606.

Magnolia Airco Gas Products Co., Houston, Tex., oxygen, breathing, June, 1951, $9086.

Markham, John R., Cambridge, Mass., consultant services, June, 1950, $3000.

Marquette Metal Products Co., Cleveland, Ohio, windshield wipers, Jan., 1950, $4586.

Martin, Glenn L. Co., Baltimore, Md., two contracts, data classified, $60,740; search antenna for radar set, Nov., 1950 (Watson Lab), $7534.

Massachusetts Institute of Technology, Cambridge, Mass., studies and investigations for the development of metal ceramic combinations, Nov., 1950, $29,850; mathematical computation services, Oct., 1950 (Cambridge Lab), $10,000; study of the general circulation of the atmosphere and the secondary circulations composing it, Sept., 1950 (Cambridge Lab), $55,365.

Master Electric Co., Dayton, vibrator drive, master electric speedranger, Dec., 1949, $1189.

Mechanical Products, Inc., Jackson, Mich., circuit breakers, Oct., 1949, $2075.

Meisel Machine and Tool Co., Toledo, Ohio, crew chief assembly stand maintenance and maintenance data, Dec., 1949, $1646.

Mercury Trading Corp., Cincinnati, radio set AN-ARC-3, Dec., 1949, $3660; racks for radio sets, Feb., 1950, $11,595.

Meriam Instrument Co., Cleveland, stand assemblies, Feb., 1950, $85,950.

Meyer, Hugo Co., Inc., New York, rangefinder spare parts, Oct., 1949, $1840.

Midland Mfg. Co., Kansas City, Mo., crystal units, Nov., 1949, $2950.

Minneapolis Honeywell Regulator Co., Minneapolis, tools for B-4 regulator systems, Feb., 1951, $38,993; tools and test equipment for electronic fuel gage, June, 1950, $37,283.

Minnesota Mining-Mfg. Co., Detroit, Mich., sealer, Dec., 1949, $1806.

Monument Engineering Co., Indianapolis, Ind., testers and maintenance data, Nov., 1949, $8422; tester, Feb., 1950, $10,097.

Moody, D. and Co., Tulsa, Okla., wing flap 24-v. motor assembly, Nov. 1949, $4290; sighting station grip assembly and rest assembly, Nov., 1949, $1900; motor assy. Oct., 1949, $10,920.

Moviola Mfg. Co., Los Angeles, spare parts for photographic equipment, Nov., 1949, $1386.

Mundet Cork Corp., Cincinnati, repair cork insulation in cold chamber building, Dec., 1949, $13,888.

Narmco, Inc., San Diego, Calif., toboggan sled, Apr., 1950, $11,353.

National Cylinder Gas Co. Chicago, oxygen, breathing, June, 1951, $5661.

National Safety Council, Chicago, special posters, Oct., 1950, $5000.

Naval Research Office, Washington, D. C., preparation and publication of volumes on aerodynamics and jet propulsion, June, 1950, $11,000.

New York University, New York, N. Y., research on development of titanium-nickel alloy systems, Oct., 1950, $20,000; research on traveling wave tube theory, June, 1950 (Cambridge Lab), $9977.

North American Aviation, Inc., Los Angeles, technicians to assist in static testing of T-28A aircraft, May, 1951, $28,753.

Octagon Process, Inc., Brooklyn, N. Y., spark plug cleaning compound, Dec., 1949, $15,440.

Ohio State University Research Foundation, Columbus, Ohio, research on antenna measurements, instrumentation and techniques, Oct., 1950, $97,350; research and investigation of pulse transformers with particular emphasis on the study, design and development of a straight-forward design procedure for step-up and step-down, Sept., 1950 (Cambridge Lab), $20,000.

Ohmite Mfg. Co., Chicago, voltage adjusting rheostats, Nov., 1949, $1273; 10-amp., 150-v. rotary switch, Nov., 1949, $1038.

Oles Envelope Co., Baltimore, envelopes, Dec., 1949, $41,931.

Ongler Envelope Co., Inc., New York, envelopes, Dec., 1949, $8619.

Pako Corp., Minneapolis, photographic print washer, Nov., 1949, $1949.

Palmer Mfg. Co., Cleveland, oxygen servicing trailer, Jan., 1950, $66,174.

Parker Appliance Co., Cleveland, aircraft hardware, Jan., 1950, $1241.

Parker Pattern and Foundry Co., Springfield, Ohio, special tools, Jan., 1950, $6423.

Patten Co., Inc., Worcester, Mass., 6-man nylon rafts with folding canopy Mar., 1950, $2900.

Patton Mfg. Co., Springfield, Ohio, small tools, Dec., 1949, $2159.

Pennsylvania Engineering Co., Philadelphia, freon gas, June, 1950, $75,006.

Perkin-Elmer Corp., Glenbrook, Conn., recording cameras, May, 1950, $73,587.

Pesco Products, Borg-Warner Corp., Cleveland, fuel pumps, Jan., 1950, $7857.

Phillips Mfg. Co., Chicago, degreaser and maintenance data, Nov., 1949, $5391.

Phoenix Trimming Co., Chicago, engineering services—facilities and materials for new series of webbings, Dec., 1949, $1080.

Polytechnic Institute of Brooklyn, N. Y., theoretical and experimental investigation of the electromagnetic properties of obstacles and slots in waveguides, Aug., 1950 (Cambridge Lab), $31,000.

Polytechnic Research and Development Co., Brooklyn, N. Y., universal Klystron power supply with provision for C-W square wave or saw-tooth modulation or for external modulation, Nov., 1949 (Watson Lab), $2500; universal Klystron power supply, Nov., 1949 (Cambridge Lab), $6250.

Porter, H. K. Inc., Somerville, Mass., cable cutter, Nov., 1949, $1183.

Pratt and Whitney, division Niles-Bement-Pond Co., West Hartford, Conn., drill presses and data, Dec., 1949, $66,650.

Press Wireless, Inc., West Newton, Mass., radar set AN-APT-6, Feb., 1950, $32,251.

Princeton University, Princeton, N. J., research on hypersonic flow problems, Sept., 1950, $42,677.

Processing Equipment Corp., Hillside, N. J., magnetic type servo system, Feb., 1950 (Watson Lab), $5887.

Progressive Welder Co., Detroit, Mich., welder and maintenance data, Dec., 1949, $35,800.

Purdue Research Foundation, Lafayette, Ind., experimental investigations of airfoil cascades with and without flow separation, Nov., 1949, $13,589.

Pyle-National Co., Chicago, male and female connector contacts, Nov., 1949, $1130.

Quaker Rubber Corp., Philadelphia, oscillators, Apr., 1950, $4996.

Radiation Counter Lab., Chicago, Geiger-Mueller tube, Oct., 1949, $2008.

Radio Magazines, Inc., New York, N. Y., services and data, Mar., 1951, (Cambridge Lab.), $14,180.

RCA, Victor division, Camden, N. J., radar set AN-CPN-2A, Dec., 1950, $17,822.

RCA Service Co., Camden, N. J., field engineering services, Dec., 1949, $7228.

Radioplane Co., Van Nuys, Calif., modification of 25 OQ-19A targets to XOQ-19B targets, flotation equipment and data, Mar., 1950, $48,438.

Ramsey, Norman F., Cambridge, Mass., consultant services, June, 1950, $1500.

Raytheon Mfg. Co., Raytheon Production Corp., Waltham, Mass., Raytheon Klystron tube, Nov., 1949 (Watson Lab), $1680; pulse-type fixed frequency packaged magnetron, Oct., 1949 (Cambridge Lab), $1470.

Reconstruction Finance, Bantam, Conn., spares for fuel tanks, Nov., 1949, $9160; airplane seats, Jan., 1950, $2250.

Recordak Corp., New York, N. Y., photographic film, Mar., 1950, $6050.

Recordak Corp., Washington, D. C., 16-mm photographic film, Dec., 1949, $3125.

Reiner Electronics Co., Inc., New York, N. Y., volt meter, engineering data revisions and electronic tube report, Apr., 1950, $13,039.

Remington Rand, Inc., Dayton, Ohio, cabinets and tables, Dec., 1949, $14,401.

Republic Aviation Corp., Farmingdale, N. Y., store, pickle and depickle 83 airplanes, Mar., 1950, $44,520; redesign engine fire seal, Sept., 1950, $8389; redesign and incorporate in production quick disconnect engine control rod and landing gear actuating cylinder lines, Sept., 1950, $20,165.

Rhodes Lewis Co., Los Angeles, equipment to be added to original camera container, June, 1950, $4175.

Ridenour, Louis N., Urbana, Ill., consultant services, June, 1950, $4500.

Ritchie, Charles, Belmar, N. J., services and materials necessary for modification to Building T-7, Nov., 1949 (Watson Lab), $2625.

Robertson, Howard P., Pasadena, Calif., consultant services, June, 1950, $1500.

Rohm and Haas Co., Philadelphia, lubricant, Dec., 1949, $1771.

Roller-Smith, Bethlehem, Pa., engine analyzer data and maintenance data, Dec., 1949, $29,176.

Romec Pump Co., Elyria, Ohio, pump HD-41-U, June, 1950, $7061.

Rosenberg, H. Z. Co., Buffalo, N. Y., B-29 and B-50 fire control spare parts, Nov., 1949, $2070; gun feed guide assembly and guide booster system, Nov., 1949, $3560; B-50 fire control spare parts, Nov., 1949, $1285.

St. Louis University, St. Louis, Mo., research services on regional distribution of cutaneous heat losses, Sept., 1950, $14,555.

Sanborn Co., Cambridge, Mass., recorder assembly with panel controls case and timer, Nov., 1949 (Watson Lab), $1115.

Sargent Engineering Corp., Huntington Park, Calif., valves, Jan., 1950, $53,865.

Schenuit, F. G. Rubber Co., Baltimore, aircraft inner tube, Dec., 1949, $2875.

Scintilla Magneto, division Bendix Aviation Corp., Sidney, N. Y., magneto test stand assembly, Apr., 1950, $4000; accessory pump rotor assemblies, Feb., 1950, $8708.

Sears, William R., Ithaca, N. Y., consultant services, June, 1950, $1500.

Seifreat Elstad Machinery Co., Dayton, Ohio, milling machine, Nov., 1949, $37,780.

Servo Corp. of America, New Hyde Park, N. Y., research, development reports on one each searching while tracking channel experimental model, design and maintenance data, Dec., 1949, (Watson Lab), $8291.

Sheffield Corp., Dayton, Ohio, bombing assembly brace equipment, Apr., 1950., $99,900.

Sikorsky Aircraft, division United Aircraft Corp., Bridgeport, Conn., aircraft characteristics charts for H-5H, Apr., 1950, $5400; aircraft characteristics charts for YH-18, Apr., 1950, $2701; miscellaneous spare parts for YH-5 and H-5 type aircraft, Nov., 1949, $5000.

Simmons Brothers, Inc., Long Island City, N. Y., 35mm enlargers and accessories, Nov., 1949, $2643.

Smith, Dr. Alpheus W., Columbus, Ohio, consultant services, Sept., 1950, $3600.

Soderberg, Richard C., Cambridge, Mass., consultant services, June, 1950, $1500.

Sola Electric Co., Chicago, transformer, Jan., 1950, $3180.

Solar Aircraft Co., San Diego, Calif., spare parts for maintenance of C-54 and program aircraft, Oct., 1949, $80,821.

Southern Oxygen Co., Inc., Washington, D. C., oxygen, breathing, June, 1951, $1614.

Sperry Gyroscope Co., Inc., division Sperry Corp., Great Neck, N. Y., 375 modification kits for A-1c sight and modification of 10 A-1c sights, Mar., 1950, $45,090; isolating transformers and knobs, Feb., 1950, $3251; modification of A-1 computer to receive polar navigational attachment, Feb., 1950, $7833; modification of A-1 computers to receive polar navigational attachment, Aug., 1951, $30,119.

Sperry Products, Inc., Danbury, Conn., flaw-detector and basic handbook data, Jan., 1950, $36,493.

Standard Pressed Steel Co., Jenkintown, Pa., nuts, Dec., 1949, $2100.

Standard Products Co., Philadelphia, boric acid and acetic acid, Dec., 1949, $7043.

Standard Rolling Mills, Inc., Brooklyn, N. Y., services and materials necessary to flight test confusion reflectors, Feb., 1950, $18,800.

Standard Steel Works, Kansas City, Mo., water-alcohol servicing kit, Dec., 1949, $6784.

Stanpat, Whitestone, N. Y., AMC forms, Nov., 1949, $2000.

Statham Laboratories, Los Angeles, pressure transmitters, Dec., 1949, $6706.

Stearns Magnetic Mfg. Co., Milwaukee, special magnetic clutch, Nov., 1949, $1940.

Stever, H. Guyford, Cambridge, Mass., consultant services, June, 1950, $1500.

Stewart Warner Corp., Chicago, pressure type lubricating pump, Mar., 1950, $12,408.

Strube, Gordon Air Industries, Inc., Burbank, Calif., B-29 and B-50 fire control maintenance and spare parts, Nov., 1949, $1250.

Summers Gyroscope Co., Santa Monica, Calif., technical services in flight test program, Oct., 1950, $16,859.

Sweeney, B. K. Mfg. Co., Denver, power wrench assembly, Mar., 1950, $29,130.

Sweeney, William J., New York, N. Y., consultant services, June, 1950, $1500.

Technical Service, Inc., Detroit, further modification to film and paper train, Jan., 1950, $6479.

Technical Training Aids, Inc., Tulsa, Okla., animated panel mock-up for heating and duct system of B-26 aircraft, Apr., 1950, $1267.

Tinnerman Products, Inc., Cleveland, aircraft hardware, Dec., 1950, $4150.

Timmons, George W., Columbus, Ohio, additional work in connection with waterproofing buildings, Nov., 1949, $3450.

Trinity Oxygen Co., Forth Worth, Tex., oxygen, breathing, June, 1951, $1699.

Triumph Mfg. Co., Chicago, electronic shutter tester, Nov., 1949, $5102.

Twain Tool and Mfg. Corp., Inc., Chicago, RF adapter UG-97-U, Dec., 1949, $1770.

Union Envelope Co., Richmond, Va., envelopes, Dec., 1949, $7485.

United Aircraft Products, Dayton, Ohio, knockout threaded taper pins, Nov., 1949, $2068.

U. S. Rubber Co., Detroit, casings and tubes, Dec., 1949, $65,198.

U. S. Rubber Co., Mishawaka, Ind., fuel cell fittings, Feb., 1950, $8030; spare parts for miscellaneous aircraft, June, 1950, $5000.

Universal Metal Products, Alhambra, Calif., hole finder fixture assemblies, Dec., 1949, $1220.

University of California at Los Angeles, Los Angeles, Calif., research on human tolerance temperatures, Dec., 1950, $19,750.

University of Texas, Galveston, Texas, studies and experimental investigation of the physiology of certain aspects of drowning, hypoxic, hypoxia, anemic hypoxia and asphysia, Nov., 1950, $8000.

Valley, George E., Jr., Cambridge, Mass., consultant services, June, 1950, $1500.

Variety Aircraft Corp., Dayton, Ohio, rear assembly support, Nov., 1949, $2967.

Varo Mfg. Co., Inc., Garland, Tex., frequency changer, 500 va, engineering data, May, 1950, $11,450.

Vitavision Corp. of America, New York, N. Y., further development to three-dimensional camera, Jan., 1950, $2071.

Von Karman, Theodore, Washington, D. C., consultant services, June, 1950, $3000.

Wagner, Ferd. Co., Cincinnati, photographic film, Mar., 1950, $25,500.

Warren Shields, Boston, Mass., consultant services, June, 1950, $1500.

Weatherhead Co., Cleveland, aircraft hardware (two contracts), Jan., 1950, $21,249.

Wells All-Steel Products, North Hollywood, Calif., engine and turret portable hoist, Mar., 1950, $70,363.

Western Electric Co., New York, N. Y., factory familiarization training, Jan., 1951, $49,505; cover for wave guide for AN-TPS-1B, May, 1950, $1966.

Western Envelope Mfg. Co., Kansas City, Mo., envelopes, Dec., 1949, $5379.

Westinghouse Electric Corp., Dayton, Ohio, generator brushes, May, 1950, $27,888.

Wilmington College, Wilmington, Ohio, educational services, Jan., 1950 $4941.

Wolf Envelope Co., Cleveland, envelopes, Dec., 1949, $5388.

Wollensak Optical, Rochester, N. Y., miscellaneous photographic equipment, Dec., 1949, $4660.

Wright Aeronautical Corp., Patterson, N. J., three items of sling assemblies, Jan., 1950, $10,897.

NEW AVIATION PRODUCTS

New Refueler Speeds Gas Handling

Light, portable equipment suitable for underground pit service, supplies fuel at 200 gal. per minute.

A new type of aircraft refueler which delivers gasoline about twice as fast as conventional equipment is being studied by major airports and airlines.

Made by Bowser, Inc., the refueler supplies filtered gasoline through a single, standard-type aviation hose at the rate of 200 gpm. It will defuel at a speed of 50 gpm. Fuel delivery rate through a single hose on tank trucks currently used is 85-125 gpm., and the defueling speed is rated at about 30-40 gpm.

The new equipment is reasonably light—it already has been carried in a comparatively small truck for demonstration purposes—and its design makes it particularly adaptable for service in underground pits on the airport apron.

► **Easy Handling**—Bowser points out that its system is not a radical development, but rather a very effective hookup of already proven devices. An especially interesting feature is a mechanism which automatically unreels the hose as soon as the service man gives it a tug. When he stops walking, the hose reel stops unwinding—like a charmed snake. After using, he gives a second sharp tug on the hose and it starts winding back on the reel.

The hose is said to be lighter than usual, because it is always empty immediately before and after refueling. Also, the nozzle is made of lightweight materials, permitting handling of the hose with one arm while filling operations are taking place.

► **Safety**—Although the entire refueling operation can be controlled by one man at the nozzle, no electrical wiring or switches are used between the nozzle and the fuel dispenser. Meters on the equipment accurately show the exact amount of gas delivered to or taken from the airplane tank.

Onlookers at a recent company demonstration at the Bowser plant at Fort Wayne, Ind., report that it performed without a hitch and backed in actual operation all the claims previously made for the equipment.

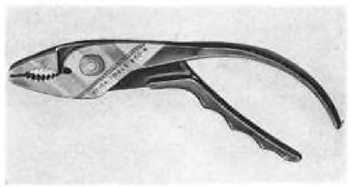
Quality Control Rule

Slide rule, developed in accordance with basic principles of quality control as adopted by American Standards Association, has special scales, in addition to the traditional log scale arrangement. Made by **Pickett & Eckel, Inc.,** 5 South Wabash Avenue, Chicago 3, Ill., device also has ordinates and areas for normal curve.

Designed to solve many problems arising in quality control, rule has one group of scales to control quality of product where quality characteristic is measurement, such as length, diameter, or eccentricity. These scales also can be used for measurements of electrical characteristics or chemical processes.

Another group of scales is used to compare limits the process actually is maintaining with those specified. One scale is used to find limits for charts for percent of parts defective. Although this calculation is one of the most difficult and tedious in elementary quality control, this slide rule handles it with one setting.

Weighing less than 4 oz., rule has non-warping, light-metal core with optical tongues and grooves to insure permanent alignment, freedom from distortion, and easy operation. Dimensions are 12⅛ × 2 × 3/32 in.



Tight-Grip Pliers

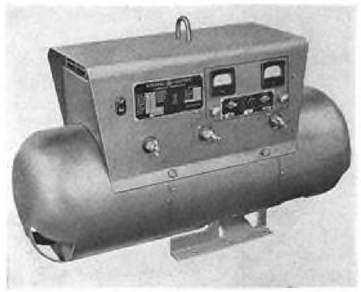
No. 550-8 slip joint pliers with offset handle, offered by **Utica Drop Forge & Tool Corp.,** Utica, N. Y., are designed to give more holding power for wire twisting and pulling when "safety-tying" equipment components in aircraft. Pistol grip handle permits tighter hold with less effort and reduces wrist fatigue. Made of forged alloy steel, pliers also are said to be specially suitable for work where it is necessary to get into tight places.

Maintenance Aid

Designed for close-quarter work, series of forged, angle-head wrenches, specially heat-treated and tempered for ruggedness and toughness, are offered by **Snap-on Tools Corp.,** Kenosha, Wis.

Wrench heads are set at different angles to handle, one 30 and other 60 deg. Since both heads on each unit are same size, switching ends permits turning nuts in narrow swing areas. Thin heads (only ¼ in. on largest size) are intended to minimize clearance problems.

Head's pear-shape simplifies use in close-quarters, while giving extra wall strength at the point of greatest strain. Draw-broaching gives clean-cut, close fitting openings. Four sizes are available, with 7/16, ½, 9/16 and ⅝ in. openings.



Aircraft Energizer

Suitable for medium requirements of low-voltage d.c. power for aircraft, airports, and aircraft testing stations, lightweight ground power supply is made by **Small and Medium Motor divisions, General Electric Co.,** Schenectady, New York.

New 265-amp., 7.5kw. unit was developed to meet the demand for smaller set for general purpose use. High overload of 500 amp. for 1 min., and dual range of regulated voltage at both 14 and 28.5v. provide wide range of application to aircraft equipment. Compact package affords regulated power supply for aircraft testing and maintenance work, for cranking small reciprocating aircraft engines, for radio and radar testing, charging batteries, and similar aircraft jobs.

Low voltage range of energizer is 13-17v., while high range is 28-35v. Voltage regulation is ±2½ percent over entire range.

Basically, equipment consists of a two-unit, two-bearing, self-ventilated motor-generator set with associated control mounted on top. Two-wheel dolly can be supplied for convenient manual handling.

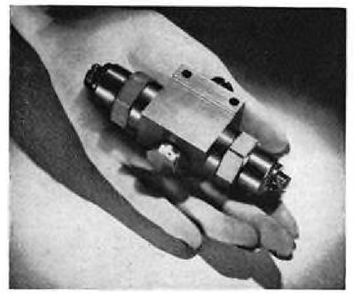
Induction motor for energizer is G-E Type K squirrel cage, 220/440 or 550v., 2 or 3 phase, 60 cycle.

Instrument Rectifier

CX14 copper oxide rectifier for instrument application, is announced by **Bradley Laboratories, Inc.,** New Haven, Conn.

Unit features gold-to-gold internal circuit arrangement made up of vacuum-processed rectifier plates with gold contacts, specially-treated gold terminals and copper alloy brackets. Rectifier is designed to insure minimum aging and high efficiency. Factory-set pressure is said to remain constant under wide temperature variation.

Impregnated and sealed to withstand extreme humidity, unit also is fungus resistant. Its construction is claimed to eliminate many difficulties found in instrument rectifiers because of mechanical design. According to maker, maximum stability under extreme operating conditions is insured with CX14. Rectifier measures ½ × 3/8 × ¼ in. and mounts on one 2-56 × ⅜ screw.



Aircraft Shuttle Valve

For aircraft hydraulic systems, 3000-psi. shuttle valve which meets or exceeds requirements of Spec. AN-V-3b is announced by **Parker Appliance Co.,** 17325 Euclid Ave., Cleveland 12, Ohio.

Designed in accordance with drawings AN6277 and AN6278, and built in tube sizes 6 (⅜-in. tube o.d.) and 8 (½-in. tube o.d.), unit will shuttle against closed line and will not unseat from surge flows or negative pressures. Surge flows will not displace rubber seat.

Valve shows no evidence of deformation or failure at burst test pressures of 7500 psi. It has pressure drop less than maximum of 10 psi. when operated at rated flow.

Unit shows zero leakage at static pressures of 5 and 3000 psi., or at proof pressure of 4500 psi., or while shuttling under air or oil pressure, and only infinitesimal internal leakage (less than spec. limits) after 20,000 cycles of impulse with peak pressures of 3750 psi. Tests also show shuttling pressure does not exceed 62 percent of allowed maximum, and that there is no leakage during temperature changes from −65 to 160F.

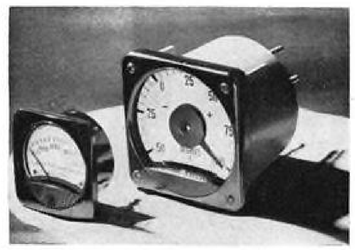
Portable Mixer

For agitating solutions in plating tanks, oil and water quench tanks, and in preparing drawing compounds, portable, mixing air-motor is announced by **Aro Equipment Corp.,** Bryan, Ohio.

Unit can be quickly clamped into position on the edge of tank or drum. Swivel clamp permits easy adjustment to desired angle. Air valve at top of motor connects to air hose, and needle valve adjusts speed control.

Motors may be selected in a choice of five models with speeds of 500, 1200, 2800, 4500 and 17,000 rpm. The 500 and 1200 rpm. motors are 6½ in. long minus valve; weight is 2 lb. 6 oz. Motor is ball-bearing mounted in all-steel housing with corrosion-resistant finish. Mounting clamp swivels on ball socket, permitting angular adjustment of unit within 90-deg. arc, and can be rotated 360-deg. horizontally.

Stirring rods are available in 12, 18 and 24-in. lengths. Aluminum propellers (left or right-hand pitch) can be used in pairs or individually on stirring rod.

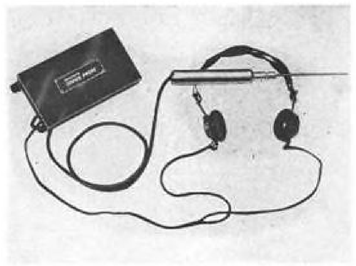


Lab Thermometers

Line of temperature indicators for industrial and laboratory use, made by **General Electric Co.,** Schenectady 5, N. Y., includes resistance thermometers for temperatures up to 300 F. and cold-end, compensated thermocouple thermometers for measuring up to 3000 F.

Designed for low temperatures where high accuracy is important, resistance thermometers are suitable for bearing temperature measurement, generator- and transformer-winding temperature indication, refrigeration and air conditioning testing, drying operations, remote fluid temperature indication, and laboratory work. They are available in two standard types; DB-15 and DD-7, 6 in. rectangular, surface- and flush-mounted instruments.

Thermocouple thermometer can be used with industrial furnaces, melting pots, infrared drying ovens, oil quenching baths, ceramic kilns, and salt baths for annealing. They also are available in two sizes: Type DO-71 with 3½-in. flange and DW-71 with 2½-in. flange.



Sound Probe

For troubleshooting aircraft or industrial mechanisms, electronic sound probe offered by **Como-Tex Co.,** 128 W. Lake St., Chicago 1, Ill., is designed to localize sound and bring it to a focal point to permit accurate tracing to source. Sound is amplified to quickly determine whether it is a normal or foreign element in particular mechanism being checked.

According to company, device "brings out a natural reproduction of noise at the source, but greatly amplified and without distortion. . . . When we listen for a particular noise in a motor or bearing, we not only hear it but . . . are able to identify it, because all foreign or built-up sounds are absent."

High Strength Solder

In aircraft, instrument or avionic applications where thin-flowing, low temperature solder is required, Eutecrod 192, hard solder-type alloy for joining aluminum to steel, bronze or copper, as well as to aluminum, is announced by **Eutectic Welding Alloys Corp.,** 40 Worth St., New York 13, N. Y.

Claimed to give highest strength bond ever obtained between aluminum, ferrous and non-ferrous metals and all alloys tested in 20 years of company research, product is reported to have bonding temperature of 650-700 F., tensile strength of 11,000 psi., good corrosion resistance and high electrical conductivity. It is available in 3/32, 1/16 and ⅛ in. coil form.

EXPERIMENTAL INSTALLATION of 10,000-candlepower sweep beam light on DC-3. Closeup shows light with red glass removed.

Lighting Planes for Safety

Near-collisions point up new need for revision of rules which govern exterior lights on transport-type aircraft.

By Charles Adams

A spate of near-collisions in midair and resulting demands for corrective safety steps have lent new urgency to the Civil Aeronautics Administration's research program for better exterior lighting for transport planes.

Conducted in cooperation with the Air Transport Assn., CAA's aircraft lighting development work has been underway for more than a year. The studies are divided into two parts: an interim program aimed at improving lighting as soon as possible by taking advantage of immediately-available equipment; and longer-range experiments with new-type, high-intensity lights for use at all locations on transport aircraft.

▶ **May Revise Regulations**—The interim exterior lighting program may soon result in revised Civil Air Regulations.

Airline engineers originally submitted comments on improved transport lighting in December, 1948, although at that time few expressed belief that the problem was serious. Last September, CAA, the military, the Air Line Pilots Assn., manufacturers and the airlines drew up a tentative program on exterior lighting. The carriers have recently been offering new suggestions on the direction CAA's experiments at Indianapolis should take.

As one phase of its research, CAA is studying the advisability of increasing the intensity of regular navigation lights up to 5000 candlepower. Fuselage navigation lights now have about 100-200 candlepower; wing-tip lights about 80 candlepower; and tail lights a maximum of 150 candlepower.

▶ **Test Results Good**—Last summer, experiments were conducted with an 8-10,000 beam candlepower red light installed in the nose of a DC-3 and oscillating over a 120-deg. arc. Results were good—the light being visible as a series of eye-catching flashes 18-20 miles away through light smoke haze.

It was noted, however, that the modified fire engine light tended to reflect back in the cockpit as the haze thickened. Consequently, CAA is studying the possibility of installing the light in the leading edge of the vertical tail fin, lower on the nose and other places.

Installation of larger, more powerful, conventional-type navigation lights in the wing tips presents a problem because of the limited space available in the structure.

Weight penalty of new high-intensity, flash-type gas tube lights (similar in physical appearance to neon lights) is an important factor in their future use. They show promise, however, of providing more candlepower with less drag than conventional lights.

▶ **Theater Marquee?**—CAA officials see real danger in dotting the plane with too many lights like an aerial theater marquee. The present red tail light could be mistaken for the red left wing light. Putting another red light in the nose might compound the confusion.

Pilots have suggested that transports be equipped with non-flashing lights similar to the sealed-beam headlights on automobiles. They say that with two planes traveling in opposite directions and closing at perhaps 600 mph. flashing navigation lights do not provide quick determination of direction or distance of the other aircraft.

For example, pilots of two 300 mph. transports approaching head-on would have only 30 seconds to avoid a collision if they spotted each other five miles away. If an oncoming plane which should become visible five miles away happens to be behind the center of the windshield or compass for a few seconds, the period for evasive action might be reduced to a hazardous degree.

▶ **More Complications**—But use of continuous (non-flashing) lights on transports also presents complications. A flashing color pattern is needed to detect a plane over lighted areas such as a city. Any bright constant light installed on a plane near a flashing light would decrease the latter's effectiveness.

Following the recent mid-air collision of an Eastern Air Lines DC-4 and a P-38 fighter plane near Washington National Airport, the Air Lines Pilots Assn. urged both improved lighting and marking of transports.

The union suggested studies to create a method of identifying by code the flashing lights of all airlines planes carrying passengers so that they can be given the right of way at all times. It recommended that three or four dots and then one dash, or some other suitable variance combination, be determined by flight tests.

With regard to markings, ALPA recommended that an orange and black or yellow and black checkered pattern or other design be painted on top of the vertical tail, on the ends of the horizontal tail, wing tips, top and bottom of the fuselage, nose of the fuselage and other parts of the plane to make it easily distinguishable during daylight.

Flameproof Plane Wiring Needed

Braniff DC-6 mishap last summer believed due to fumes from insulation; oxygen equipment mislocated.

Twin danger of insulating materials that give off acrid smoke when burning and of mislocated cockpit oxygen equipment has been pointed up by investigation of a Braniff Airways DC-6 accident last summer.

The mishap might have resulted in a repetition of the fatal crash of a United Air Lines DC-6 near Mt. Carmel, Pa., in June, 1948, when the crew was believed to have been overcome by carbon dioxide gas.

The Braniff plane was about 20 mi. out from Dallas after takeoff and at 4500 ft. altitude on Aug. 16, when the captain observed smoke from the heater fire control panel and from the main junction box. Captain put on an oxygen mask, while a flight engineer instructor in the cockpit began to fight the fire, using two carbon dioxide extinguishers.

▶ **Dazed by Smoke**—The instructor, a flight engineer trainee and the co-pilot all breathed oxygen at intervals from a hose, but all three were in dazed condition from the smoke and gas fumes. A test installation of loud speakers in the airplane had caused non-standard location of other oxygen masks so that the crew was not able to find them quickly. Also a walk-around oxygen bottle was not in its specified place at the top guard rail of the radio rack but was at the bottom of the rack almost on the floor. The instructor said he used the hose because he was unable to reach the walk-around in time.

Plane returned to make a normal landing at Dallas after the fire was extinguished. Opening of co-pilot's window helped clear the cockpit of gas fumes and smoke, and to revive the three men who did not have masks. Plane had descended to 500 ft. and had flaps lowered in preparation for an emergency landing off the airport, before the instructor reported that the fire was out.

▶ **Wiring Short**—Fire was attributed to a short in wiring of an A1 3047-6 floodlite at a point where size 16 wire had been spliced into a size 20 wire. Short caused a high current flow into the wire feeding the power to the light, which overheated, burning insulation off and igniting insulation of adjacent wires.

It was believed that plastic tubing covering the wiring had been damaged by rough handling in adjustment of the swivel-type lamp, previously. Failure of a 10-amp. circuit breaker which guards this lamp, was also reported. In later tests the circuit breaker again failed to function and was forwarded to CAA for examination.

▶ **Less Smoke**—Recommendations after study of the fire, call for development of suitable aircraft wire less susceptible to burning, and with insulation material that will not produce pungent, acrid smoke if it burns. (Tests are now being made on several so-called flameproof wires, and Braniff is soon to work with Douglas in a service test of a General Electric SI-57351 wire in engine section wiring.)

Other recommendations are to relocate and standardize location of oxygen masks for crew, to check circuit breakers at next overhaul, to eliminate swivel type lamps or limit movement to prevent binding of wires, and to check all similar lamp installations at next overhaul.

Lines in Germany Can Convert Marks

(McGraw-Hill World News)

FRANKFURT—Airlines serving Germans within Germany, now will be able to convert marks into their own currency. Convertibility up to the total of $1,130,000 in the various currencies has been granted for a six-month period, dating from Oct. 1.

New policy is applicable to marks earnings for carrying German passengers, freight and mail from one point to another in Western Germany and to Berlin. It also applies on international flights from these points up to the German border. Beyond the border of Germany, service by U. S. carriers is still payable in dollars, not marks.

▶ **Convertibility Basis**—Ceiling up to which each carrier can obtain convertibility of mark earnings for internal service is based on ton-miles flown. But none of the carriers, except American Overseas Airlines, will have earnings anywhere near the ceiling. Actually, the amount of convertibility available is expected to exceed requirements for the first six-month period.

▶ **AOA's Big Stake**—AOA, because of its Frankfurt-Berlin operation, has the biggest stake in present internal service. Total internal service rendered by foreign airlines in October involved carrying 8170 German passengers, 350,701 lb. cargo and 88,755 lb. mail. Of this, AOA hauled 5705 passengers, 315,404 lb. cargo and 83,361 lb. mail.

It is estimated that AOA's convertibility ceiling, based upon ton miles flown, will amount to about 34 percent of the total. And, despite the fact that AOA's internal service is by far the heaviest mark earner, the ceiling is still considered sufficient to permit convertibility of its entire net mark proceeds.

Spanish Airliner Completing Tests

(McGraw-Hill World News)

PARIS—The prototype of the first Spanish postwar commercial airplane, the CASA-201 Alcotan, is winding up its test flight program at Towejou de Arroz near Madrid.

The standard Alcotan will carry 10 passengers, a crew of three, and 500 lb. of baggage. Another version will be able to accommodate 12 passengers and a crew of two. This version will be convertible into an eight-patient ambulance plane.

The plane is a twin-engine low-wing monoplane of all metal construction. The wing is made in three sections of approximately equal length—two outer panels and a center section. Two Elizalde Sirio seven-cylinder engines developing 450 hp. at 2000 rpm. are used. They are fitted with three-bladed variable pitch propellers.

▶ **Specifications**—Characteristics of the Alcotan are: Span 60.3 ft., length 45.25 ft., height 12.26 ft., wing area 450 sq.ft. Maximum wing loading is 27 lb. sq.ft., aileron area 34 sq.ft., flap area 48.4 sq.ft. Wing loading per horsepower 12.75 lb., maximum loaded weight 12,088 lb., weight empty 7820 lb. Payload is 2220 lb. Top speed at sea level is stated to be 185 mph., top speed at cruising altitude 210 mph., cruising speed at cruising altitude 175 mph., landing speed fully loaded 70 mph. Theoretical ceiling is given as 20,000 ft., practical ceiling 18,000 ft., practical ceiling on one engine 8000 ft. Radius of action is specified as 600 mi.

Construcciones Aeronauticas, 4 rue Francisco, Madrid, makers of the Alcotan, are building a second prototype

which will be powered by Hispano-Suiza engines. It's scheduled to be ready for flight testing early next year.

Fix Blame In Mexico Crash

(McGraw-Hill World News)

MEXICO CITY—American carriers operating into Mexico may be affected by proposed revisions to the country's air code. They were offered as part of an investigating committee report into the crash of a Cia. Mexicana de Aviacion DC-3 Sept. 28 into the 17,000-ft. Popocatepetl volcano (AVIATION WEEK, Oct. 17).

Investigators decided the crackup was due to pilot error, and fixed blame on officials of the airline. Sen. Gabriel Ramos Millan, prominent Mexican legislator, was among the 25 people killed in the crash.

▶ **New Proposals**—Here are the committee's suggestions to the Mexican Congress:

- **Responsibility** of individuals and companies for the safety of passengers should be clearly fixed.
- **Latest navigation** and safety aids, such as telecommunications between airports, radio directional finders, radio beams, and radar should be installed by all companies. Navigational aids should be installed along every air route in Mexico. International flights have such aids now.
- **Airfields** should be equipped with adequate lighting, including a system of landing lights.
- **In the event** of accidents, the airline is obliged to notify the relatives of victims as soon as possible.
- **Airlines should insure** passengers for 50,000 pesos (about $6000) each instead of the present 5000 pesos ($600).

State Department Criticizes Colonial

Secretary of State Dean Acheson has rapped Colonial Airlines for taking an alleged frivolous attitude in its defense against a Canadian Air Transport Board order proposing suspension of the carrier's New York-Montreal operating rights.

During a recent hearing on the show cause order, Colonial refused to argue in its defense, saying it was prevented from doing so by the Logan Act, which was passed in 1799 to prevent private individuals from interfering with U.S. foreign relations.

Acheson said that while Colonial representatives had been in constant touch with the State Department they had never requested an interpretation of the Logan Act.

"As a result," the secretary declared, "it is a little hard for me to take their position seriously. The Logan Act is (not) applicable in this case. If Colonial had really felt that the Logan Act was involved they could have asked (the State Department) for permission to appear (at the Canadian hearing), and we certainly would have told them we had no objection to their appearing and taking all steps to protect their rights."

Previously, the State Department had made clear it did not believe the Canadian Air Transport Board had authority to suspend Colonial's license. The Canadian Board took action against Colonial after the U.S. carrier had obtained an injunction in the American courts which has blocked Trans-Canada Air Lines' application for a Montreal-New York foreign air carrier permit.

TCA was designated for the route under provisions of last June's U. S. Canada civil air transport agreement. Colonial contends the pact is invalid.

A special U.S. delegation, consisting of Civil Aeronautics Board and State Department representatives, has been consulting with the Canadian government in an effort to iron out the dispute. The State Department asked Canada to withhold action on the Colonial suspension pending conclusion of the consultations.

AMBASSADOR DUNKED

Test fuselage for Great Britain's twin-engine medium-range Airspeed Ambassador transport is shown in a dock at Portsmouth, England, during preparations for full-scale pressure trials. Two prototypes of the Ambassador have been flown, and the first production aircraft are due for delivery to British European Airways in 1951.

AAA Seeks Route Revision

With a little over two years to go on its three-year feeder franchise, All American Airways has launched a traffic-building and cost cutting program aimed at insuring renewal of its certificate in 1952.

AAA hopes for substantial increases in its passenger business through a recently-inaugurated "two-day two-way travel plan," which brings fares below eastern rail rates in many instances. The new tariff slashes return fares 75 percent on roundtrips completed within 48 hr. between intermediate points and terminal cities on the company's system where there is no competitive air service.

All American claims its two-day two-way plan is even more economical than air coach. Moreover, the new tariff is effective on all of the feeder's scheduled flights.

Whereas regular roundtrip fare between Williamsport, Pa., an intermediate point, and New York, a terminal point, is $20.10 plus tax, the two-day roundtrip rate is only $13.20.

▶ **Seeks Route Revision**—Claiming that its first year of service has pointed up weaknesses in its route setup, AAA asked the Civil Aeronautics Board for permission to alter some services.

Specifically, All American wants to extend its routes from Atlantic City to New York via Asbury Park to close a gap in the eastern part of its system. The company also wants to suspend service temporarily at Dover and Georgetown, Del., Martinsburg, W. Va., and Frederick, Md., because of insufficient traffic.

▶ **Requests Fast Action**—AAA called on CAB to act on its application quickly via the exemption process. The feederline said that since it has only three years to prove itself, it cannot afford to be "hamstrung" for six months to a year on its extension and suspension requests while awaiting action through regular administrative machinery.

As a further means of cutting costs, the feeder has asked CAB permission to over-fly intermediate points where no traffic is to be enplaned or deplaned on a given flight. Similar authority has been given other feeders.

During the first nine months of 1949, AAA had a passenger load factor of 22.52 percent and suffered a $587,000 loss. Recently the company's efforts to cut costs have been complicated by Air Line Pilots Assn. demands for higher wages. The dispute is now in mediation.

New Air Policies For Australia?

(McGraw-Hill World News)

MELBOURNE—Election of the new conservative government in Australia will probably mean a new deal for domestic and foreign airline operators who, up to now, have found rough sledding in securing landing rights and other privileges.

If it were practicable, the new government would wipe out the Labor-created public-owned airlines with a stroke of the pen.

▶ **Money Losers**—The airlines owned either by the Australian government alone or in partnership with the governments of Britain or New Zealand have been consistent money losers, even though they have been enjoying advantages denied to private competitors.

The Labor government's lukewarm attitude on defense matters was one reason for its downfall, so the new regime can be counted on to increase the effective strength of the Royal Australian Air Force.

CEA Would Resume Nonsked Operations

California Eastern Airways, which in 1948 stopped all-cargo flights and began leasing its planes to irregular passenger carriers, is now seeking to start nonscheduled operations on its own behalf.

The Oakland, Calif., company owns four DC-4s equipped for high-density passenger flights. It is an applicant for a certificate in the Civil Aeronautics Board's transcontinental coach-type service case, on which hearings are to start Jan. 4.

Unlike a number of other applicants in the case, CEA holds no nonscheduled exemption. Its letter of registration as an all-cargo carrier has expired. No new letters of registration for large irregular operators are being issued by CAB.

▶ **Would Acquire Carrier**—Therefore, California's President Samuel J. Solomon has asked CAB for permission to acquire control of Air Services, Inc., a Miami Springs, Fla., company which holds a valid letter of registration as a large irregular operator.

Solomon pointed out that if the nonskeds which now lease CEA planes should buy aircraft of their own or rent them elsewhere it would be difficult for California Eastern to find ways of using its equipment.

Through acquisition of Air Services, Inc., CEA says it would not only be able to assure utilization of its equipment but could help prove to CAB its fitness, willingness and ability to conduct scheduled coast-to-coast air coach service under a certificate.

Don't Blame Us

The railroads shouldn't blame their woes on airline competition, according to Air Transport Assn. Executive Vice President Robert Ramspeck.

In 1948, the airlines provided only 1.6 percent of the nation's total passenger transportation and only one-half of 1 percent of the total freight transportation, Ramspeck declared in a speech before the Chicago Rotary Club.

He pointed out that between 1923 and 1933, when the airlines never carried more than half a million passengers per year, railroad passengers declined from one billion to 433 million.

While their penetration of the total passenger transportation market is not large, the airlines are expected to handle a record 41 percent of all first-class intercity travel this year, Ramspeck said.

Nonsked Expands Maintenance Facility

Alaska Airlines' nonsked operations between the States and Alaska having been severely restricted by CAB directions, the carrier is turning to maintenance to supplement its income. It has set up a new company, Alaska Aviation Maintenance, Inc., which will start operations as an independent entity Jan. 1.

Headquarters of Alaska Aviation Maintenance are at Paine Field, north of Seattle, Wash., where the company has had a maintenance division since March, 1948. President of the wholly-owned subsidiary is Ed S. Hudson, vice-president of engineering and maintenance for Alaska Airlines.

▶ **Extensive Facilities**—The company's Paine Field maintenance facilities, representing an investment of more than $1 million are regarded as the finest north of San Francisco and west of Denver, and comprise the only CAA-approved repair station in that area. They include 65,000 sq. ft. of hangar space in two hangars, both owned by Snohomish County and leased to the company on favorable terms. One of

the hangars was completed only this year. Hangar space is sufficient to work on seven C-54s at one time.

Other facilities include an additional 70,000 sq. ft. of covered working space and 1,500,000 sq. ft. of paved ramps and parking areas. Shops include those for general overhaul, props, engines, accessories, electrical, welding, fabric, carpentry, painting, etc.

Hudson has a staff of 125 men, many of whom came to Alaska Airlines from American Airlines several years ago.

Alaska Aviation Maintenance intends to specialize in 8000-hr. overhauls of DC-4s and do other work on multi-engined aircraft similar to that done on the Alaska Airlines' fleet. The accessories shop is equipped to handle engine overhaul on an assembly line basis, making the power package change at a fixed price. An 8000-hr. overhaul for a DC-4, for example, would cost about $20,000.

► **Must Hustle**—To operate at a profit, the company will have to secure much more business than there now is in the Pacific Northwest and Alaska, in which Territory it operates as a scheduled carrier. It has been doing some accessories work for the Navy and is bidding on further military contracts. Its private customers in recent weeks have included West Coast Airlines of Seattle, Near East Transport, and ITAV of Brazil.

As Paine Field often is fog-free when Boeing Field and the Seattle-Tacoma Airport are fogged in, and thus is used as an alternate field by scheduled airlines, Alaska Aviation Maintenance, Inc., is negotiating to do all line maintenance for the airlines on such occasions.

All Alaska Airlines maintenance will be handled by Alaska Aviation Maintenance, Inc.

Since overhead expenses at Paine Field are low, the new company believes it will be able to compete favorably with other maintenance concerns.

CPA to Get Comets In Late '51

Two turbojet de Havilland Comet transports ordered by Canadian Pacific Air Lines (AVIATION WEEK, Dec. 19) are slated for delivery late in 1951, according to CPA President Grant McConachie.

McConachie tested the Comet prototype during a recent visit to England, where he flew the ship for over four hours at over 500 mph. and at 40,000 ft. He reported that the Comet's smoothness of handling, lack of vibration and reduced fire hazard had convinced him of the excellent future of jet-propelled commercial aircraft.

CPA plans to use the Comets on its North Pacific service from Vancouver, B. C., to Tokyo and Hong Kong. With a 500 mph. cruising speed, the planes are expected to make the Vancouver-Tokyo run in ten hours flying time and the return trip in eight hours. Pilots slated for the high-speed service will be indoctrinated on jet transport operations in England.

CAB Approves Big Feeder Merger

Prospects for a super-feederline in the Rocky Mountain area have brightened with the Civil Aeronautics Board's approval of a Monarch Air Lines-Challenger Airlines merger.

Monarch, which operates from Denver to Salt Lake City and Albuquerque, N. M., is certificated for 1683 route-mi. Challenger has 2424 route-mi. extending from Denver to Salt Lake City and Billings, Mont.

The two feeders have had consolidated traffic, sales, station, advertising, maintenance, overhaul and engineering activities since 1948. Both are based at Denver and operate DC-3s.

The merger will be accomplished through acquisition of Challenger's stock by H. S. Darr, president and controlling stockholder of Monarch. The agreement calls for Darr to purchase 224,000 shares of Challenger's common stock from Claude Neon, Inc., for $277,000.

Monarch is still awaiting CAB action on its proposed acquisition of Arizona Airways, Phoenix, which has 1020 mi. of feeder routes in Arizona, New Mexico and Texas. Arizona Airways was designated for a certificate in Feb. 1948, but has been unable to raise enough money to inaugurate service.

Continental Air Lines opposed the Monarch-Challenger merger. It pointed out that the combined MAL-Challenger route network will be well above 4000 mi. and will exceed the size of many domestic trunklines (including Colonial, Continental, Chicago & Southern, Delta, Inland, Mid-Continent, National, Northeast and Western).

Oakland Coach Tops

Oakland Municipal Airport handled more air coach passengers during October than regular-fare passengers.

Totals of 11,172 coach and 7720 regular passengers in October brought the airport's coach passengers for the first ten months of 1949 to 86,239 and regular passengers to 95,550. In the first ten months of 1948 there were only 22,465 coach-type passengers, compared to 99,217 regular passengers.

SHORTLINES

► **Air Line Pilots Assn.**—Says it recently completed a study which shows conclusively that technological unemployment among pilots is rising because of increased use of larger and faster equipment. Survey found that in 1945 the domestic airlines flew an average of 572,519 revenue plane miles daily with 4967 first pilots and copilots, while in 1948 the carriers flew 925,677 revenue plane miles daily with only 4710 first pilots and copilots.

► **Braniff**—Has asked CAB to extend its routes from Chicago to Detroit.

► **Meteor Air Transport**—CAB says the DC-3 which crashed near Detroit City Airport Nov. 19 was loaded to 27,239 lb., which was 339 lb. more than the allowable limit of 26,900 lb. Pilot and copilot of the nonscheduled cargo plane were killed in the mishap along with an occupant of the house the DC-3 hit. Investigation to date has revealed no evidence of structural failure or engine malfunctioning.

► **Northern Consolidated**—CAB has offered to raise the Anchorage carrier's Fairbanks-Bethel temporary mail rate for past and future periods to relieve the company's critical financial condition.

► **Northwest**—Planned to start coach service between Minneapolis/St. Paul and Anchorage, Alaska, this month with combination passenger/cargo DC-4s. Four roundtrips weekly will be offered at a $126 one-way fare, compared with the regular fare of $188.40 . . . NWA has asked CAB permission to offer reduced-rate books of six 30-day-limit commutation tickets on the Twin Cities-Chicago, Twin Cities-Fargo, Portland-Spokane and Seattle-Spokane links, starting Jan. 1.

► **Pan American**—Carried 2283 passengers between Seattle and Alaska in November compared with 2158 in the same 1948 month.

► **Resort Airlines**—Plans to begin its all-expense cruises to the Caribbean on Jan. 7. The certificated carrier recently received CAB permission to stop at Grand Bahama Island, B.W.I., where Butlin, Ltd., a British company, has built an $8 million "holiday village" for all-expense tour vacationers.

► **Southern Airways**—Has acquired another DC-3, bringing its feeder fleet to five. Ship was obtained from Colonial Airlines.

► **Transocean**—Has sold two DC-4s to TWA for the latter's air coach services . . . CAB has authorized Transocean to make a maximum of 10 roundtrip flights between Guam and Toyko in the next three months. Only roundtrip tickets with a maximum return limit of 15 days may be sold on the flights, which will cater largely to Guam-based servicemen wishing to spend their leave in Japan.

► **TWA**—Has announced a series of all-expense tours to Italy and France during the 1950 Holy Year.

CAB SCHEDULE

Jan. 4—Hearing on transcontinental coach service. (Docket 3397 et al)

Jan. 5—Hearing in Florida Airways mail rate case. Postponed from Dec. 19. (Docket 3695)

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

Jan. 16—Hearing in New York City area helicopter case. Postponed from Jan. 9. (Docket 946 et al)

Jan. 17—Hearing in National Airlines route transfer case. (Docket 3500)

Jan. 23—Hearing in air freight accumulation, assembly and distribution tariffs. Postponed from Jan. 9. (Docket 1705 et al)

Jan. 23—Hearing on Cuba-Florida foreign air carrier permit case. Postponed from Jan. 9. (Docket 3717 et al)

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

Feb. 13—Hearing in West Coast Airlines' certificate renewal case. (Docket 3966)

Feb. 24—Hearing on CAB's enforcement action against Meteor Air Transport. Postponed from Jan. 24. (Docket 4100)

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EDITORIAL

A Lesson From the Wright Brothers

(Editor's Note: In the high-pressure, high-speed environment of present-day aviation a reminder of human values in aviation such as that presented by Charles A. Lindbergh in his brief Washington talk at the 46th anniversary of the first powerplant flights by the Wright brothers, should not be overlooked. Aviation Week herewith publishes the Lindbergh talk in full as a service to its readers.

—Robert H. Wood)

Orville and Wilbur Wright will always inspire the men who follow them in aviation. To be awarded the trophy which bears their name is an honor I appreciate beyond the ability of my words to describe.

Looking at the model of that early plane brings conflicting emotions to my mind. We who meet on the anniversary of Kitty Hawk have marvelled at the growth and changing forms of aircraft. Many of us have seen, with our own eyes, the metamorphosis of the Wright biplanes into supersonic prototypes with close to thirty times their speed. Now, we plan huge rockets that will travel, faster than a rifle's bullet, for thousands of miles. And we talk about flying to the moon as freely as people talked about flying from one city to another before that December day at Kitty Hawk.

The Wright brothers, with their first power-driven flights, opened the door to all this progress. They are symbolic, to us, of the pioneer—his daring, his vision, his fortitude. They represent a quality in Western man without which our civilization could not survive. For generations, we have based our progress on discovery, and protected our nations through the invention and use of new tools. Today, whether it be for peace or war, we Westerners depend on wings. We depend on past, present and future contributions of men like the Wright brothers.

But the Wright brothers, being pioneers, also symbolize a quality of life which withers in an atmosphere of scientific progress. As they represent progress on the one hand, they represent the "log cabin days" of aviation on the other. And from the log cabin, there is much that modern man could learn.

One need only glance at a picture of their first flight to realize the difference between the life they lived and ours. Orville lies prone in the open air, on top of his lower wing, while Wilbur runs with him, against the wind, over a sandy flat. While their minds were studying structures and the aerodynamics of flight, their bodies were in contact with sun and earth, and weather.

We hear mariners speak nostalgically of the era of iron men and wooden ships. In a similar sense, I sometimes feel that the decline of aviation began with the self-starter and the closed cockpit. Before the advent of these items, and the instruments that went with them, flving was an art that required the use of the body and all its senses. In that early environment, a man could keep in better balance. He spent much of his time in the country, for he flew from farmers' fields. He experienced the beauty of sunset. His skin felt the freshness of rain. He had to know texture of earth and shading of grass to keep from nosing over in a mire. Pulling a stubborn engine through kept his muscles in condition. He relied on sight of horizon, touch of control, sound of engine. He might even test a battery by taste.

Now, flying has become a science in which the mind ascends, and the body becomes an increasingly unnecessary part. Hurtling through the air in a jet fighter, or vibrating through cloud on multi-engine instruments, hour after hour, I realize how intellectual flying has become. We no longer sense the qualities of earth and air. We look at almost everything through print and glass. Today, we press a button to engage an automatic pilot to carry us across an unseen ocean, or to destroy an unseen city below.

Our engineers crowd air-conditioned drafting rooms, and seldom use their hands to test their theories. Our pilots fly in supercharged and heated cabins. They judge their weather through ticker tapes and crayoned paper sheets. As we have progressed in the science of aviation, we have separated ourselves from the balanced quality of life.

The dream of the Wright brothers was to build a power-driven airplane, and to fly it successfully. They accomplished that dream; and we, their disciples, have perfected it to a high degree. Now, as in so many phases of modern life, we are faced with a different problem. How are these perfected aircraft to be used for the benefit of man, to raise his standards in the deeper sense?

Great factories full of workers, great speeds over the surface of the earth, great destructive power—such items are impressive; they are even essential to our survival in these chaotic years. But in themselves, they do not contribute to the quality of human life. We must not let science hypnotize us into believing that simply by sitting in front of desks and drawing boards and instruments all day, we are contributing to the character of man.

Personally, I am convinced that man cannot thrive indefinitely in the hot-house atmosphere we are creating. I believe that for permanent survival, he must balance science with other qualities of life, qualities of body and spirit as well as those of mind—qualities he cannot develop when he lets mechanics and luxury insulate him too greatly from the earth to which he was born. We must realize that even vision and judgment depend upon the body as well as on the mind. It is for this reason I say that the Kitty Hawk plane stirs conflicting emotions within me. As it symbolizes our progress, it also symbolizes qualities of life we have left behind and which, to be successful in a deeper sense, we must retrieve.

How are we to retrieve these qualities? Certainly we cannot turn back the clock. Certainly it cannot be done in any revolutionary way without greater loss than gain. I believe it can be done only through a re-orientation of our standards, only by placing the character of man above the value of his products. If we are to be finally successful, we must measure scientific accomplishments by their effect on man himself.

In honoring the Wright brothers, it is proper and customary to emphasize their contribution to scientific progress. But I believe it is equally important to emphasize the qualities in their pioneering life, and the character in man that such a life produced. The Wright brothers balanced success with modesty; science, with simplicity. At Kitty Hawk, their intellects and senses worked in mutual support They represented man in balance. And from that balance came wings to lift a world.

These meetings will stretch forward into eras of supersonic and, possibly, even inter-planetary flight. We cannot predict with certainty what discoveries and developments the future will unroll. But December 17th will always create oppportunities for us to learn from, as well as to honor, the qualities of great pioneers.

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